

# One year of sound recorded by a MERMAID float in the Pacific: Hydroacoustic earthquake signals and infrasonic ambient noise

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## SUMMARY

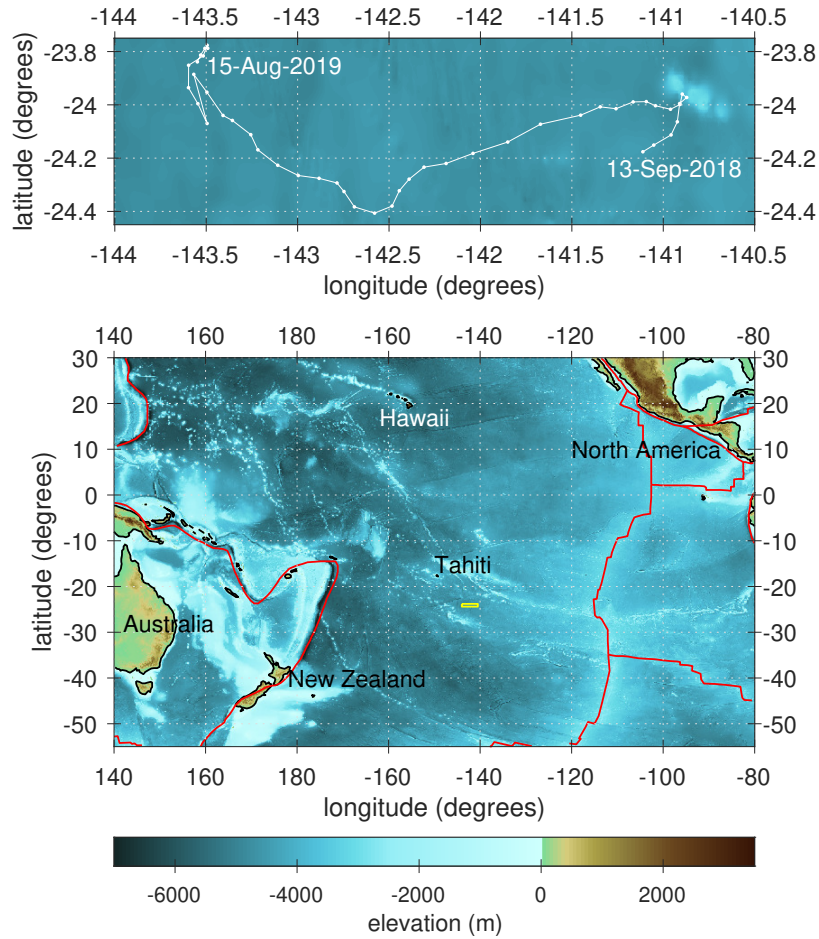
A fleet of autonomously drifting profiling floats equipped with hydrophones, known by their acronym MERMAID, monitors worldwide seismic activity from inside the oceans. The instruments are programmed to detect and transmit acoustic pressure conversions from teleseismic  $P$  wave arrivals for use in mantle tomography. Reporting seismograms in near-real time, within hours or days after they were recorded, the instruments are not usually recovered, but if and when they are, their memory buffers can be read out. We present a unique one-year-long data set of sound recorded at frequencies between 0.1–20 Hz in the South Pacific around French Polynesia by a MERMAID float that was, in fact, recovered. Using time-domain, frequency-domain, and time-frequency-domain techniques to comb through the time series, we identified signals from 213 global earthquakes known to published catalogs, with magnitudes 4.6–8.0, and at epicentral distances between  $24^\circ$ – $168^\circ$ . The observed signals contain seismoacoustic conversions of compressional and shear waves traveling through crust, mantle, and core, including  $P$ ,  $S$ ,  $Pdif$ ,  $Sdif$ ,  $PKIKP$ ,  $SKIKS$ , surface waves, and hydroacoustic  $T$  phases. Only 10 earthquake records had been automatically reported by the instrument—the others were deemed low-priority by the onboard processing algorithm. After removing all seismic signals from the record, and also those from other transient, dominantly non-seismic, sources, we are left with the infrasonic ambient noise field recorded at 1500 m depth. We relate the temporally varying noise spectral density to a time-resolved ocean-wave model, WAVEWATCH III. The noise record is extremely well explained, both in spectral shape and in temporal variability, by the interaction of oceanic surface gravity waves. These produce secondary microseisms at acoustic frequencies between 0.1–1 Hz according to the well-known frequency-doubling mechanism.

**Key words:** Seismic noise, infrasound, Pacific Ocean

## 1 INTRODUCTION

Global seismic tomography, the imaging of three-dimensional wave-speed structure inside the Earth (Ritsema & Lekić 2020; Tromp 2020), is data-limited by the sparsity of oceanic stations (Romanowicz 2008). Approaches to mitigate this problem include installing moored hydrophones (e.g., Fox et al. 1993) and ocean bottom seismometers (e.g., Stephen et al. 2003). The logistical difficulties and high costs of installation and data recovery of these devices render such methods not viable for filling vast gaps in the ocean with sufficient station density for seismic tomography. Repurposing ocean-bottom telecommunication optic fibers for distributed acoustic sensing (e.g., Marra et al. 2018) may hold promise for extending the range of existing seismic arrays (e.g., Williams et al. 2019). MERMAID (Mobile Earthquake Recording in Marine Areas by Independent Divers) is a more established recent alternative (Simons et al. 2006b; Sukhovich et al. 2015; Simon et al. 2020, 2021a). This low-cost, easily deployable, and generally unrecovered robotic instrument is capable of maintaining a constant depth in the ocean, where it continuously records the acoustic pressure field, and autonomously reports seismoacoustic waveform arrivals in near-real time. A combination of time-domain triggering and probabilistic wavelet-domain identification algorithms (Simons et al. 2006a; Sukhovich et al. 2011) running onboard determines detections of likely teleseismic earthquake  $P$ -wave arrivals, prompting MERMAID to surface and report the recorded waveforms via satellite before resuming its mission.

Over the last decade, multiple generations of MERMAID instruments have collected thousands of earthquake signals recorded in the oceans, suitable for seismic tomography, and more (Simons et al. 2009; Sukhovich et al. 2015; Nolet et al. 2019; Simon et al. 2021b). Nevertheless, the bulk of the acoustic record never gets transmitted but remains in the instrument's memory, which, in the third MERMAID generation (Hello & Nolet 2020; Simons et al. 2021), holds one year of data. The memory buffer might contain unreported earthquakes,



**Figure 1.** (Top) Trajectory of MERMAID P0023 from its launch on 13 September 2018 to its recovery on 15 August 2019. Each dot is a different, approximately weekly, surfacing. Connecting lines do not take into account the complexities of the currents at depth. (Bottom) Bathymetry and topography of the area of the Pacific centered on French Polynesia. Coastlines are drawn in black, plate boundaries in red. The yellow rectangle identifies the upper panel.

undetected earthquakes, and noise from a variety of terrestrial, oceanic, and biological sources. We do note that frequencies above 20 Hz are filtered out by the acquisition module, which effectively avoids whale vocalizations—future versions of MERMAID instruments may well be designed to specifically capture those (Bonnieux et al. 2020). In principle, all such data can be recovered, as MERMAID’s current satellite protocol provides for two-way communication that allows for data requests (Simon et al. 2021b). The MERMAID instrument itself is not meant to be recovered, unless special circumstances permit. Exceptionally, during a cruise leg of the South Pacific Plume Imaging and Modeling (SPPIM) experiment conducted in August 2019, Princeton University’s instrument P0023 was recovered and redeployed, allowing for the repatriation of a one-year time-series.

Working in the time-domain (raw seismograms), in the time-frequency domain (spectrograms), and in the spectral domain (power-spectral densities), we mined the data set for signal and noise. We first identified all possible earthquake arrivals in the buffer and then matched them, to the extent possible, with known earthquakes from the United States Geological Survey (USGS) National Earthquake Information Center (NEIC) Preliminary Determination of Epicenters (PDE) database, accessed via the Incorporated Research Institutions for Seismology (IRIS) Data Management Center (DMC). In total 213 wave arrivals were matched in this way. Only ten of those had already been transmitted by MERMAID.

We removed all identified and suspected seismoacoustic (e.g.,  $P$ ,  $S$  and surface-wave conversions) and transient hydroacoustic arrivals (e.g.,  $T$  phases) from the record to obtain the background noise. We computed the noise spectral density over yearly, monthly, and weekly intervals to study its fluctuation over the year. Our data rather directly confirm that the ocean surface is responsible for the infrasonic ambient noise at 1500 m depth through the secondary-microseism generating process which creates seismic energy at double the driving frequency (see Kerman 1993; Nakata et al. 2019, and references therein). Our in situ observations of acoustic noise in the 0.1–1.0 Hz frequency range are remarkably coherent with sea-surface pressure obtained from completely independent ocean gravity wave modeling (WAVEWATCH III, Tolman 2009).

Our study highlights the promise for recording and recovery of seismic phases beyond the most prominent automatically reported ones (see also Simon et al. 2021b), and illustrates the potential of MERMAID as an environmental low-frequency ambient-noise sensor.



## 2 DATA AND METHODS

Our data are time-domain records of acoustic pressure acquired by MERMAID P0023 at a parking depth of 1500 m below the ocean surface in Pacific French Polynesia between its first deployment on 13 September 2018 and its fortuitous recovery on 15 August 2019. Their nominal sampling rate is 40 Hz, corresponding to a Nyquist frequency of 20 Hz. The hydrophone has approximately linear sensitivity to pressure down to about 0.1 Hz, with a (negative!) scaling factor of  $-1.494 \times 10^5$  counts/Pa. A transfer function (Guust Nolet, Olivier Gerbaud, and Frédéric Rocca, *personal communication*, see also Joubert et al. 2015) is on record at and available from the IRIS DMC. The incoming data stream is filtered between 0.1 Hz and 10 Hz before digitization.

In-between surfacings, which take about 22 hours round-trip (Simon et al. 2021a) and during which recording is halted, the time series is continuous except for sporadic intervals of depth adjustments, which interrupt data acquisition for a few minutes each. MERMAID returns to the surface as soon as it deems a detected *P*-wave arrival likely to be of use for seismic tomography, which occurs on average every 6–7 days. At this rate of data return, the lifetime of a MERMAID instrument on a single set of lithium batteries is about 5 years.

At the time of data transmission, Global Positioning System (GPS) location and time are obtained and bundled as metadata. The GPS time stamp is used to correct for instrument clock drift (Joubert et al. 2016), typically by a fraction of a second (Simon et al. 2021a). Over the course of the eleven-month (about 336 days, or 8064 hours) period discussed here, MERMAID surfaced 44 times. In total, we have 7029 hours of data available, an “uptime” equivalent of 87% of the deployed time.

Fig. 1 shows the instrument’s trajectory over the period discussed in this paper. In the figure lines are drawn to connect surface locations, but when time-tagging particular events in the seismograms recorded at depth, a more sophisticated procedure is being followed, which takes into account the difference in drift rate between the surface and the usually 1500 m parking depth (Joubert et al. 2016). Examples and details of drift statistics are given by Nolet et al. (2019) and Simon et al. (2021a).

We analyze the data in the time-frequency domain, in the frequency domain, and in the time-domain, in various frequency bands. The choice of corner frequencies arose from visual inspection of spectrograms and spectral densities (Simons et al. 2009), and with an eye towards identifying earthquake signatures (seismoacoustic *P* and *S* conversions) and hydroacoustic *T* phase arrivals. An example for an interval that contains a teleseismic earthquake is shown in Fig. 2. The spectrogram is shown in Fig. 2(a), the spectral density compared to the background for the month in Fig. 2(b). Raw pressure time-series are shown in Fig. 2(c). Data filtered between 2–10 Hz appear in Fig. 2(d), and in the band 0.05–0.10 Hz in Fig. 2(e). Filtering is accomplished using two-pass, two-pole Butterworth filters. For the lowest-frequency bandpass, the time-series was decimated by a factor of 5 prior to filtering. Moving averages (in green) and moving averages of root mean-squared values (in red) over 30 s intervals are plotted overlaying the traces in Figs. 2(c)–2(e).

Spectrograms were computed using moving segments of 100 s length and with 70 per cent overlap, windowed using a single prolate-spheroidal taper with a concentration of four times the fundamental frequency (Simons et al. 2009). Spectral densities were computed using the Chave et al. (1987) algorithm on hour-long segments using the same windowed segmentation, with bootstrap error estimates. When reporting spectral densities over longer time periods, we show the median, 5th and 95th percentiles of their distribution over the time interval of interest. Fig. 2(b) is an example of both modes of presentation, where the spectrum of the hour-long data segment shown in Fig. 2(c) is shown (in red) against the background spectrum for the month during which it was acquired (in blue), so that the transient increase in spectral power evident from Fig. 2(a) can be appreciated against the context of the background ambient noise.

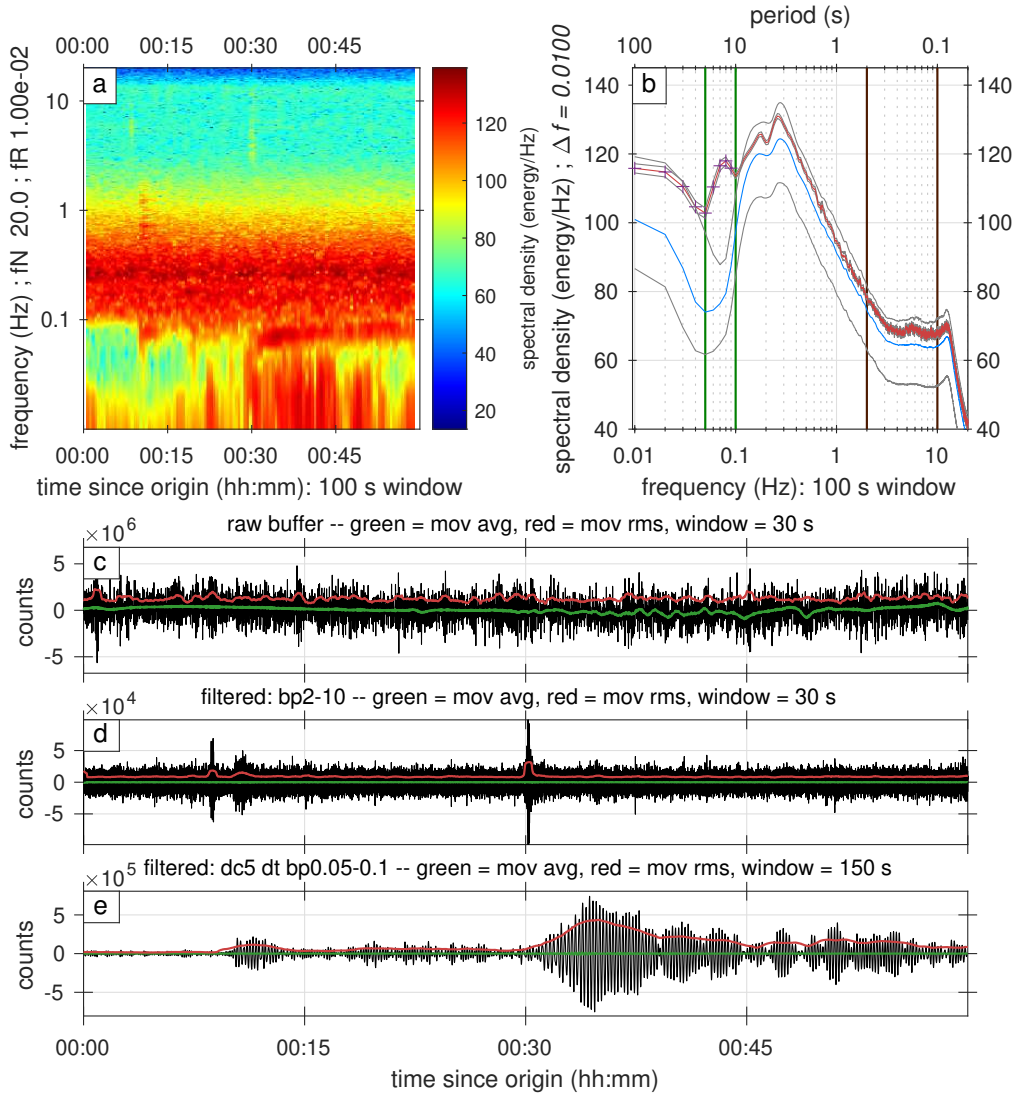
## 3 SIGNAL: EARTHQUAKES AND OTHER TRANSIENTS

In this section we designate as “signal” all short-time transients of any origin that stand out from a continuous, longer-time, background after manual analysis and visual inspection.

### 3.1 Earthquakes of known and unknown origin

MERMAID P0023 automatically reported ten 200–250 s long acoustic data segments that could identifiably be matched to global earthquakes following the procedure of Simon et al. (2021a). For 8 of these, the triggering caused the recording to be halted and the ascent to be initiated, resulting in truncated records. However, some triggered segments were kept in memory without interrupting data acquisition, earmarked for later, lower-priority reporting. The complete signatures of those events remained in the record that was ultimately recovered.

Fig. 2 is an example of such a case, displaying the magnitude 6.7 earthquake (IRIS ID 10997608) that occurred at a depth of 55 km on 20 January 2019 at 01:32:52.480 UTC near the coast of Coquimbo, Chile, when MERMAID floated at an epicentral distance of  $62.17^\circ$ . In the ak135 reference model (Kennett et al. 1995), the *P* and *S* waves from this earthquake arrive at 615.52 s and 1116.87 s, respectively. Their seabed conversions to acoustic pressure in the water column are visible in the spectrogram (Fig. 2a), as brief increases of power in the range 0.08–0.10 Hz. The third instance of increased energy occurs between 0.03–0.10 Hz around 30 minutes after the origin time, for an equivalent speed of 3.84 km/s along the Earth’s surface. The power spectral density for the same time interval (Fig. 2b) shows the deviation of energy in the band 0.05–0.1 Hz for this hour-long segment compared to the expectation for the entire month of January. The raw time series is shown in Fig. 2(c), with the 30 s moving average overlaid in green, and the equivalent moving root mean-squared value superimposed in red. The 2–10 Hz filtered time series (Fig. 2d) shows the *P* arrival at 10 minutes, as well as a brief spike around 30 minutes. In the 0.05–0.10 Hz filtered seismogram (Fig. 2e) we clearly see that the arrival emerging around the 30 minute mark represents the surface wave train, while the *P* arrival remains visible as well.



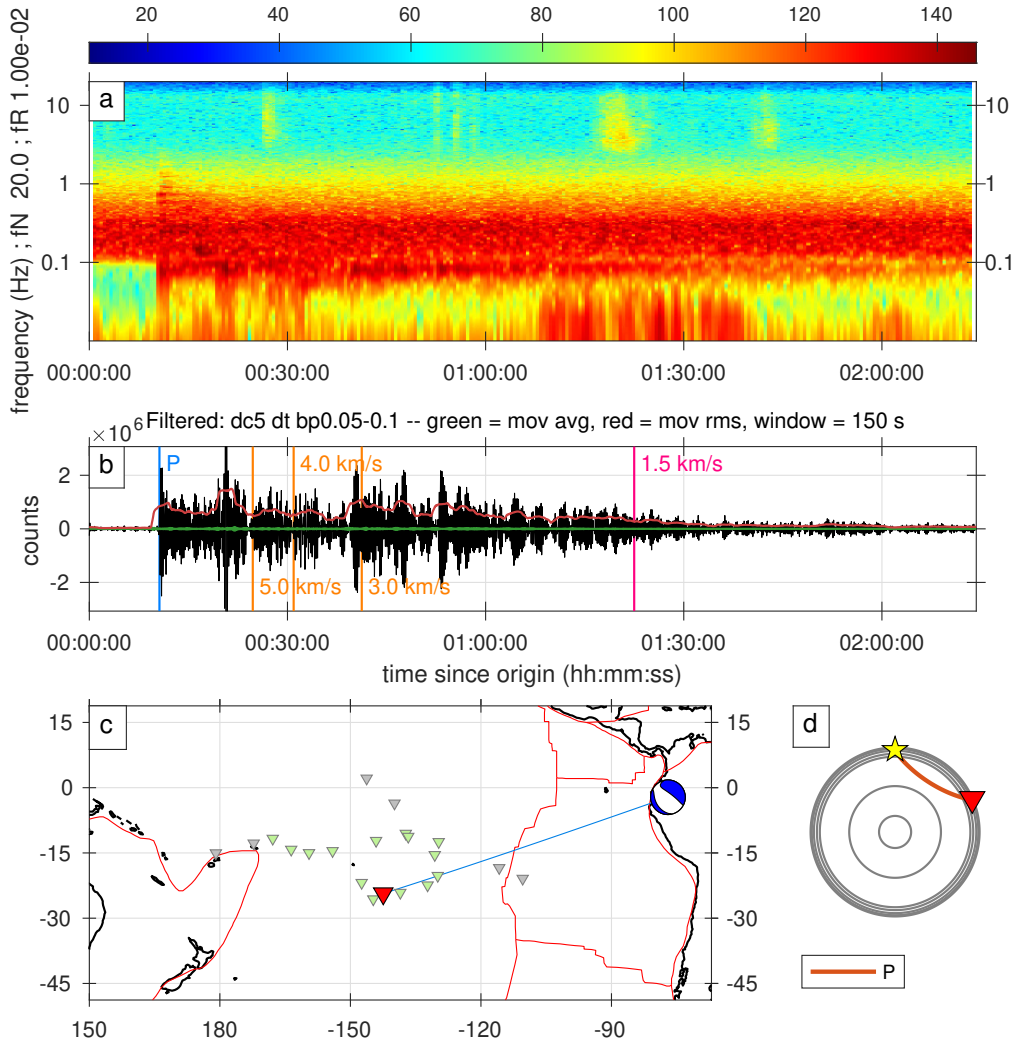
**Figure 2.** One hour of acoustic pressure data from the recovered MERMAID P0023 buffer, in uncalibrated instrument counts. The interval contains the signal from a magnitude 6.7 earthquake near the coast of Coquimbo, Chile on 20 January 2019 at 01:32:52.480 UTC. (a) Spectrogram showing seismic arrivals most prominently in the 0.08–0.10 Hz frequency band. (b) Spectral density of the data in (a), shown in red with grey uncertainty intervals, compared to the noise spectral density representative of the entire month of January 2019, in blue with grey uncertainties. Both curves differ most at frequencies below 0.10 Hz. (c) Time-domain raw seismogram. (d) Seismogram filtered between 2–10 Hz. (e) Seismogram filtered between 0.05–0.10 Hz. Green and red lines in (c)–(e) are moving averages and moving root mean-squared values.

All ten of the automatically reported events showed similar spectral energy fingerprints, and good time-domain signal-to-noise ratios in the 0.05–0.10 Hz range for the *P* and/or surface-wave arrivals. Hence we took these signatures as the basis to hunt, by visual inspection, for earthquake activity throughout the data set. In this manner we found no fewer than 274 segments containing likely earthquake arrivals.

Approximate MERMAID locations at the corresponding times were obtained by linearly interpolating between surfacing locations. Subsequently we queried (using `irisfetch.m`) the USGS NEIC PDE catalog maintained by IRIS for global earthquakes and computed (using `taupTime.m`) travel times within the `ak135` velocity model. We retained events whose body-wave arrivals fell within three minutes from the times that we had identified in our time series. When the segment contained a likely surface wave, we chose the catalog earthquake whose surface-wave arrival would imply a speed between 3–5 km/s.

Following this procedure resulted in 213 out of the 274 candidates being positively associated with a catalog earthquake. Fig. 3 shows another previously reported earthquake, and Fig. 4 one that had not already been reported by MERMAID, for comparison.

Fig. 3 shows the pressure-converted wave train from a magnitude 7.5 earthquake (IRIS ID 11007849) that occurred at a depth of 132 km in the Peru-Ecuador border region on 22 February 2019 at 10:17:22.410 UTC, at an epicentral distance of  $66.77^\circ$ . The arrival did not trigger ascent yet was reported by MERMAID P0023 (and by fourteen others in our fleet of 16 instruments). The amplitudes of the *P* and *S* body waves far exceed the background noise, and they are clearly visible in the spectrogram, Fig. 3(a), and in the time-domain record, Fig. 3(b). Focusing on the 0.05–0.1 Hz frequency band, surface waves are seen to follow, and in the time-domain we marked the times associated with speeds along the surface of 5, 4 and 3 km/s. In the higher frequency ranges, between 2–10 Hz, hydroacoustic arrivals are observed in the



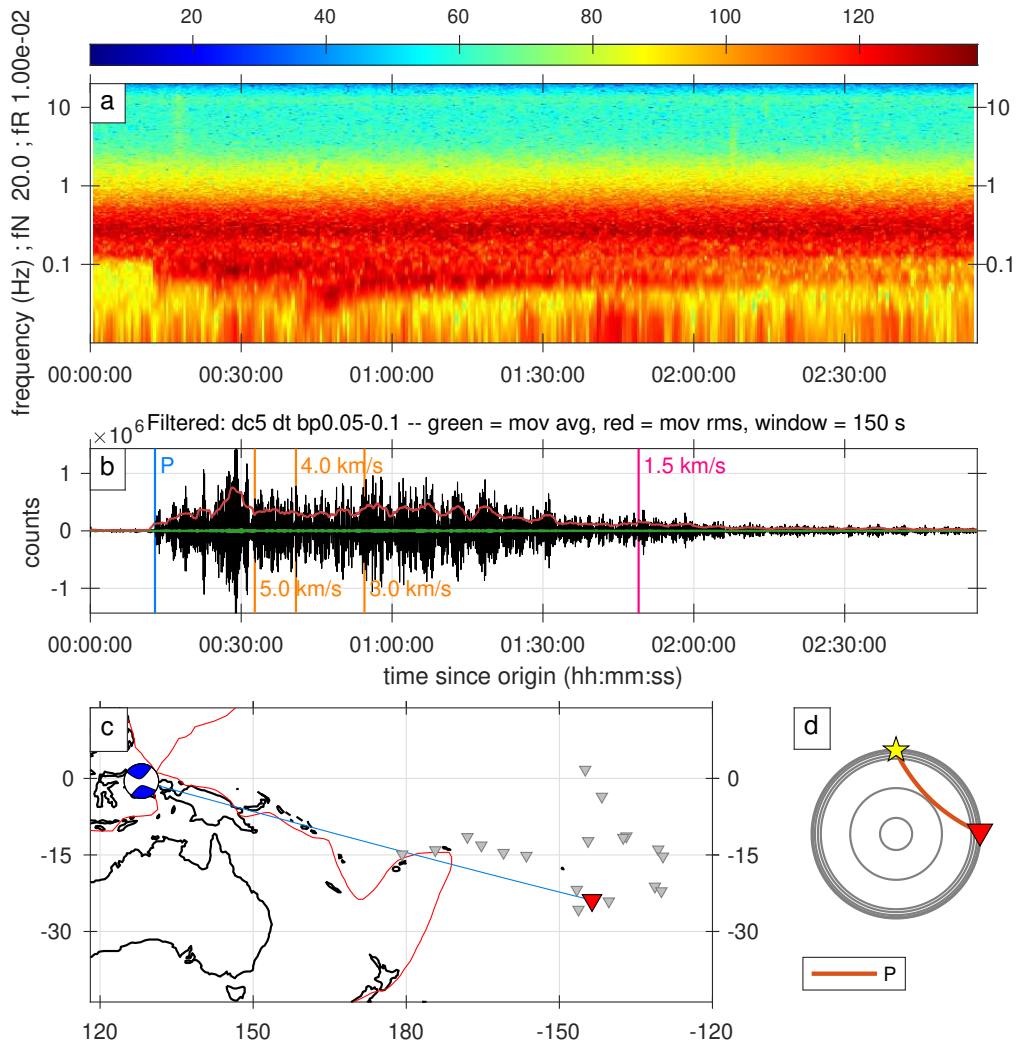
**Figure 3.** An earthquake that was automatically reported by MERMAID P0023, the magnitude 7.5 Peru-Ecuador border earthquake on 22 February 2019 at 10:17:22.410 UTC. (a) Spectrogram and (b) filtered 0.05–0.10 Hz seismogram. (c) Focal mechanism, ray path to MERMAID P0023 (red triangle), and array configuration at the time of recording (triangles). The green triangles identify other MERMAIDS that also automatically reported the earthquake arrival. (d) Cross section through Earth showing the path of the *P* wave from the event (yellow star, rotated to the North Pole) to MERMAID P0023 (red triangle).

spectrogram. Since the propagation path of any *T* waves generated by this earthquake is almost entirely in the water, we marked the 1.5 km/s arrival on the record as well. Fig. 3(c) shows a map with the location of the earthquake and the array configuration at the time of its recording, and Fig. 3(d) shows the  $a_{k135}$  ray path on a cross-section through Earth.

Fig. 4 shows the magnitude 7.3 Halmahera, Indonesia, earthquake (IRIS ID 11073718) that occurred at a depth of 10 km on 14 July 2019 at 09:10:50.533 UTC, at an epicentral distance of 88.24°. Smaller than the event shown in Fig. 3 and almost 22° more distant, this particular event did not trigger automatic reporting by MERMAID P0023 nor by any other MERMAID instrument. The *S* and surface wave arrivals are not as clearly differentiated as in Fig. 3, and any *T* wave arrivals are not obvious.

The *Supplementary Material* contains the full complement of waveforms identified in the manner described in this section. Most of these lead with a mantle *P*-wave arrival, though there are some that contain core-transmitted waves. (Simon et al. 2021b, provide a detailed discussion of these and other phases beyond *P* heard by MERMAID).

Fig. 5 summarizes the distributions of epicentral distances and magnitudes of all 213 identified earthquakes. Their magnitudes span the range from 4.6 to 8.0, with the majority between magnitude 5.5–6.5. Events that had already been reported by MERMAID (yellow stars) have magnitudes of 6.4–8.0, ranking among the largest of the recorded set. Most identified earthquakes occurred in the Pacific Ocean around the Ring of Fire and the East Pacific Rise. The furthest earthquakes are at 168.10° distance. We found no matches in the catalog smaller than magnitude 4.4 or closer than 24.78°, the distance to the nearest major plate boundary. On the other hand, our analysis comprises several (274 – 213 = 61) arrivals from candidate earthquakes that remain as yet unidentified. Those could arise from closer events not reported to the USGS NEIC PDE database.



**Figure 4.** An example of an event that was not automatically reported by MERMAID P0023, the magnitude 7.3 Halmahera, Indonesia earthquake on 14 July 2019 at 09:10:50.533 UTC. Figure layout, labels and annotations as in Fig. 3. Note the difference in structural complexity of the travel path, along the active subduction zone, compared to the path for the event in Fig. 3.

### 3.2 Other Transients: *T* Phases, Ship Traffic, Bursts and Swarms

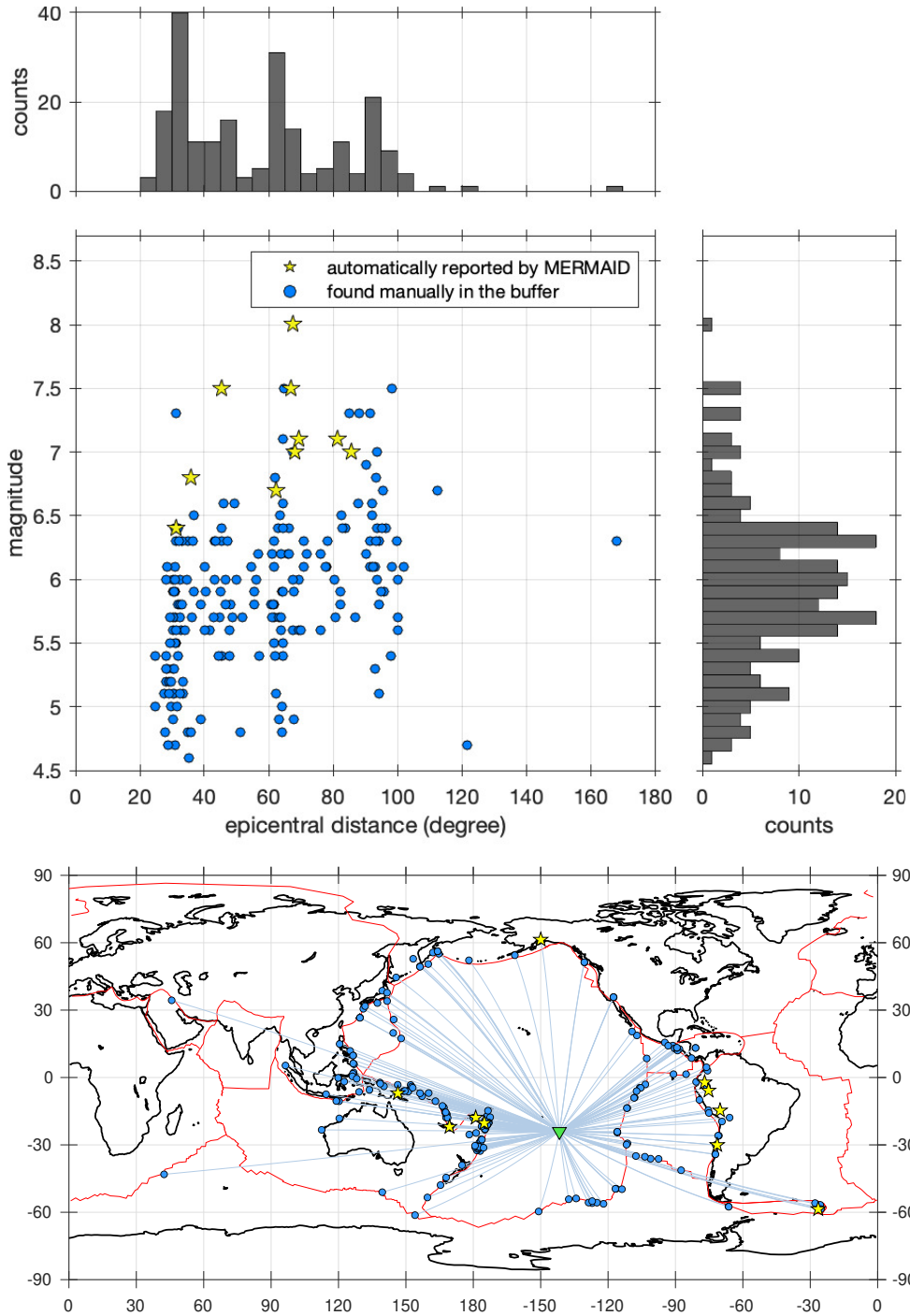
We performed a search for transient signals in a manner reminiscent of traditional STA/LTA analysis (Allen 1978) by computing a short-time (30 s) moving-window root mean-squared time series of the 2–10 Hz filtered data, and comparing it to a long-term (3 h) windowed version. We used an iterative procedure to obtain a stable long-term average.

After computing a 3-hour moving-window average version (denoted  $L3.0$ ) of the 30 s moving-window root-mean-squared record (denoted  $S30.0$ ), we replace the values of  $S30.0$  by those of  $L3.0$  whenever the values in  $S30.0$  exceeded those in  $L3.0$ . This results in a new short-term average sequence,  $S30.1$ . From this we compute a new long-term average  $L3.1$ , and again we threshold the values in  $S30.1$  to those in  $L3.1$ , and so on. After three iterations, a threshold of 1.5 for the ratio of the original short-time average ( $S30.0$ ) to the final long-term average ( $L3.3$ ) was used to identify intervals of transient power excess, many of which lasted for about 5–10 minutes each.

As expected, this transient detection method captured multiple isolated *T* phases, phases with emergent onsets, a well-defined duration on the order of minutes, and occupying a wide frequency band. See, for example, Fig. A1. For immediate comparison with an acoustic earthquake conversion we show Fig. A2, which displays a sharper onset and a much lower-frequency occupied bandwidth.

In addition, we identified a number of intervals with noise due to ships, characterized in the time-frequency domain by energy dominating a narrow frequency band over periods of time that are usually longer than a few minutes but not more than a few hours (Simons et al. 2009). The power spectral density of ship noise contains peaks with narrow widths, e.g., at 6, 8, 10, 12, 14, and 16 Hz. See, for example, Fig. A3.

Finally, the record contains a large number of repeated bursts of energy spanning the range 2–20 Hz, each of them lasting a handful of minutes and separated from each other by 2–5 minutes. Periods with such anomalous activity often lasted several days, beginning slowly, growing over time to reach a peak from which they gradually subsided at about the same rate. Storms could be thought to be responsible for these episodes (Gualtieri et al. 2018). However, we made detections, e.g., between June 2019 and August 2019, that did not correspond to any known cyclone occurrence in the Southern Pacific in the International Best Track Archive for Climate Stewardship (IBTrACS) database.



**Figure 5.** Distributions of epicentral distances and magnitudes of the 213 earthquakes identified in the buffer, out of 274 candidates. The yellow stars are those earthquakes that had been automatically reported by MERMAID, all the others were found by our visual analysis of the memory buffer. The 213 identified earthquakes match events known to the USGS NEIC PDE global catalog.

Swarms of nearby small earthquakes, or *T* phases, could be another possible explanation (e.g., Talandier & Okal 2001; Talandier et al. 2016; Simon et al. 2021b), but we were unable to identify any precursory body wave or surface wave arrivals. Finally, submarine volcanic activity may be responsible (e.g., Metz et al. 2016). Further investigation is needed into the nature of these transient episodes, but for now, we removed them from the record. Two examples are in Figs A4 and A5. The spectrogram of Fig. A4 is rendered linearly in the frequencies between 0–20 Hz, while that of Fig. A5 has a logarithmic frequency axis limited to 0.01–20 Hz.

An example record with no detectable transients at all is shown in Fig. A6 and another one with very little activity in Fig. A7, again using a logarithmic and a linear spectrogram frequency scale, respectively. Fig. A7 contains the hour of quiescence before the arrival of the seismoacoustic earthquake conversions shown in Fig. A8, where we note that Fig. A8 is a version of Fig. 2 that omits the noise spectral density for the entire month. Fig. A9 shows the signature earthquake of Fig. 2 in a layout easily compared with Fig. 3–4.

## 4 INFRASONIC AMBIENT NOISE AND ITS SEASONALITY

The removal of clearly detected or merely suspected earthquakes, seismoacoustic and hydroacoustic phases, and other transients from the yearly record amounted to the cutting of 1459 hours of “signal”, leaving 5570 hours of “noise”, whose time-evolving spectral density we now discuss.

Fig. 6 is the monthly summary of this infrasonic ambient noise. It peaks between 0.01–0.03 Hz and 0.10–0.50 Hz, with a much quieter band in-between. Noise levels come down as the frequency rises above 0.50 Hz. The significant drop above 14 Hz is due to filtering of the data in post-processing, and we also note that the instrument begins to lose sensitivity at the low frequencies below about 0.1 Hz. While it is hard to make out details on a logarithmic scale without closer scrutiny, it is readily apparent that the noise spectral densities vary from month to month. For example, at 0.05 Hz the spectral density fell below 80 on our logarithmic scale during September 2018–March 2019, but rose above 80 during April–August 2019. In order to quantitatively describe the variation of the background noise, we studied the temporal variations of energy levels integrated over distinct frequency bands of interest, primarily between 0.05–0.10 Hz, 0.10–0.50 Hz, and 2–10 Hz, where we found the most significant temporal variation.

To attribute the observed time-dependence to a particular physical mechanism, we investigated the influence of the weather on the ambient noise field in the ocean. Wind and swell are the cause of ocean surface gravity waves, and when two ocean wave trains arrive from opposite directions, they generate a pressure field at double the driving frequency that attenuates only weakly with depth (Longuet-Higgins 1950; Hasselmann 1963), registering on ocean bottom seismometers (Babcock et al. 1994; Webb 1998) and rather prominently as Rayleigh and Love (Gualtieri et al. 2020, 2021) surface waves on seismometers on land (Gualtieri et al. 2013, 2014; Nakata et al. 2019). We correlate the time-evolving spectral density of our MERMAID noise record with the spectral density of the equivalent surface pressure from the WAVEWATCH III Hindcast Model (WAVEWATCH III Development Group 2019). The model used wind speed to derive surface pressure and its spectral density between 0.041 and 0.304 Hz in three-hour intervals. We computed the medians of these spectral density models of the driving process at the matching geographic location over week-long windows, for comparison with the spectral density received by MERMAID at depth of 1500 m.

Fig. 7 shows two examples, for the weeks of 8–15 November 2018 and 21–28 February 2019. In this figure, we deconvolved the MERMAID transfer function from the record (see also Burky et al. 2021), so the units of the WAVEWATCH III and the MERMAID spectral densities match (both are  $\text{Pa}^2/\text{Hz}$ ). Figs 7(a) and 7(c) clearly show their matching shapes, and the relative flatness of the offset is apparent from Figs 7(b) and 7(d). The MERMAID spectral density is shown by the red triangles, with a dark grey envelope containing the 5th and 95th percentile of the values over the week, respectively. The WAVEWATCH III spectral density is shown in blue triangles, within a 5th and 95th percentile band of light grey triangles.

We computed the temporal evolution of the energy comprised within logarithmically evenly spaced frequency intervals, both for the surface pressure of the WAVEWATCH III Hindcast Model and for the noise recorded by MERMAID, over the entire year-long period. Each data point in the time-series is obtained from the spectral density computed over a week-long window. The resulting map of the correlation coefficients between both time-series is shown in Fig. 8(a). They are highest along the double-frequency line (examples labeled in Figs 8b–d), validating the assertion that surface-driven processes drive the infrasonic ambient noise in the 0.08–0.6 Hz range. The WAVEWATCH III model does not provide any information at higher frequencies, hence MERMAID’s records in this range have the potential to become primary environmental data.

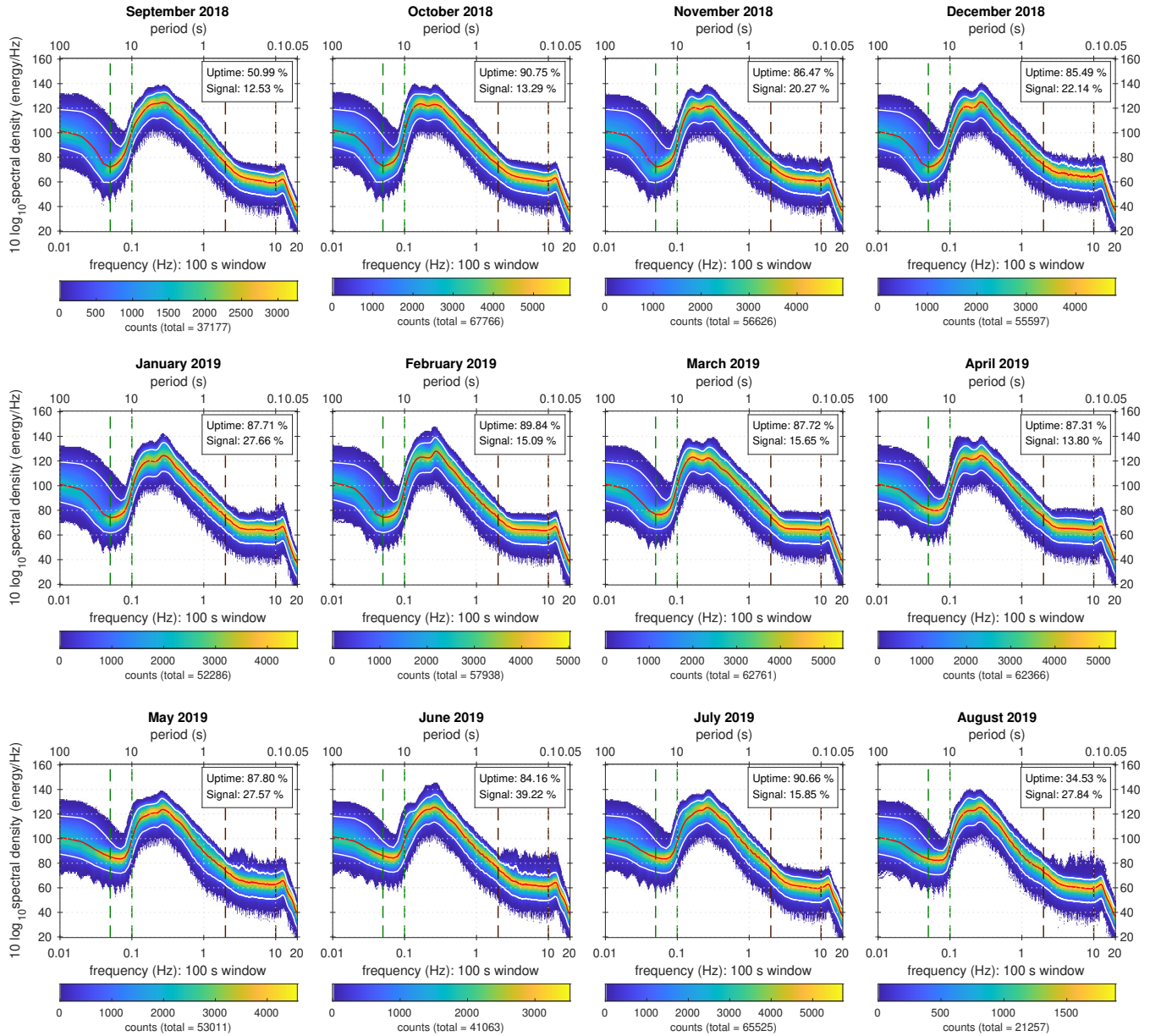
## 5 CONCLUSIONS

Over the course of an eleven-month period, a freely drifting hydroacoustic MERMAID float automatically reported short seismograms from two handfuls of triggered teleseismic earthquakes. An exceptional recovery allowed us to analyze the full, nearly continuous, record preserved on board. Our analysis reveals that MERMAID P0023 recorded no fewer than 213 teleseismic events of magnitude above 4.5, various transients, and an interpretable record of background noise. The earthquakes detected corresponded to 2.38 per cent of events present in the global seismic catalog between 13 September 2018 and 15 August 2019. A detailed discussion of what MERMAID’s return rates (under automatic reporting) mean for global seismology, and for seismic tomography in particular, is provided by Simon et al. (2021a), and interpreted examples of non-primary arrivals (often included with the automatically reported segments) are given by Simon et al. (2021b). In the present paper we largely focused on the novelty of the complete noise record of a MERMAID float that was, rather uncharacteristically, recovered (and returned to active duty). The comparison of the noise series to an independent model of wave height variations shows that infrasonic ambient noise in the 0.08–0.8 Hz frequency band is driven by the interaction between the atmosphere and the ocean at the surface through the well-known frequency-doubling secondary-microseism generating mechanism. A new model MERMAID instrument, which will de-emphasize teleseismic earthquake detection and instead report time-varying noise spectral densities directly, has been designed and constructed. Its deployment is planned within the year, and the results will be reported elsewhere.

## 6 DATA AVAILABILITY AND RESOURCES

Earthquake data (source locations, times, and magnitudes) were obtained from the Incorporated Research Institutions for Seismology (IRIS) and the Federation of Digital Seismograph Networks (FDSN). Focal mechanisms were provided by the Global Centroid Moment Tensor





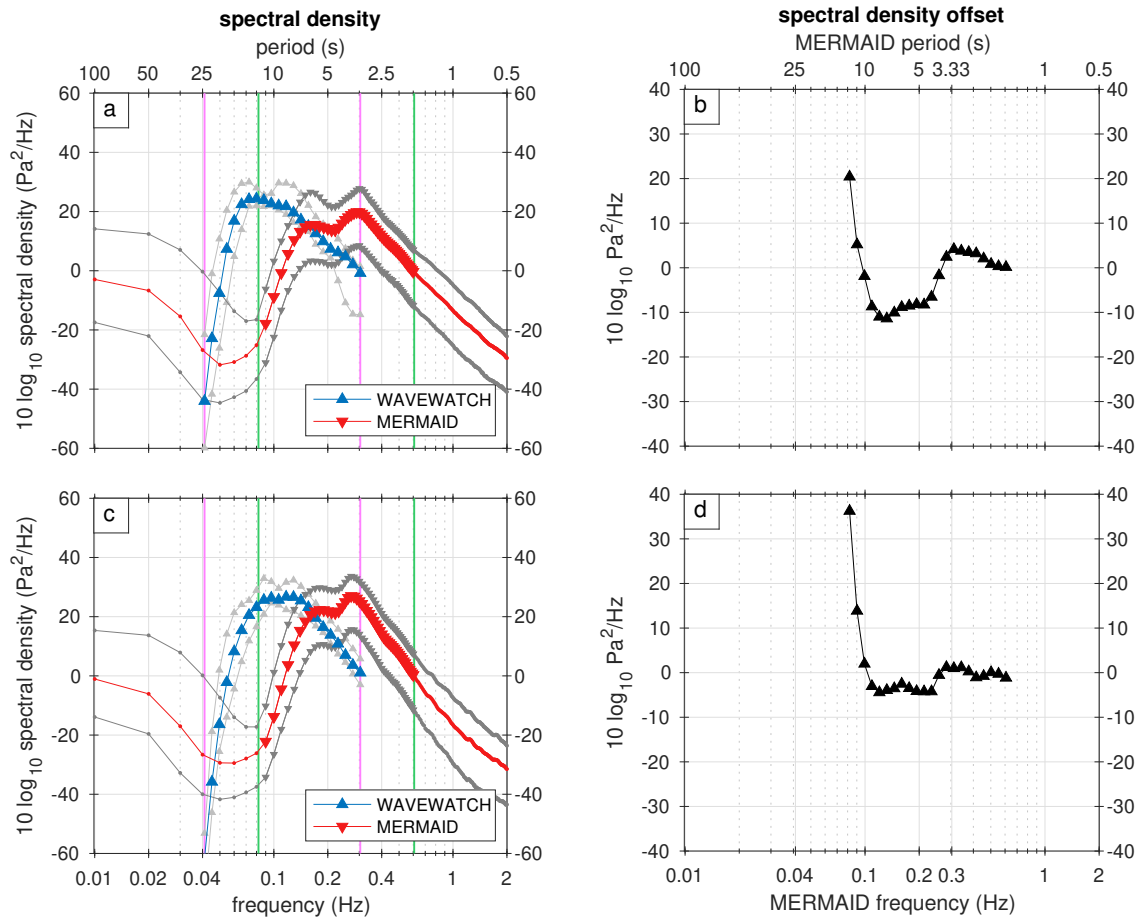
**Figure 6.** Monthly summaries of low-frequency noise recorded by MERMAID P0023. Each panel represents a population of spectral densities determined from segments analyzed with 100 s overlapping windows as explained in the text. The colors correspond to the population density of noise curves, with their total numbers listed in the color bar below. The red curve is the median, and the white curves the 5th and 95 percentiles. “Uptime” refers to the percentage of time within the month for which MERMAID’s recording of acoustic pressure was available. “Signal” refers to the percentage of the record that contained signal that we removed prior to spectral density computation. The seismoacoustic frequency range in which earthquakes are clearly seen, 0.05–0.10 Hz, is marked by green dashed vertical lines. The hydroacoustic frequency range where  $T$  phase arrivals are observed, 2–10 Hz, is marked by brown dashed vertical lines.

(CMT) project. Focal mechanisms were drawn using `focalmech.m` written by James A. Conder. The software for data analysis was written in MATLAB, and is documented and publicly available from [https://github.com/sirpipat/mermaid\\_buffer](https://github.com/sirpipat/mermaid_buffer).

Spectral densities of the equivalent surface pressure from the WAVEWATCH III Hindcast Model are from the National Oceanic and Atmospheric Administration (NOAA) Environmental Modeling Center (EMC), accessed at <ftp://ftp.ifremer.fr/ifremer/wv3/>.

## 7 ACKNOWLEDGEMENTS

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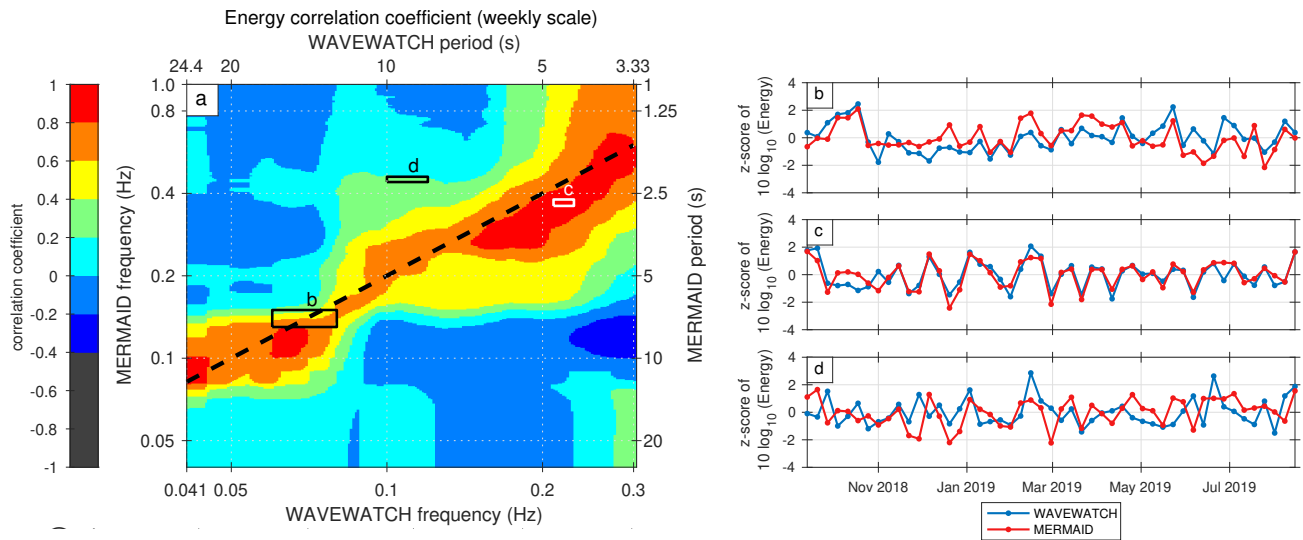


**Figure 7.** Spectral density of ocean acoustic noise recorded by MERMAID P0023 compared to that of sea-surface pressure from the WAVEWATCH III Hindcast Model, for two different weeks. (a,c) Spectral density of the WAVEWATCH III surface pressure model (blue triangles), and the spectral density of the acoustic pressure noise data recorded by MERMAID (filled red circles and triangles). Solid vertical lines mark the boundaries of the compared frequency ranges: pink for WAVEWATCH III and green for MERMAID. (b,d) Vertical offset between the (interpolated) log-spectral densities of WAVEWATCH III and MERMAID pressure, quoted at the recorded MERMAID frequencies, which are double those of the WAVEWATCH III driving frequencies. Panels (a) and (b) are for the week of 8–15 November 2018, (c) and (d) are for the week of 21–28 February 2019.

ering and redeploying the MERMAID float. We are grateful for the expert handling of the manuscript by Associate Editor, Dr. Gabi Laske, and appreciate the thoughtful and helpful reviews by Dr. DelWayne Bohnenstiehl and another, anonymous, reviewer.

## REFERENCES

- Allen, R. V., 1978. Automatic earthquake recognition and timing from single traces, *B. Seismol. Soc. Am.*, **68**(5), 1521–1532.
- Babcock, J. M., Kirkendall, B. A. & Orcutt, J. A., 1994. Relationships between ocean bottom noise and the environment, *B. Seismol. Soc. Am.*, **84**(6), 1991–2007.
- Bonnieux, S., Cazau, D., Mosser, S., Blay-Fornarino, M., Hello, Y. & Nolet, G., 2020. MeLa: A programming language for a new multidisciplinary oceanographic float, *Sensors*, **20**(21), 6081, doi: 10.3390/s20216081.
- Burky, A., Irving, J. C. E. & Simons, F. J., 2021. Instrument response removal and the 2020 M3.1 Marlboro, New Jersey, earthquake, *Seismol. Res. Lett.*, p. in press.
- Chave, A. D., Thomson, D. J. & Ander, M. E., 1987. On the robust estimation of power spectra, coherences, and transfer functions, *J. Geophys. Res.*, **92**(B1), 633–648, doi: 10.1029/JB092iB01p00633.
- Fox, C. G., Dziak, R. P., Matsumoto, H. & Schreiner, A. E., 1993. Potential for monitoring low-level seismicity on the Juan-de-Fuca ridge using military hydrophone arrays, *Mar. Tech. Soc. J.*, **27**(4), 22–30.
- Gualtieri, L., Stutzmann, E., Capdeville, Y., Arduin, F., Schimmel, M., Mangeny, A. & Morelli, A., 2013. Modelling secondary microseismic noise by normal mode summation, *Geophys. J. Int.*, **193**(3), 1732–1745, 10.1093/gji/ggt090.
- Gualtieri, L., Stutzmann, E., Farra, V., Capdeville, Y., Schimmel, M., Arduin, F. & Morelli, A., 2014. Modelling the ocean site effect on seismic noise body waves, *Geophys. J. Int.*, **197**(2), 1096–1106, 10.1093/gji/ggu042.
- Gualtieri, L., Camargo, S. J., Pascale, S., Pons, F. M. E. & Ekström, G., 2018. The persistent signature of tropical cyclones in ambient seismic noise, *Earth Planet. Sci. Lett.*, **484**, 287–294, doi: 10.1016/j.epsl.2017.12.026.

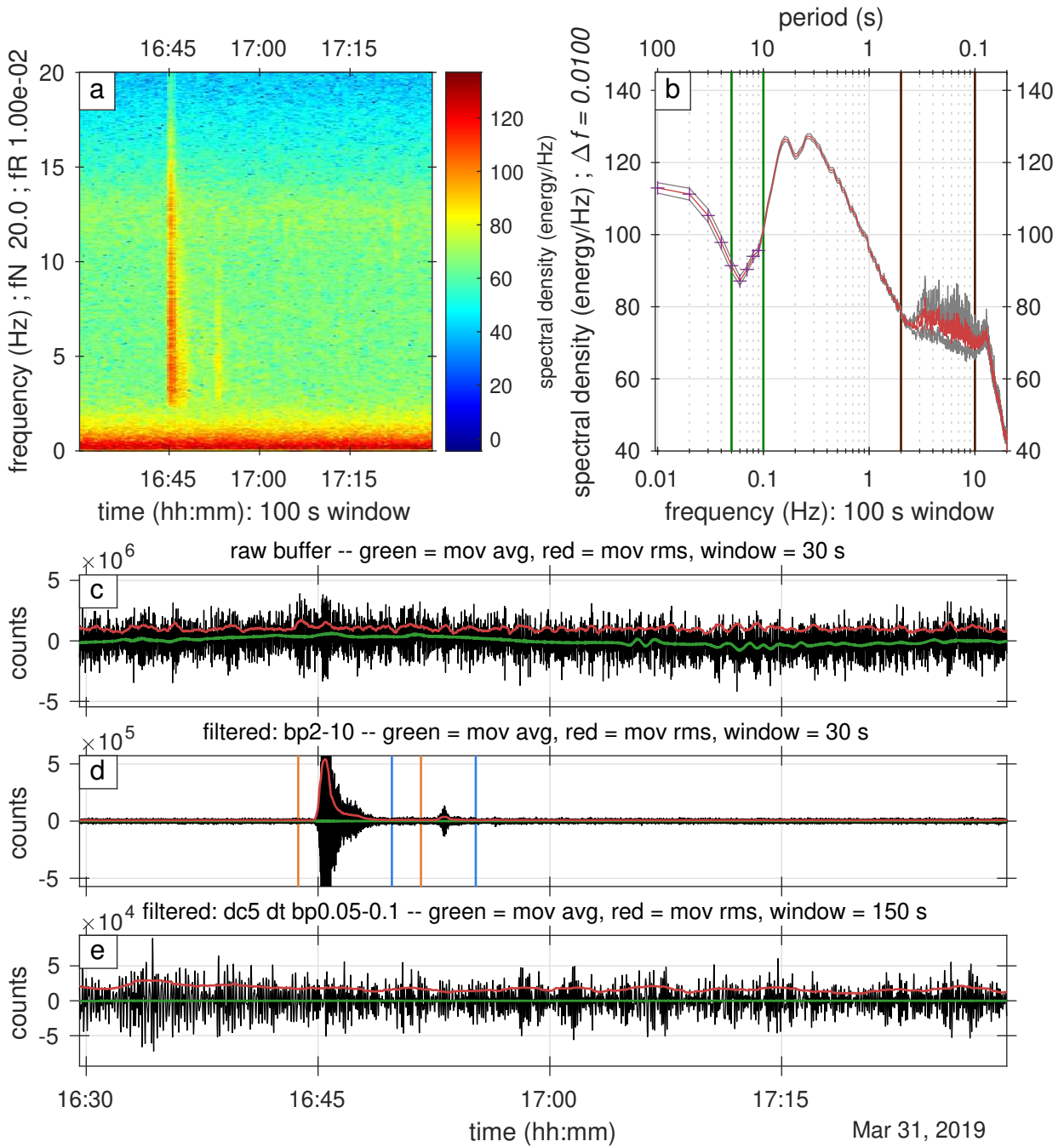


**Figure 8.** Correlation between ocean acoustic noise recorded by MERMAID P0023 and WAVEWATCH III sea-surface pressure over the year-long observation period. (a) Correlation coefficients in narrow frequency bins. The dashed black line links ocean-wave frequencies on the horizontal axis to acoustic-pressure frequencies on the vertical axis. Boxes marked *b*, *c*, and *d* are called out for analysis in the three panels to the right. (b) Energy time series in a portion of the band that lies on the frequency-doubling line. The WAVEWATCH III ocean-wave frequency band is 0.06–0.08 Hz and the MERMAID pressure frequency band 0.13–0.15 Hz. Their correlation coefficient is 0.559. (c) Another example for frequencies lying along the double frequency line, 0.21–0.23 Hz for WAVEWATCH III and 0.36–0.38 Hz for MERMAID. Their correlation coefficient is 0.845. (d) An example of the correlation coefficient off the frequency-doubling line, WAVEWATCH III in the 0.10–0.12 Hz band and MERMAID between 0.44–0.46 Hz. Their correlation coefficient is 0.150.

- Gualtieri, L., Bachmann, E., Simons, F. J. & Tromp, J., 2020. The origin of secondary microseism Love waves, *Proc. Natl. Acad. Sci.*, **117**(47), 29504–29511, doi: 10.1073/pnas.2013806117.
- Gualtieri, L., Bachmann, E., Simons, F. J. & Tromp, J., 2021. Generation of secondary microseism Love waves: effects of bathymetry, 3-D structure, and source seasonality, *Geophys. J. Int.*, **226**(1), 192–219, doi: 10.1093/gji/ggab095.
- Hasselmann, K., 1963. A statistical analysis of the generation of microseisms, *Rev. Geophys.*, **1**(2), 177–210, doi: 10.1029/RG001i002p00177.
- Hello, Y. & Nolet, G., 2020. Floating seismographs (mermaids), in *Encyclopedia of Solid Earth Geophysics*, edited by H. K. Gupta, Encyclopedia of Earth Sciences, pp. 1–6, doi: 10.1007/978-3-030-10475-7\_248-1, Springer, New York.
- Joubert, C., Nolet, G., Sukhovich, A., Ogé, A., Argentino, J.-F. & Hello, Y., 2015. Hydrophone calibration at very low frequencies, *B. Seismol. Soc. Am.*, **105**(3), 1797–1802, doi: 10.1785/0120140265.
- Joubert, C., Nolet, G., Bonnieux, S., Deschamps, A., Dessa, J.-X. & Hello, Y., 2016. *P*-delays from floating seismometers (MERMAID), Part I: Data processing, *Seismol. Res. Lett.*, **87**(1), 73–80, doi: 10.1785/0220150111.
- Kennett, B. L. N., Engdahl, E. R. & Buland, R., 1995. Constraints on seismic velocities in the Earth from travel-times, *Geophys. J. Int.*, **122**(1), 108–124, doi: 10.1111/j.1365-246X.1995.tb03540.x.
- Kerman, B. R., 1993. *Natural Physical Sources of Underwater Sound: Sea Surface Sound (2)*, Springer, Dordrecht, Neth.
- Longuet-Higgins, M. S., 1950. A theory of the origin of microseisms, *Phil. Trans. R. Soc. London, Ser. A*, **243**(857), 1–35, doi: 10.1098/rsta.1950.0012.
- Marra, G., Clivati, C., Luckett, R., Tampellini, A., Kronjäger, J., Wright, L., Mura, A., Levi, F., Robinson, S., Xuereb, A., Baprie, B. & Calonico, D., 2018. Ultrastable laser interferometry for earthquake detection with terrestrial and submarine cables, *Science*, **361**(6401), 486–490, 10.1126/science.aat4458.
- Metz, D., Watts, A. B., Grevemeyer, I., Rodgers, M. & Paulatto, M., 2016. Ultra-long-range hydroacoustic observations of submarine volcanic activity at Monowai, Kermadec arc, *Geophys. Res. Lett.*, **43**(4), 1529–1536, 10.1002/2015GL067259.
- Nakata, N., Gualtieri, L. & Fichtner, A., 2019. *Seismic Ambient Noise*, Cambridge Univ. Press, Cambridge, UK.
- Nolet, G., Hello, Y., van der Lee, S., Bonnieux, S., Ruiz, M. C., Pazmino, N. A., Deschamps, A., Regnier, M. M., Font, Y., Chen, Y. J. & Simons, F. J., 2019. Imaging the Galápagos mantle plume with an unconventional application of floating seismometers, *Sci. Rep.*, **9**, 1326, doi: 10.1038/s41598-018-36835-w.
- Ritsema, J. & Lekić, V., 2020. Heterogeneity of seismic wave velocity in Earth’s mantle, *Annu. Rev. Earth. Planet. Sci.*, **48**, 377–401, doi: 10.1146/annurev-earth-082119-065909.
- Romanowicz, B., 2008. Using seismic waves to image Earth’s structure, *Nature*, **451**, 266–268, doi: 10.1038/nature06583.
- Simon, J. D., Simons, F. J. & Nolet, G., 2020. Multiscale estimation of event arrival times and their uncertainties in hydroacoustic records from autonomous oceanic floats, *B. Seismol. Soc. Am.*, **110**(3), 970–997, doi: 10.1785/0120190173.
- Simon, J. D., Simons, F. J. & Irving, J. C. E., 2021. Recording earthquakes for tomographic imaging of the mantle beneath the South Pacific by autonomous MERMAID floats, *Geophys. J. Int.*, pp. in press, doi: 10.31223/X59C7N.
- Simon, J. D., Simons, F. J. & Irving, J. C. E., 2021. A MERMAID miscellany: Seismoacoustic signals beyond the *P* wave, *Seismol. Res. Lett.*, pp. 1–11, doi: 10.1785/022021005.
- Simons, F. J., Dando, B. D. E. & Allen, R. M., 2006. Automatic detection and rapid determination of earthquake magnitude by wavelet multiscale analysis of the primary arrival, *Earth Planet. Sci. Lett.*, **250**(1–2), 214–223, doi: 10.1016/j.epsl.2006.07.039.
- Simons, F. J., Nolet, G., Babcock, J. M., Davis, R. E. & Orcutt, J. A., 2006. A future for drifting seismic networks, *Eos Trans. AGU*, **87**(31), 305 & 307, doi: 10.1029/2006EO310002.

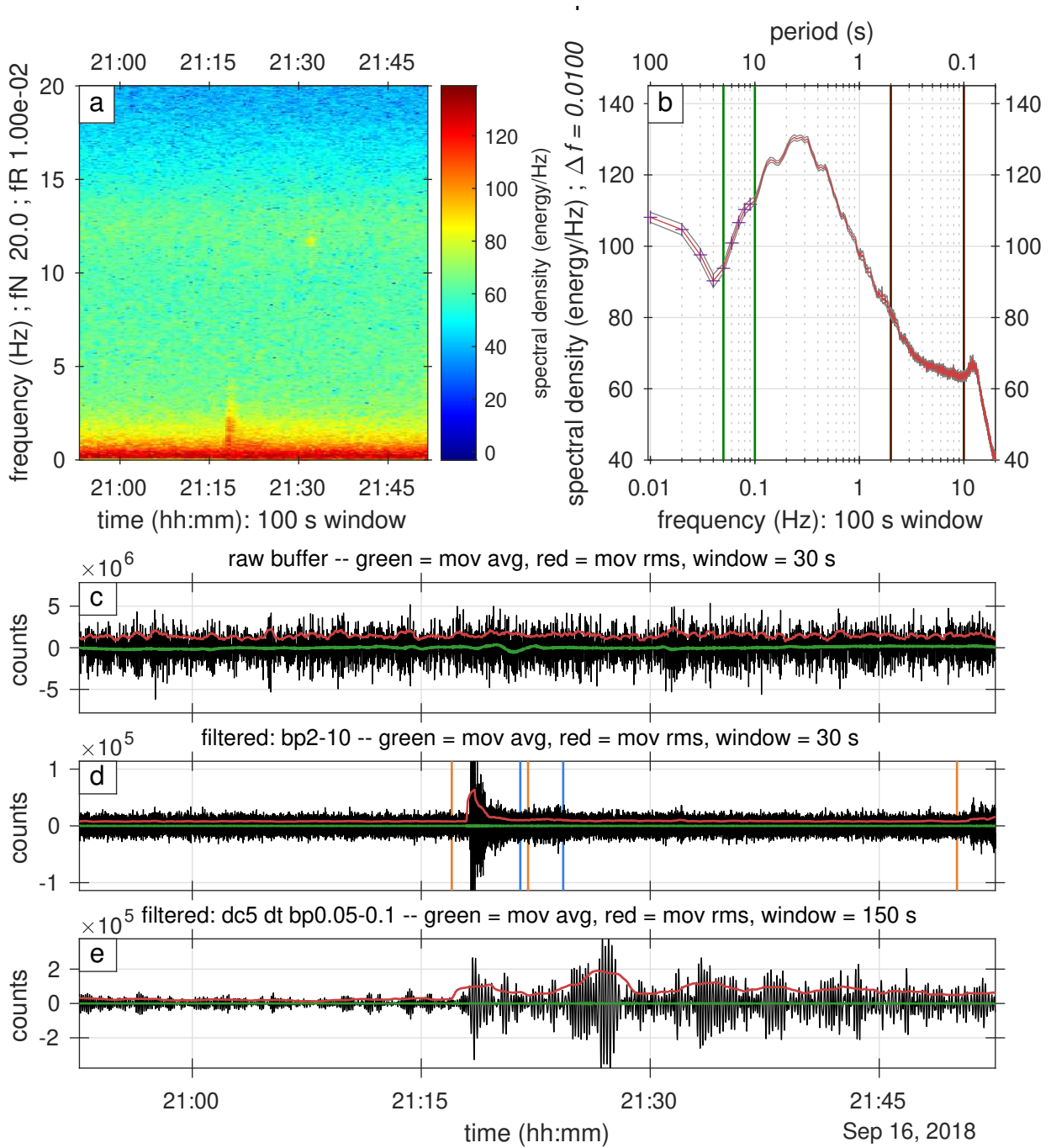
- Simons, F. J., Nolet, G., Georgief, P., Babcock, J. M., Regier, L. A. & Davis, R. E., 2009. On the potential of recording earthquakes for global seismic tomography by low-cost autonomous instruments in the oceans, *J. Geophys. Res.*, **114**, B05307, doi: 10.1029/2008JB006088.
- Simons, F. J., Simon, J. D. & Pipatprathanporn, S., 2021. Twenty-thousand leagues under the sea: Recording earthquakes with autonomous floats, *Acoustics Today*, **17**(2), 42–51, doi: 10.1121/AT.2021.17.2.42.
- Stephen, R. A., Spiess, F. N., Collins, J. A., Hildebrand, J. A., Orcutt, J. A., Peal, K. R., Vernon, F. L. & Wooding, F. B., 2003. Ocean Seismic Network Pilot Experiment, *Geochem. Geophys. Geosys.*, **4**(10), 1092, doi: 10.1029/2002GC000485.
- Sukhovich, A., Irisson, J.-O., Simons, F. J., Ogé, A., Hello, Y. M., Deschamps, A. & Nolet, G., 2011. Automatic discrimination of underwater acoustic signals generated by teleseismic *P*-waves: A probabilistic approach, *Geophys. Res. Lett.*, **38**(18), L18605, doi: 10.1029/2011GL048474.
- Sukhovich, A., Bonnieux, S., Hello, Y., Irisson, J.-O., Simons, F. J. & Nolet, G., 2015. Seismic monitoring in the oceans by autonomous floats, *Nat. Commun.*, **6**(1), 1–6, doi: 10.1038/ncomms9027.
- Talandier, J. & Okal, E. A., 2001. Identification criteria for sources of *T* waves recorded in French Polynesia, in *Monitoring the Comprehensive Nuclear-Test-Ban Treaty: Hydroacoustics*, edited by C. deGroot Hedlin & J. Orcutt, vol. 158, pp. 567–603, doi: 10.1007/978-3-0348-8270-5\_7, Birkhäuser, Basel.
- Talandier, J., Hyvernaud, O. & Maury, R. C., 2016. Unusual seismic activity in 2011 and 2013 at the submarine volcano Rocard, Society hot spot (French Polynesia), *Geophys. Res. Lett.*, **43**(9), 4247–4254, doi: 10.1002/2016GL068342.
- Tolman, L. H., 2009. User manual and system documentation of WAVEWATCH III (TM) version 3.14, Tech. Rep. 276, Environmental Modeling Center, Marine Modeling and Analysis Branch.
- Tromp, J., 2020. Seismic wavefield imaging of Earth’s interior across scales, *Nat. Rev. Earth Env.*, **1**, 40–53, doi: 10.1038/s43017-019-0003-8.
- WAVEWATCH III Development Group, 2019, User manual and system documentation of WAVEWATCH III version 6.07, Tech. Rep. 333, Environmental Modeling Center, Marine Modeling and Analysis Branch.
- Webb, S. C., 1998. Broadband seismology and noise under the ocean, *Rev. Geophys.*, **36**(1), 105–142, doi: 10.1029/97RG02287.
- Williams, E. F., Fernández-Ruiz, M. R., Magalhaes, R., Vanthillo, R., Zhan, Z., González-Herráez, M. & Martins, H. F., 2019. Distributed sensing of microseisms and teleseisms with submarine dark fibers, *Nat. Commun.*, **10**(1), 5778, doi: 10.1038/s41467-019-13262-7.

## APPENDIX A: APPENDIX



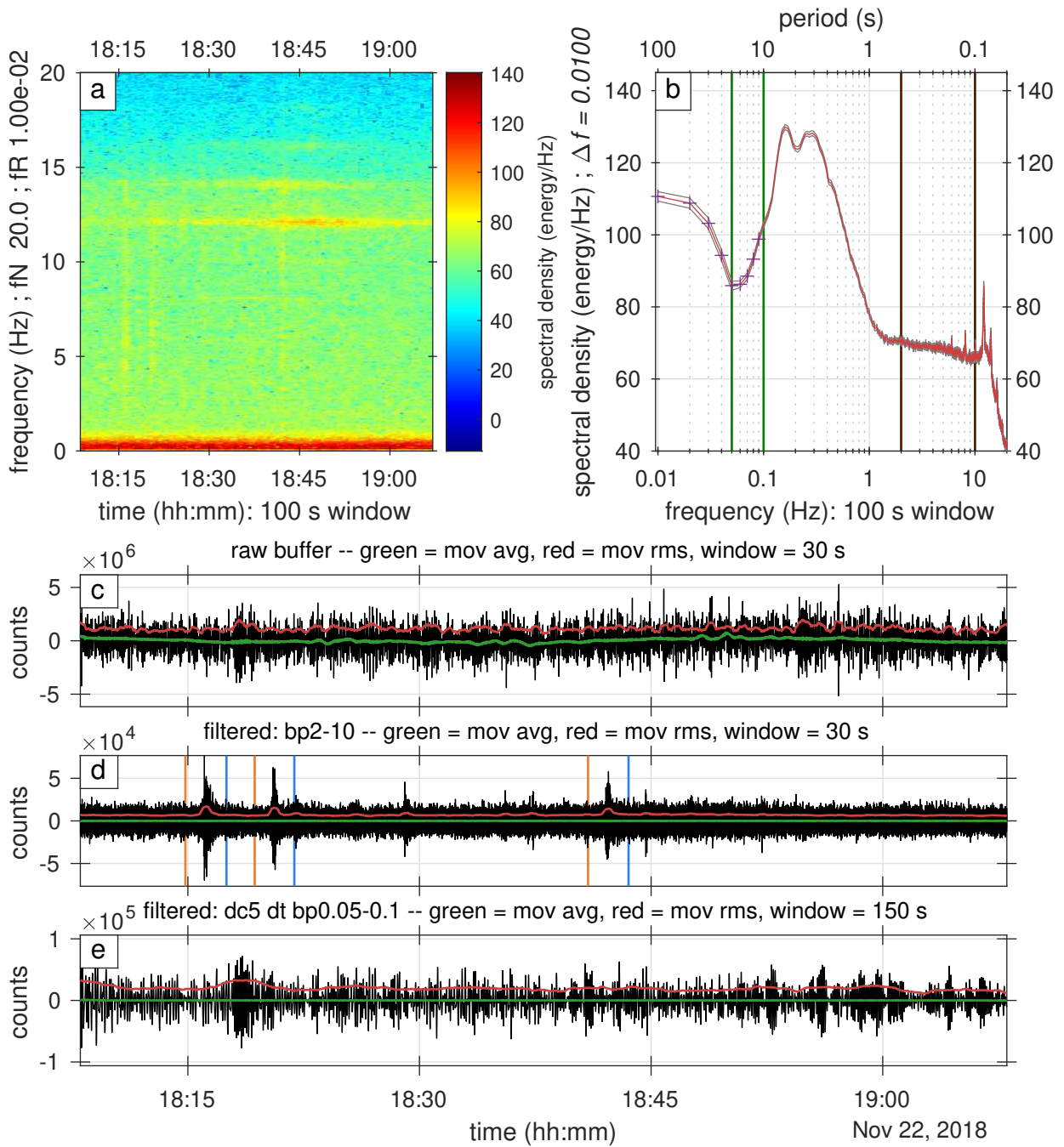
**Figure A1.** An isolated *T* phase. (a) Spectrogram. (b) spectral density. (c) Raw signal. (d) Filtered signal 2—10 Hz. (e) Filtered signal 0.05—0.1 Hz. The green and red lines in (c)–(e) are moving averages and moving root mean-squared values. The orange and blue vertical lines are the beginnings and the ends of the sections removed as discussed in Section 3.2.



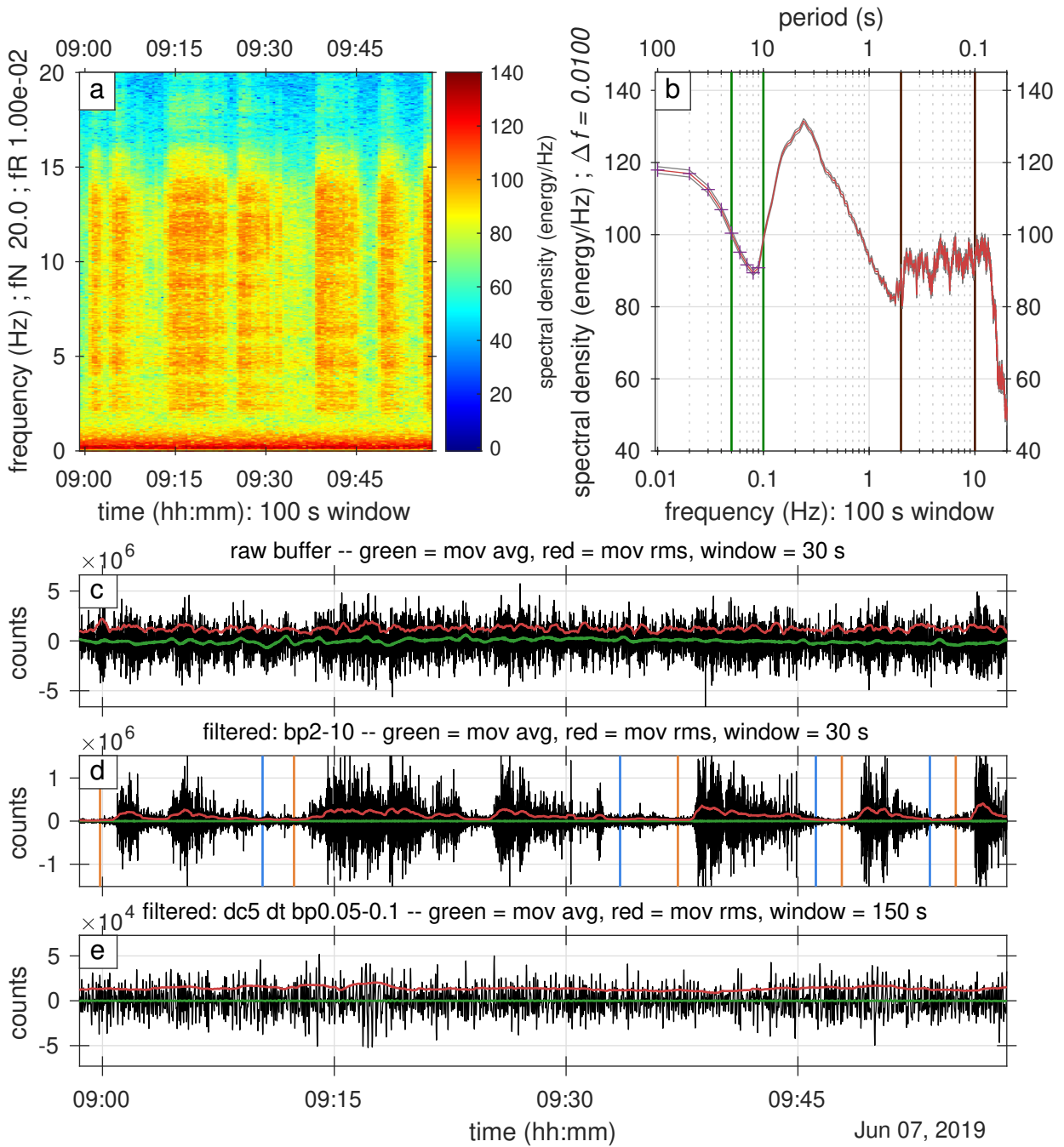


**Figure A2.** An hour-long section containing an earthquake arrival from the magnitude 6.5 south of Fiji Islands earthquake on 16 September 2018 at 21:11:48.820 UTC. Layout and labeling as in Fig. A1.





**Figure A3.** An hour-long section containing ship noise, marked by horizontal stripes in the spectrogram, and narrow harmonic peaks in the spectral density. Layout and labeling as in Fig. A1.



**Figure A4.** An hour-long section within a swarm period from 6 June 2019, 02:00 UTC to 10 June 2019, 01:30 UTC. Layout and labeling as in Fig. A1.

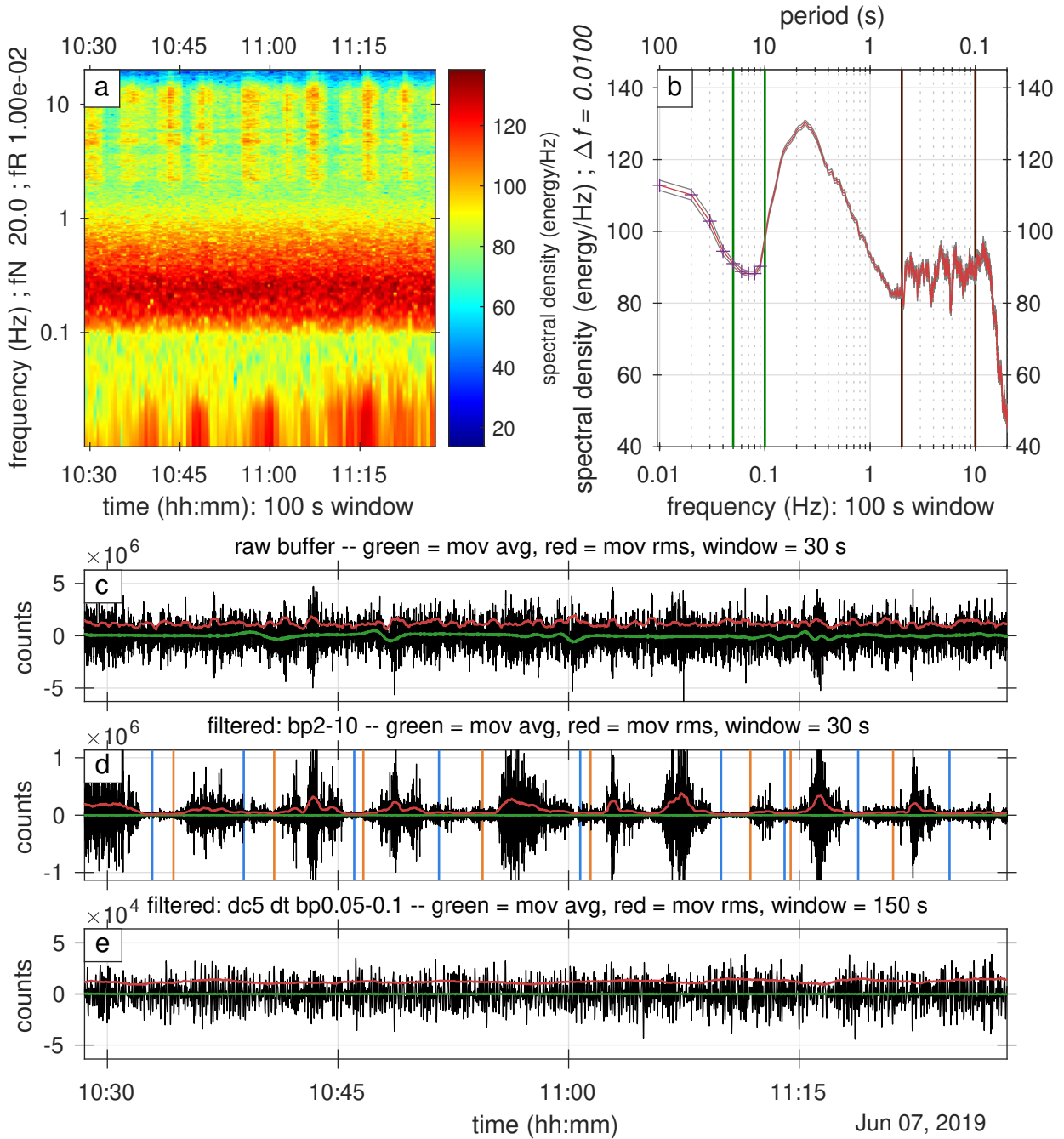
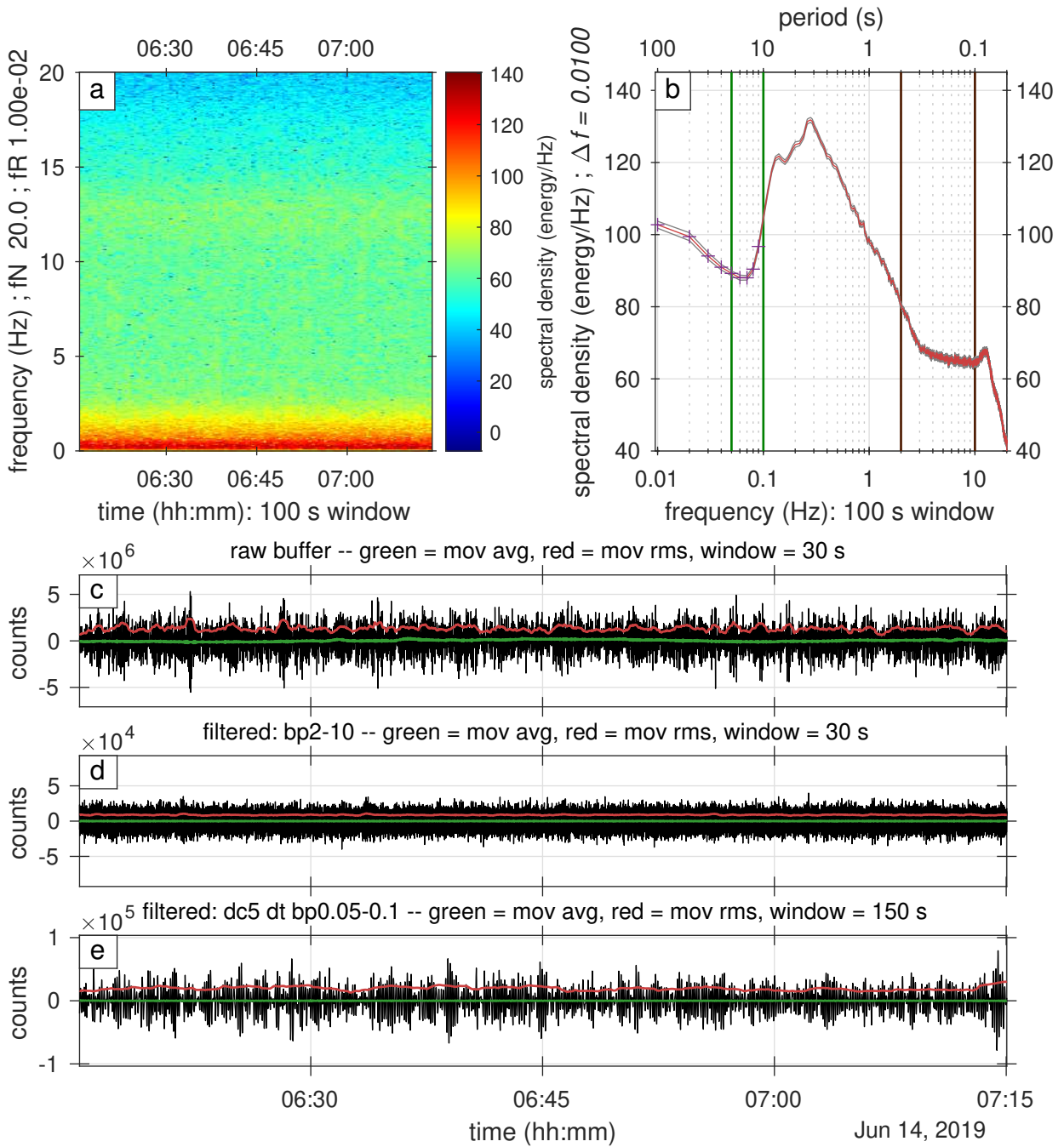
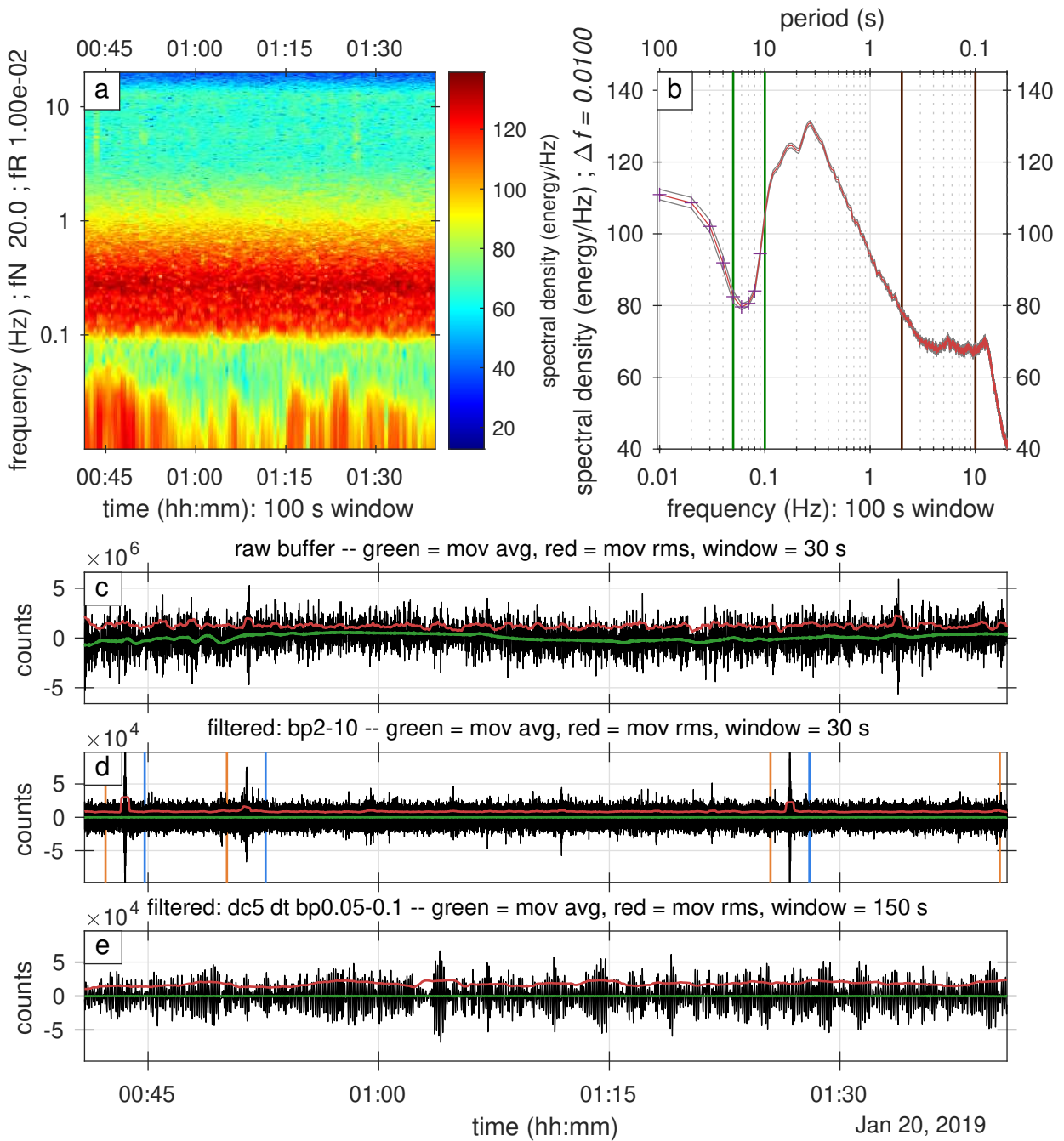


Figure A5. An hour-long section within a swarm period, on a logarithmic frequency axis, for comparison with Fig A4. Layout and labeling as in Fig. A1.

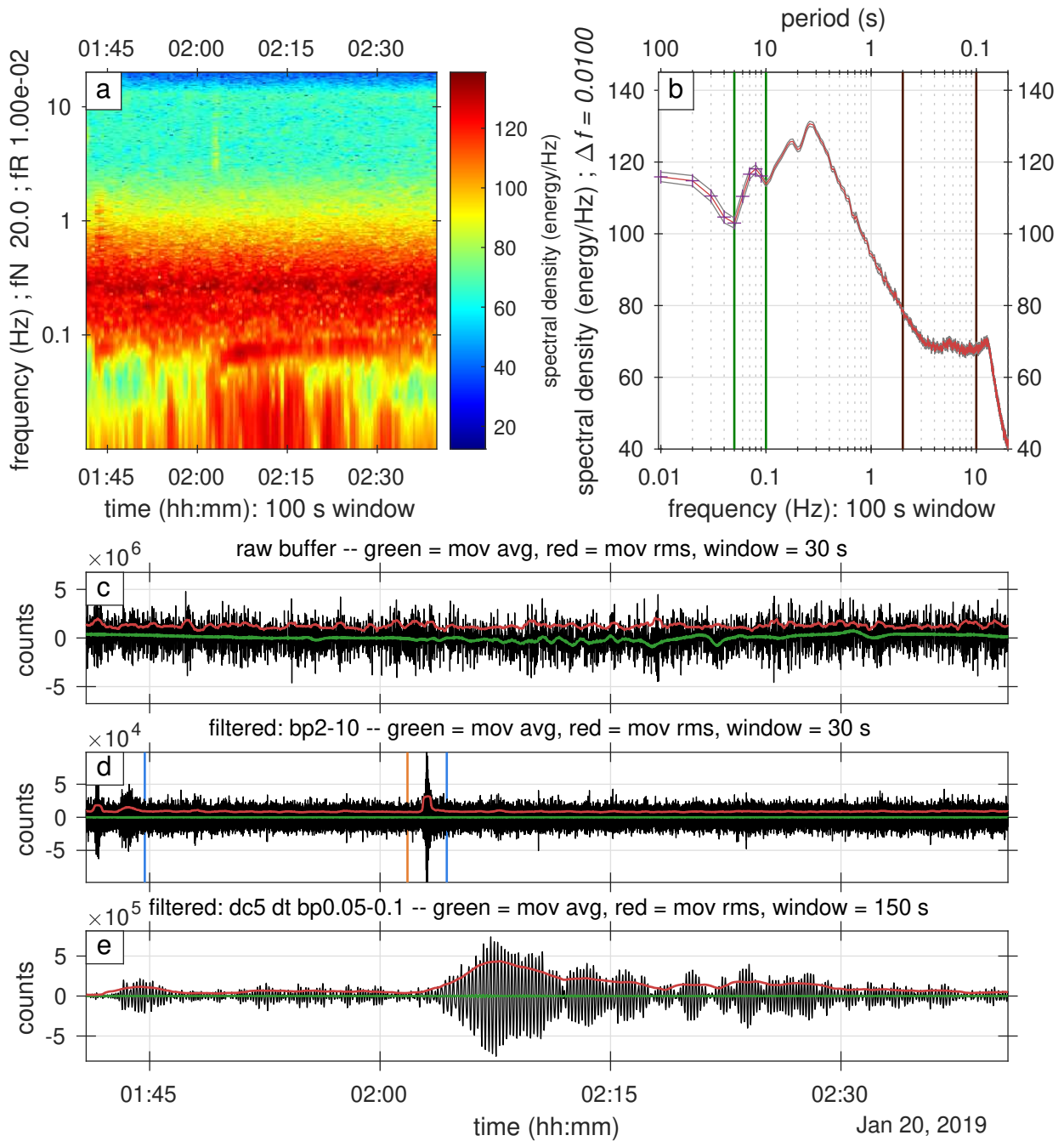


**Figure A6.** An hour-long section without transients, that is, only infrasonic ambient noise. Layout and labeling as in Fig. A1.



**Figure A7.** Another hour without transients (i.e., the hour before the event shown in Fig. 2 and Fig. A8), on a logarithmic frequency scale, for comparison with Fig. A6. Layout and labeling as in Fig. A1.





**Figure A8.** Another version of the event shown in Fig. 2, now drawn without the background noise curve. Layout and labeling as in Fig. A1.



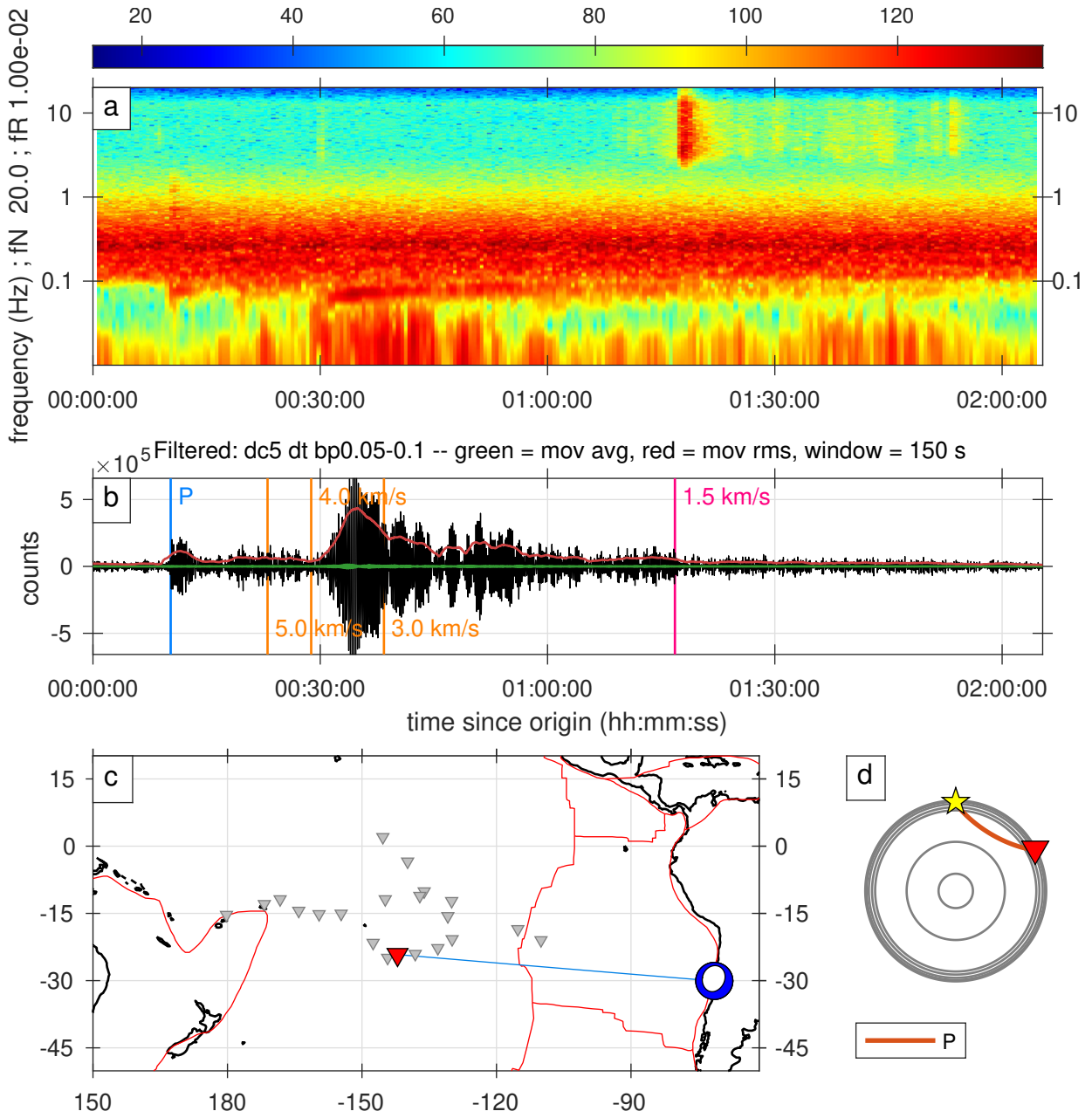


Figure A9. The full record of the signature earthquake Fig. 2, for comparison with Figs. 3 and 4.

# Supplementary Material 1:

## One year of sound recorded by a MERMAID float in the Pacific: Hydroacoustic earthquake signals and infrasonic ambient noise

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28 July 2021

In this Supplement we list all the identified events in order of tag, which is a combination of rating and arrival type, and then chronologically. The ratings are DET, REQ, 3stars, 2star, and 1stars. The first two ratings, DET and REQ, apply to events that we have the time series and know that they contain earthquake signals prior to searching for the missing earthquake signals. DET means the event is reported by the instrument automatically after it receives *P* wave arrivals. REQ means the event which the time series has been requested prior to its work. Therefore, we know that these time series contain potential earthquake signals. The other ratings apply to the events manually found by us in the buffer. More stars indicate the more outstanding signals from the background level. The arrival types are *body* and *surface*. For *body* type events, we match the events whose expected body wave arrival times fell within three minutes from the times that we have identified in our time series. We computed the body expected arrival times using the ak135 velocity model. For *surface* type events, we match the events whose surface wave arrival would imply a speed between 3–5 km/s. The ratings for the body wave type are \*\*\*, \*\*, and \* for surface waves which correspond to 3stars, 2stars, and 1stars. The ratings for the surface wave type are S3, S2, and S1 for surface waves which correspond to 3stars, 2stars, and 1star, respectively. All events are sorted by tag form DET, REQ, 3stars (\*\*\*, S3), 2stars (\*\*, S2), and 1star (\*, S1) where the parentheses indicate equal ranking.

Each listed identified events contain the arrival time we identified in the time series, tag, arrival type, IRIS event ID, event's origin time and location (latitude, longitude, and depth), the magnitude with the magnitude type, station location (latitude and longitude), the epicentral distance, and the expected *P* and *S* wave arrival times. All latitudes, longitudes, and distance are in degrees. All times are in yyyy-mm-dd hh:mm:ss.sss format.

The catalog is provided by the Incorporated Research Institutions for Seismology (IRIS) Data Management Center (DMC).

Event number 1

Picked arrival: 2018-11-18 20:32:00.000

Tag : DET

Arrival type : body

Event parameters

IRIS Event ID : 10972756

Origin time : 2018-11-18 20:25:46.590

Latitude : -17.8735

Longitude : -178.9273

Depth : 540.0000

Magnitude : 6.80 Mww

Station parameters

Latitude : -24.0200

Longitude : -140.9600

Distance : 35.8776

Phase parameters ak135

Phase Travel time Expected arrival time

P 374.5523 2018-11-18 20:32:01.142

S 674.1316 2018-11-18 20:37:00.721

-----

2

Event number 2

Picked arrival: 2018-11-30 17:42:00.000

Tag : DET

Arrival type : body

Event parameters

IRIS Event ID : 10976411

Origin time : 2018-11-30 17:29:29.330

Latitude : 61.3464

Longitude : -149.9552

Depth : 46.7000

Magnitude : 7.00 mww

Station parameters

Latitude : -23.9900

Longitude : -141.0900

Distance : 85.6372

Phase parameters ak135

Phase Travel time Expected arrival time

P 753.5483 2018-11-30 17:42:02.878

S 1382.1568 2018-11-30 17:52:31.486

-----

Event number 3

Picked arrival: 2018-12-05 04:26:35.000

Tag : DET

Arrival type : body

Event parameters

IRIS Event ID : 10980271

Origin time : 2018-12-05 04:18:08.400

Latitude : -21.9568

Longitude : 169.4179

Depth : 10.0000

Magnitude : 7.50 Mww

Station parameters

Latitude : -23.9900

Longitude : -141.1600

Distance : 45.3152

Phase parameters ak135

Phase Travel time Expected arrival time

P 498.0299 2018-12-05 04:26:26.429

S 898.5665 2018-12-05 04:33:06.966

-----

4

Event number 4

Picked arrival: 2018-12-11 02:38:40.000

Tag : DET

Arrival type : body

Event parameters

IRIS Event ID : 10983619

Origin time : 2018-12-11 02:26:32.730

Latitude : -58.5981

Longitude : -26.4656

Depth : 164.6600

Magnitude : 7.10 mww

Station parameters

Latitude : -24.0100

Longitude : -141.2500

Distance : 81.5019

Phase parameters ak135

Phase Travel time Expected arrival time

P 718.8821 2018-12-11 02:38:31.612

S 1316.7266 2018-12-11 02:48:29.456

-----



Event number 5  
Picked arrival: 2018-12-23 23:14:45.000  
Tag : DET  
Arrival type : body

Event parameters

IRIS Event ID : 10988734  
Origin time : 2018-12-23 23:08:43.340  
Latitude : -20.2873  
Longitude : -175.0923  
Depth : 113.0000  
Magnitude : 6.40 mww

Station parameters

Latitude : -24.0400  
Longitude : -141.4500  
Distance : 31.3082

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	369.3536	2018-12-23 23:14:52.693
	S	667.9228	2018-12-23 23:19:51.262

---

6

Event number 6

Picked arrival: 2019-01-20 01:43:00.000

Tag : DET

Arrival type : body

Event parameters

IRIS Event ID : 10997608

Origin time : 2019-01-20 01:32:51.850

Latitude : -30.0710

Longitude : -71.4202

Depth : 54.8200

Magnitude : 6.70 mww

Station parameters

Latitude : -24.1900

Longitude : -142.0700

Distance : 62.1676

Phase parameters ak135

Phase Travel time Expected arrival time

P 615.5213 2019-01-20 01:43:07.371

S 1116.8725 2019-01-20 01:51:28.722

-----

Event number 7  
Picked arrival: 2019-02-22 10:27:55.000  
Tag : DET  
Arrival type : body

Event parameters

IRIS Event ID : 11007849  
Origin time : 2019-02-22 10:17:22.410  
Latitude : -2.1990  
Longitude : -77.0231  
Depth : 132.3600  
Magnitude : 7.50 mww

Station parameters

Latitude : -24.3300  
Longitude : -142.4500  
Distance : 66.7683

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	637.0342	2019-02-22 10:27:59.444
	S	1158.6117	2019-02-22 10:36:41.021

---

8

Event number 8

Picked arrival: 2019-03-01 09:01:00.000

Tag : DET

Arrival type : body

Event parameters

IRIS Event ID : 11010219

Origin time : 2019-03-01 08:50:42.620

Latitude : -14.7016

Longitude : -70.1350

Depth : 267.0000

Magnitude : 7.00 mww

Station parameters

Latitude : -24.3800

Longitude : -142.4800

Distance : 68.1637

Phase parameters ak135

Phase Travel time Expected arrival time

P 631.5244 2019-03-01 09:01:14.144

S 1149.5468 2019-03-01 09:09:52.166

-----

Event number 9

Picked arrival: 2019-05-06 21:30:30.000

Tag : DET

Arrival type : body

Event parameters

IRIS Event ID : 11034341

Origin time : 2019-05-06 21:19:37.981

Latitude : -6.9730

Longitude : 146.4505

Depth : 146.0000

Magnitude : 7.10 mww

Station parameters

Latitude : -24.1700

Longitude : -143.2100

Distance : 69.2440

Phase parameters ak135

Phase Travel time Expected arrival time

P 651.0118 2019-05-06 21:30:28.992

S 1185.3917 2019-05-06 21:39:23.372

-----

10

Event number 10

Picked arrival: 2019-05-26 07:52:10.000

Tag : DET

Arrival type : body

Event parameters

IRIS Event ID : 11041250

Origin time : 2019-05-26 07:41:15.058

Latitude : -5.8132

Longitude : -75.2775

Depth : 122.4000

Magnitude : 8.00 Mww

Station parameters

Latitude : -24.0400

Longitude : -143.4000

Distance : 67.6779

Phase parameters ak135

Phase Travel time Expected arrival time

P 643.8708 2019-05-26 07:51:58.928

S 1171.4285 2019-05-26 08:00:46.486

-----

Event number 11  
Picked arrival: 2018-10-10 20:59:00.000  
Tag : REQ  
Arrival type : body

Event parameters

IRIS Event ID : 10957936  
Origin time : 2018-10-10 20:48:20.750  
Latitude : -5.7078  
Longitude : 151.2197  
Depth : 45.0500  
Magnitude : 7.00 mww

Station parameters

Latitude : -24.0400  
Longitude : -140.9200  
Distance : 67.4812

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	651.1530	2018-10-10 20:59:11.903
	S	1184.0860	2018-10-10 21:08:04.835

---



12

Event number 12

Picked arrival: 2018-10-10 23:29:00.000

Tag : REQ

Arrival type : body

Event parameters

IRIS Event ID : 10957985

Origin time : 2018-10-10 23:16:02.130

Latitude : 49.2902

Longitude : 156.2968

Depth : 20.0000

Magnitude : 6.50 mww

Station parameters

Latitude : -24.0400

Longitude : -140.9200

Distance : 92.0844

Phase parameters ak135

Phase Travel time Expected arrival time

P 787.7058 2018-10-10 23:29:09.835

S 1448.8930 2018-10-10 23:40:11.022

-----

Event number 13  
Picked arrival: 2018-10-16 00:36:35.000  
Tag : REQ  
Arrival type : body

Event parameters

IRIS Event ID : 10959899  
Origin time : 2018-10-16 00:28:12.710  
Latitude : -21.9362  
Longitude : 169.4899  
Depth : 10.0000  
Magnitude : 6.30 Mww

Station parameters

Latitude : -24.0000  
Longitude : -140.9100  
Distance : 45.4794

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	499.3307	2018-10-16 00:36:32.040
	S	900.9359	2018-10-16 00:43:13.645

---

14

Event number 14

Picked arrival: 2018-10-16 01:12:00.000

Tag : REQ

Arrival type : body

Event parameters

IRIS Event ID : 10959905

Origin time : 2018-10-16 01:03:43.090

Latitude : -21.7260

Longitude : 169.4867

Depth : 10.0000

Magnitude : 6.40 mww

Station parameters

Latitude : -24.0000

Longitude : -140.9100

Distance : 45.5287

Phase parameters ak135

Phase Travel time Expected arrival time

P 499.7209 2018-10-16 01:12:02.810

S 901.6467 2018-10-16 01:18:44.736

-----

Event number 15  
Picked arrival: 2018-11-15 20:14:40.000  
Tag : REQ  
Arrival type : body

Event parameters

IRIS Event ID : 10971760  
Origin time : 2018-11-15 20:02:22.920  
Latitude : -56.7065  
Longitude : -25.5460  
Depth : 15.0000  
Magnitude : 6.40 mww

Station parameters

Latitude : -24.0100  
Longitude : -140.9400  
Distance : 82.8147

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	743.5921	2018-11-15 20:14:46.512
	S	1361.3421	2018-11-15 20:25:04.262

---

16

Event number 16

Picked arrival: 2018-12-29 03:52:20.000

Tag : REQ

Arrival type : body

Event parameters

IRIS Event ID : 10990548

Origin time : 2018-12-29 03:39:09.740

Latitude : 5.8983

Longitude : 126.9209

Depth : 60.2100

Magnitude : 7.00 mww

Station parameters

Latitude : -24.0600

Longitude : -141.5800

Distance : 93.7646

Phase parameters ak135

Phase Travel time Expected arrival time

P 790.2772 2018-12-29 03:52:20.017

S 1454.8178 2018-12-29 04:03:24.557

-----

Event number 17  
Picked arrival: 2019-01-06 17:40:25.000  
Tag : REQ  
Arrival type : body

Event parameters

IRIS Event ID : 10993072  
Origin time : 2019-01-06 17:27:20.670  
Latitude : 2.2414  
Longitude : 126.7361  
Depth : 60.0000  
Magnitude : 6.60 mww

Station parameters

Latitude : -24.1100  
Longitude : -141.7800  
Distance : 92.2692

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	783.4112	2019-01-06 17:40:24.081
	S	1441.6521	2019-01-06 17:51:22.322

---

18

Event number 18

Picked arrival: 2019-01-22 05:24:30.000

Tag : REQ

Arrival type : body

Event parameters

IRIS Event ID : 10998150

Origin time : 2019-01-22 05:10:03.670

Latitude : -10.4663

Longitude : 119.0309

Depth : 27.0100

Magnitude : 6.40 Mww

Station parameters

Latitude : -24.2000

Longitude : -142.1100

Distance : 93.6504

Phase parameters ak135

Phase Travel time Expected arrival time

P 793.8895 2019-01-22 05:23:17.559

S 1461.0501 2019-01-22 05:34:24.720

-----



Event number 19  
Picked arrival: 2019-03-06 15:52:30.000  
Tag : REQ  
Arrival type : body

Event parameters

IRIS Event ID : 11011889  
Origin time : 2019-03-06 15:46:14.900  
Latitude : -32.0238  
Longitude : -177.8845  
Depth : 29.0000  
Magnitude : 6.40 Mww

Station parameters

Latitude : -24.4000  
Longitude : -142.5400  
Distance : 31.9129

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	382.8821	2019-03-06 15:52:37.782
	S	692.0554	2019-03-06 15:57:46.955

---

20

Event number 20

Picked arrival: 2019-04-02 21:48:00.000

Tag : REQ

Arrival type : body

Event parameters

IRIS Event ID : 11021706

Origin time : 2019-04-02 21:35:30.015

Latitude : 52.1675

Longitude : 178.0679

Depth : 7.9000

Magnitude : 6.40 mww

Station parameters

Latitude : -24.3000

Longitude : -142.7800

Distance : 83.7721

Phase parameters ak135

Phase Travel time Expected arrival time

P 749.7044 2019-04-02 21:47:59.719

S 1372.9879 2019-04-02 21:58:23.002

-----

Event number 21  
Picked arrival: 2018-09-16 21:18:05.000  
Tag : \*\*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10948555  
Origin time : 2018-09-16 21:11:48.820  
Latitude : -25.4210  
Longitude : 178.2059  
Depth : 576.0000  
Magnitude : 6.50 Mww

Station parameters

Latitude : -24.1600  
Longitude : -141.0800  
Distance : 36.8400

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	380.2737	2018-09-16 21:18:09.093
	S	684.3492	2018-09-16 21:23:13.169

---

Event number 22

Picked arrival: 2018-09-28 10:16:30.000

Tag : \*\*\*

Arrival type : body

Event parameters

IRIS Event ID : 10953070

Origin time : 2018-09-28 10:02:43.480

Latitude : -0.1781

Longitude : 119.8401

Depth : 10.0000

Magnitude : 7.50 Mww

Station parameters

Latitude : -24.1200

Longitude : -140.9700

Distance : 98.3079

Phase parameters ak135

Phase Travel time Expected arrival time

P 817.7831 2018-09-28 10:16:21.263

S 1505.8097 2018-09-28 10:27:49.289

-----

Event number 23  
Picked arrival: 2018-10-28 22:34:10.000  
Tag : \*\*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10965035  
Origin time : 2018-10-28 22:23:54.080  
Latitude : 12.9489  
Longitude : -90.3848  
Depth : 24.6900  
Magnitude : 6.10 Mww

Station parameters

Latitude : -23.9700  
Longitude : -140.8800  
Distance : 61.6104

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	615.3845	2018-10-28 22:34:09.464
	S	1116.0289	2018-10-28 22:42:30.108

---

24

Event number 24

Picked arrival: 2018-11-15 23:16:00.000

Tag : \*\*\*

Arrival type : body

Event parameters

IRIS Event ID : 10971868

Origin time : 2018-11-15 23:09:01.060

Latitude : -56.2363

Longitude : -122.0441

Depth : 10.0000

Magnitude : 6.30 Mww

Station parameters

Latitude : -24.0100

Longitude : -140.9400

Distance : 35.0562

Phase parameters ak135

Phase Travel time Expected arrival time

P 412.9913 2018-11-15 23:15:54.051

S 745.2812 2018-11-15 23:21:26.341

-----

Event number 25  
Picked arrival: 2018-11-22 16:13:20.000  
Tag : \*\*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10973739  
Origin time : 2018-11-22 16:07:05.380  
Latitude : -54.2047  
Longitude : -137.4990  
Depth : 10.0000  
Magnitude : 5.90 Mww

Station parameters

Latitude : -24.0100  
Longitude : -140.9900  
Distance : 30.3075

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	371.4488	2018-11-22 16:13:16.828
	S	671.4195	2018-11-22 16:18:16.799

---



26

Event number 26

Picked arrival: 2018-11-24 23:52:00.000

Tag : \*\*\*

Arrival type : body

Event parameters

IRIS Event ID : 10974269

Origin time : 2018-11-24 23:42:39.530

Latitude : -47.9039

Longitude : 165.4217

Depth : 10.0000

Magnitude : 5.80 Mww

Station parameters

Latitude : -24.0100

Longitude : -141.0200

Distance : 48.2657

Phase parameters ak135

Phase Travel time Expected arrival time

P 521.1267 2018-11-24 23:51:20.656

S 940.7530 2018-11-24 23:58:20.282

-----

Event number 27  
Picked arrival: 2018-12-19 01:45:00.000  
Tag : \*\*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10986932  
Origin time : 2018-12-19 01:37:40.500  
Latitude : -36.1378  
Longitude : -101.0723  
Depth : 10.0000  
Magnitude : 6.30 Mww

Station parameters

Latitude : -24.0100  
Longitude : -141.3400  
Distance : 36.5954

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	426.1928	2018-12-19 01:44:46.692
	S	768.8755	2018-12-19 01:50:29.375

---

28

Event number 28

Picked arrival: 2018-12-20 17:15:00.000

Tag : \*\*\*

Arrival type : body

Event parameters

IRIS Event ID : 10987513

Origin time : 2018-12-20 17:01:55.150

Latitude : 55.0999

Longitude : 164.6993

Depth : 16.5600

Magnitude : 7.30 mww

Station parameters

Latitude : -24.0200

Longitude : -141.3700

Distance : 91.4989

Phase parameters ak135

Phase Travel time Expected arrival time

P 785.5704 2018-12-20 17:15:00.720

S 1444.5690 2018-12-20 17:25:59.718

-----

Event number 29  
Picked arrival: 2019-01-15 18:15:20.000  
Tag : \*\*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10996154  
Origin time : 2019-01-15 18:06:34.290  
Latitude : -13.3312  
Longitude : 166.8787  
Depth : 35.0000  
Magnitude : 6.60 mww

Station parameters

Latitude : -24.1700  
Longitude : -141.9800  
Distance : 49.3538

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	525.8405	2019-01-15 18:15:20.130
	S	950.0711	2019-01-15 18:22:24.361

---

Event number 30

Picked arrival: 2019-01-22 19:16:00.000

Tag : \*\*\*

Arrival type : body

Event parameters

IRIS Event ID : 10998373

Origin time : 2019-01-22 19:01:43.580

Latitude : -43.1219

Longitude : 42.3568

Depth : 13.0000

Magnitude : 6.70 Mww

Station parameters

Latitude : -24.2000

Longitude : -142.1200

Distance : 112.5520

Phase parameters ak135

Phase Travel time Expected arrival time

Pdiff 880.6424 2019-01-22 19:16:24.222

SKIKS 1547.7719 2019-01-22 19:27:31.351

Sdiff 1623.8994 2019-01-22 19:28:47.479

---

Event number 31  
Picked arrival: 2019-04-16 09:38:30.000  
Tag : S3  
Arrival type : surface

Event parameters

IRIS Event ID : 11026352  
Origin time : 2019-04-16 09:22:32.921  
Latitude : -31.1808  
Longitude : -179.0887  
Depth : 10.0000  
Magnitude : 5.80 Mww

Station parameters

Latitude : -24.2700  
Longitude : -142.9300  
Distance : 32.5938

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	391.5751	2019-04-16 09:29:04.496
	S	707.1606	2019-04-16 09:34:20.081

---

Event number 32

Picked arrival: 2019-05-14 13:09:15.000

Tag : \*\*\*

Arrival type : body

Event parameters

IRIS Event ID : 11037207

Origin time : 2019-05-14 12:58:26.074

Latitude : -4.0810

Longitude : 152.5694

Depth : 10.0000

Magnitude : 7.50 Mww

Station parameters

Latitude : -24.1200

Longitude : -143.2500

Distance : 64.8123

Phase parameters ak135

Phase Travel time Expected arrival time

P 638.8976 2019-05-14 13:09:04.971

S 1159.7959 2019-05-14 13:17:45.869

-----

Event number 33  
Picked arrival: 2019-05-30 09:14:00.000  
Tag : \*\*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11042482  
Origin time : 2019-05-30 09:03:28.971  
Latitude : 13.1462  
Longitude : -89.3663  
Depth : 25.0000  
Magnitude : 6.60 Mww

Station parameters

Latitude : -24.0000  
Longitude : -143.4500  
Distance : 64.5745

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	635.0191	2019-05-30 09:14:03.990
	S	1153.0230	2019-05-30 09:22:41.994

---



34

Event number 34

Picked arrival: 2019-06-02 10:42:20.000

Tag : \*\*\*

Arrival type : body

Event parameters

IRIS Event ID : 11043682

Origin time : 2019-06-02 10:36:29.659

Latitude : -21.2091

Longitude : -173.9076

Depth : 10.0000

Magnitude : 6.00 Mww

Station parameters

Latitude : -23.9700

Longitude : -143.4800

Distance : 28.1748

Phase parameters ak135

Phase Travel time Expected arrival time

P 352.5336 2019-06-02 10:42:22.192

S 637.9074 2019-06-02 10:47:07.566

-----

Event number 35  
Picked arrival: 2019-06-14 00:29:40.000  
Tag : \*\*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11048697  
Origin time : 2019-06-14 00:19:12.401  
Latitude : -30.0557  
Longitude : -72.0819  
Depth : 11.0000  
Magnitude : 6.40 Mww

Station parameters

Latitude : -23.9200  
Longitude : -143.5600  
Distance : 62.9730

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	626.6234	2019-06-14 00:29:39.024
	S	1136.6903	2019-06-14 00:38:09.091

---

36

Event number 36

Picked arrival: 2019-06-15 22:02:00.000

Tag : \*\*\*

Arrival type : body

Event parameters

IRIS Event ID : 11049511

Origin time : 2019-06-15 21:56:10.835

Latitude : -21.1807

Longitude : -174.1690

Depth : 13.0000

Magnitude : 6.10 Mww

Station parameters

Latitude : -23.9500

Longitude : -143.5400

Distance : 28.3646

Phase parameters ak135

Phase Travel time Expected arrival time

P 353.7675 2019-06-15 22:02:04.602

S 640.1410 2019-06-15 22:06:50.975

-----

Event number 37  
Picked arrival: 2019-06-15 23:01:19.842  
Tag : \*\*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11049517  
Origin time : 2019-06-15 22:55:04.132  
Latitude : -30.6440  
Longitude : -178.1060  
Depth : 46.0000  
Magnitude : 7.30 Mww

Station parameters

Latitude : -23.9700  
Longitude : -143.5400  
Distance : 31.3014

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	375.6700	2019-06-15 23:01:19.801
	S	679.2982	2019-06-15 23:06:23.430

---

38

Event number 38

Picked arrival: 2019-06-16 05:23:30.000

Tag : \*\*\*

Arrival type : body

Event parameters

IRIS Event ID : 11049599

Origin time : 2019-06-16 05:17:16.244

Latitude : -31.0690

Longitude : -178.0827

Depth : 31.5200

Magnitude : 6.30 Mww

Station parameters

Latitude : -23.9600

Longitude : -143.5400

Distance : 31.3154

Phase parameters ak135

Phase Travel time Expected arrival time

P 377.3013 2019-06-16 05:23:33.545

S 682.1756 2019-06-16 05:28:38.419

-----

Event number 39  
Picked arrival: 2019-06-17 06:08:15.000  
Tag : \*\*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11049903  
Origin time : 2019-06-17 06:02:05.750  
Latitude : -30.9381  
Longitude : -177.5972  
Depth : 16.0000  
Magnitude : 6.00 Mww

Station parameters

Latitude : -23.9800  
Longitude : -143.5300  
Distance : 30.8917

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	375.6952	2019-06-17 06:08:21.445
	S	679.0669	2019-06-17 06:13:24.816

---

40

Event number 40

Picked arrival: 2019-06-18 16:11:20.000

Tag : \*\*\*

Arrival type : body

Event parameters

IRIS Event ID : 11050483

Origin time : 2019-06-18 16:05:17.442

Latitude : -31.0214

Longitude : -177.5541

Depth : 15.0000

Magnitude : 5.90 Mww

Station parameters

Latitude : -24.0100

Longitude : -143.5200

Distance : 30.8595

Phase parameters ak135

Phase Travel time Expected arrival time

P 375.5640 2019-06-18 16:11:33.005

S 678.8146 2019-06-18 16:16:36.256

-----

Event number 41  
Picked arrival: 2019-06-19 07:08:00.000  
Tag : \*\*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11050823  
Origin time : 2019-06-19 07:01:42.801  
Latitude : -30.6004  
Longitude : -177.7870  
Depth : 10.0000  
Magnitude : 6.40 Mww

Station parameters

Latitude : -24.0200  
Longitude : -143.5200  
Distance : 31.0247

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	377.7852	2019-06-19 07:08:00.586
	S	682.6610	2019-06-19 07:13:05.462

---



42

Event number 42

Picked arrival: 2019-06-19 17:36:50.000

Tag : \*\*\*

Arrival type : body

Event parameters

IRIS Event ID : 11050987

Origin time : 2019-06-19 17:24:48.833

Latitude : -2.2430

Longitude : 138.4599

Depth : 10.0000

Magnitude : 6.30 Mww

Station parameters

Latitude : -24.0300

Longitude : -143.5100

Distance : 78.1579

Phase parameters ak135

Phase Travel time Expected arrival time

P 719.4076 2019-06-19 17:36:48.240

S 1313.9109 2019-06-19 17:46:42.743

-----

Event number 43  
Picked arrival: 2019-06-24 03:05:40.000  
Tag : \*\*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11052554  
Origin time : 2019-06-24 02:53:39.830  
Latitude : -6.4078  
Longitude : 129.1692  
Depth : 212.0000  
Magnitude : 7.30 mww

Station parameters

Latitude : -24.0500  
Longitude : -143.5100  
Distance : 84.9571

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	731.2561	2019-06-24 03:05:51.086
	S	1341.9155	2019-06-24 03:16:01.745

---

44

Event number 44

Picked arrival: 2019-06-24 11:38:00.000

Tag : \*\*\*

Arrival type : body

Event parameters

IRIS Event ID : 11052627

Origin time : 2019-06-24 11:34:08.913

Latitude : -30.7630

Longitude : -177.3528

Depth : 10.0000

Magnitude : 5.90 Mww

Station parameters

Latitude : -24.0500

Longitude : -143.5100

Distance : 30.6618

Phase parameters ak135

Phase Travel time Expected arrival time

P 374.5841 2019-06-24 11:40:23.497

S 676.9805 2019-06-24 11:45:25.893

-----

Event number 45  
Picked arrival: 2019-06-27 11:18:00.000  
Tag : S3  
Arrival type : surface

Event parameters

IRIS Event ID : 11053874  
Origin time : 2019-06-27 11:04:57.020  
Latitude : -30.3859  
Longitude : -179.2332  
Depth : 10.0000  
Magnitude : 6.30 Mww

Station parameters

Latitude : -24.0200  
Longitude : -143.5300  
Distance : 32.2485

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	388.5453	2019-06-27 11:11:25.565
	S	701.7783	2019-06-27 11:16:38.798

---

46

Event number 46

Picked arrival: 2019-07-04 17:45:00.000

Tag : \*\*\*

Arrival type : body

Event parameters

IRIS Event ID : 11056847

Origin time : 2019-07-04 17:33:49.040

Latitude : 35.7052

Longitude : -117.5060

Depth : 10.7100

Magnitude : 6.40 mw

Station parameters

Latitude : -23.9600

Longitude : -143.5700

Distance : 64.5586

Phase parameters ak135

Phase Travel time Expected arrival time

P 637.1336 2019-07-04 17:44:26.173

S 1156.4799 2019-07-04 17:53:05.519

-----

Event number 47  
Picked arrival: 2019-07-06 03:30:30.000  
Tag : \*\*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11058875  
Origin time : 2019-07-06 03:19:53.040  
Latitude : 35.7695  
Longitude : -117.5993  
Depth : 8.0000  
Magnitude : 7.10 mw

Station parameters

Latitude : -23.9500  
Longitude : -143.5800  
Distance : 64.5770

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	637.6927	2019-07-06 03:30:30.732
	S	1157.4299	2019-07-06 03:39:10.469

---

48

Event number 48

Picked arrival: 2019-07-06 06:45:00.000

Tag : S3

Arrival type : surface

Event parameters

IRIS Event ID : 11058978

Origin time : 2019-07-06 06:31:58.231

Latitude : -27.6402

Longitude : -176.1720

Depth : 10.0000

Magnitude : 5.50 mb

Station parameters

Latitude : -23.9500

Longitude : -143.5800

Distance : 29.4906

Phase parameters ak135

Phase Travel time Expected arrival time

P 364.2222 2019-07-06 06:38:02.453

S 658.6017 2019-07-06 06:42:56.832

-----

Event number 49  
Picked arrival: 2019-07-14 09:23:40.000  
Tag : \*\*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11073718  
Origin time : 2019-07-14 09:10:50.533  
Latitude : -0.5290  
Longitude : 128.0931  
Depth : 10.0000  
Magnitude : 7.30 Mww

Station parameters

Latitude : -23.8800  
Longitude : -143.6000  
Distance : 88.2377

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	771.4253	2019-07-14 09:23:41.958
	S	1416.1175	2019-07-14 09:34:26.650

---



50

Event number 50

Picked arrival: 2019-07-31 15:10:30.000

Tag : \*\*\*

Arrival type : body

Event parameters

IRIS Event ID : 11089506

Origin time : 2019-07-31 15:02:33.853

Latitude : -16.1985

Longitude : 167.9982

Depth : 181.0000

Magnitude : 6.60 mww

Station parameters

Latitude : -23.7900

Longitude : -143.5000

Distance : 45.9921

Phase parameters ak135

Phase Travel time Expected arrival time

P 485.0464 2019-07-31 15:10:38.899

S 876.1289 2019-07-31 15:17:09.981

-----

Event number 51  
Picked arrival: 2019-08-01 18:38:30.000  
Tag : \*\*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11090197  
Origin time : 2019-08-01 18:28:07.272  
Latitude : -34.2367  
Longitude : -72.3079  
Depth : 25.0000  
Magnitude : 6.80 mww

Station parameters

Latitude : -23.7800  
Longitude : -143.5000  
Distance : 61.9161

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	617.4058	2019-08-01 18:38:24.677
	S	1119.8309	2019-08-01 18:46:47.102

---

52

Event number 52

Picked arrival: 2018-09-26 17:45:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10952325

Origin time : 2018-09-26 17:33:35.770

Latitude : -34.9486

Longitude : -107.6074

Depth : 10.0000

Magnitude : 5.70 Mww

Station parameters

Latitude : -24.1300

Longitude : -140.9900

Distance : 30.8167

Phase parameters ak135

Phase Travel time Expected arrival time

P 375.9521 2018-09-26 17:39:51.722

S 679.4066 2018-09-26 17:44:55.176

-----

Event number 53  
Picked arrival: 2018-10-09 08:00:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10957286  
Origin time : 2018-10-09 07:45:11.750  
Latitude : 49.3941  
Longitude : 156.2319  
Depth : 20.0000  
Magnitude : 6.10 Mww

Station parameters

Latitude : -24.0500  
Longitude : -140.9200  
Distance : 92.1874

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	788.1818	2018-10-09 07:58:19.931
	S	1449.8182	2018-10-09 08:09:21.568

---

54

Event number 54

Picked arrival: 2018-10-13 11:24:40.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10958985

Origin time : 2018-10-13 11:10:22.400

Latitude : 52.8549

Longitude : 153.2429

Depth : 461.0000

Magnitude : 6.70 Mww

Station parameters

Latitude : -24.0200

Longitude : -140.9200

Distance : 95.6644

Phase parameters ak135

Phase Travel time Expected arrival time

P 755.2697 2018-10-13 11:22:57.669

S 1391.9242 2018-10-13 11:33:34.324

-----

Event number 55  
Picked arrival: 2018-10-29 07:04:40.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10965132  
Origin time : 2018-10-29 06:54:21.440  
Latitude : -57.4045  
Longitude : -66.4086  
Depth : 10.0000  
Magnitude : 6.30 Mww

Station parameters

Latitude : -23.9700  
Longitude : -140.8800  
Distance : 61.7022

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	618.2800	2018-10-29 07:04:39.719
	S	1120.9405	2018-10-29 07:13:02.380

---

56

Event number 56

Picked arrival: 2018-10-29 20:27:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10965319

Origin time : 2018-10-29 20:17:22.520

Latitude : -57.5496

Longitude : -66.3040

Depth : 10.0000

Magnitude : 5.80 Mww

Station parameters

Latitude : -23.9700

Longitude : -140.8800

Distance : 61.7563

Phase parameters ak135

Phase Travel time Expected arrival time

P 618.6455 2018-10-29 20:27:41.165

S 1121.6264 2018-10-29 20:36:04.146

-----

Event number 57  
Picked arrival: 2018-10-29 23:35:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10965401  
Origin time : 2018-10-29 23:26:09.160  
Latitude : -4.5730  
Longitude : -105.9099  
Depth : 10.0000  
Magnitude : 5.80 Mww

Station parameters

Latitude : -23.9700  
Longitude : -140.8800  
Distance : 38.8503

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	445.2621	2018-10-29 23:33:34.422
	S	803.0828	2018-10-29 23:39:32.242

---



58

Event number 58

Picked arrival: 2018-10-30 02:21:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10965448

Origin time : 2018-10-30 02:13:39.550

Latitude : -39.0541

Longitude : 174.9766

Depth : 227.2800

Magnitude : 6.10 Mww

Station parameters

Latitude : -23.9700

Longitude : -140.8800

Distance : 40.0789

Phase parameters ak135

Phase Travel time Expected arrival time

P 433.3111 2018-10-30 02:20:52.861

S 782.0053 2018-10-30 02:26:41.555

-----

Event number 59  
Picked arrival: 2018-11-01 22:30:20.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10966680  
Origin time : 2018-11-01 22:19:51.540  
Latitude : -19.5882  
Longitude : -69.2923  
Depth : 102.0000  
Magnitude : 6.20 Mww

Station parameters

Latitude : -23.9600  
Longitude : -140.8900  
Distance : 65.9247

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	634.9875	2018-11-01 22:30:26.527
	S	1154.2697	2018-11-01 22:39:05.809

---

60

Event number 60

Picked arrival: 2018-11-06 16:17:30.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10968334

Origin time : 2018-11-06 16:11:39.670

Latitude : -22.1851

Longitude : -174.5298

Depth : 10.0000

Magnitude : 5.50 Mww

Station parameters

Latitude : -23.9800

Longitude : -140.9000

Distance : 30.9173

Phase parameters ak135

Phase Travel time Expected arrival time

P 376.8390 2018-11-06 16:17:56.508

S 680.9811 2018-11-06 16:23:00.651

-----

Event number 61  
Picked arrival: 2018-11-10 08:38:25.000  
Tag : \*\*  
Arrival type : body

## Event parameters

IRIS Event ID : 10969935  
Origin time : 2018-11-10 08:33:21.140  
Latitude : -20.4538  
Longitude : -174.0081  
Depth : 35.0000  
Magnitude : 6.10 Mww

## Station parameters

Latitude : -23.9900  
Longitude : -140.9100  
Distance : 30.7736

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	372.0669	2018-11-10 08:39:33.206
	S	672.9400	2018-11-10 08:44:34.079

---

62

Event number 62

Picked arrival: 2018-11-12 22:51:30.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10970552

Origin time : 2018-11-12 22:37:27.530

Latitude : -3.0760

Longitude : -103.3972

Depth : 10.0000

Magnitude : 5.60 Mww

Station parameters

Latitude : -24.0000

Longitude : -140.9200

Distance : 41.8130

Phase parameters ak135

Phase Travel time Expected arrival time

P 469.8044 2018-11-12 22:45:17.334

S 847.3401 2018-11-12 22:51:34.870

-----

Event number 63  
Picked arrival: 2018-11-14 21:35:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10971336  
Origin time : 2018-11-14 21:21:50.960  
Latitude : 55.6324  
Longitude : 162.0008  
Depth : 50.2100  
Magnitude : 6.10 Mww

Station parameters

Latitude : -24.0100  
Longitude : -140.9300  
Distance : 93.1839

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	788.7787	2018-11-14 21:34:59.738
	S	1451.8062	2018-11-14 21:46:02.766

---

64

Event number 64

Picked arrival: 2018-11-16 03:36:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10971960

Origin time : 2018-11-16 03:26:55.400

Latitude : -10.5489

Longitude : 163.1581

Depth : 8.8400

Magnitude : 6.10 mww

Station parameters

Latitude : -24.0100

Longitude : -140.9400

Distance : 54.6941

Phase parameters ak135

Phase Travel time Expected arrival time

P 569.4407 2018-11-16 03:36:24.840

S 1029.7253 2018-11-16 03:44:05.125

-----

Event number 65  
Picked arrival: 2018-11-24 15:50:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10974188  
Origin time : 2018-11-24 15:42:00.790  
Latitude : -21.1183  
Longitude : -175.5379  
Depth : 10.0000  
Magnitude : 5.40 Mww

Station parameters

Latitude : -24.0100  
Longitude : -141.0100  
Distance : 31.9375

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	385.8178	2018-11-24 15:48:26.607
	S	696.9302	2018-11-24 15:53:37.720

---



66

Event number 66

Picked arrival: 2018-11-25 03:54:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10974301

Origin time : 2018-11-25 03:40:50.810

Latitude : 13.1817

Longitude : -81.0931

Depth : 10.0000

Magnitude : 6.00 Mww

Station parameters

Latitude : -24.0100

Longitude : -141.0200

Distance : 69.3354

Phase parameters ak135

Phase Travel time Expected arrival time

P 667.6385 2018-11-25 03:51:58.448

S 1214.3510 2018-11-25 04:01:05.161

-----

Event number 67  
Picked arrival: 2018-11-25 06:21:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10974322  
Origin time : 2018-11-25 06:14:30.950  
Latitude : -28.9745  
Longitude : -177.3019  
Depth : 38.0000  
Magnitude : 5.60 Mww

Station parameters

Latitude : -24.0100  
Longitude : -141.0200  
Distance : 32.7216

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	388.8978	2018-11-25 06:20:59.847
	S	702.8255	2018-11-25 06:26:13.775

---

68

Event number 68

Picked arrival: 2018-11-25 16:57:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10974404

Origin time : 2018-11-25 16:37:32.710

Latitude : 34.3464

Longitude : 45.7432

Depth : 18.0000

Magnitude : 6.30 Mww

Station parameters

Latitude : -24.0100

Longitude : -141.0200

Distance : 168.1039

Phase parameters ak135

Phase Travel time Expected arrival time

PKIKP 1205.3055 2018-11-25 16:57:38.015

SKIKS 1628.1725 2018-11-25 17:04:40.882

-----

Event number 69  
Picked arrival: 2018-11-26 00:30:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10974477  
Origin time : 2018-11-26 00:24:40.520  
Latitude : -53.8525  
Longitude : -134.2271  
Depth : 10.0000  
Magnitude : 5.30 mb

Station parameters

Latitude : -24.0100  
Longitude : -141.0300  
Distance : 30.2764

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	371.1744	2018-11-26 00:30:51.694
	S	670.9328	2018-11-26 00:35:51.452

---

70

Event number 70

Picked arrival: 2018-12-06 23:35:20.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10981467

Origin time : 2018-12-06 23:26:59.560

Latitude : -22.3519

Longitude : 169.6372

Depth : 9.0000

Magnitude : 5.90 Mww

Station parameters

Latitude : -24.0000

Longitude : -141.1900

Distance : 45.0036

Phase parameters ak135

Phase Travel time Expected arrival time

P 495.7096 2018-12-06 23:35:15.269

S 894.3150 2018-12-06 23:41:53.874

-----

Event number 71  
Picked arrival: 2018-12-12 13:22:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10984273  
Origin time : 2018-12-12 13:13:56.150  
Latitude : -55.6764  
Longitude : -128.6835  
Depth : 10.0000  
Magnitude : 6.30 Mww

Station parameters

Latitude : -24.0100  
Longitude : -141.2700  
Distance : 32.9926

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	395.0731	2018-12-12 13:20:31.223
	S	713.3667	2018-12-12 13:25:49.516

---

72

Event number 72

Picked arrival: 2018-12-26 14:17:30.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10989514

Origin time : 2018-12-26 14:11:21.830

Latitude : -17.2789

Longitude : -174.0153

Depth : 120.0000

Magnitude : 5.70 Mww

Station parameters

Latitude : -24.0500

Longitude : -141.5100

Distance : 31.0828

Phase parameters ak135

Phase Travel time Expected arrival time

P 366.7130 2018-12-26 14:17:28.542

S 663.2137 2018-12-26 14:22:25.043

-----

Event number 73  
Picked arrival: 2018-12-31 02:48:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10991212  
Origin time : 2018-12-31 02:35:37.670  
Latitude : 54.4266  
Longitude : -161.5131  
Depth : 31.0000  
Magnitude : 6.00 Mww

Station parameters

Latitude : -24.0700  
Longitude : -141.6300  
Distance : 80.3422

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	728.0927	2018-12-31 02:47:45.762
	S	1331.7340	2018-12-31 02:57:49.403

---



74

Event number 74

Picked arrival: 2019-01-08 12:53:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10993586

Origin time : 2019-01-08 12:39:31.040

Latitude : 30.5926

Longitude : 131.0371

Depth : 35.0000

Magnitude : 6.30 Mww

Station parameters

Latitude : -24.1300

Longitude : -141.8200

Distance : 99.7237

Phase parameters ak135

Phase Travel time Expected arrival time

Pdiff 820.2104 2019-01-08 12:53:11.250

S 1511.2163 2019-01-08 13:04:42.256

-----

Event number 75  
Picked arrival: 2019-01-11 06:04:40.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10994409  
Origin time : 2019-01-11 05:58:12.590  
Latitude : -21.4119  
Longitude : -173.9918  
Depth : 10.0000  
Magnitude : 5.20 Mww

Station parameters

Latitude : -24.1500  
Longitude : -141.8800  
Distance : 29.6694

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	365.8043	2019-01-11 06:04:18.394
	S	661.4078	2019-01-11 06:09:13.997

---

76

Event number 76

Picked arrival: 2019-01-21 01:45:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10997852

Origin time : 2019-01-21 01:36:34.380

Latitude : -21.9331

Longitude : 169.1985

Depth : 9.0000

Magnitude : 5.70 Mww

Station parameters

Latitude : -24.1900

Longitude : -142.0900

Distance : 44.6510

Phase parameters ak135

Phase Travel time Expected arrival time

P 492.8988 2019-01-21 01:44:47.278

S 889.2025 2019-01-21 01:51:23.582

-----

Event number 77  
Picked arrival: 2019-01-21 12:08:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10997943  
Origin time : 2019-01-21 11:57:20.180  
Latitude : 15.5944  
Longitude : -94.7318  
Depth : 29.0000  
Magnitude : 5.70 Mww

Station parameters

Latitude : -24.1900  
Longitude : -142.0900  
Distance : 60.9857

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	610.5553	2019-01-21 12:07:30.735
	S	1107.0921	2019-01-21 12:15:47.272

---

78

Event number 78

Picked arrival: 2019-01-22 00:14:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10998098

Origin time : 2019-01-21 23:59:22.600

Latitude : -10.3113

Longitude : 119.1472

Depth : 16.7700

Magnitude : 6.00 Mww

Station parameters

Latitude : -24.2000

Longitude : -142.1000

Distance : 93.6225

Phase parameters ak135

Phase Travel time Expected arrival time

P 795.3403 2019-01-22 00:12:37.940

S 1463.4373 2019-01-22 00:23:46.037

-----

Event number 79  
Picked arrival: 2019-01-26 04:01:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 10999596  
Origin time : 2019-01-26 03:51:38.430  
Latitude : -7.0194  
Longitude : 156.3109  
Depth : 361.9200  
Magnitude : 6.20 Mww

Station parameters

Latitude : -24.2200  
Longitude : -142.1700  
Distance : 61.1993

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	577.5552	2019-01-26 04:01:15.985
	S	1047.9878	2019-01-26 04:09:06.417

---

80

Event number 80

Picked arrival: 2019-01-26 08:25:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 10999641

Origin time : 2019-01-26 08:12:48.740

Latitude : -5.4962

Longitude : 133.7648

Depth : 10.0000

Magnitude : 5.90 Mww

Station parameters

Latitude : -24.2200

Longitude : -142.1800

Distance : 82.3390

Phase parameters ak135

Phase Travel time Expected arrival time

P 741.9430 2019-01-26 08:25:10.683

S 1357.8533 2019-01-26 08:35:26.593

-----

Event number 81  
Picked arrival: 2019-01-30 15:45:20.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11001050  
Origin time : 2019-01-30 15:31:33.440  
Latitude : -4.6334  
Longitude : -105.4800  
Depth : 10.0000  
Magnitude : 5.90 Mww

Station parameters

Latitude : -24.2300  
Longitude : -142.2400  
Distance : 40.4178

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	458.3211	2019-01-30 15:39:11.761
	S	826.6042	2019-01-30 15:45:20.044

---



82

Event number 82

Picked arrival: 2019-02-27 02:59:00.000

Tag : S2

Arrival type : surface

Event parameters

IRIS Event ID : 11009267

Origin time : 2019-02-27 02:44:29.760

Latitude : -49.5160

Longitude : -116.3691

Depth : 10.0000

Magnitude : 5.10 mb

Station parameters

Latitude : -24.3600

Longitude : -142.4700

Distance : 32.3452

Phase parameters ak135

Phase Travel time Expected arrival time

P 389.3943 2019-02-27 02:50:59.154

S 703.2874 2019-02-27 02:56:13.047

-----

Event number 83  
Picked arrival: 2019-03-01 01:10:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11010051  
Origin time : 2019-03-01 01:02:12.300  
Latitude : -53.4127  
Longitude : 159.5769  
Depth : 10.0000  
Magnitude : 5.70 Mww

Station parameters

Latitude : -24.3800  
Longitude : -142.4800  
Distance : 51.7134

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	547.3153	2019-03-01 01:11:19.615
	S	988.8614	2019-03-01 01:18:41.161

---

84

Event number 84

Picked arrival: 2019-03-06 20:26:30.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11011957

Origin time : 2019-03-06 20:19:59.560

Latitude : -32.2471

Longitude : -177.7754

Depth : 11.1800

Magnitude : 5.80 Mww

Station parameters

Latitude : -24.4000

Longitude : -142.5400

Distance : 31.8401

Phase parameters ak135

Phase Travel time Expected arrival time

P 384.7821 2019-03-06 20:26:24.342

S 695.1101 2019-03-06 20:31:34.670

-----

Event number 85  
Picked arrival: 2019-03-07 15:35:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11012420  
Origin time : 2019-03-07 15:27:23.380  
Latitude : -32.7160  
Longitude : -176.9057  
Depth : 10.0000  
Magnitude : 5.50 Mww

Station parameters

Latitude : -24.4000  
Longitude : -142.5500  
Distance : 31.1496

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	378.8862	2019-03-07 15:33:42.266
	S	684.6158	2019-03-07 15:38:47.995

---

86

Event number 86

Picked arrival: 2019-03-07 16:43:00.000

Tag : S2

Arrival type : surface

Event parameters

IRIS Event ID : 11012435

Origin time : 2019-03-07 16:29:09.320

Latitude : -32.4748

Longitude : -178.4034

Depth : 20.8000

Magnitude : 5.70 Mww

Station parameters

Latitude : -24.4000

Longitude : -142.5500

Distance : 32.3804

Phase parameters ak135

Phase Travel time Expected arrival time

P 388.0653 2019-03-07 16:35:37.385

S 701.1359 2019-03-07 16:40:50.455

-----

Event number 87  
Picked arrival: 2019-03-17 00:52:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11015463  
Origin time : 2019-03-17 00:43:30.510  
Latitude : -20.1485  
Longitude : -173.6948  
Depth : 10.0000  
Magnitude : 5.10 Mww

Station parameters

Latitude : -24.3900  
Longitude : -142.6700  
Distance : 28.9615

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	359.5345	2019-03-17 00:49:30.044
	S	650.2859	2019-03-17 00:54:20.795

---

88

Event number 88

Picked arrival: 2019-03-20 15:32:20.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11016677

Origin time : 2019-03-20 15:23:58.680

Latitude : -15.5965

Longitude : 167.6551

Depth : 119.0000

Magnitude : 6.30 Mww

Station parameters

Latitude : -24.3700

Longitude : -142.7000

Distance : 47.2306

Phase parameters ak135

Phase Travel time Expected arrival time

P 500.8819 2019-03-20 15:32:19.561

S 904.8521 2019-03-20 15:39:03.532

-----

Event number 89  
Picked arrival: 2019-03-26 12:34:00.000  
Tag : S2  
Arrival type : surface

Event parameters

IRIS Event ID : 11018667  
Origin time : 2019-03-26 12:01:48.040  
Latitude : 12.4956  
Longitude : -89.2334  
Depth : 10.0000  
Magnitude : 5.60 Mww

Station parameters

Latitude : -24.3300  
Longitude : -142.7400  
Distance : 63.9003

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	632.9197	2019-03-26 12:12:20.959
	S	1148.5235	2019-03-26 12:20:56.563

---



90

Event number 90

Picked arrival: 2019-03-28 22:20:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11019798

Origin time : 2019-03-28 22:06:49.400

Latitude : 50.5022

Longitude : 159.9632

Depth : 8.9600

Magnitude : 6.20 Mww

Station parameters

Latitude : -24.3200

Longitude : -142.7500

Distance : 90.2608

Phase parameters ak135

Phase Travel time Expected arrival time

P 781.0978 2019-03-28 22:19:50.497

S 1435.3538 2019-03-28 22:30:44.753

-----

Event number 91  
Picked arrival: 2019-03-31 07:14:15.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11020682  
Origin time : 2019-03-31 07:04:04.800  
Latitude : -1.9440  
Longitude : -80.8089  
Depth : 18.0000  
Magnitude : 6.20 Mww

Station parameters

Latitude : -24.3100  
Longitude : -142.7700  
Distance : 63.7615

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	630.7106	2019-03-31 07:14:35.510
	S	1144.6670	2019-03-31 07:23:09.467

---

Event number 92

Picked arrival: 2019-04-05 19:16:30.000

Tag : S2

Arrival type : surface

Event parameters

IRIS Event ID : 11022811

Origin time : 2019-04-05 18:46:42.673

Latitude : 1.4513

Longitude : -85.2664

Depth : 10.0000

Magnitude : 5.80 Mww

Station parameters

Latitude : -24.2900

Longitude : -142.8000

Distance : 61.3989

Phase parameters ak135

Phase Travel time Expected arrival time

P 616.2310 2019-04-05 18:56:58.903

S 1117.0964 2019-04-05 19:05:19.769

---

Event number 93  
Picked arrival: 2019-04-07 16:08:00.000  
Tag : S2  
Arrival type : surface

Event parameters

IRIS Event ID : 11023279  
Origin time : 2019-04-07 15:45:08.095  
Latitude : -41.2892  
Longitude : -87.4826  
Depth : 7.0900  
Magnitude : 5.70 Mww

Station parameters

Latitude : -24.2900  
Longitude : -142.8200  
Distance : 48.6274

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	524.3694	2019-04-07 15:53:52.464
	S	946.6145	2019-04-07 16:00:54.709

---

94

Event number 94

Picked arrival: 2019-04-09 18:06:15.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11024052

Origin time : 2019-04-09 17:53:59.096

Latitude : -58.6064

Longitude : -25.2559

Depth : 44.8300

Magnitude : 6.50 Mww

Station parameters

Latitude : -24.2800

Longitude : -142.8500

Distance : 82.4695

Phase parameters ak135

Phase Travel time Expected arrival time

P 737.6393 2019-04-09 18:06:16.735

S 1350.8089 2019-04-09 18:16:29.904

-----

Event number 95  
Picked arrival: 2019-04-12 11:54:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11024890  
Origin time : 2019-04-12 11:40:49.886  
Latitude : -1.8518  
Longitude : 122.5527  
Depth : 17.4800  
Magnitude : 6.80 Mww

Station parameters

Latitude : -24.2800  
Longitude : -142.8800  
Distance : 93.3974

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	794.1865	2019-04-12 11:54:04.072
	S	1461.2654	2019-04-12 12:05:11.151

---

96

Event number 96

Picked arrival: 2019-04-18 14:56:30.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11027275

Origin time : 2019-04-18 14:46:01.901

Latitude : -51.0555

Longitude : 139.4904

Depth : 10.0000

Magnitude : 6.50 Mww

Station parameters

Latitude : -24.2700

Longitude : -142.9600

Distance : 63.6902

Phase parameters ak135

Phase Travel time Expected arrival time

P 631.5364 2019-04-18 14:56:33.437

S 1145.9123 2019-04-18 15:05:07.813

-----

Event number 97  
Picked arrival: 2019-04-23 05:50:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11028997  
Origin time : 2019-04-23 05:37:52.979  
Latitude : 11.8458  
Longitude : 125.1869  
Depth : 54.0000  
Magnitude : 6.40 Mww

Station parameters

Latitude : -24.2600  
Longitude : -143.0200  
Distance : 96.4458

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	803.2556	2019-04-23 05:51:16.234
	S	1479.4117	2019-04-23 06:02:32.390

---



98

Event number 98

Picked arrival: 2019-04-23 14:26:20.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11029096

Origin time : 2019-04-23 14:20:17.830

Latitude : -24.7059

Longitude : -178.7639

Depth : 385.5800

Magnitude : 6.00 Mww

Station parameters

Latitude : -24.2500

Longitude : -143.0300

Distance : 32.4318

Phase parameters ak135

Phase Travel time Expected arrival time

P 355.7556 2019-04-23 14:26:13.585

S 641.4394 2019-04-23 14:30:59.269

-----

Event number 99  
Picked arrival: 2019-05-03 07:07:30.000  
Tag : S2  
Arrival type : surface

Event parameters

IRIS Event ID : 11033150  
Origin time : 2019-05-03 06:55:27.428  
Latitude : -24.2675  
Longitude : -115.9506  
Depth : 10.0000  
Magnitude : 5.00 mb

Station parameters

Latitude : -24.2000  
Longitude : -143.1600  
Distance : 24.7717

Phase parameters ak135

Phase	Travel time	Expected arrival time
P	321.8217	2019-05-03 07:00:49.249
P	323.3884	2019-05-03 07:00:50.816
P	324.3342	2019-05-03 07:00:51.762
S	584.0628	2019-05-03 07:05:11.490
S	589.7765	2019-05-03 07:05:17.204
S	590.7445	2019-05-03 07:05:18.172

-----

100

Event number 100

Picked arrival: 2019-05-03 07:35:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11033154

Origin time : 2019-05-03 07:25:29.171

Latitude : -6.9280

Longitude : 160.1389

Depth : 10.0000

Magnitude : 6.20 Mww

Station parameters

Latitude : -24.2000

Longitude : -143.1600

Distance : 56.8694

Phase parameters ak135

Phase Travel time Expected arrival time

P 584.8582 2019-05-03 07:35:14.029

S 1058.4162 2019-05-03 07:43:07.587

-----

Event number 101  
Picked arrival: 2019-05-04 00:19:00.000  
Tag : S2  
Arrival type : surface

## Event parameters

IRIS Event ID : 11033418  
Origin time : 2019-05-04 00:07:47.112  
Latitude : -24.4810  
Longitude : -115.8373  
Depth : 10.0000  
Magnitude : 5.40 Mww

## Station parameters

Latitude : -24.1900  
Longitude : -143.1700  
Distance : 24.8649

## Phase parameters ak135

Phase	Travel time	Expected arrival time
P	322.6696	2019-05-04 00:13:09.781
P	324.3487	2019-05-04 00:13:11.460
P	325.2409	2019-05-04 00:13:12.352
S	585.5551	2019-05-04 00:17:32.667
S	591.5085	2019-05-04 00:17:38.620
S	592.3959	2019-05-04 00:17:39.507

-----

102

Event number 102

Picked arrival: 2019-05-08 14:18:20.000

Tag : S2

Arrival type : surface

Event parameters

IRIS Event ID : 11035010

Origin time : 2019-05-08 13:47:19.701

Latitude : -15.7761

Longitude : -75.0959

Depth : 15.3400

Magnitude : 5.70 Mww

Station parameters

Latitude : -24.1600

Longitude : -143.2200

Distance : 63.9962

Phase parameters ak135

Phase Travel time Expected arrival time

P 632.6863 2019-05-08 13:57:52.387

S 1148.2917 2019-05-08 14:06:27.992

-----

Event number 103  
Picked arrival: 2019-05-10 03:30:00.000  
Tag : \*\*  
Arrival type : body

Event parameters

IRIS Event ID : 11035792  
Origin time : 2019-05-10 03:23:33.007  
Latitude : -28.6675  
Longitude : -176.7791  
Depth : 10.0000  
Magnitude : 5.70 Mww

Station parameters

Latitude : -24.1500  
Longitude : -143.2300  
Distance : 30.2859

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	371.2585	2019-05-10 03:29:44.265
	S	671.0820	2019-05-10 03:34:44.088

---

104

Event number 104

Picked arrival: 2019-05-12 19:35:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11036537

Origin time : 2019-05-12 19:24:50.395

Latitude : 8.6227

Longitude : -82.8326

Depth : 19.0000

Magnitude : 6.00 Mww

Station parameters

Latitude : -24.1300

Longitude : -143.2400

Distance : 67.4001

Phase parameters ak135

Phase Travel time Expected arrival time

P 654.0539 2019-05-12 19:35:44.448

S 1188.8848 2019-05-12 19:44:39.279

-----

Event number 105  
Picked arrival: 2019-05-16 23:05:00.000  
Tag : S2  
Arrival type : surface

## Event parameters

IRIS Event ID : 11038220  
Origin time : 2019-05-16 22:30:55.318  
Latitude : 12.0142  
Longitude : -89.0699  
Depth : 10.0000  
Magnitude : 4.80 mb

## Station parameters

Latitude : -24.1000  
Longitude : -143.2700  
Distance : 64.0698

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	634.0350	2019-05-16 22:41:29.352
	S	1150.6272	2019-05-16 22:50:05.945

---



106

Event number 106

Picked arrival: 2019-05-19 01:31:20.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11039010

Origin time : 2019-05-19 01:23:29.151

Latitude : -21.6619

Longitude : 169.7779

Depth : 20.0000

Magnitude : 6.30 mww

Station parameters

Latitude : -24.0900

Longitude : -143.3000

Distance : 43.1017

Phase parameters ak135

Phase Travel time Expected arrival time

P 478.7284 2019-05-19 01:31:27.879

S 863.7632 2019-05-19 01:37:52.914

-----

Event number 107  
Picked arrival: 2019-05-19 14:35:00.000  
Tag : \*\*  
Arrival type : body

## Event parameters

IRIS Event ID : 11039134  
Origin time : 2019-05-19 14:27:12.394  
Latitude : -21.7384  
Longitude : 169.5741  
Depth : 19.9500  
Magnitude : 6.00 Mww

## Station parameters

Latitude : -24.0900  
Longitude : -143.3000  
Distance : 43.2699

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	480.0947	2019-05-19 14:35:12.488
	S	866.2396	2019-05-19 14:41:38.633

---

108

Event number 108

Picked arrival: 2019-05-19 15:15:00.000

Tag : S2

Arrival type : surface

Event parameters

IRIS Event ID : 11039137

Origin time : 2019-05-19 14:56:50.691

Latitude : -21.6074

Longitude : 169.4692

Depth : 20.0000

Magnitude : 6.30 mww

Station parameters

Latitude : -24.0900

Longitude : -143.3000

Distance : 43.3936

Phase parameters ak135

Phase Travel time Expected arrival time

P 481.0870 2019-05-19 15:04:51.778

S 868.0382 2019-05-19 15:11:18.729

-----

Event number 109  
Picked arrival: 2019-05-30 15:50:00.000  
Tag : S2  
Arrival type : surface

## Event parameters

IRIS Event ID : 11042571  
Origin time : 2019-05-30 15:38:01.451  
Latitude : -21.7541  
Longitude : -176.3171  
Depth : 177.8500  
Magnitude : 6.00 Mww

## Station parameters

Latitude : -24.0000  
Longitude : -143.4500  
Distance : 30.2977

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	354.4577	2019-05-30 15:43:55.908
	S	641.1726	2019-05-30 15:48:42.623

---

110

Event number 110

Picked arrival: 2019-06-14 04:00:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11048737

Origin time : 2019-06-14 03:53:15.804

Latitude : -21.1717

Longitude : -174.0415

Depth : 10.0000

Magnitude : 5.40 Mww

Station parameters

Latitude : -23.9200

Longitude : -143.5600

Distance : 28.2319

Phase parameters ak135

Phase Travel time Expected arrival time

P 353.0424 2019-06-14 03:59:08.846

S 638.8069 2019-06-14 04:03:54.610

-----

Event number 111  
Picked arrival: 2019-06-16 21:12:30.000  
Tag : S2  
Arrival type : surface

Event parameters

IRIS Event ID : 11049804  
Origin time : 2019-06-16 20:58:26.015  
Latitude : -31.6364  
Longitude : -177.8066  
Depth : 35.0000  
Magnitude : 5.60 Mww

Station parameters

Latitude : -23.9700  
Longitude : -143.5300  
Distance : 31.1351

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	375.2537	2019-06-16 21:04:41.268
	S	678.5977	2019-06-16 21:09:44.612

---

112

Event number 112

Picked arrival: 2019-06-17 16:59:10.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11050099

Origin time : 2019-06-17 16:53:04.175

Latitude : -30.8019

Longitude : -177.4871

Depth : 17.4100

Magnitude : 5.50 Mww

Station parameters

Latitude : -23.9900

Longitude : -143.5300

Distance : 30.7835

Phase parameters ak135

Phase Travel time Expected arrival time

P 374.5251 2019-06-17 16:59:18.700

S 677.0170 2019-06-17 17:04:21.191

-----

Event number 113  
Picked arrival: 2019-06-18 13:35:45.000  
Tag : \*\*  
Arrival type : body

## Event parameters

IRIS Event ID : 11050447  
Origin time : 2019-06-18 13:22:19.009  
Latitude : 38.6370  
Longitude : 139.4804  
Depth : 12.0000  
Magnitude : 6.40 Mww

## Station parameters

Latitude : -24.0100  
Longitude : -143.5200  
Distance : 95.3676

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	804.1401	2019-06-18 13:35:43.149
	S	1479.9875	2019-06-18 13:46:58.996

---



114

Event number 114

Picked arrival: 2019-06-19 23:21:40.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11051151

Origin time : 2019-06-19 23:14:59.879

Latitude : -12.6558

Longitude : 166.2638

Depth : 10.0000

Magnitude : 5.70 Mww

Station parameters

Latitude : -24.0300

Longitude : -143.5100

Distance : 48.7509

Phase parameters ak135

Phase Travel time Expected arrival time

P 524.8598 2019-06-19 23:23:44.738

S 947.6015 2019-06-19 23:30:47.480

-----

Event number 115  
Picked arrival: 2019-06-19 23:21:40.000  
Tag : \*\*  
Arrival type : body

## Event parameters

IRIS Event ID : 11051151  
Origin time : 2019-06-19 23:14:59.879  
Latitude : -12.6558  
Longitude : 166.2638  
Depth : 10.0000  
Magnitude : 5.70 Mww

## Station parameters

Latitude : -24.0300  
Longitude : -143.5100  
Distance : 48.7509

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	524.8598	2019-06-19 23:23:44.738
	S	947.6015	2019-06-19 23:30:47.480

---

116

Event number 116

Picked arrival: 2019-06-26 02:31:15.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11053269

Origin time : 2019-06-26 02:18:07.857

Latitude : 56.1779

Longitude : 164.1101

Depth : 10.0000

Magnitude : 6.30 Mww

Station parameters

Latitude : -24.0300

Longitude : -143.5200

Distance : 91.5992

Phase parameters ak135

Phase Travel time Expected arrival time

P 787.1321 2019-06-26 02:31:14.989

S 1447.2958 2019-06-26 02:42:15.152

-----

Event number 117  
Picked arrival: 2019-06-26 18:14:00.000  
Tag : \*\*  
Arrival type : body

## Event parameters

IRIS Event ID : 11053541  
Origin time : 2019-06-26 18:06:30.078  
Latitude : -30.9068  
Longitude : -177.3267  
Depth : 10.0000  
Magnitude : 5.30 Mww

## Station parameters

Latitude : -24.0300  
Longitude : -143.5200  
Distance : 30.6489

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	374.4698	2019-06-26 18:12:44.547
	S	676.7778	2019-06-26 18:17:46.855

---

118

Event number 118

Picked arrival: 2019-07-01 17:22:00.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11055406

Origin time : 2019-07-01 17:13:29.073

Latitude : -15.4376

Longitude : 167.5238

Depth : 97.0900

Magnitude : 6.00 Mww

Station parameters

Latitude : -23.9900

Longitude : -143.5500

Distance : 46.6193

Phase parameters ak135

Phase Travel time Expected arrival time

P 498.3540 2019-07-01 17:21:47.427

S 900.1094 2019-07-01 17:28:29.182

-----

Event number 119  
Picked arrival: 2019-07-02 04:15:00.000  
Tag : \*\*  
Arrival type : body

## Event parameters

IRIS Event ID : 11055619  
Origin time : 2019-07-02 04:07:14.730  
Latitude : -31.2586  
Longitude : -175.4206  
Depth : 10.0000  
Magnitude : 5.20 mb

## Station parameters

Latitude : -23.9800  
Longitude : -143.5600  
Distance : 29.0419

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	360.2486	2019-07-02 04:13:14.978
	S	651.5519	2019-07-02 04:18:06.281

---

120

Event number 120

Picked arrival: 2019-07-04 05:04:00.000

Tag : S2

Arrival type : surface

Event parameters

IRIS Event ID : 11056637

Origin time : 2019-07-04 04:30:44.297

Latitude : 51.2215

Longitude : -130.5150

Depth : 10.0000

Magnitude : 6.20 Mww

Station parameters

Latitude : -23.9700

Longitude : -143.5700

Distance : 76.0664

Phase parameters ak135

Phase Travel time Expected arrival time

P 707.6595 2019-07-04 04:42:31.956

S 1291.1417 2019-07-04 04:52:15.438

-----

Event number 121  
Picked arrival: 2019-07-07 15:21:50.000  
Tag : \*\*  
Arrival type : body

## Event parameters

IRIS Event ID : 11061463  
Origin time : 2019-07-07 15:08:40.525  
Latitude : 0.5126  
Longitude : 126.1892  
Depth : 35.0000  
Magnitude : 6.90 Mww

## Station parameters

Latitude : -23.9400  
Longitude : -143.5900  
Distance : 90.4098

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	777.7222	2019-07-07 15:21:38.247
	S	1429.9804	2019-07-07 15:32:30.505

---



122

Event number 122

Picked arrival: 2019-07-13 08:15:00.000

Tag : S2

Arrival type : surface

Event parameters

IRIS Event ID : 11072684

Origin time : 2019-07-13 07:59:33.543

Latitude : -49.5515

Longitude : -116.7443

Depth : 10.0000

Magnitude : 5.80 Mww

Station parameters

Latitude : -23.8900

Longitude : -143.6000

Distance : 33.1343

Phase parameters ak135

Phase Travel time Expected arrival time

P 396.3115 2019-07-13 08:06:09.854

S 715.5656 2019-07-13 08:11:29.108

-----

Event number 123  
Picked arrival: 2019-07-14 05:52:30.000  
Tag : \*\*  
Arrival type : body

## Event parameters

IRIS Event ID : 11073569  
Origin time : 2019-07-14 05:39:23.427  
Latitude : -18.2237  
Longitude : 120.3574  
Depth : 10.0000  
Magnitude : 6.60 Mww

## Station parameters

Latitude : -23.8800  
Longitude : -143.6000  
Distance : 87.9844

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	770.2170	2019-07-14 05:52:13.644
	S	1413.7097	2019-07-14 06:02:57.136

---

124

Event number 124

Picked arrival: 2019-07-15 08:32:20.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11074626

Origin time : 2019-07-15 08:21:35.928

Latitude : -5.9904

Longitude : 149.5517

Depth : 58.9700

Magnitude : 6.20 Mww

Station parameters

Latitude : -23.8700

Longitude : -143.6000

Distance : 66.4340

Phase parameters ak135

Phase Travel time Expected arrival time

P 642.9750 2019-07-15 08:32:18.902

S 1168.7643 2019-07-15 08:41:04.692

-----

Event number 125  
Picked arrival: 2019-07-18 01:45:00.000  
Tag : S2  
Arrival type : surface

Event parameters

IRIS Event ID : 11077729  
Origin time : 2019-07-18 01:17:07.792  
Latitude : 1.4701  
Longitude : -90.8891  
Depth : 10.0000  
Magnitude : 5.40 Mww

Station parameters

Latitude : -23.8500  
Longitude : -143.5900  
Distance : 57.0659

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	586.2525	2019-07-18 01:26:54.044
	S	1061.0082	2019-07-18 01:34:48.800

---

126

Event number 126

Picked arrival: 2019-07-20 18:37:30.000

Tag : S2

Arrival type : surface

Event parameters

IRIS Event ID : 11080390

Origin time : 2019-07-20 18:23:54.336

Latitude : -29.3232

Longitude : -111.3838

Depth : 10.0000

Magnitude : 5.10 mb

Station parameters

Latitude : -23.8400

Longitude : -143.5600

Distance : 29.1976

Phase parameters ak135

Phase Travel time Expected arrival time

P 361.6297 2019-07-20 18:29:55.965

S 654.0005 2019-07-20 18:34:48.336

-----

Event number 127  
Picked arrival: 2019-07-27 10:12:40.000  
Tag : S2  
Arrival type : surface

## Event parameters

IRIS Event ID : 11086279  
Origin time : 2019-07-27 09:55:08.207  
Latitude : -59.6436  
Longitude : -150.9124  
Depth : 10.0000  
Magnitude : 5.70 Mww

## Station parameters

Latitude : -23.8100  
Longitude : -143.5100  
Distance : 36.2090

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	422.8894	2019-07-27 10:02:11.096
	S	762.9672	2019-07-27 10:07:51.174

---

128

Event number 128

Picked arrival: 2019-07-31 06:05:30.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11089323

Origin time : 2019-07-31 05:54:55.289

Latitude : 13.2662

Longitude : -89.3376

Depth : 72.5000

Magnitude : 5.90 Mww

Station parameters

Latitude : -23.7900

Longitude : -143.5000

Distance : 64.6037

Phase parameters ak135

Phase Travel time Expected arrival time

P 629.6811 2019-07-31 06:05:24.970

S 1143.7999 2019-07-31 06:13:59.088

-----

Event number 129  
Picked arrival: 2019-08-02 06:05:30.000  
Tag : S2  
Arrival type : surface

Event parameters

IRIS Event ID : 11090460  
Origin time : 2019-08-02 05:50:55.239  
Latitude : -49.7307  
Longitude : -113.8331  
Depth : 10.0000  
Magnitude : 6.00 Mww

Station parameters

Latitude : -23.7800  
Longitude : -143.5000  
Distance : 34.7512

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	410.3566	2019-08-02 05:57:45.595
	S	740.5823	2019-08-02 06:03:15.821

---



130

Event number 130

Picked arrival: 2019-08-04 10:36:30.000

Tag : \*\*

Arrival type : body

Event parameters

IRIS Event ID : 11091618

Origin time : 2019-08-04 10:23:03.736

Latitude : 37.7597

Longitude : 141.6089

Depth : 38.0000

Magnitude : 6.30 Mww

Station parameters

Latitude : -23.7800

Longitude : -143.4900

Distance : 93.3516

Phase parameters ak135

Phase Travel time Expected arrival time

P 790.9806 2019-08-04 10:36:14.716

S 1455.8270 2019-08-04 10:47:19.562

-----

Event number 131  
Picked arrival: 2019-08-05 09:07:20.000  
Tag : \*\*  
Arrival type : body

## Event parameters

IRIS Event ID : 11092028  
Origin time : 2019-08-05 09:01:08.554  
Latitude : -19.3534  
Longitude : -174.8786  
Depth : 10.0000  
Magnitude : 5.70 mb

## Station parameters

Latitude : -23.7800  
Longitude : -143.4900  
Distance : 29.4641

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	363.9881	2019-08-05 09:07:12.542
	S	658.1863	2019-08-05 09:12:06.740

---

132

Event number 132

Picked arrival: 2019-08-09 17:57:00.000

Tag : S2

Arrival type : surface

Event parameters

IRIS Event ID : 11094587

Origin time : 2019-08-09 17:45:46.896

Latitude : -21.0605

Longitude : -173.8121

Depth : 10.0000

Magnitude : 5.30 Mww

Station parameters

Latitude : -23.7900

Longitude : -143.5000

Distance : 28.1000

Phase parameters ak135

Phase Travel time Expected arrival time

P 351.8653 2019-08-09 17:51:38.761

S 636.7298 2019-08-09 17:56:23.625

-----

Event number 133  
Picked arrival: 2019-08-14 22:02:00.000  
Tag : S2  
Arrival type : surface

## Event parameters

IRIS Event ID : 11097877  
Origin time : 2019-08-14 21:35:18.158  
Latitude : 20.4598  
Longitude : -109.3606  
Depth : 10.0000  
Magnitude : 5.90 Mww

## Station parameters

Latitude : -23.8300  
Longitude : -143.5400  
Distance : 55.4037

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	574.3825	2019-08-14 21:44:52.540
	S	1038.9367	2019-08-14 21:52:37.094

---

134

Event number 134

Picked arrival: 2018-09-15 08:20:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10948197

Origin time : 2018-09-15 08:05:29.100

Latitude : 26.6827

Longitude : 129.6017

Depth : 10.0000

Magnitude : 5.70 Mww

Station parameters

Latitude : -24.1700

Longitude : -141.0900

Distance : 100.0216

Phase parameters ak135

Phase Travel time Expected arrival time

Pdiff 825.4396 2018-09-15 08:19:14.539

Sdiff 1520.2258 2018-09-15 08:30:49.325

-----

Event number 135  
Picked arrival: 2018-09-15 16:38:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 10948285  
Origin time : 2018-09-15 16:24:34.810  
Latitude : 26.5742  
Longitude : 129.5279  
Depth : 10.2000  
Magnitude : 5.60 Mww

## Station parameters

Latitude : -24.1700  
Longitude : -141.0900  
Distance : 100.0419

## Phase parameters ak135

Phase Travel time Expected arrival time  
Pdiff 825.4962 2018-09-15 16:38:20.306  
Sdiff 1520.3391 2018-09-15 16:49:55.149

---

136

Event number 136

Picked arrival: 2018-09-18 07:50:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10953395

Origin time : 2018-09-18 07:33:41.950

Latitude : 5.3410

Longitude : 96.3888

Depth : 47.1000

Magnitude : 4.70 mb

Station parameters

Latitude : -24.1600

Longitude : -141.0700

Distance : 121.7865

Phase parameters ak135

Phase Travel time Expected arrival time

Pdiff 916.8704 2018-09-18 07:48:58.820

PKIKP 1128.7008 2018-09-18 07:52:30.650

SKIKS 1556.7872 2018-09-18 07:59:38.737

Sdiff 1692.6975 2018-09-18 08:01:54.647

-----

Event number 137  
Picked arrival: 2018-09-18 12:07:30.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 10949274  
Origin time : 2018-09-18 11:57:52.040  
Latitude : -8.3287  
Longitude : 157.2172  
Depth : 10.0000  
Magnitude : 5.80 Mww

## Station parameters

Latitude : -24.1600  
Longitude : -141.0700  
Distance : 60.8494

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	612.5129	2018-09-18 12:08:04.552
	S	1110.1007	2018-09-18 12:16:22.140

---



138

Event number 138

Picked arrival: 2018-09-21 03:49:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10950337

Origin time : 2018-09-21 03:40:40.550

Latitude : -17.9071

Longitude : -179.9776

Depth : 652.3500

Magnitude : 5.90 Mww

Station parameters

Latitude : -24.1500

Longitude : -141.0500

Distance : 36.7493

Phase parameters ak135

Phase Travel time Expected arrival time

P 375.1263 2018-09-21 03:46:55.676

S 674.8901 2018-09-21 03:51:55.440

-----

Event number 139  
Picked arrival: 2018-09-28 07:17:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 10953041  
Origin time : 2018-09-28 07:03:18.350  
Latitude : -0.2102  
Longitude : 120.0175  
Depth : 10.0000  
Magnitude : 5.40 mb

## Station parameters

Latitude : -24.1200  
Longitude : -140.9800  
Distance : 98.1240

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	816.9575	2018-09-28 07:16:55.307
	S	1504.2461	2018-09-28 07:28:22.596

---

140

Event number 140

Picked arrival: 2018-10-02 00:13:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10954454

Origin time : 2018-10-01 23:59:42.730

Latitude : -10.5574

Longitude : 120.2417

Depth : 29.0000

Magnitude : 6.00 Mww

Station parameters

Latitude : -24.1000

Longitude : -140.9500

Distance : 93.5891

Phase parameters ak135

Phase Travel time Expected arrival time

P 793.3129 2018-10-02 00:12:56.042

S 1460.0201 2018-10-02 00:24:02.750

-----

Event number 141  
Picked arrival: 2018-10-02 10:17:20.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 10954594  
Origin time : 2018-10-02 10:08:37.460  
Latitude : -17.8250  
Longitude : 167.8506  
Depth : 10.0000  
Magnitude : 5.60 Mww

## Station parameters

Latitude : -24.1000  
Longitude : -140.9500  
Distance : 47.9693

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	518.8339	2018-10-02 10:17:16.293
	S	936.5535	2018-10-02 10:24:14.013

---

142

Event number 142

Picked arrival: 2018-10-05 21:18:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10956142

Origin time : 2018-10-05 21:08:26.670

Latitude : -21.9791

Longitude : 169.6002

Depth : 5.6100

Magnitude : 5.40 Mww

Station parameters

Latitude : -24.0800

Longitude : -140.9300

Distance : 45.3413

Phase parameters ak135

Phase Travel time Expected arrival time

P 498.9260 2018-10-05 21:16:45.595

S 900.0768 2018-10-05 21:23:26.746

-----

Event number 143  
Picked arrival: 2018-10-07 00:40:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 10956451  
Origin time : 2018-10-07 00:26:43.620  
Latitude : 12.6527  
Longitude : -88.2276  
Depth : 55.0400  
Magnitude : 4.90 mb

## Station parameters

Latitude : -24.0700  
Longitude : -140.9300  
Distance : 63.2246

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	622.5375	2018-10-07 00:37:06.157
	S	1130.0785	2018-10-07 00:45:33.698

---

144

Event number 144

Picked arrival: 2018-10-10 18:59:30.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10957904

Origin time : 2018-10-10 18:44:55.280

Latitude : -7.4530

Longitude : 114.4555

Depth : 9.0000

Magnitude : 6.00 Mww

Station parameters

Latitude : -24.0400

Longitude : -140.9200

Distance : 100.1248

Phase parameters ak135

Phase Travel time Expected arrival time

Pdiff 826.0660 2018-10-10 18:58:41.345

Sdiff 1521.3655 2018-10-10 19:10:16.645

-----

Event number 145  
Picked arrival: 2018-10-12 03:03:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 10958500  
Origin time : 2018-10-12 02:52:03.620  
Latitude : -6.2837  
Longitude : 151.0485  
Depth : 10.0000  
Magnitude : 5.60 Mww

## Station parameters

Latitude : -24.0300  
Longitude : -140.9200  
Distance : 67.4064

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	655.5579	2018-10-12 03:02:59.177
	S	1191.3728	2018-10-12 03:11:54.992

---



146

Event number 146

Picked arrival: 2018-10-12 09:48:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10958593

Origin time : 2018-10-12 09:40:21.080

Latitude : -55.9204

Longitude : -127.0905

Depth : 10.0000

Magnitude : 5.10 mb

Station parameters

Latitude : -24.0300

Longitude : -140.9200

Distance : 33.4648

Phase parameters ak135

Phase Travel time Expected arrival time

P 399.1971 2018-10-12 09:47:00.277

S 720.6948 2018-10-12 09:52:21.774

-----

Event number 147  
Picked arrival: 2018-10-12 21:20:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 10958761  
Origin time : 2018-10-12 21:09:49.310  
Latitude : 14.1973  
Longitude : -91.1973  
Depth : 64.3300  
Magnitude : 5.70 Mww

## Station parameters

Latitude : -24.0300  
Longitude : -140.9200  
Distance : 61.8001

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	612.0351	2018-10-12 21:20:01.345
	S	1110.4212	2018-10-12 21:28:19.731

---

148

Event number 148

Picked arrival: 2018-10-26 09:18:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10964339

Origin time : 2018-10-26 09:05:39.700

Latitude : 17.3785

Longitude : 147.8766

Depth : 10.0000

Magnitude : 5.70 mww

Station parameters

Latitude : -23.9700

Longitude : -140.8700

Distance : 80.8558

Phase parameters ak135

Phase Travel time Expected arrival time

P 734.1066 2018-10-26 09:17:53.806

S 1342.5018 2018-10-26 09:28:02.201

-----

Event number 149  
Picked arrival: 2018-11-01 19:42:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 10966577  
Origin time : 2018-11-01 19:30:20.940  
Latitude : -58.0742  
Longitude : -25.2059  
Depth : 29.0000  
Magnitude : 5.80 Mww

## Station parameters

Latitude : -23.9600  
Longitude : -140.8900  
Distance : 82.2284

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	738.3890	2018-11-01 19:42:39.329
	S	1351.7968	2018-11-01 19:52:52.736

---

150

Event number 150

Picked arrival: 2018-11-04 19:40:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10967700

Origin time : 2018-11-04 19:26:03.400

Latitude : 44.5474

Longitude : 145.6505

Depth : 9.0000

Magnitude : 5.90 Mww

Station parameters

Latitude : -23.9700

Longitude : -140.9000

Distance : 95.7096

Phase parameters ak135

Phase Travel time Expected arrival time

P 806.2028 2018-11-04 19:39:29.602

S 1483.7948 2018-11-04 19:50:47.194

-----

Event number 151  
Picked arrival: 2018-11-25 21:10:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 10974444  
Origin time : 2018-11-25 20:56:36.180  
Latitude : 13.1735  
Longitude : -81.0334  
Depth : 10.0000  
Magnitude : 5.60 Mww

## Station parameters

Latitude : -24.0100  
Longitude : -141.0300  
Distance : 69.3884

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	667.9656	2018-11-25 21:07:44.145
	S	1214.9753	2018-11-25 21:16:51.155

---

152

Event number 152

Picked arrival: 2018-11-29 02:44:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10975815

Origin time : 2018-11-29 02:33:53.890

Latitude : -13.5788

Longitude : -111.4734

Depth : 10.0000

Magnitude : 5.00 mb

Station parameters

Latitude : -24.0000

Longitude : -141.0700

Distance : 29.8144

Phase parameters ak135

Phase Travel time Expected arrival time

P 367.0865 2018-11-29 02:40:00.976

S 663.6819 2018-11-29 02:44:57.571

-----

Event number 153  
Picked arrival: 2018-12-03 21:40:00.000  
Tag : S1  
Arrival type : surface

Event parameters

IRIS Event ID : 10979158  
Origin time : 2018-12-03 21:24:21.070  
Latitude : -22.7294  
Longitude : -174.7066  
Depth : 10.0000  
Magnitude : 5.10 mb

Station parameters

Latitude : -23.9900  
Longitude : -141.1400  
Distance : 30.7688

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	375.5299	2018-12-03 21:30:36.599
	S	678.6570	2018-12-03 21:35:39.727

---



154

Event number 154

Picked arrival: 2018-12-15 20:33:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10985560

Origin time : 2018-12-15 20:21:54.830

Latitude : -16.4160

Longitude : 168.2201

Depth : 11.0800

Magnitude : 5.40 Mww

Station parameters

Latitude : -24.0100

Longitude : -141.3000

Distance : 47.7331

Phase parameters ak135

Phase Travel time Expected arrival time

P 516.8324 2018-12-15 20:30:31.662

S 932.9248 2018-12-15 20:37:27.754

-----

Event number 155  
Picked arrival: 2018-12-16 09:52:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 10985766  
Origin time : 2018-12-16 09:42:37.200  
Latitude : -3.9226  
Longitude : 140.2323  
Depth : 61.9700  
Magnitude : 6.10 Mww

## Station parameters

Latitude : -24.0100  
Longitude : -141.3100  
Distance : 77.8668

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	710.8924	2018-12-16 09:54:28.092
	S	1299.0312	2018-12-16 10:04:16.231

---

156

Event number 156

Picked arrival: 2018-12-16 14:40:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10985829

Origin time : 2018-12-16 14:26:19.620

Latitude : -23.3226

Longitude : 112.4979

Depth : 10.0000

Magnitude : 5.80 Mww

Station parameters

Latitude : -24.0100

Longitude : -141.3100

Distance : 94.1761

Phase parameters ak135

Phase Travel time Expected arrival time

P 799.0188 2018-12-16 14:39:38.638

S 1470.1638 2018-12-16 14:50:49.783

-----

Event number 157  
Picked arrival: 2018-12-22 14:33:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 10988309  
Origin time : 2018-12-22 14:25:01.220  
Latitude : -13.3940  
Longitude : 166.8116  
Depth : 42.0000  
Magnitude : 6.00 Mww

## Station parameters

Latitude : -24.0300  
Longitude : -141.4100  
Distance : 49.9061

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	529.3218	2018-12-22 14:33:50.541
	S	956.5059	2018-12-22 14:40:57.725

---

158

Event number 158

Picked arrival: 2018-12-25 00:25:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10989140

Origin time : 2018-12-25 00:10:30.610

Latitude : 34.0277

Longitude : 141.6252

Depth : 10.0000

Magnitude : 5.30 Mww

Station parameters

Latitude : -24.0400

Longitude : -141.4700

Distance : 93.2377

Phase parameters ak135

Phase Travel time Expected arrival time

P 794.7040 2018-12-25 00:23:45.313

S 1461.9366 2018-12-25 00:34:52.546

-----

Event number 159  
Picked arrival: 2018-12-26 23:50:00.000  
Tag : S1  
Arrival type : surface

## Event parameters

IRIS Event ID : 10989721  
Origin time : 2018-12-26 23:36:20.260  
Latitude : -23.2219  
Longitude : -174.8427  
Depth : 10.0000  
Magnitude : 5.10 mb

## Station parameters

Latitude : -24.0500  
Longitude : -141.5200  
Distance : 30.4670

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	372.8605	2018-12-26 23:42:33.120
	S	673.9233	2018-12-26 23:47:34.183

---

160

Event number 160

Picked arrival: 2018-12-27 15:00:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10989901

Origin time : 2018-12-27 14:46:16.820

Latitude : -23.0050

Longitude : -174.7981

Depth : 10.0000

Magnitude : 4.90 mb

Station parameters

Latitude : -24.0500

Longitude : -141.5400

Distance : 30.4404

Phase parameters ak135

Phase Travel time Expected arrival time

P 372.6252 2018-12-27 14:52:29.445

S 673.5061 2018-12-27 14:57:30.326

-----

Event number 161  
Picked arrival: 2018-12-28 20:10:00.000  
Tag : S1  
Arrival type : surface

## Event parameters

IRIS Event ID : 10996998  
Origin time : 2018-12-28 19:52:22.230  
Latitude : -8.9006  
Longitude : -108.1580  
Depth : 10.0000  
Magnitude : 4.60 mb

## Station parameters

Latitude : -24.0600  
Longitude : -141.5700  
Distance : 35.3027

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	415.1176	2018-12-28 19:59:17.347
	S	749.0744	2018-12-28 20:04:51.304

---



162

Event number 162

Picked arrival: 2018-12-28 20:37:30.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 10990456

Origin time : 2018-12-28 20:20:12.110

Latitude : -9.0561

Longitude : -108.4182

Depth : 10.0000

Magnitude : 4.80 mb

Station parameters

Latitude : -24.0600

Longitude : -141.5700

Distance : 35.0024

Phase parameters ak135

Phase Travel time Expected arrival time

P 412.5267 2018-12-28 20:27:04.636

S 744.4526 2018-12-28 20:32:36.562

-----

Event number 163  
Picked arrival: 2019-01-05 23:07:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 10992877  
Origin time : 2019-01-05 22:54:14.440  
Latitude : 25.8233  
Longitude : 144.5691  
Depth : 14.2800  
Magnitude : 5.70 Mww

## Station parameters

Latitude : -24.1100  
Longitude : -141.7600  
Distance : 86.9582

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	764.5536	2019-01-05 23:06:58.993
	S	1402.6789	2019-01-05 23:17:37.118

---

164

Event number 164

Picked arrival: 2019-01-17 15:18:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 10996799

Origin time : 2019-01-17 15:06:35.640

Latitude : -3.2525

Longitude : 146.3564

Depth : 10.0000

Magnitude : 6.20 Mww

Station parameters

Latitude : -24.1800

Longitude : -142.0200

Distance : 71.9182

Phase parameters ak135

Phase Travel time Expected arrival time

P 683.3895 2019-01-17 15:17:59.029

S 1244.4491 2019-01-17 15:27:20.089

-----

Event number 165  
Picked arrival: 2019-01-25 04:55:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 10999355  
Origin time : 2019-01-25 04:45:22.140  
Latitude : -14.5405  
Longitude : -75.3797  
Depth : 60.9100  
Magnitude : 5.70 Mww

## Station parameters

Latitude : -24.2100  
Longitude : -142.1600  
Distance : 63.1907

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	621.6743	2019-01-25 04:55:43.814
	S	1128.5283	2019-01-25 05:04:10.668

---

166

Event number 166

Picked arrival: 2019-01-26 13:05:00.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 10999684

Origin time : 2019-01-26 12:32:26.880

Latitude : 3.0271

Longitude : -75.7211

Depth : 10.0000

Magnitude : 5.60 Mww

Station parameters

Latitude : -24.2200

Longitude : -142.1800

Distance : 69.9965

Phase parameters ak135

Phase Travel time Expected arrival time

P 671.7216 2019-01-26 12:43:38.601

S 1222.1289 2019-01-26 12:52:49.008

-----

Event number 167  
Picked arrival: 2019-01-30 07:55:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 11000968  
Origin time : 2019-01-30 07:44:45.250  
Latitude : -25.8985  
Longitude : -70.6676  
Depth : 51.0000  
Magnitude : 5.60 Mww

## Station parameters

Latitude : -24.2300  
Longitude : -142.2400  
Distance : 63.9878

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	628.0016	2019-01-30 07:55:13.251
	S	1140.3433	2019-01-30 08:03:45.593

---

168

Event number 168

Picked arrival: 2019-02-08 12:08:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 11003845

Origin time : 2019-02-08 11:55:08.370

Latitude : 9.8311

Longitude : 126.5297

Depth : 24.7100

Magnitude : 5.90 Mww

Station parameters

Latitude : -24.2600

Longitude : -142.3500

Distance : 95.0324

Phase parameters ak135

Phase Travel time Expected arrival time

P 800.5730 2019-02-08 12:08:28.942

S 1473.6820 2019-02-08 12:19:42.052

-----

Event number 169  
Picked arrival: 2019-02-15 13:02:00.000  
Tag : S1  
Arrival type : surface

Event parameters

IRIS Event ID : 11005855  
Origin time : 2019-02-15 12:47:27.100  
Latitude : -13.6438  
Longitude : -111.6324  
Depth : 10.0000  
Magnitude : 4.70 mb

Station parameters

Latitude : -24.2900  
Longitude : -142.4100  
Distance : 30.9031

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	376.7134	2019-02-15 12:53:43.813
	S	680.7583	2019-02-15 12:58:47.858

---



170

Event number 170

Picked arrival: 2019-02-16 00:00:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 11006952

Origin time : 2019-02-15 23:51:40.680

Latitude : -55.7216

Longitude : -124.9470

Depth : 10.0000

Magnitude : 5.60 Mww

Station parameters

Latitude : -24.2900

Longitude : -142.4100

Distance : 33.9420

Phase parameters ak135

Phase Travel time Expected arrival time

P 403.3462 2019-02-15 23:58:24.026

S 728.0892 2019-02-16 00:03:48.769

-----

Event number 171  
Picked arrival: 2019-02-17 14:45:50.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 11006560  
Origin time : 2019-02-17 14:35:55.840  
Latitude : -3.3412  
Longitude : 152.1319  
Depth : 368.1200  
Magnitude : 6.40 Mww

## Station parameters

Latitude : -24.3000  
Longitude : -142.4200  
Distance : 66.2940

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	609.8883	2019-02-17 14:46:05.728
	S	1109.1443	2019-02-17 14:54:24.984

---

172

Event number 172

Picked arrival: 2019-03-06 07:38:00.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 11011831

Origin time : 2019-03-06 07:20:45.320

Latitude : -36.2365

Longitude : -97.5054

Depth : 10.0000

Magnitude : 5.60 Mww

Station parameters

Latitude : -24.3900

Longitude : -142.5400

Distance : 40.2504

Phase parameters ak135

Phase Travel time Expected arrival time

P 456.9342 2019-03-06 07:28:22.254

S 824.1010 2019-03-06 07:34:29.421

-----

Event number 173  
Picked arrival: 2019-03-11 16:36:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 11013478  
Origin time : 2019-03-11 16:25:51.980  
Latitude : -6.0469  
Longitude : 149.0143  
Depth : 34.6400  
Magnitude : 5.90 Mww

## Station parameters

Latitude : -24.4000  
Longitude : -142.6000  
Distance : 67.8454

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	654.6197	2019-03-11 16:36:46.599
	S	1190.4936	2019-03-11 16:45:42.473

---

174

Event number 174

Picked arrival: 2019-03-15 05:15:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 11014923

Origin time : 2019-03-15 05:03:50.060

Latitude : -17.8744

Longitude : -65.9072

Depth : 359.0000

Magnitude : 6.30 Mww

Station parameters

Latitude : -24.3900

Longitude : -142.6500

Distance : 71.0028

Phase parameters ak135

Phase Travel time Expected arrival time

P 639.5621 2019-03-15 05:14:29.622

S 1165.7025 2019-03-15 05:23:15.762

-----

Event number 175  
Picked arrival: 2019-03-15 18:00:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 11015065  
Origin time : 2019-03-15 17:53:33.980  
Latitude : -27.4733  
Longitude : -176.4580  
Depth : 10.0000  
Magnitude : 5.60 Mww

## Station parameters

Latitude : -24.3900  
Longitude : -142.6500  
Distance : 30.4675

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	372.8644	2019-03-15 17:59:46.844
	S	673.9303	2019-03-15 18:04:47.910

---

176

Event number 176

Picked arrival: 2019-03-20 19:09:30.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 11016738

Origin time : 2019-03-20 19:03:01.784

Latitude : -17.6861

Longitude : -172.4876

Depth : 10.0000

Magnitude : 5.30 Mww

Station parameters

Latitude : -24.3700

Longitude : -142.7100

Distance : 28.5245

Phase parameters ak135

Phase Travel time Expected arrival time

P 355.6502 2019-03-20 19:08:57.434

S 643.4125 2019-03-20 19:13:45.196

-----

Event number 177

Picked arrival: 2019-03-23 07:55:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 11017711

Origin time : 2019-03-23 07:47:42.160

Latitude : -31.8488

Longitude : -177.7856

Depth : 10.0000

Magnitude : 5.00 Mww

Station parameters

Latitude : -24.3500

Longitude : -142.7200

Distance : 31.6811

Phase parameters ak135

Phase Travel time Expected arrival time

P 383.5683 2019-03-23 07:54:05.728

S 692.9245 2019-03-23 07:59:15.084

-----



178

Event number 178

Picked arrival: 2019-03-23 19:32:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 11017822

Origin time : 2019-03-23 19:21:18.010

Latitude : 4.5629

Longitude : -76.2231

Depth : 122.0000

Magnitude : 6.10 Mww

Station parameters

Latitude : -24.3500

Longitude : -142.7300

Distance : 70.7782

Phase parameters ak135

Phase Travel time Expected arrival time

P 663.0236 2019-03-23 19:32:21.033

S 1207.9401 2019-03-23 19:41:25.950

-----

Event number 179  
Picked arrival: 2019-03-24 04:50:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 11017911  
Origin time : 2019-03-24 04:37:35.909  
Latitude : 1.6617  
Longitude : 126.3800  
Depth : 45.0000  
Magnitude : 6.10 Mww

## Station parameters

Latitude : -24.3400  
Longitude : -142.7300  
Distance : 91.4955

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	781.5872	2019-03-24 04:50:37.496
	S	1437.8104	2019-03-24 05:01:33.719

---

180

Event number 180

Picked arrival: 2019-03-31 15:55:00.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 11020776

Origin time : 2019-03-31 15:27:57.880

Latitude : -9.9668

Longitude : -79.3227

Depth : 29.0000

Magnitude : 5.50 Mww

Station parameters

Latitude : -24.3100

Longitude : -142.7700

Distance : 61.8041

Phase parameters ak135

Phase Travel time Expected arrival time

P 616.0842 2019-03-31 15:38:13.964

S 1117.4786 2019-03-31 15:46:35.358

-----

Event number 181  
Picked arrival: 2019-04-05 16:27:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 11022772  
Origin time : 2019-04-05 16:14:16.754  
Latitude : -55.9206  
Longitude : -27.8560  
Depth : 58.6000  
Magnitude : 6.40 mww

## Station parameters

Latitude : -24.2900  
Longitude : -142.8000  
Distance : 82.8010

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	737.7750	2019-04-05 16:26:34.529
	S	1351.3979	2019-04-05 16:36:48.151

---

182

Event number 182

Picked arrival: 2019-04-08 22:57:00.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 11023834

Origin time : 2019-04-08 22:25:42.595

Latitude : 12.5442

Longitude : -89.1985

Depth : 35.0000

Magnitude : 5.00 mb

Station parameters

Latitude : -24.2800

Longitude : -142.8400

Distance : 64.0116

Phase parameters ak135

Phase Travel time Expected arrival time

P 629.9050 2019-04-08 22:36:12.500

S 1143.7250 2019-04-08 22:44:46.319

-----

Event number 183  
Picked arrival: 2019-04-22 09:28:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 11028716  
Origin time : 2019-04-22 09:11:11.745  
Latitude : 14.9236  
Longitude : 120.4972  
Depth : 20.0000  
Magnitude : 6.10 Mww

## Station parameters

Latitude : -24.2600  
Longitude : -143.0100  
Distance : 101.8546

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
Pdiff	831.9114	2019-04-22 09:25:03.656	
Sdiff	1532.7231	2019-04-22 09:36:44.468	

-----

184

Event number 184

Picked arrival: 2019-04-23 05:05:00.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 11028990

Origin time : 2019-04-23 04:52:01.962

Latitude : -20.0376

Longitude : -173.0654

Depth : 10.0000

Magnitude : 5.20 mb

Station parameters

Latitude : -24.2600

Longitude : -143.0200

Distance : 28.0915

Phase parameters ak135

Phase Travel time Expected arrival time

P 351.7896 2019-04-23 04:57:53.751

S 636.5966 2019-04-23 05:02:38.558

-----

Event number 185  
Picked arrival: 2019-04-26 06:58:40.000  
Tag : S1  
Arrival type : surface

## Event parameters

IRIS Event ID : 11030576  
Origin time : 2019-04-26 06:22:34.323  
Latitude : -25.8987  
Longitude : -71.0119  
Depth : 29.0000  
Magnitude : 5.50 Mww

## Station parameters

Latitude : -24.2400  
Longitude : -143.0600  
Distance : 64.3964

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	633.2888	2019-04-26 06:33:07.611
	S	1149.8895	2019-04-26 06:41:44.212

---



186

Event number 186

Picked arrival: 2019-04-26 06:58:40.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 11030576

Origin time : 2019-04-26 06:22:34.323

Latitude : -25.8987

Longitude : -71.0119

Depth : 29.0000

Magnitude : 5.50 Mww

Station parameters

Latitude : -24.2400

Longitude : -143.0600

Distance : 64.3964

Phase parameters ak135

Phase Travel time Expected arrival time

P 633.2888 2019-04-26 06:33:07.611

S 1149.8895 2019-04-26 06:41:44.212

-----

Event number 187  
Picked arrival: 2019-04-27 11:19:00.000  
Tag : S1  
Arrival type : surface

Event parameters

IRIS Event ID : 11031077  
Origin time : 2019-04-27 10:59:17.333  
Latitude : -35.2762  
Longitude : -103.6067  
Depth : 10.0000  
Magnitude : 4.80 mb

Station parameters

Latitude : -24.2400  
Longitude : -143.0800  
Distance : 35.7353

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	418.8341	2019-04-27 11:06:16.167
	S	755.7148	2019-04-27 11:11:53.047

---

188

Event number 188

Picked arrival: 2019-05-04 04:45:30.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 11033566

Origin time : 2019-05-04 04:33:43.090

Latitude : -24.1519

Longitude : -115.9052

Depth : 10.0000

Magnitude : 5.00 mb

Station parameters

Latitude : -24.1900

Longitude : -143.1800

Distance : 24.8435

Phase parameters ak135

Phase Travel time Expected arrival time

P 322.4741 2019-05-04 04:39:05.564

P 324.1273 2019-05-04 04:39:07.217

P 325.0319 2019-05-04 04:39:08.121

S 585.2111 2019-05-04 04:43:28.301

S 591.1092 2019-05-04 04:43:34.199

S 592.0149 2019-05-04 04:43:35.104

-----

Event number 189  
Picked arrival: 2019-05-10 00:37:00.000  
Tag : S1  
Arrival type : surface

Event parameters

IRIS Event ID : 11035661  
Origin time : 2019-05-09 23:48:42.764  
Latitude : 31.7719  
Longitude : 131.8503  
Depth : 22.0000  
Magnitude : 6.10 Mww

Station parameters

Latitude : -24.1500  
Longitude : -143.2300  
Distance : 98.4373

Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	816.3914	2019-05-10 00:02:19.155
	S	1503.6223	2019-05-10 00:13:46.386

---

190

Event number 190

Picked arrival: 2019-05-17 22:48:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 11038666

Origin time : 2019-05-17 22:37:47.788

Latitude : -4.5834

Longitude : 153.0098

Depth : 21.0000

Magnitude : 5.90 Mww

Station parameters

Latitude : -24.1000

Longitude : -143.2800

Distance : 64.1739

Phase parameters ak135

Phase Travel time Expected arrival time

P 632.9595 2019-05-17 22:48:20.747

S 1149.0161 2019-05-17 22:56:56.804

-----

Event number 191  
Picked arrival: 2019-05-23 15:10:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 11040302  
Origin time : 2019-05-23 15:02:18.599  
Latitude : -21.6535  
Longitude : 169.7938  
Depth : 19.0000  
Magnitude : 5.70 Mww

## Station parameters

Latitude : -24.0600  
Longitude : -143.3500  
Distance : 43.0472

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	478.4441	2019-05-23 15:10:17.043
	S	863.2192	2019-05-23 15:16:41.818

---

192

Event number 192

Picked arrival: 2019-05-31 10:26:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 11042835

Origin time : 2019-05-31 10:12:32.135

Latitude : 6.2643

Longitude : 126.5518

Depth : 90.2100

Magnitude : 6.10 Mww

Station parameters

Latitude : -23.9900

Longitude : -143.4600

Distance : 92.5320

Phase parameters ak135

Phase Travel time Expected arrival time

P 781.0912 2019-05-31 10:25:33.226

S 1437.7268 2019-05-31 10:36:29.861

-----

Event number 193  
Picked arrival: 2019-05-31 12:23:00.000  
Tag : S1  
Arrival type : surface

## Event parameters

IRIS Event ID : 11042843  
Origin time : 2019-05-31 11:57:24.579  
Latitude : 18.7319  
Longitude : -107.1693  
Depth : 10.0000  
Magnitude : 5.80 Mww

## Station parameters

Latitude : -23.9900  
Longitude : -143.4600  
Distance : 55.4710

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	574.8664	2019-05-31 12:06:59.445
	S	1039.8375	2019-05-31 12:14:44.416

---



194

Event number 194

Picked arrival: 2019-06-11 23:40:00.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 11047824

Origin time : 2019-06-11 23:23:41.310

Latitude : -55.0453

Longitude : -127.0710

Depth : 10.0000

Magnitude : 5.20 mb

Station parameters

Latitude : -23.8900

Longitude : -143.5600

Distance : 33.4648

Phase parameters ak135

Phase Travel time Expected arrival time

P 399.1968 2019-06-11 23:30:20.506

S 720.6943 2019-06-11 23:35:42.004

-----

Event number 195  
Picked arrival: 2019-06-13 07:45:00.000  
Tag : S1  
Arrival type : surface

## Event parameters

IRIS Event ID : 11048373  
Origin time : 2019-06-13 07:33:58.066  
Latitude : -21.1645  
Longitude : -173.8065  
Depth : 10.0000  
Magnitude : 5.20 mb

## Station parameters

Latitude : -23.9000  
Longitude : -143.5600  
Distance : 28.0186

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	351.1373	2019-06-13 07:39:49.203
	P	356.0186	2019-06-13 07:39:54.084
	P	356.0191	2019-06-13 07:39:54.085
	S	635.4482	2019-06-13 07:44:33.514

-----

196

Event number 196

Picked arrival: 2019-06-14 16:55:00.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 11048883

Origin time : 2019-06-14 16:26:26.087

Latitude : 14.1355

Longitude : -93.2341

Depth : 10.0000

Magnitude : 5.10 Mww

Station parameters

Latitude : -23.9300

Longitude : -143.5500

Distance : 62.1646

Phase parameters ak135

Phase Travel time Expected arrival time

P 621.3959 2019-06-14 16:36:47.482

S 1126.7940 2019-06-14 16:45:12.880

-----

Event number 197  
Picked arrival: 2019-06-24 01:17:30.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 11052533  
Origin time : 2019-06-24 01:05:29.464  
Latitude : -2.7756  
Longitude : 138.5675  
Depth : 28.0000  
Magnitude : 6.10 Mww

## Station parameters

Latitude : -24.0500  
Longitude : -143.5100  
Distance : 77.8436

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	714.8481	2019-06-24 01:17:24.312
	S	1305.8734	2019-06-24 01:27:15.337

---

198

Event number 198

Picked arrival: 2019-06-25 09:18:40.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 11052941

Origin time : 2019-06-25 09:05:40.871

Latitude : 56.2080

Longitude : 164.1836

Depth : 10.0000

Magnitude : 6.30 mww

Station parameters

Latitude : -24.0400

Longitude : -143.5200

Distance : 91.5994

Phase parameters ak135

Phase Travel time Expected arrival time

P 787.1330 2019-06-25 09:18:48.003

S 1447.2975 2019-06-25 09:29:48.168

-----

Event number 199  
Picked arrival: 2019-06-28 16:05:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 11054354  
Origin time : 2019-06-28 15:51:31.302  
Latitude : 19.8515  
Longitude : 144.3477  
Depth : 410.0000  
Magnitude : 6.40 Mww

## Station parameters

Latitude : -24.0100  
Longitude : -143.5400  
Distance : 82.7772

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	699.4806	2019-06-28 16:03:10.782
	S	1282.4743	2019-06-28 16:12:53.776

---

200

Event number 200

Picked arrival: 2019-07-05 02:21:00.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 11057330

Origin time : 2019-07-05 02:08:23.181

Latitude : -14.7878

Longitude : -173.4547

Depth : 10.0000

Magnitude : 5.20 Mww

Station parameters

Latitude : -23.9600

Longitude : -143.5700

Distance : 29.5731

Phase parameters ak135

Phase Travel time Expected arrival time

P 364.9523 2019-07-05 02:14:28.133

S 659.8965 2019-07-05 02:19:23.077

-----

Event number 201  
Picked arrival: 2019-07-05 11:40:00.000  
Tag : S1  
Arrival type : surface

## Event parameters

IRIS Event ID : 11057796  
Origin time : 2019-07-05 11:07:53.040  
Latitude : 35.7603  
Longitude : -117.5750  
Depth : 6.9500  
Magnitude : 5.40 Mww

## Station parameters

Latitude : -23.9600  
Longitude : -143.5800  
Distance : 64.5867

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	637.9260	2019-07-05 11:18:30.965
	S	1157.8295	2019-07-05 11:27:10.869

---



202

Event number 202

Picked arrival: 2019-07-05 13:37:30.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 11057951

Origin time : 2019-07-05 12:58:28.335

Latitude : 51.3371

Longitude : -130.5696

Depth : 5.1100

Magnitude : 5.60 Mww

Station parameters

Latitude : -23.9600

Longitude : -143.5800

Distance : 76.1635

Phase parameters ak135

Phase Travel time Expected arrival time

P 709.0186 2019-07-05 13:10:17.353

S 1293.5389 2019-07-05 13:20:01.873

-----

Event number 203  
Picked arrival: 2019-07-17 22:43:00.000  
Tag : S1  
Arrival type : surface

## Event parameters

IRIS Event ID : 11077612  
Origin time : 2019-07-17 22:16:44.213  
Latitude : 8.4684  
Longitude : -102.8086  
Depth : 10.0000  
Magnitude : 4.80 mb

## Station parameters

Latitude : -23.8500  
Longitude : -143.5900  
Distance : 51.2847

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	544.1053	2019-07-17 22:25:48.318
	S	982.9479	2019-07-17 22:33:07.160

---

204

Event number 204

Picked arrival: 2019-07-20 14:25:00.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 11080263

Origin time : 2019-07-20 14:11:04.219

Latitude : -20.4419

Longitude : -173.5290

Depth : 10.0000

Magnitude : 4.80 mb

Station parameters

Latitude : -23.8400

Longitude : -143.5600

Distance : 27.9145

Phase parameters ak135

Phase Travel time Expected arrival time

P 350.2059 2019-07-20 14:16:54.424

P 354.9974 2019-07-20 14:16:59.216

P 355.0021 2019-07-20 14:16:59.221

S 633.8085 2019-07-20 14:21:38.027

-----

Event number 205  
Picked arrival: 2019-07-20 15:30:30.000  
Tag : S1  
Arrival type : surface

## Event parameters

IRIS Event ID : 11080254  
Origin time : 2019-07-20 15:16:29.205  
Latitude : -20.2775  
Longitude : -173.1769  
Depth : 10.0000  
Magnitude : 5.10 Mww

## Station parameters

Latitude : -23.8400  
Longitude : -143.5600  
Distance : 27.6288

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	347.6495	2019-07-20 15:22:16.854
	P	352.1901	2019-07-20 15:22:21.395
	P	352.2108	2019-07-20 15:22:21.415
	S	629.3080	2019-07-20 15:26:58.513

---

206

Event number 206

Picked arrival: 2019-07-21 21:14:00.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 11081248

Origin time : 2019-07-21 20:59:02.212

Latitude : -29.9016

Longitude : -111.7789

Depth : 10.0000

Magnitude : 4.70 mb

Station parameters

Latitude : -23.8300

Longitude : -143.5500

Distance : 28.8876

Phase parameters ak135

Phase Travel time Expected arrival time

P 358.8789 2019-07-21 21:05:01.090

S 649.1239 2019-07-21 21:09:51.335

-----

Event number 207

Picked arrival: 2019-07-23 10:55:00.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 11082724

Origin time : 2019-07-23 10:33:24.010

Latitude : -61.2936

Longitude : 154.0630

Depth : 10.0000

Magnitude : 6.00 Mww

Station parameters

Latitude : -23.8300

Longitude : -143.5400

Distance : 56.0861

Phase parameters ak135

Phase Travel time Expected arrival time

P 579.2796 2019-07-23 10:43:03.289

S 1048.0309 2019-07-23 10:50:52.040

-----

208

Event number 208

Picked arrival: 2019-07-27 18:45:00.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 11086537

Origin time : 2019-07-27 18:31:07.514

Latitude : 33.1461

Longitude : 137.3250

Depth : 367.0000

Magnitude : 6.30 Mww

Station parameters

Latitude : -23.8100

Longitude : -143.5100

Distance : 94.4012

Phase parameters ak135

Phase Travel time Expected arrival time

P 758.8730 2019-07-27 18:43:46.387

S 1398.1841 2019-07-27 18:54:25.698

-----

Event number 209  
Picked arrival: 2019-08-02 01:26:00.000  
Tag : S1  
Arrival type : surface

## Event parameters

IRIS Event ID : 11090368  
Origin time : 2019-08-02 00:55:16.872  
Latitude : -34.1794  
Longitude : -72.1980  
Depth : 14.0400  
Magnitude : 5.40 Mww

## Station parameters

Latitude : -23.7800  
Longitude : -143.5000  
Distance : 62.0163

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	619.7498	2019-08-02 01:05:36.621
	S	1123.8482	2019-08-02 01:14:00.720

---



210

Event number 210

Picked arrival: 2019-08-06 17:40:00.000

Tag : S1

Arrival type : surface

Event parameters

IRIS Event ID : 11092784

Origin time : 2019-08-06 17:20:57.028

Latitude : -6.0700

Longitude : -107.3111

Depth : 10.0000

Magnitude : 4.90 mb

Station parameters

Latitude : -23.7800

Longitude : -143.4900

Distance : 39.0000

Phase parameters ak135

Phase Travel time Expected arrival time

P 446.5140 2019-08-06 17:28:23.541

S 805.3382 2019-08-06 17:34:22.366

-----

Event number 211  
Picked arrival: 2019-08-06 22:22:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 11092895  
Origin time : 2019-08-06 22:14:14.863  
Latitude : -17.9594  
Longitude : 168.5844  
Depth : 150.0000  
Magnitude : 5.90 Mww

## Station parameters

Latitude : -23.7800  
Longitude : -143.4900  
Distance : 44.9553

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	479.9614	2019-08-06 22:22:14.824
	S	866.7886	2019-08-06 22:28:41.651

---

212

Event number 212

Picked arrival: 2019-08-07 05:41:40.000

Tag : \*

Arrival type : body

Event parameters

IRIS Event ID : 11093088

Origin time : 2019-08-07 05:32:40.468

Latitude : -15.5082

Longitude : 167.7054

Depth : 123.3000

Magnitude : 5.80 Mww

Station parameters

Latitude : -23.7900

Longitude : -143.4900

Distance : 46.4822

Phase parameters ak135

Phase Travel time Expected arrival time

P 494.6204 2019-08-07 05:40:55.088

S 893.4374 2019-08-07 05:47:33.905

-----

Event number 213  
Picked arrival: 2019-08-12 10:45:00.000  
Tag : \*  
Arrival type : body

## Event parameters

IRIS Event ID : 11096114  
Origin time : 2019-08-12 10:35:28.468  
Latitude : -44.5471  
Longitude : 167.9051  
Depth : 10.0000  
Magnitude : 5.40 Mww

## Station parameters

Latitude : -23.8000  
Longitude : -143.5200  
Distance : 44.3962

## Phase parameters ak135

	Phase	Travel time	Expected arrival time
	P	490.7067	2019-08-12 10:43:39.174
	S	885.2429	2019-08-12 10:50:13.710

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# Supplementary Material 2:

## One year of sound recorded by a MERMAID float in the Pacific: Hydroacoustic earthquake signals and infrasonic ambient noise

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In this Supplement we show hourlong segments of reviewed records sorted by tag which is a combination of rating and arrival type, and then chronologically in the same way as the list in Supplementary Material 1. The ratings are `DET`, `REQ`, `3stars`, `2star`, and `1stars`. The first two ratings, `DET` and `REQ`, apply to events that we have the time series and know that they contain earthquake signals prior to searching for the missing earthquake signals. `DET` means the event is reported by the instrument automatically after it receives *P* wave arrivals. `REQ` means the event which the time series has been requested prior to its work. Therefore, we know that these time series contain potential earthquake signals. The other ratings apply to the events manually found by us in the buffer. More stars indicate the more outstanding signals from the background level. The arrival types are `body` and `surface`. For `body` type events, we match the events whose expected body wave arrival times fell within three minutes from the times that we have identified in our time series. We computed the body expected arrival times using the `ak135` velocity model. For `surface` type events, we match the events whose surface wave arrival would imply a speed between 3–5 km/s. The ratings for the body wave type are `***`, `**`, and `*` for surface waves which correspond to `3stars`, `2stars`, and `1stars`. The ratings for the surface wave type are `S3`, `S2`, and `S1` for surface waves which correspond to `3stars`, `2stars`, and `1star`, respectively. All events are sorted by tag form `DET`, `REQ`, `3stars (***, S3)`, `2stars (**, S2)`, and `1star (*, S1)` where the parentheses indicate equal ranking. The event parameters are listed in Supplementary Material 1.

Events automatically reported by MERMAID start at page 2.

Events requested from the buffer start at page 12.

Events that received a 3-star rating start at page 22.

Events that received a 2-star rating start at page 53.

Events that received a 1-star rating start at page 135.

Arrival: 2018-11-18T20:32:00.000000, ID: 10972756

Mww = 6.80, distance = 35.88 degrees, depth = 540.00 km  
93.69 - 100.00 percent

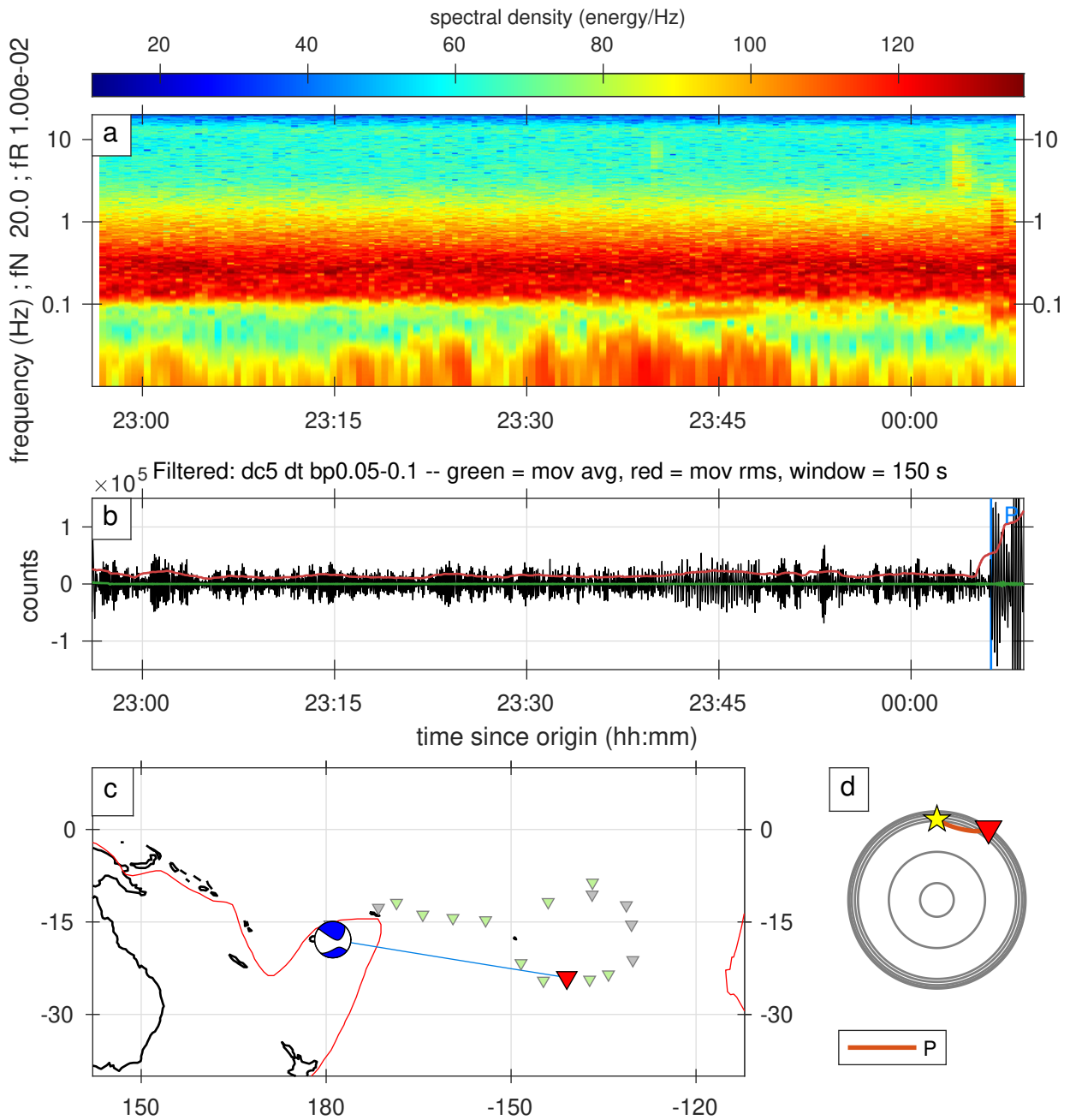


Figure S1. A full record of an earthquake classified as DET category.

Arrival: 2018-11-30T17:42:00.000000, ID: 10976411

mww = 7.00, distance = 85.64 degrees, depth = 46.70 km  
72.08 - 100.00 percent

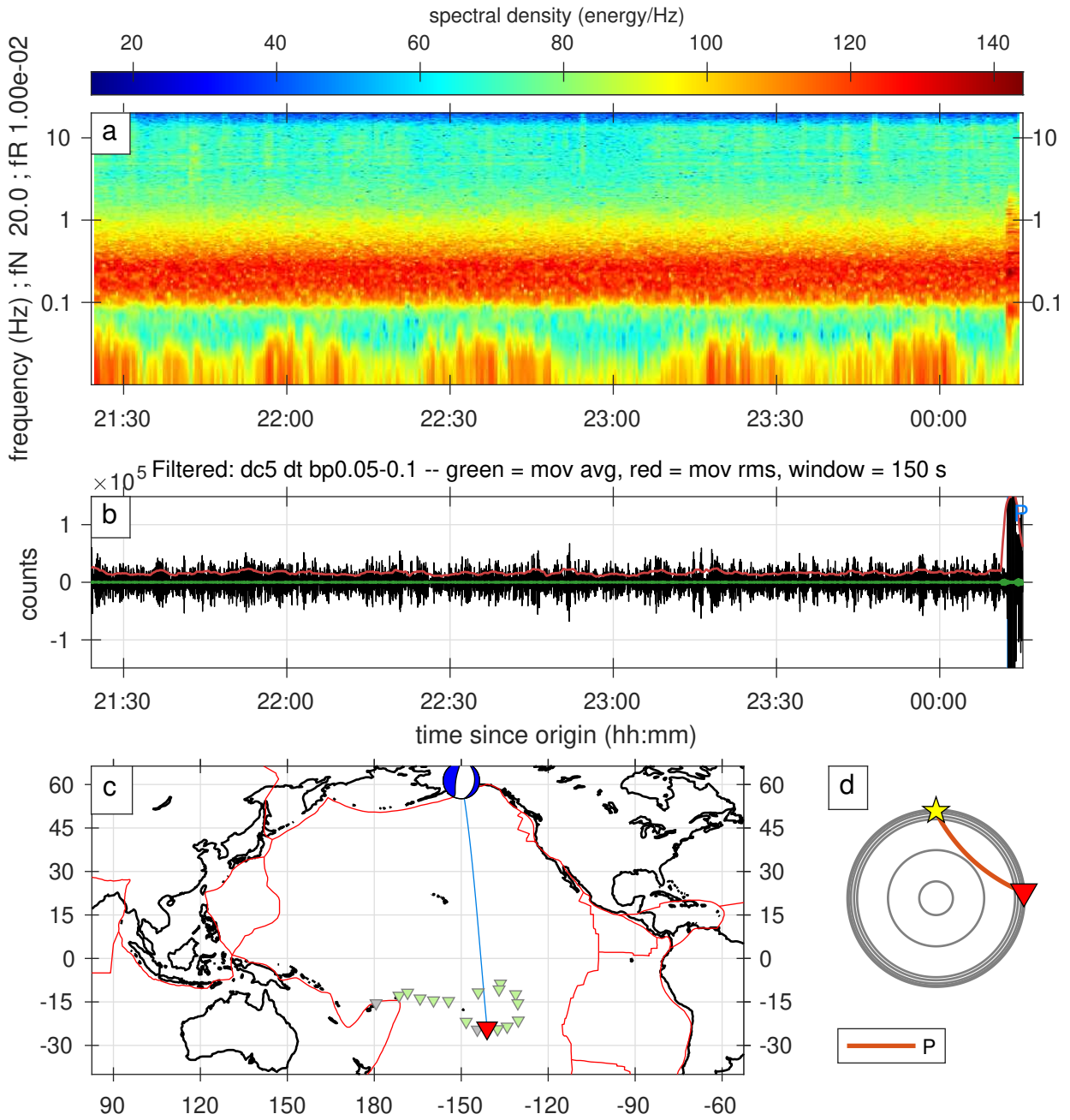


Figure S2. A full record of an earthquake classified as DET category.

Arrival: 2018-12-05T04:26:35.000000, ID: 10980271

Mww = 7.50, distance = 45.31 degrees, depth = 10.00 km  
97.92 - 100.00 percent

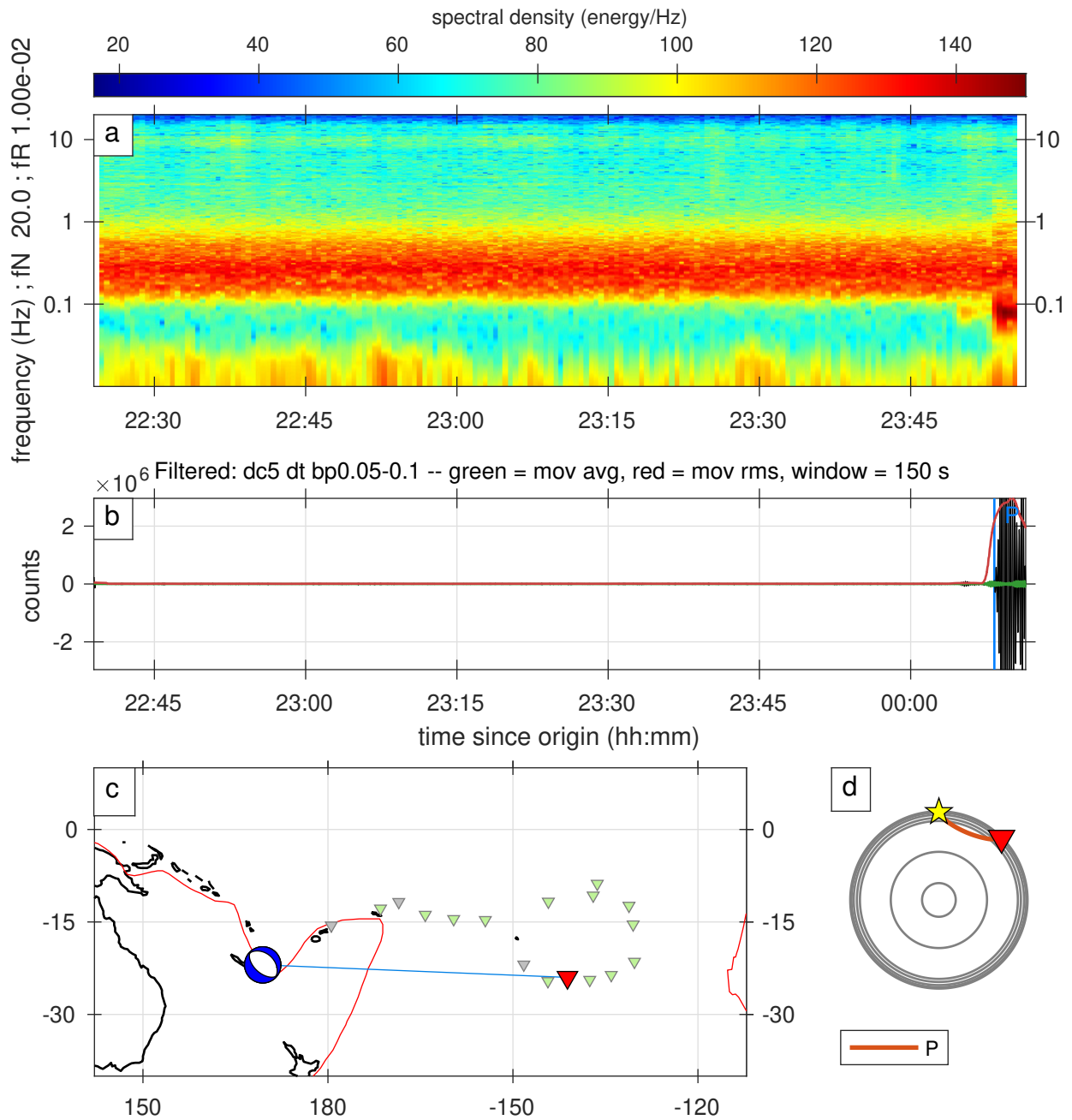


Figure S3. A full record of an earthquake classified as DET category.



Arrival: 2018-12-11T02:38:40.000000, ID: 10983619

mww = 7.10, distance = 81.50 degrees, depth = 164.66 km  
96.53 - 100.00 percent

spectral density (energy/Hz)

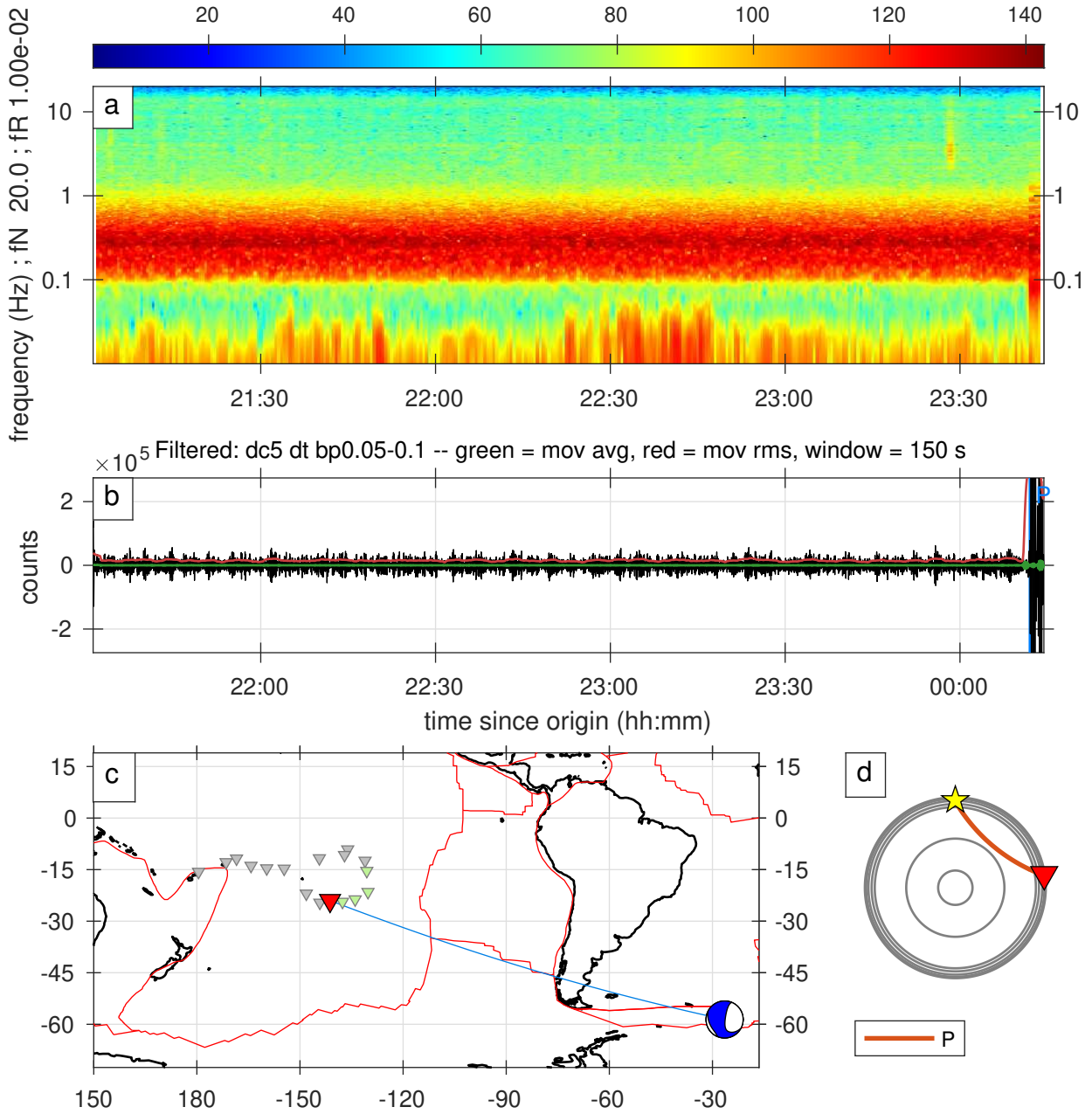


Figure S4. A full record of an earthquake classified as DET category.

Arrival: 2018-12-23T23:14:45.000000, ID: 10988734

mww = 6.40, distance = 31.31 degrees, depth = 113.00 km

64.01 - 100.00 percent

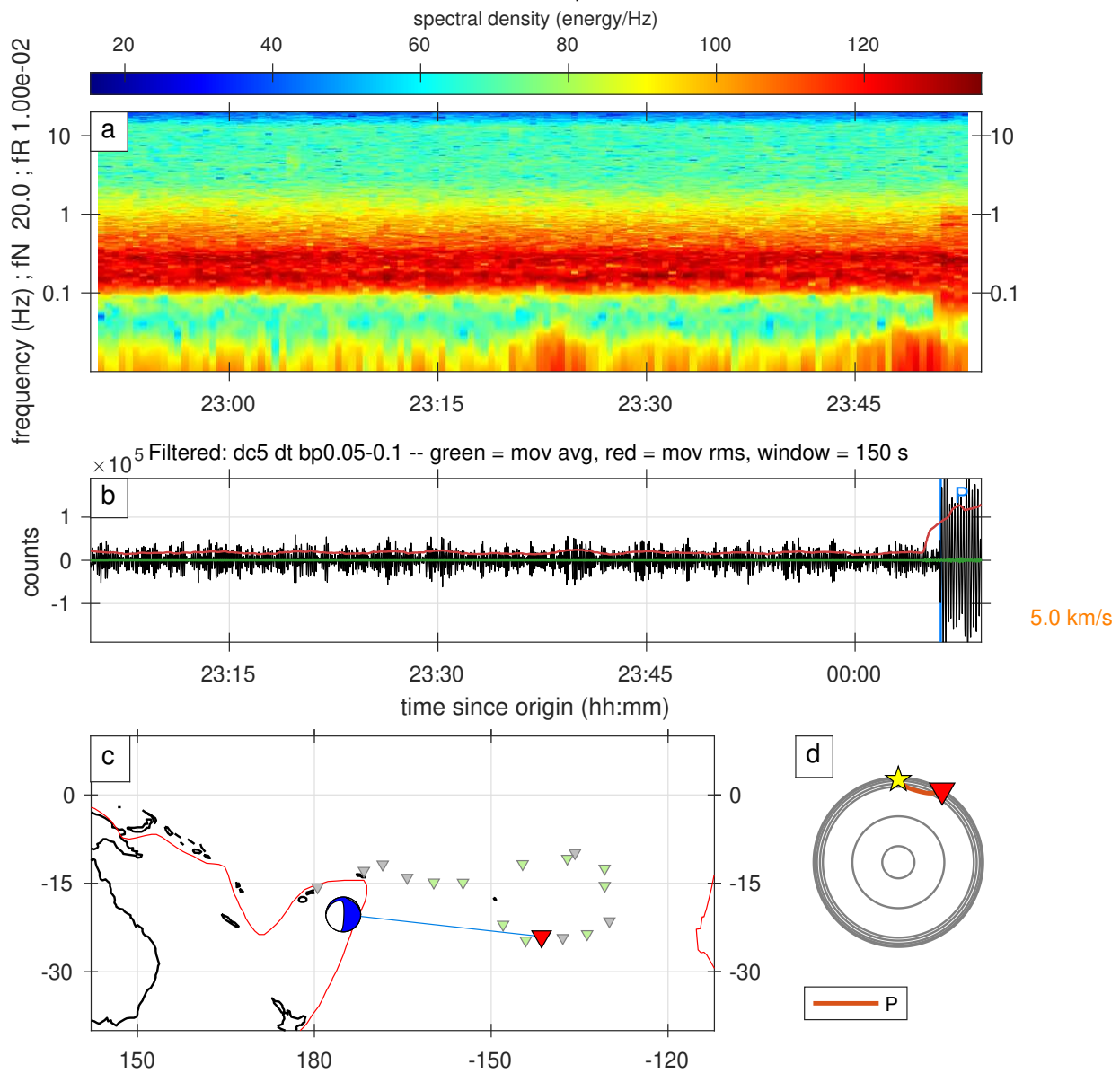


Figure S5. A full record of an earthquake classified as DET category.

Arrival: 2019-01-20T01:43:00.000000, ID: 10997608

mww = 6.70, distance = 62.17 degrees, depth = 54.82 km  
 36.93 - 40.92 percent

spectral density (energy/Hz)

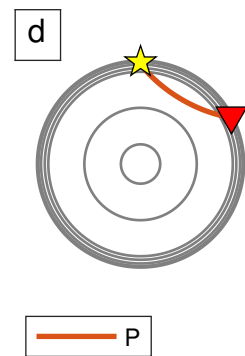
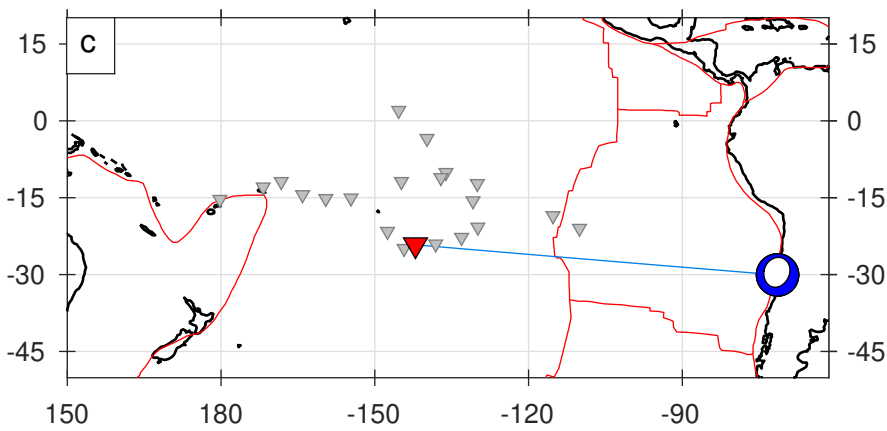
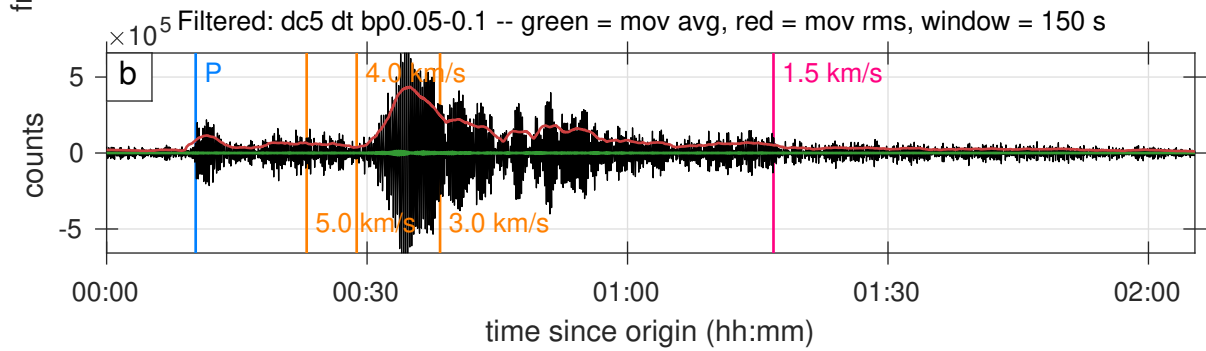
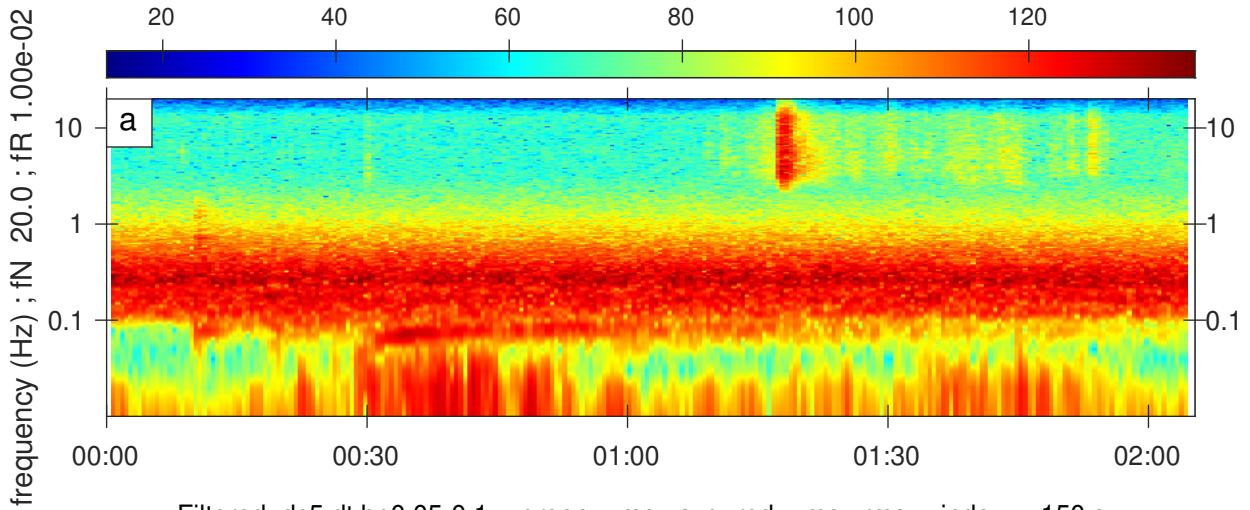


Figure S6. A full record of an earthquake classified as DET category.

Arrival: 2019-02-22T10:27:55.000000, ID: 11007849

mww = 7.50, distance = 66.77 degrees, depth = 132.36 km  
24.55 - 30.10 percent

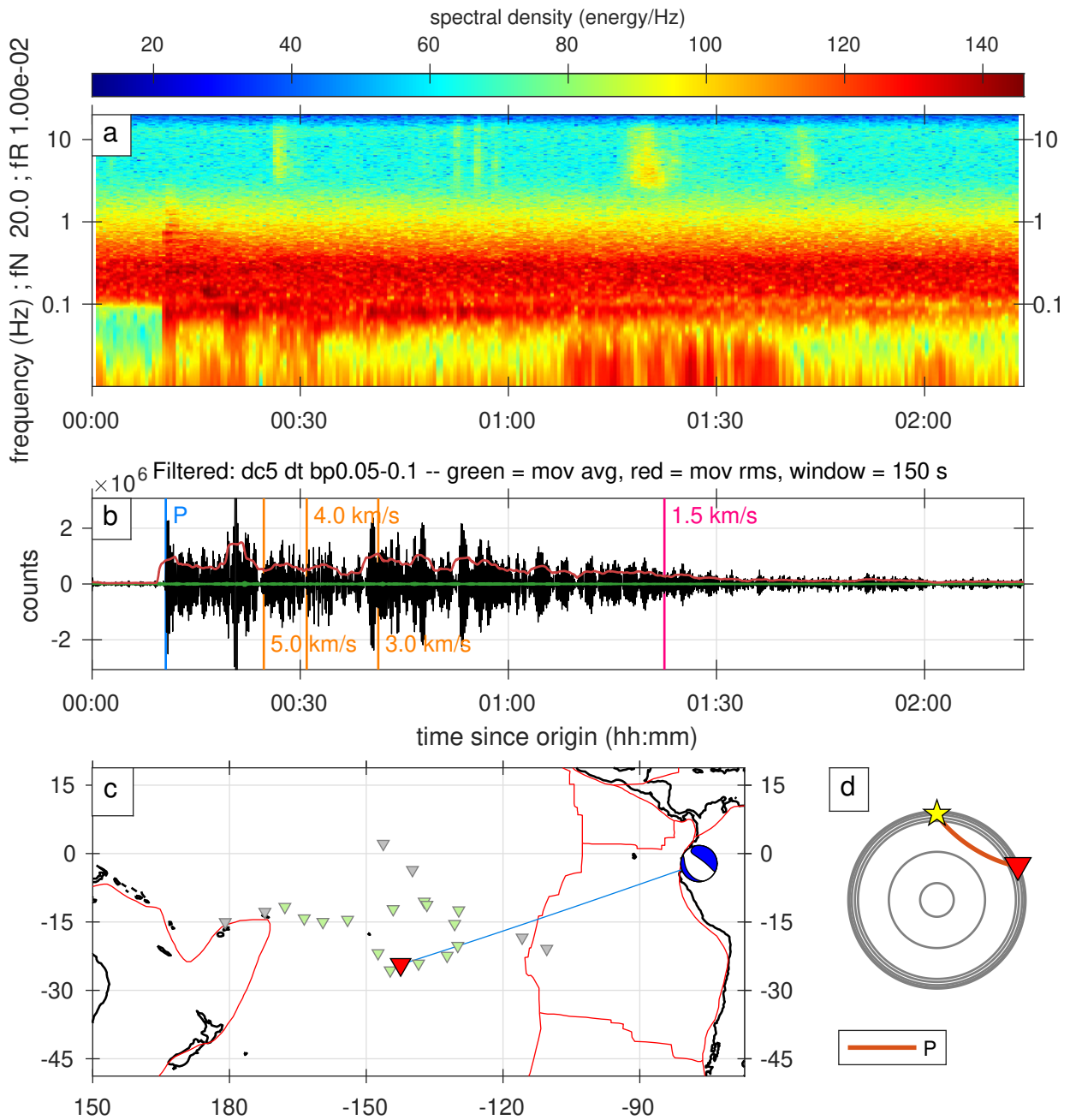


Figure S7. A full record of an earthquake classified as DET category.

Arrival: 2019-03-01T09:01:00.000000, ID: 11010219

mww = 7.00, distance = 68.17 degrees, depth = 267.00 km  
 98.24 - 100.00 percent

spectral density (energy/Hz)

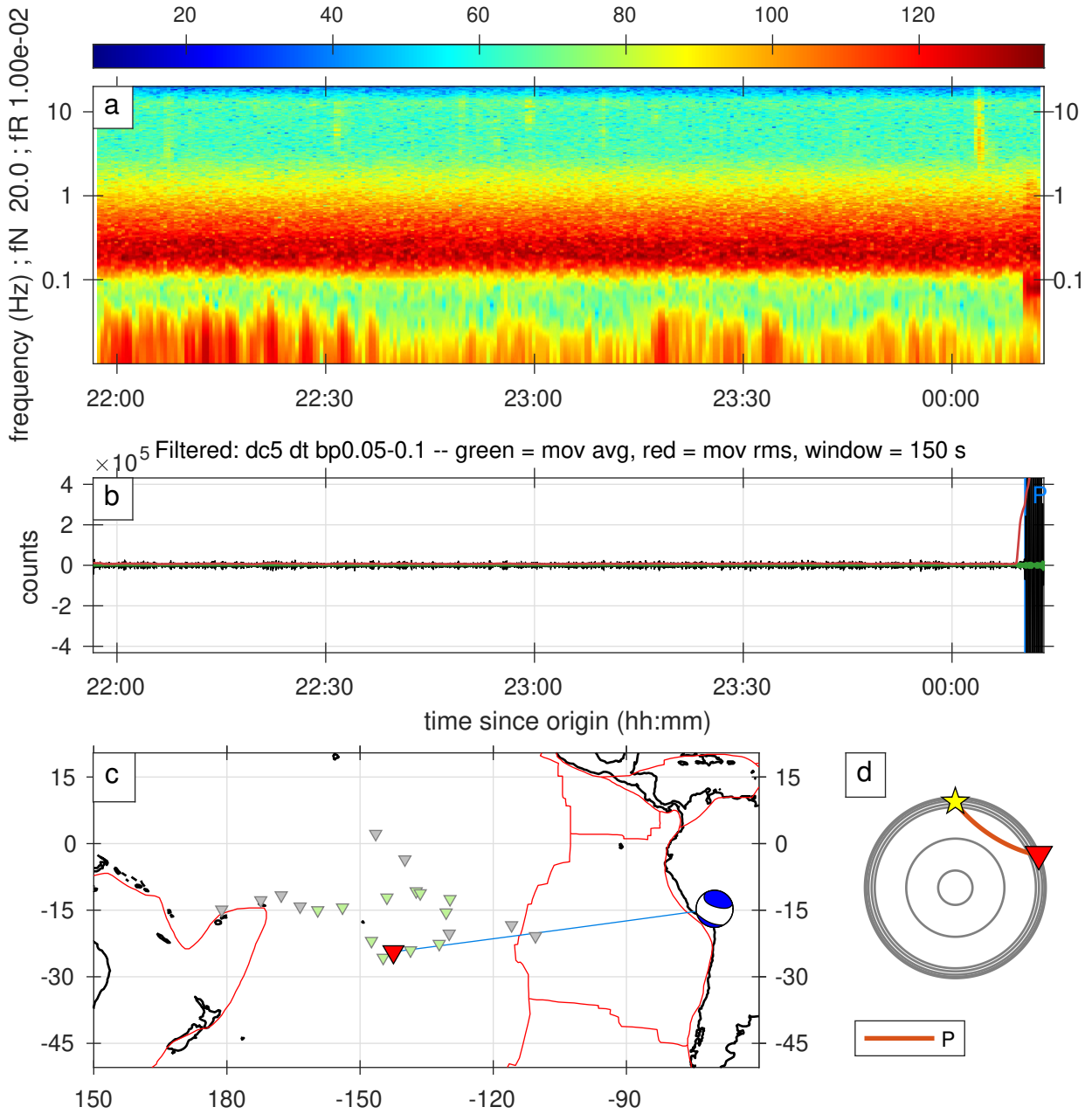


Figure S8. A full record of an earthquake classified as DET category.



Arrival: 2019-05-06T21:30:30.000000, ID: 11034341

mww = 7.10, distance = 69.24 degrees, depth = 146.00 km  
98.01 - 100.00 percent

spectral density (energy/Hz)

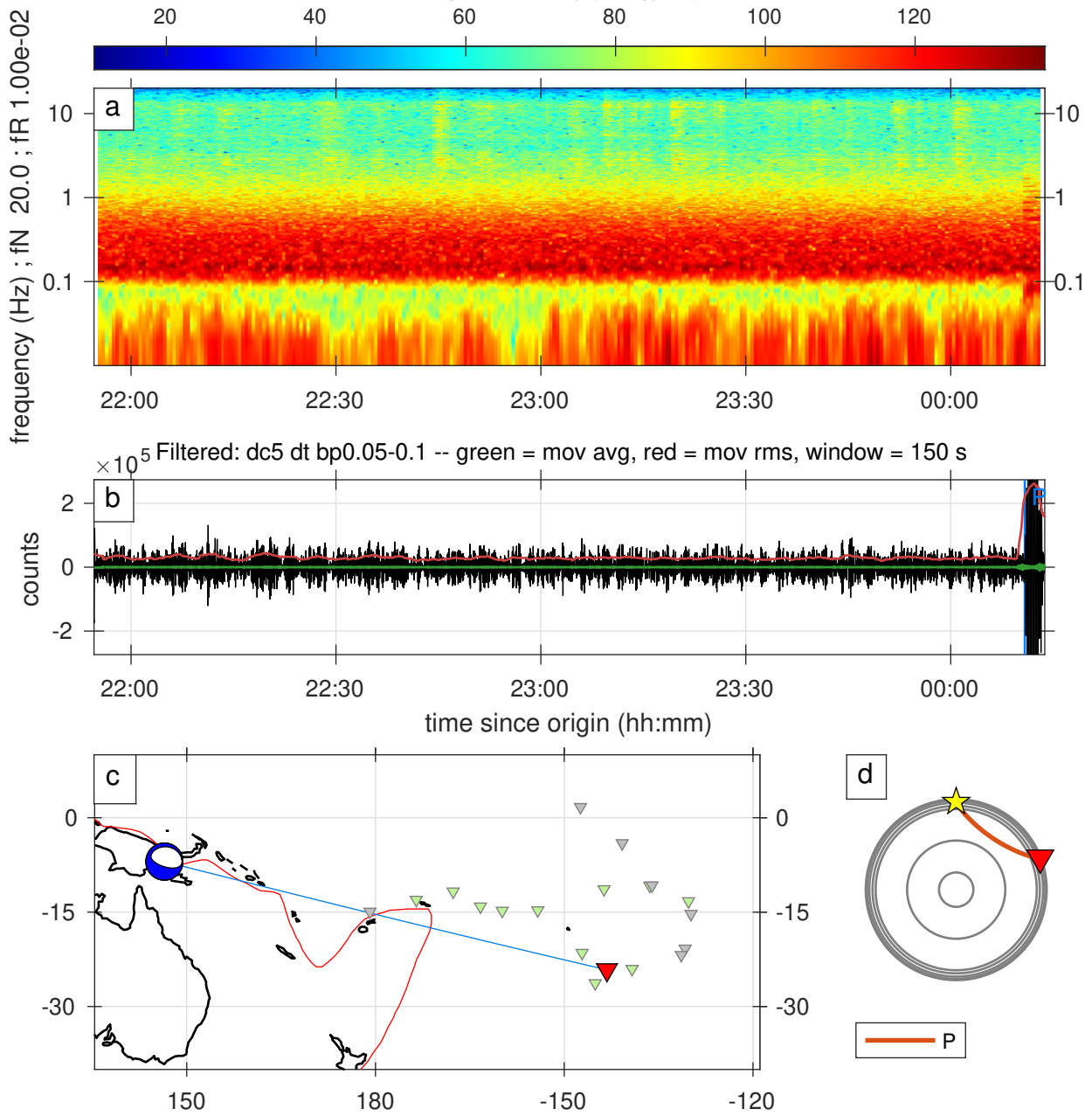


Figure S9. A full record of an earthquake classified as DET category.

Arrival: 2019-05-26T07:52:10.000000, ID: 11041250

Mww = 8.00, distance = 67.68 degrees, depth = 122.40 km  
77.07 - 100.00 percent

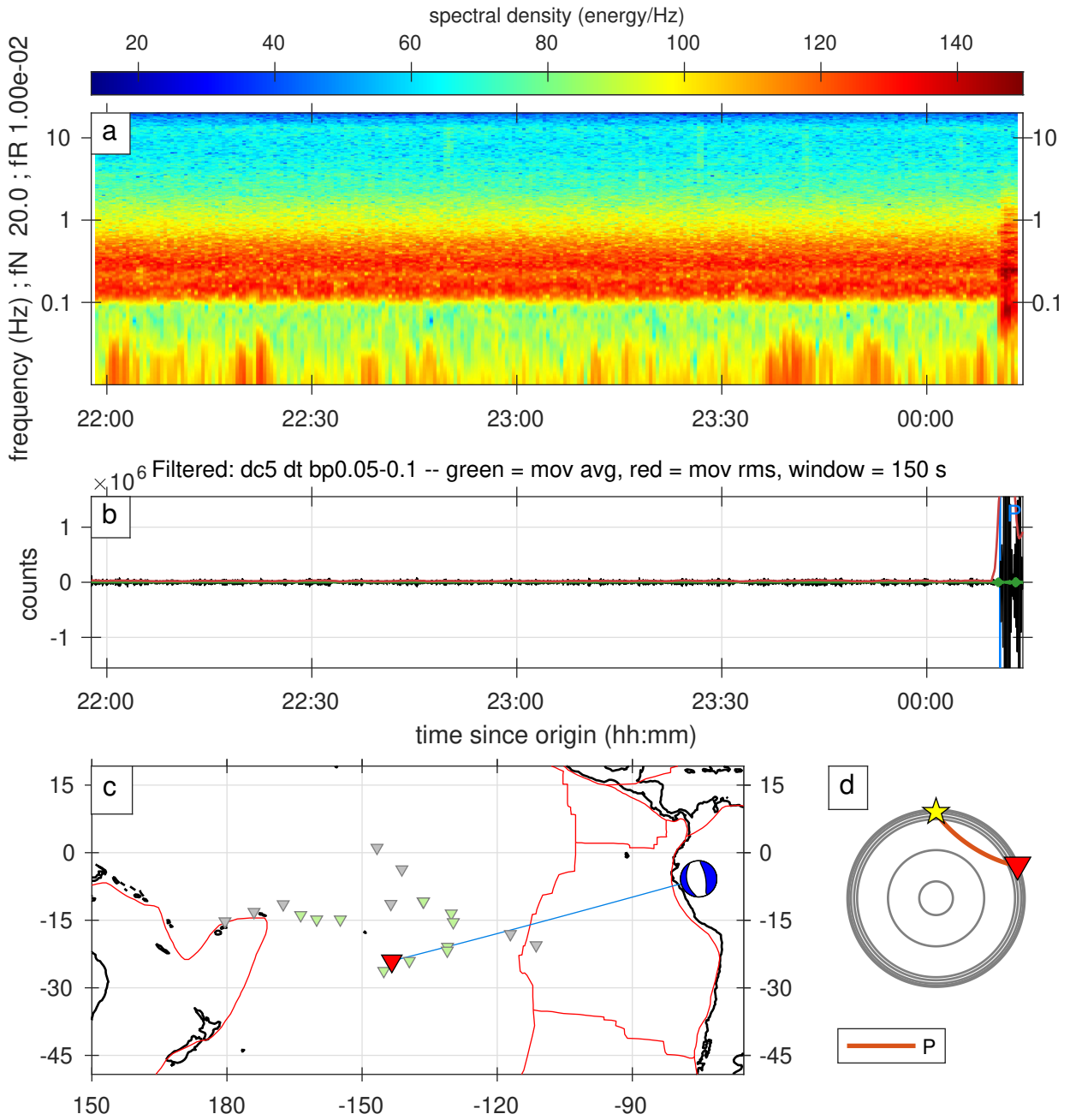


Figure S10. A full record of an earthquake classified as DET category.

Arrival: 2018-10-10T20:59:00.000000, ID: 10957936

mww = 7.00, distance = 67.48 degrees, depth = 45.05 km  
60.08 - 63.32 percent

spectral density (energy/Hz)

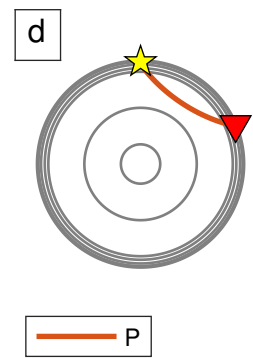
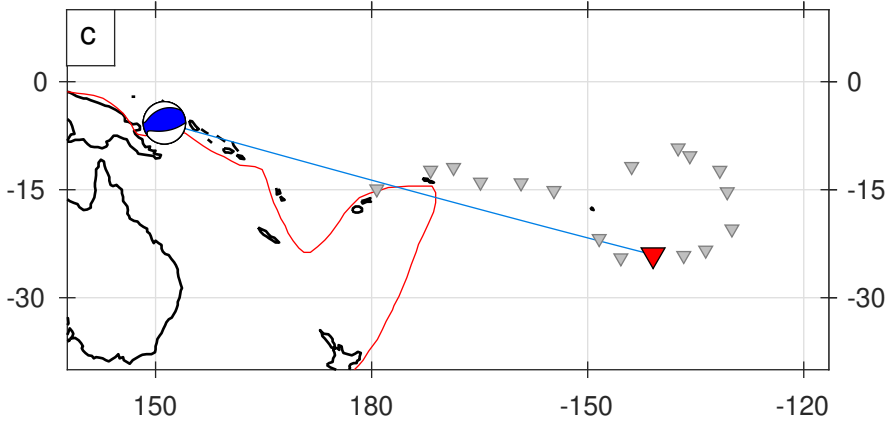
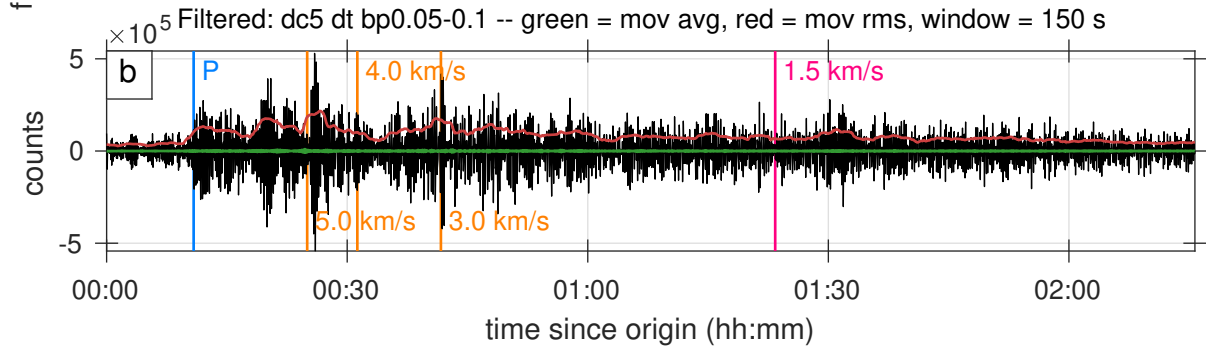
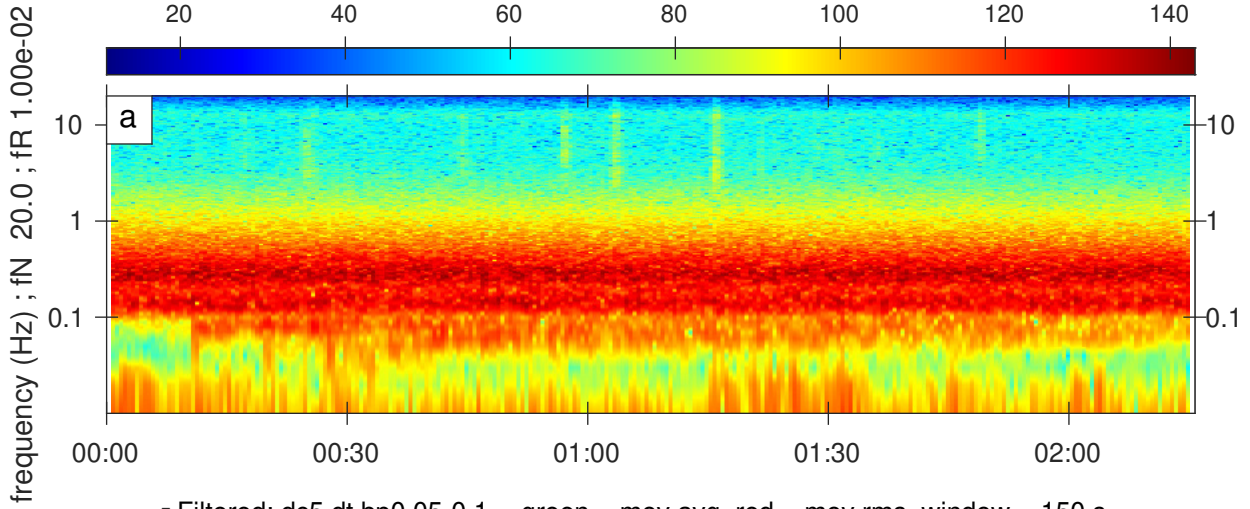


Figure S11. A full record of an earthquake classified as REQ category.



Arrival: 2018-10-10T23:29:00.000000, ID: 10957985

mww = 6.50, distance = 92.09 degrees, depth = 20.00 km  
63.60 - 67.99 percent

spectral density (energy/Hz)

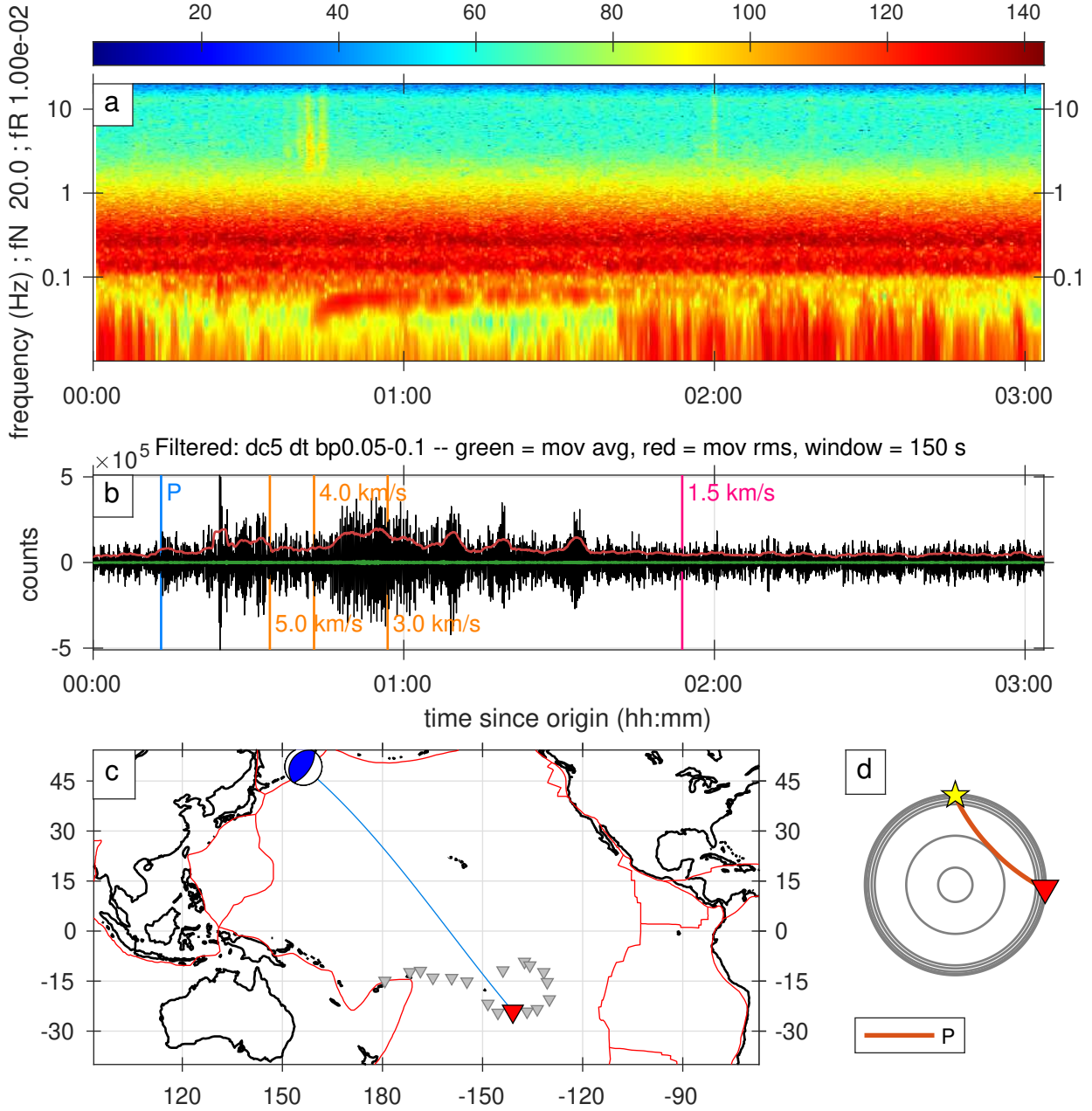


Figure S12. A full record of an earthquake classified as REQ category.

Arrival: 2018-10-16T00:36:35.000000, ID: 10959899

Mww = 6.30, distance = 45.48 degrees, depth = 10.00 km  
46.55 - 52.29 percent

spectral density (energy/Hz)

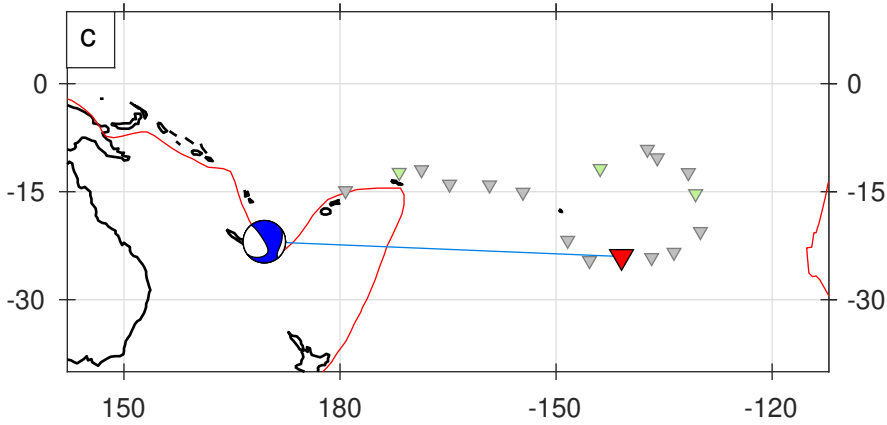
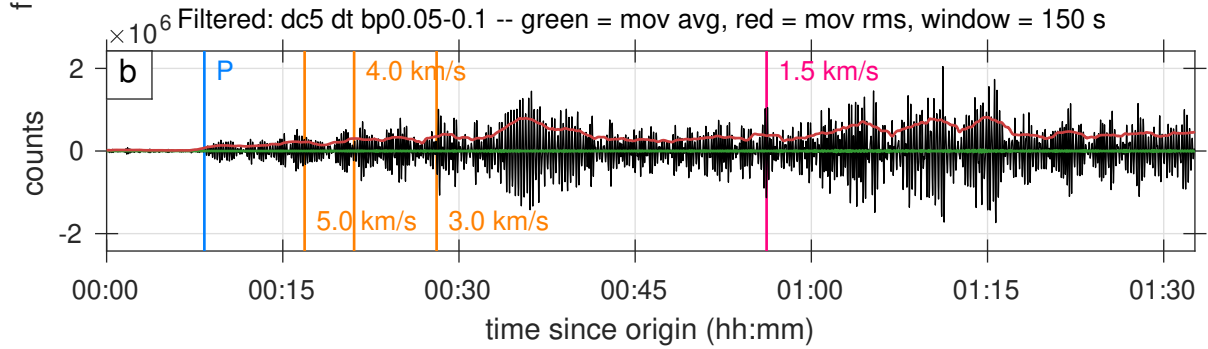
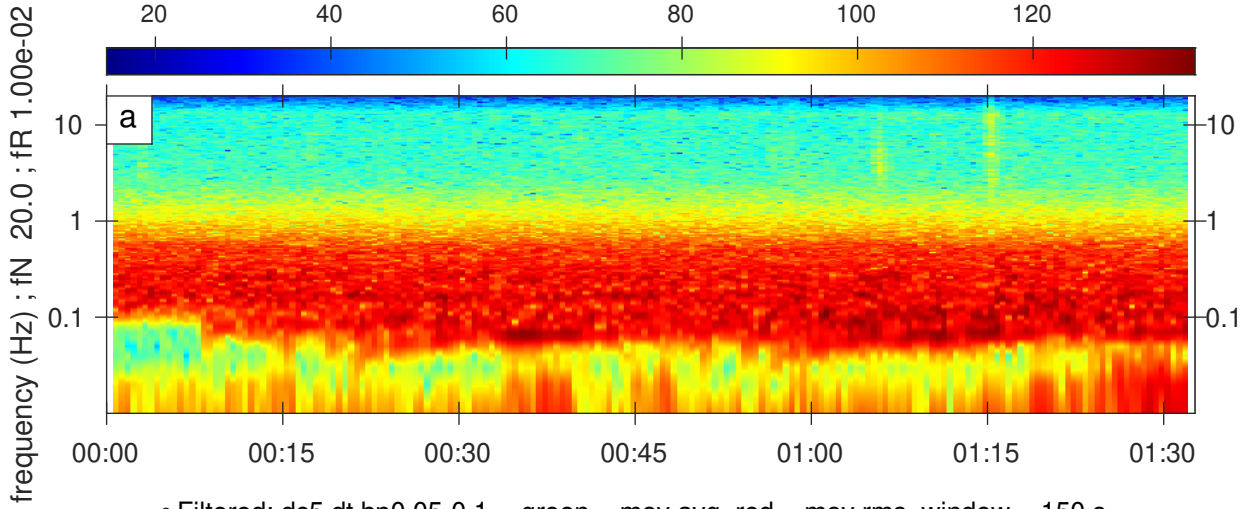


Figure S13. A full record of an earthquake classified as REQ category.

Arrival: 2018-10-16T01:12:00.000000, ID: 10959905

mww = 6.40, distance = 45.53 degrees, depth = 10.00 km  
 48.75 - 54.49 percent

spectral density (energy/Hz)

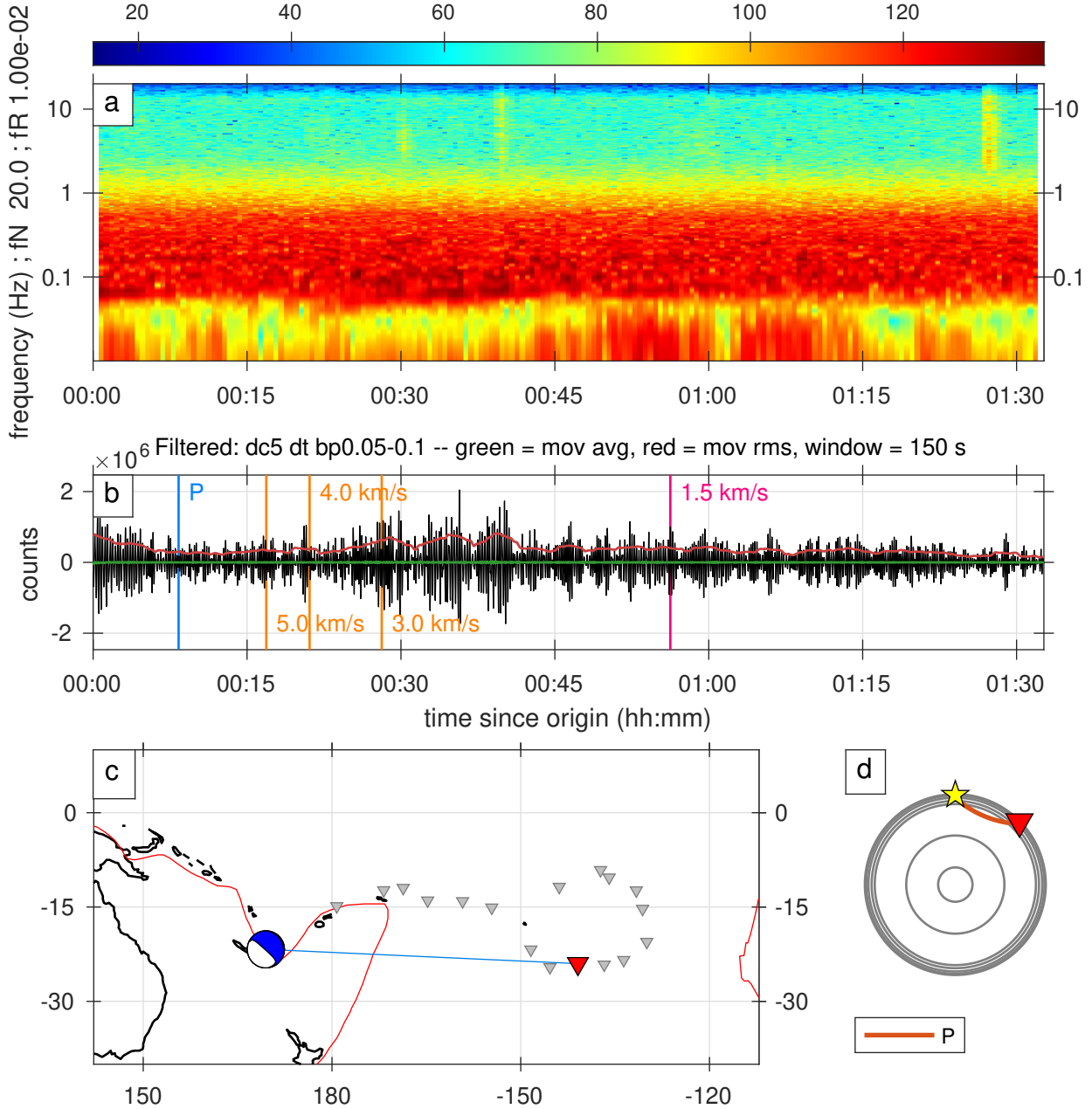


Figure S14. A full record of an earthquake classified as REQ category.

Arrival: 2018-11-15T20:14:40.000000, ID: 10971760

mww = 6.40, distance = 82.81 degrees, depth = 15.00 km

85.59 - 100.00 percent

spectral density (energy/Hz)

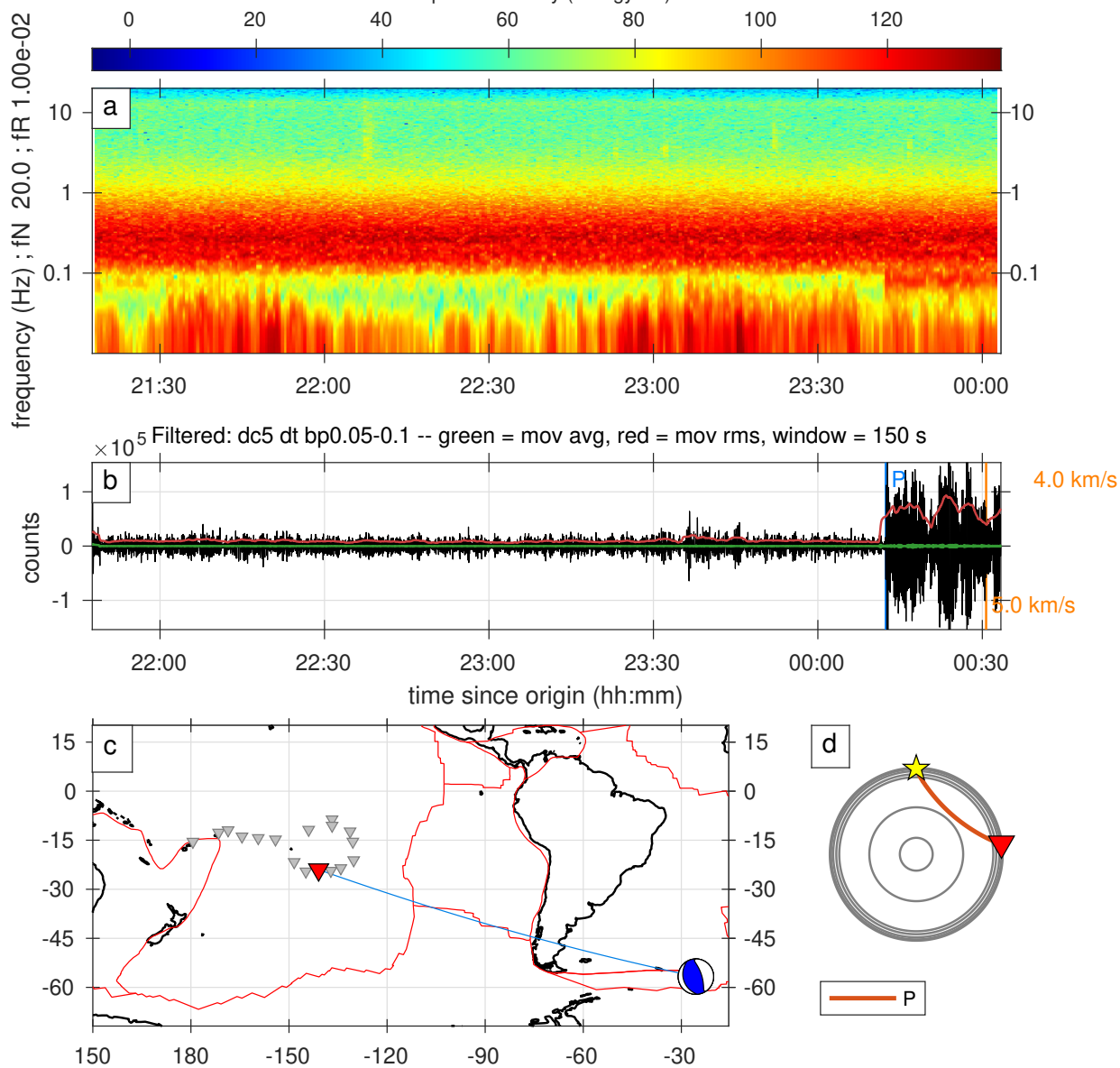


Figure S15. A full record of an earthquake classified as REQ category.

Arrival: 2018-12-29T03:52:20.000000, ID: 10990548

mww = 7.00, distance = 93.76 degrees, depth = 60.21 km  
78.69 - 82.76 percent

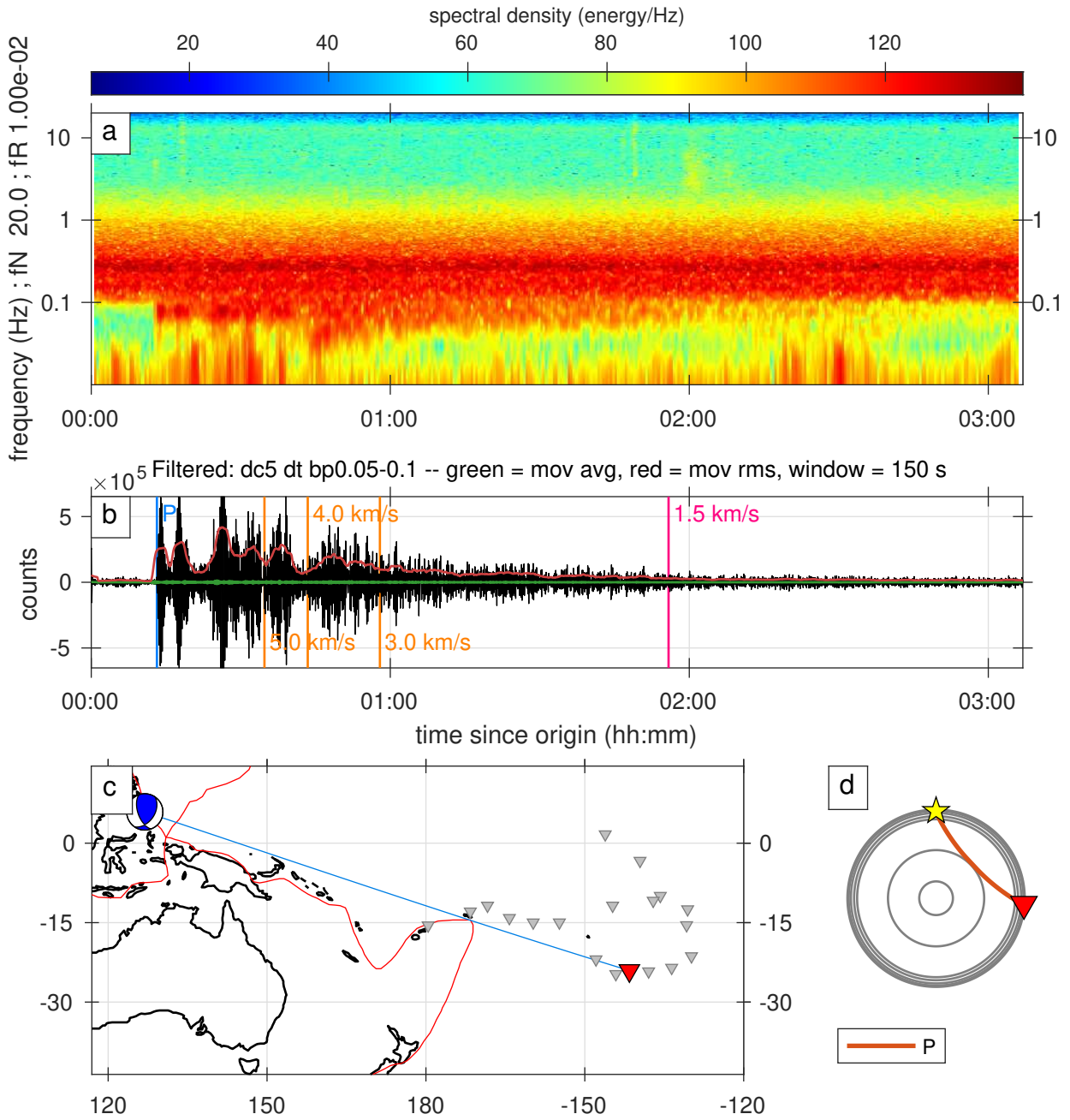


Figure S16. A full record of an earthquake classified as REQ category.



Arrival: 2019-01-06T17:40:25.000000, ID: 10993072

mww = 6.60, distance = 92.27 degrees, depth = 60.00 km  
42.73 - 53.81 percent

spectral density (energy/Hz)

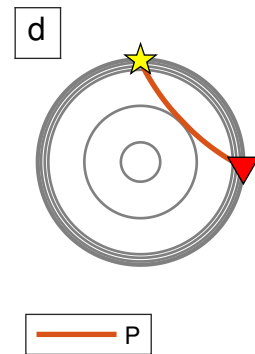
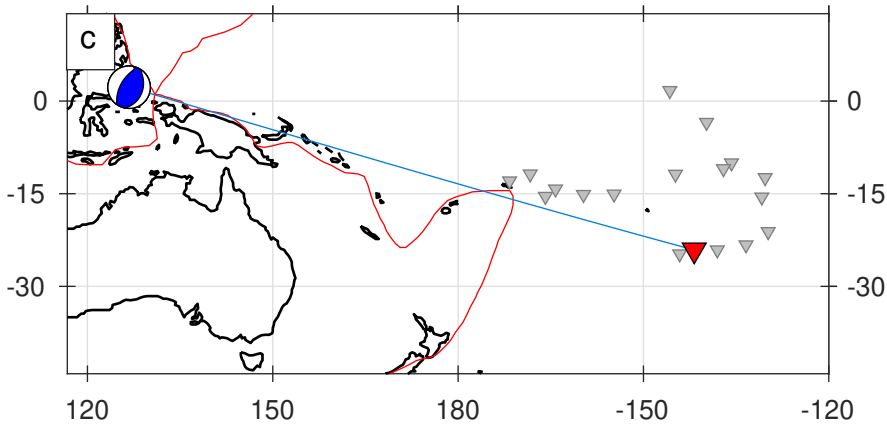
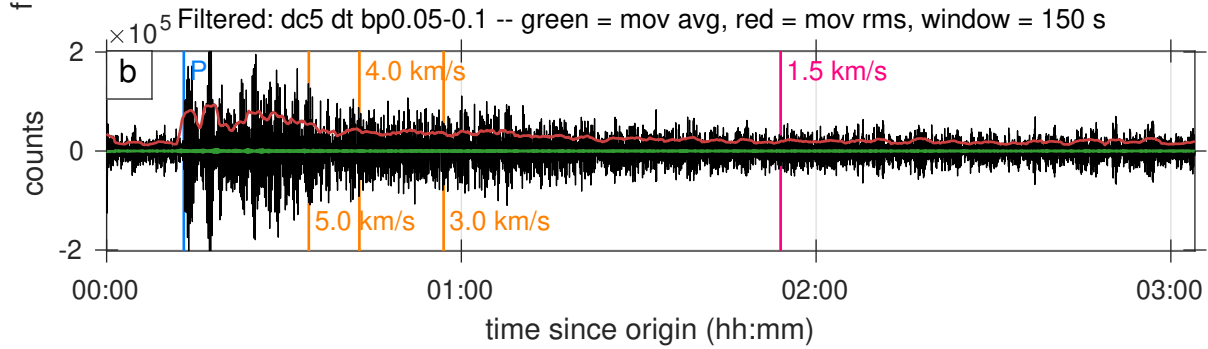
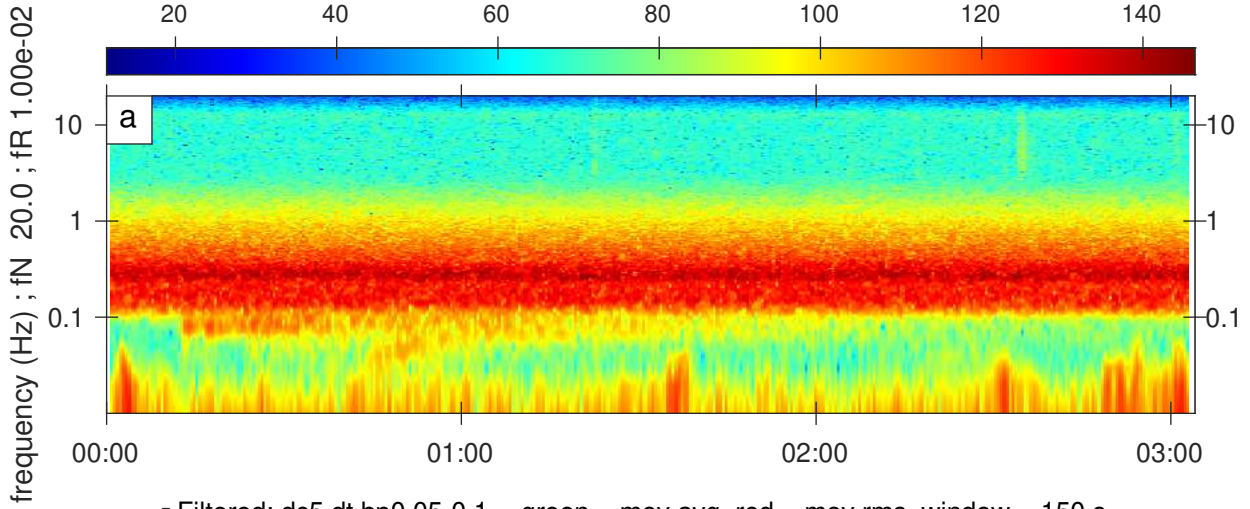


Figure S17. A full record of an earthquake classified as REQ category.

Arrival: 2019-01-22T05:24:30.000000, ID: 10998150

Mww = 6.40, distance = 93.65 degrees, depth = 27.01 km  
84.96 - 100.00 percent

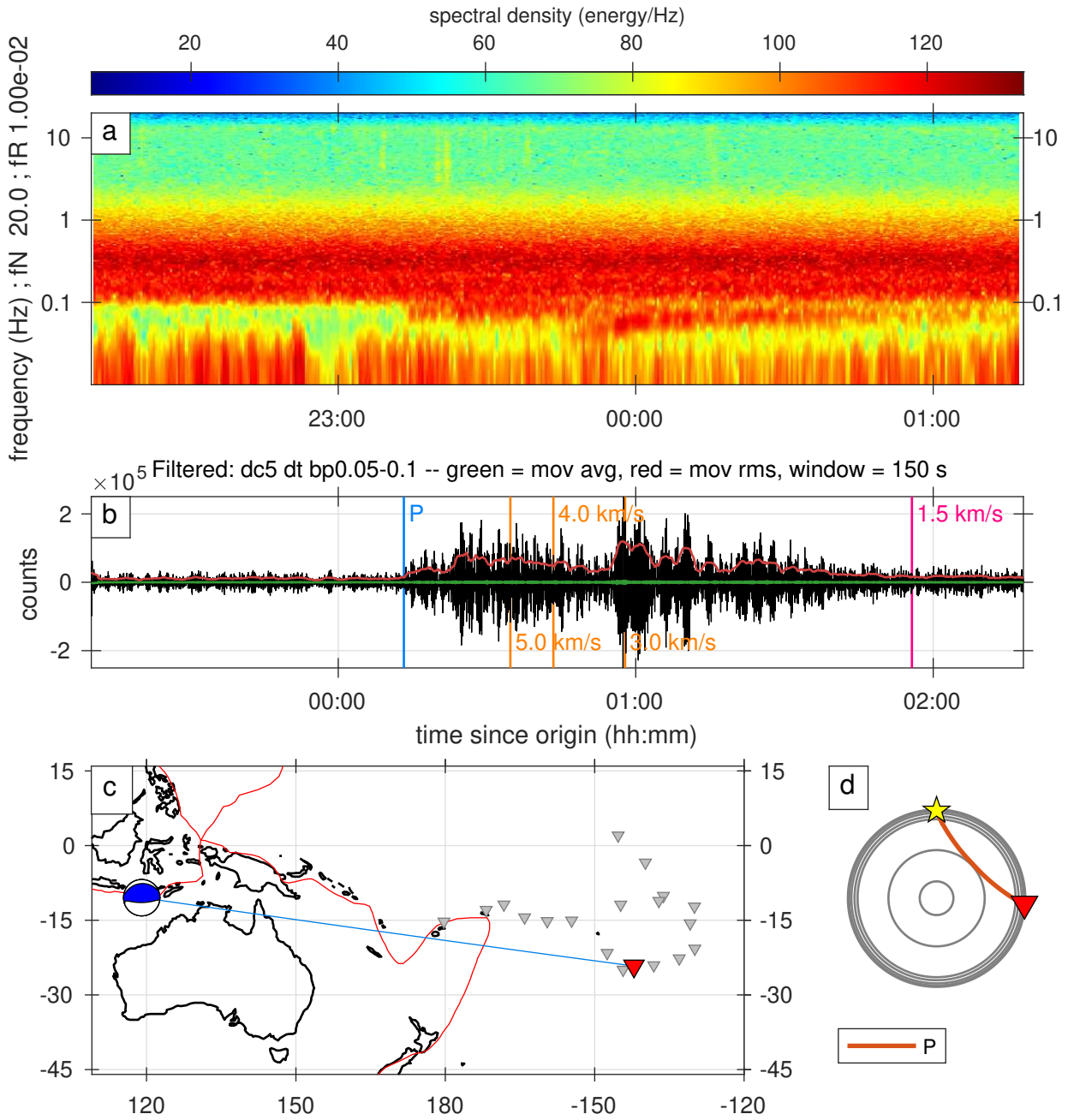


Figure S18. A full record of an earthquake classified as REQ category.

Arrival: 2019-03-06T15:52:30.000000, ID: 11011889

Mww = 6.40, distance = 31.91 degrees, depth = 29.00 km  
88.90 - 89.91 percent

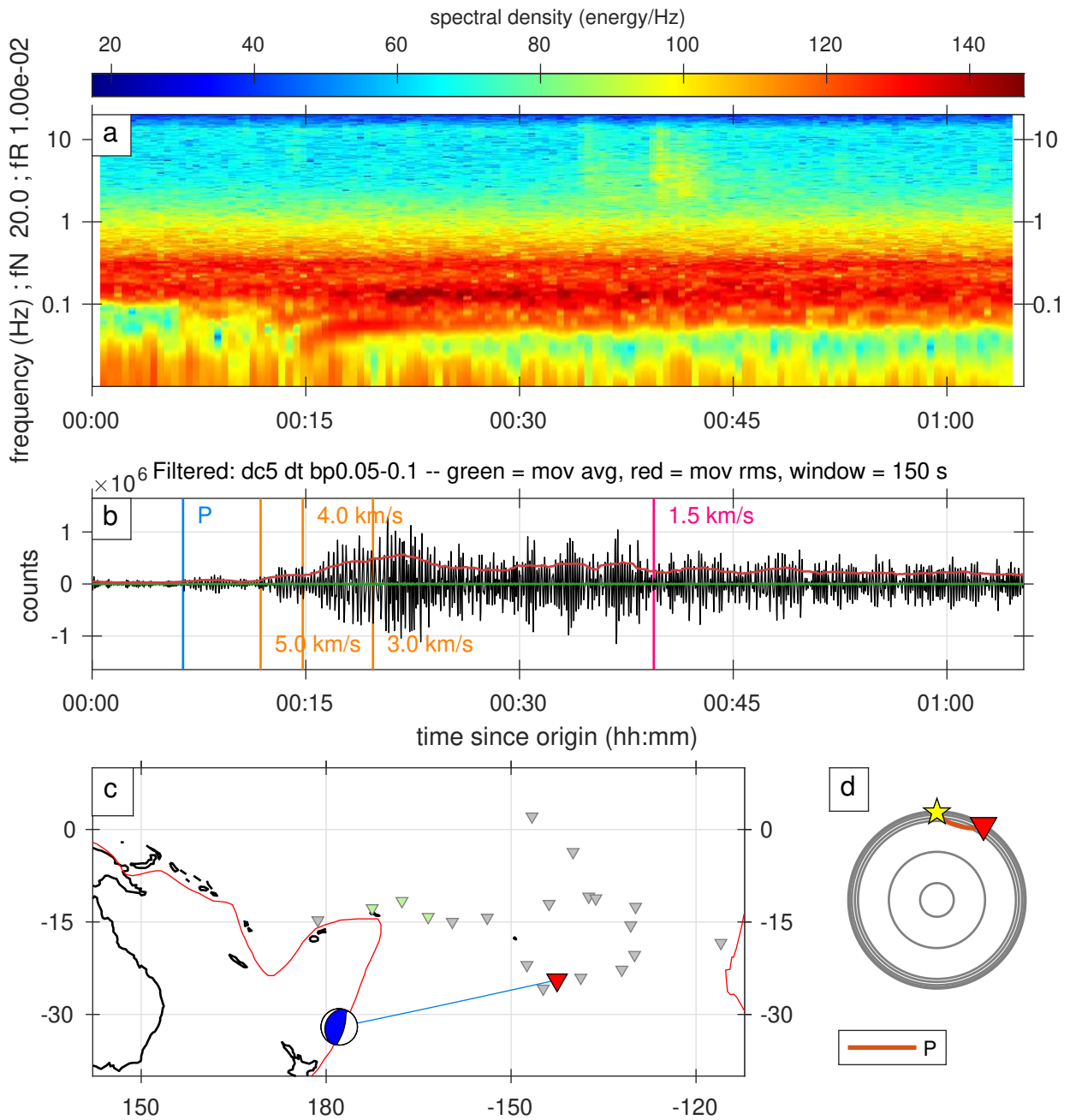


Figure S19. A full record of an earthquake classified as REQ category.



Arrival: 2019-04-02T21:48:00.000000, ID: 11021706

mww = 6.40, distance = 83.77 degrees, depth = 7.90 km  
65.31 - 77.51 percent

spectral density (energy/Hz)

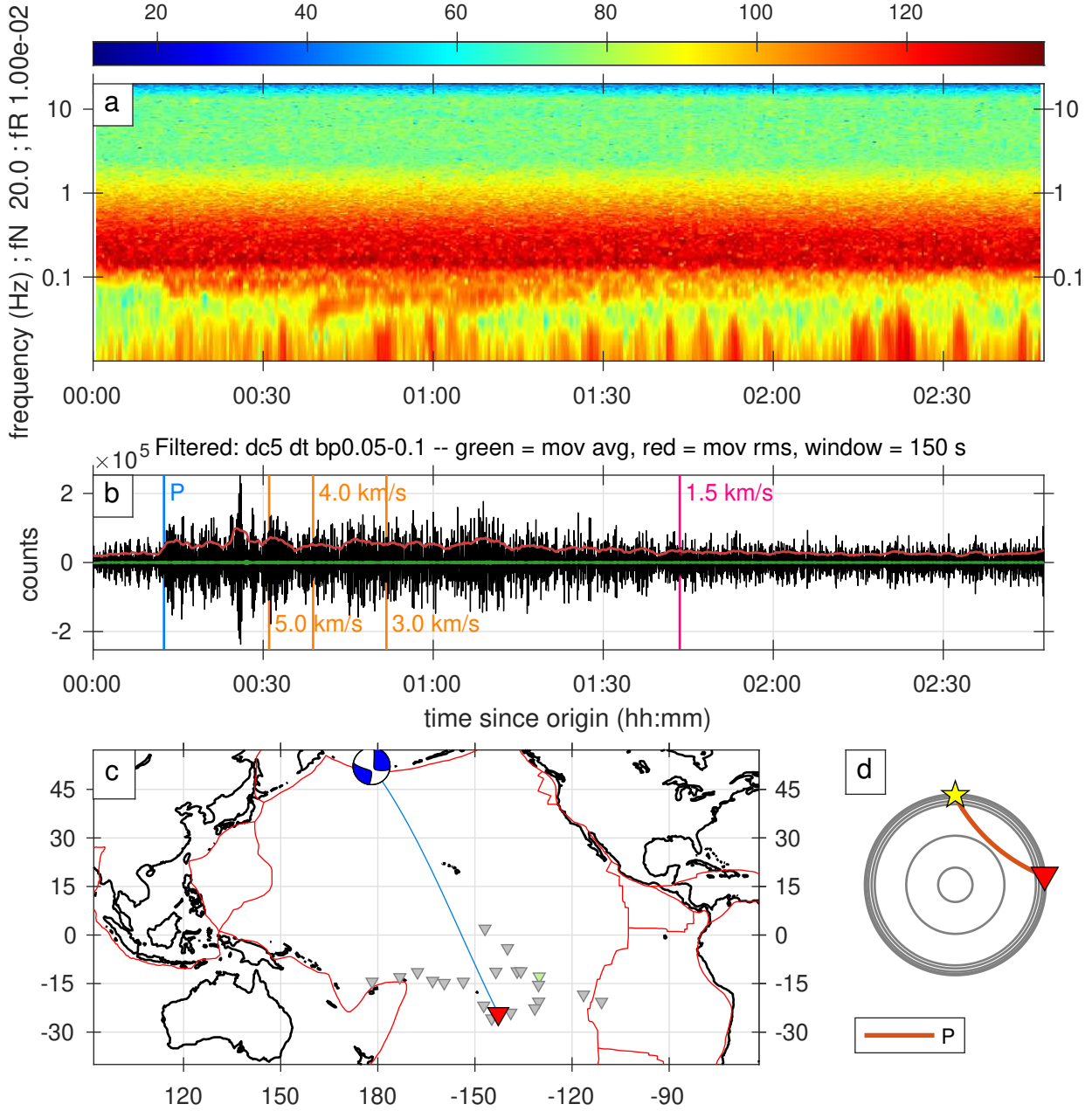


Figure S20. A full record of an earthquake classified as REQ category.

Arrival: 2018-09-16T21:18:05.000000, ID: 10948555

Mww = 6.50, distance = 36.84 degrees, depth = 576.00 km  
91.97 - 95.80 percent

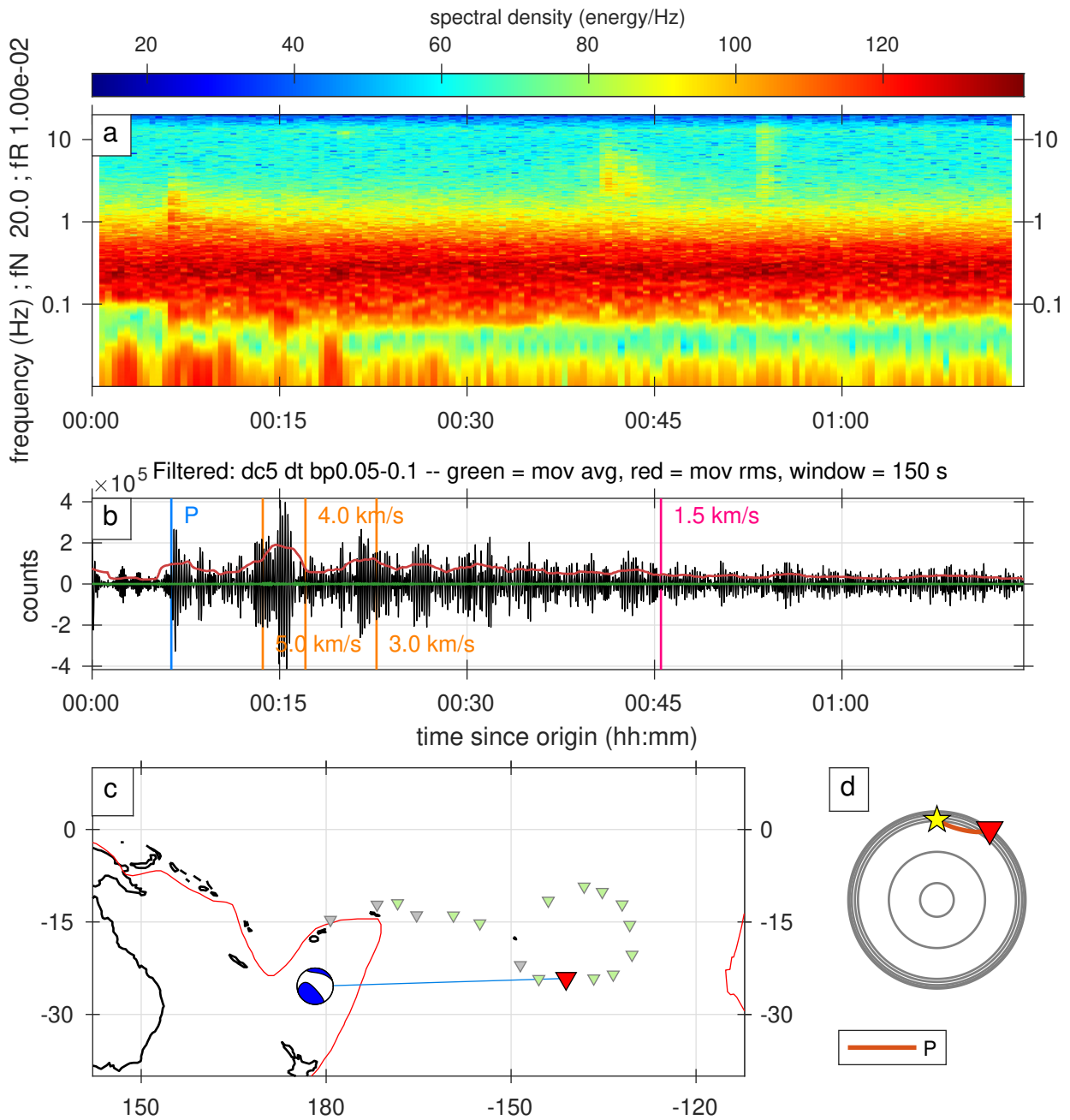


Figure S21. A full record of an earthquake classified as 3stars category.

Arrival: 2018-09-28T10:16:30.000000, ID: 10953070

Mww = 7.50, distance = 98.30 degrees, depth = 10.00 km  
 49.47 - 54.66 percent

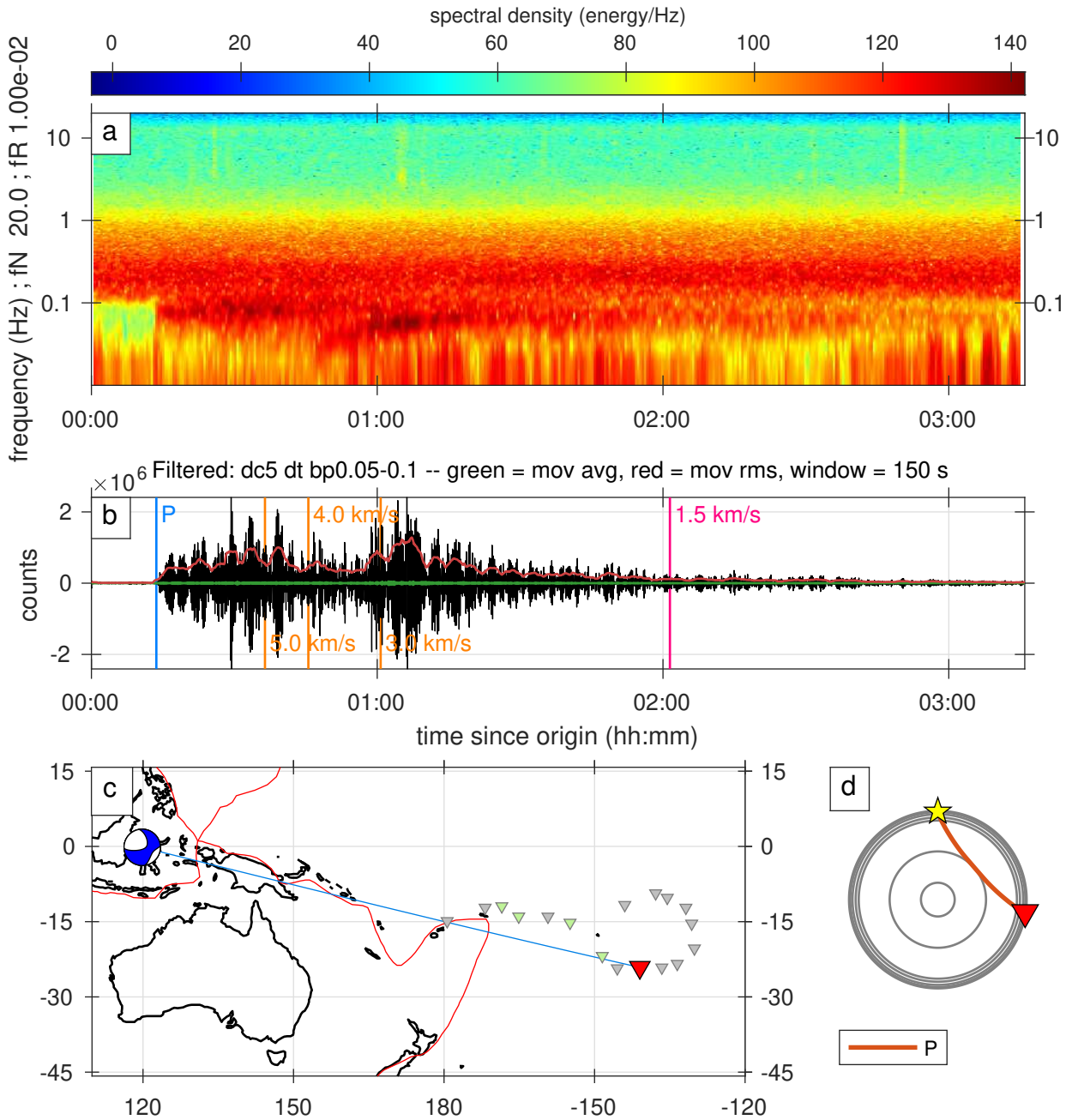


Figure S22. A full record of an earthquake classified as 3stars category.

Arrival: 2018-10-28T22:34:10.000000, ID: 10965035

Mww = 6.10, distance = 61.61 degrees, depth = 24.69 km

39.02 - 40.17 percent

spectral density (energy/Hz)

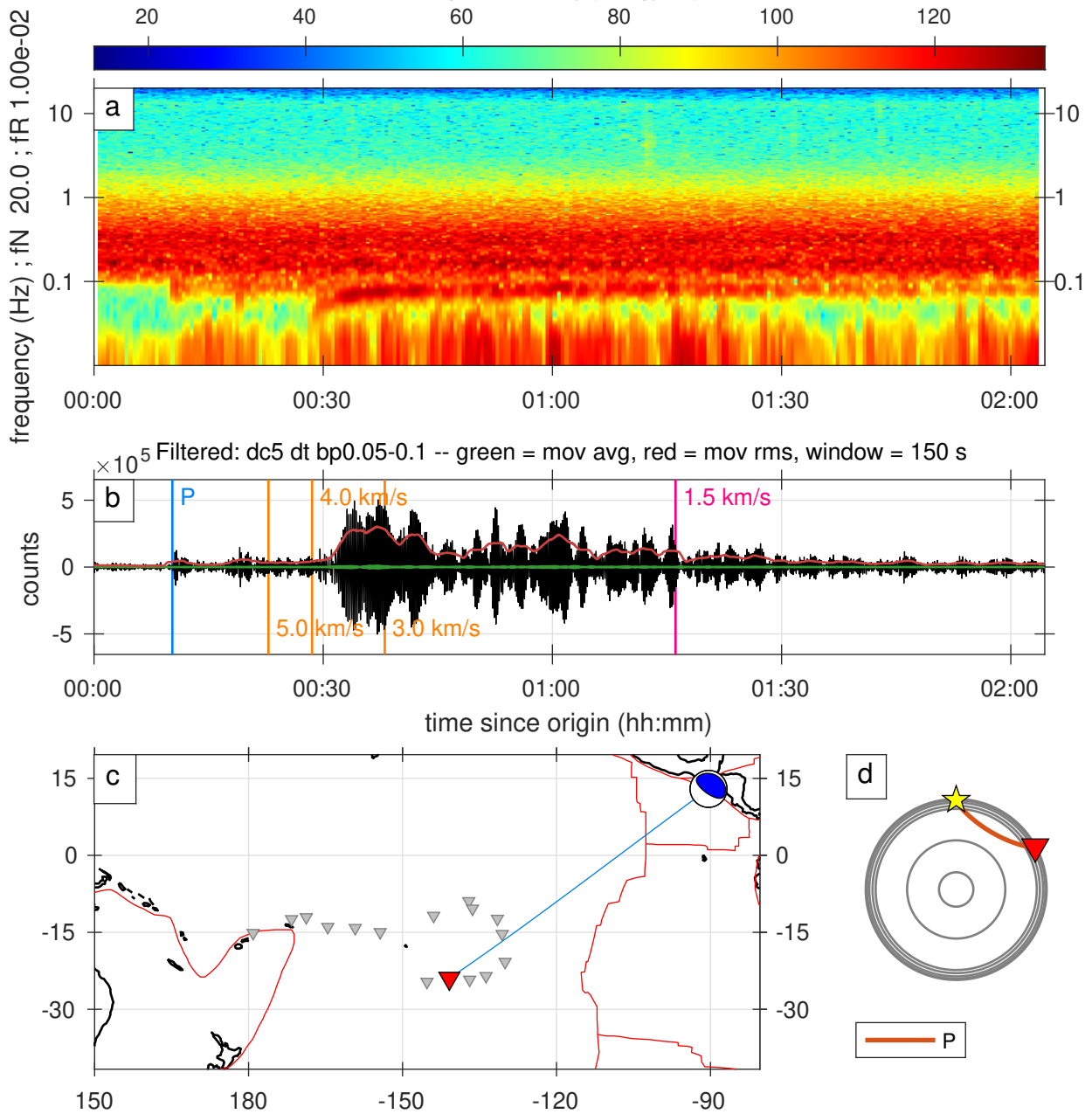


Figure S23. A full record of an earthquake classified as 3stars category.

Arrival: 2018-11-15T23:16:00.000000, ID: 10971868

Mww = 6.30, distance = 35.06 degrees, depth = 10.00 km  
3.80 - 6.10 percent

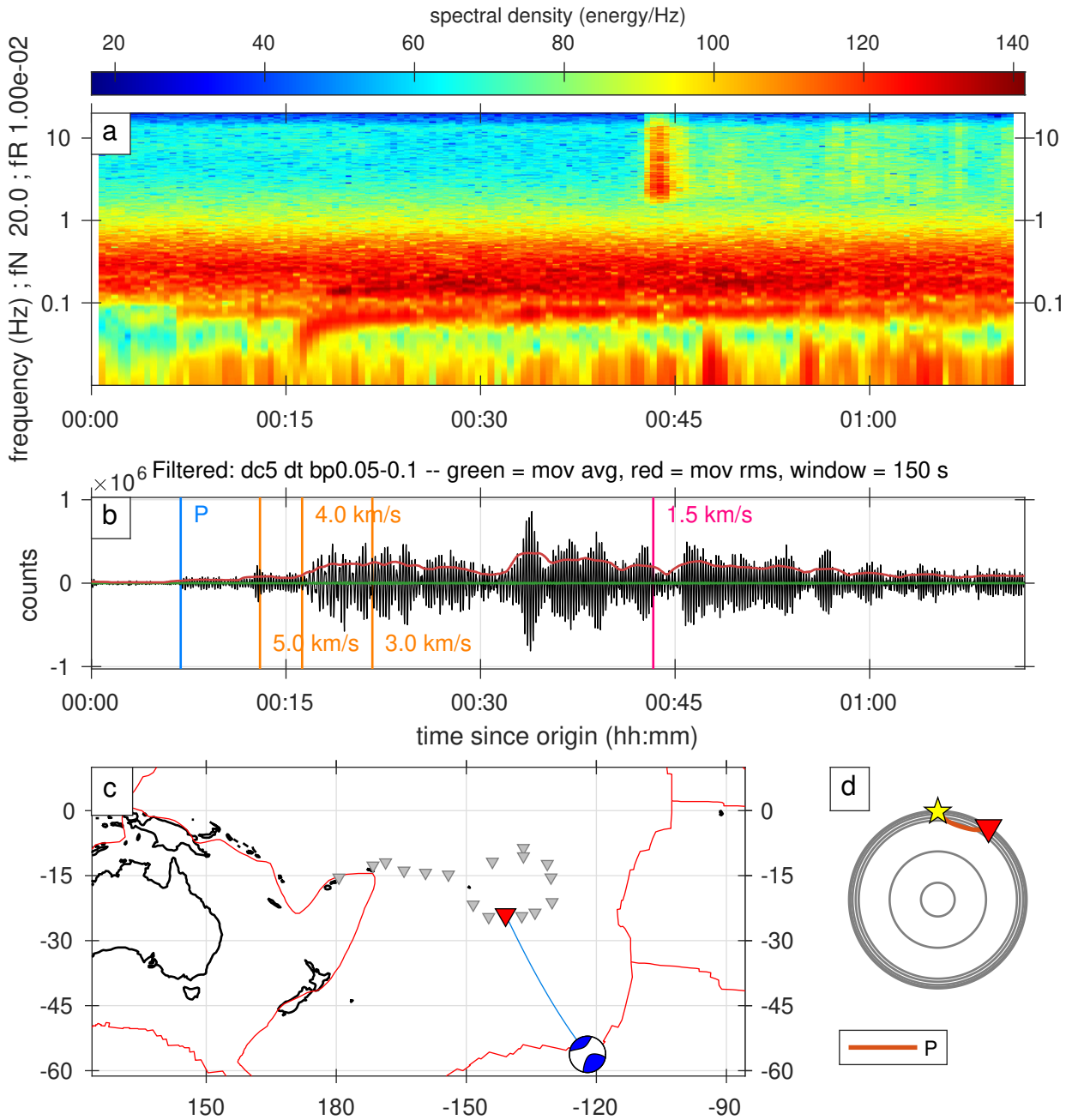


Figure S24. A full record of an earthquake classified as 3stars category.



Arrival: 2018-11-22T16:13:20.000000, ID: 10973739

Mww = 5.90, distance = 30.31 degrees, depth = 10.00 km  
68.40 - 70.50 percent

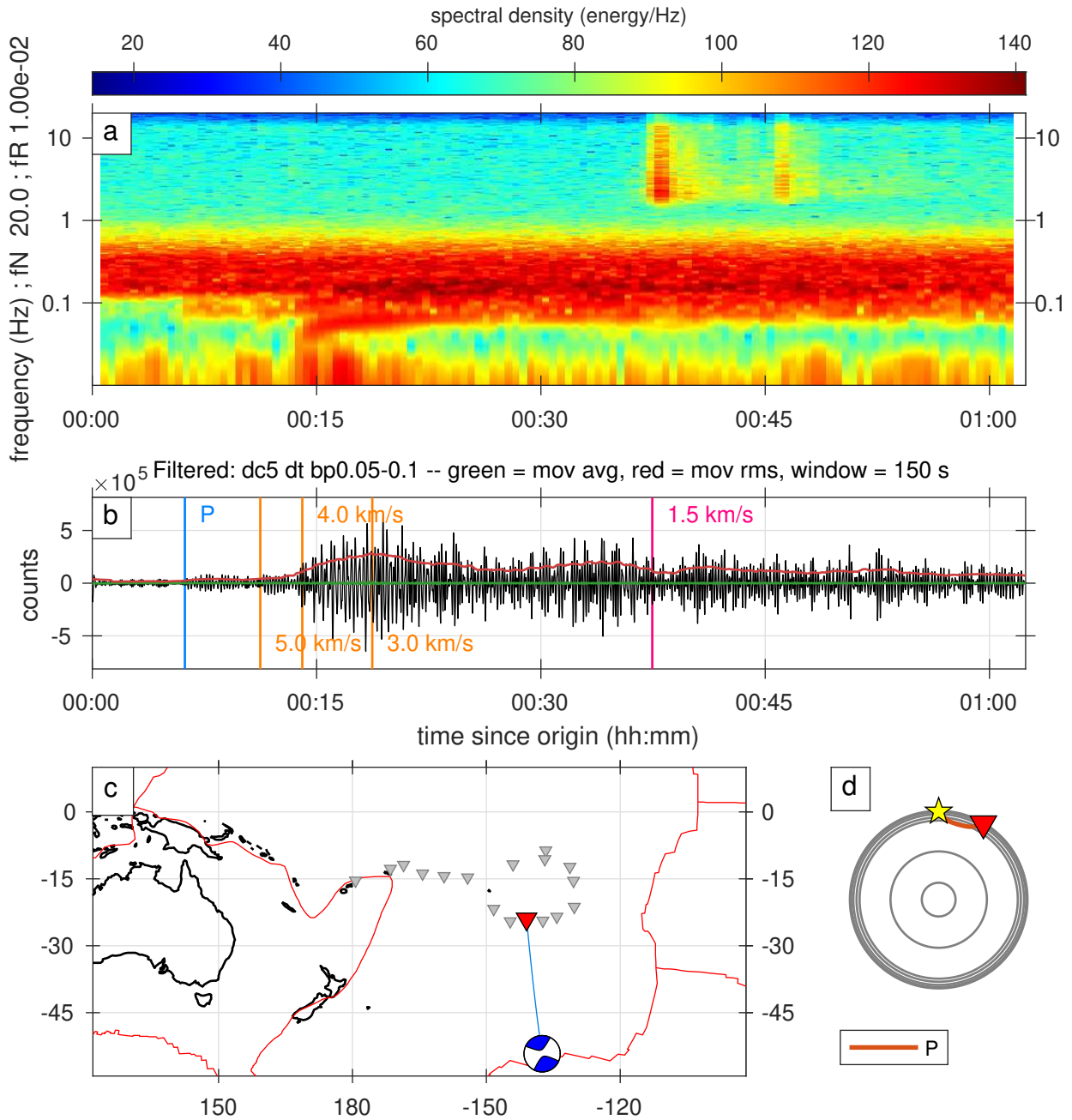


Figure S25. A full record of an earthquake classified as 3stars category.

Arrival: 2018-11-24T23:52:00.000000, ID: 10974269

Mww = 5.80, distance = 48.27 degrees, depth = 10.00 km  
 34.57 - 36.51 percent

spectral density (energy/Hz)

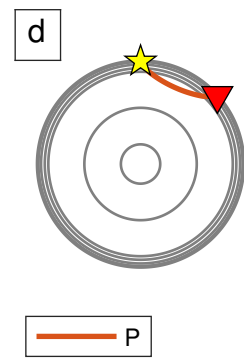
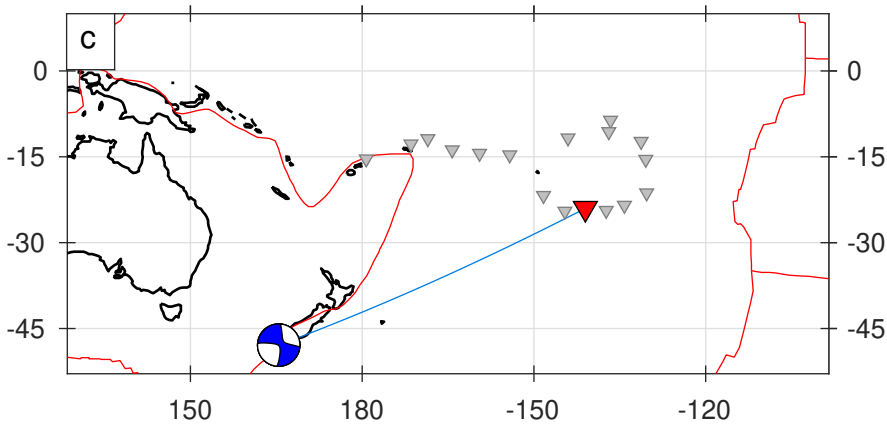
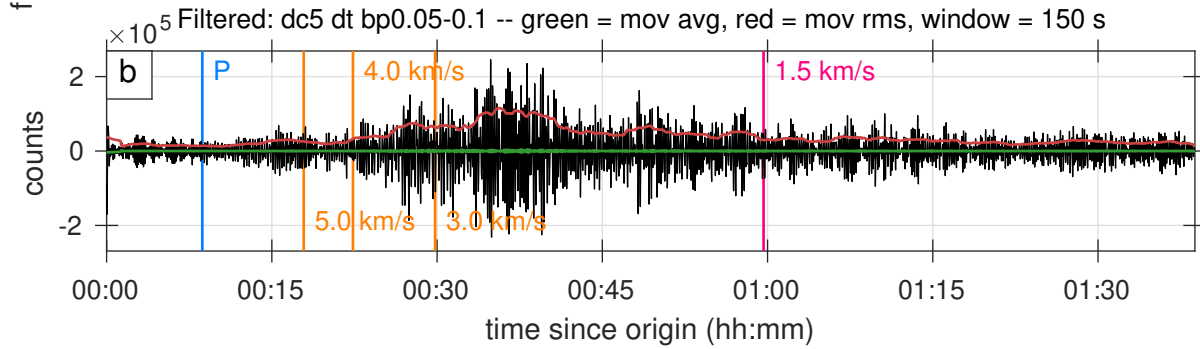
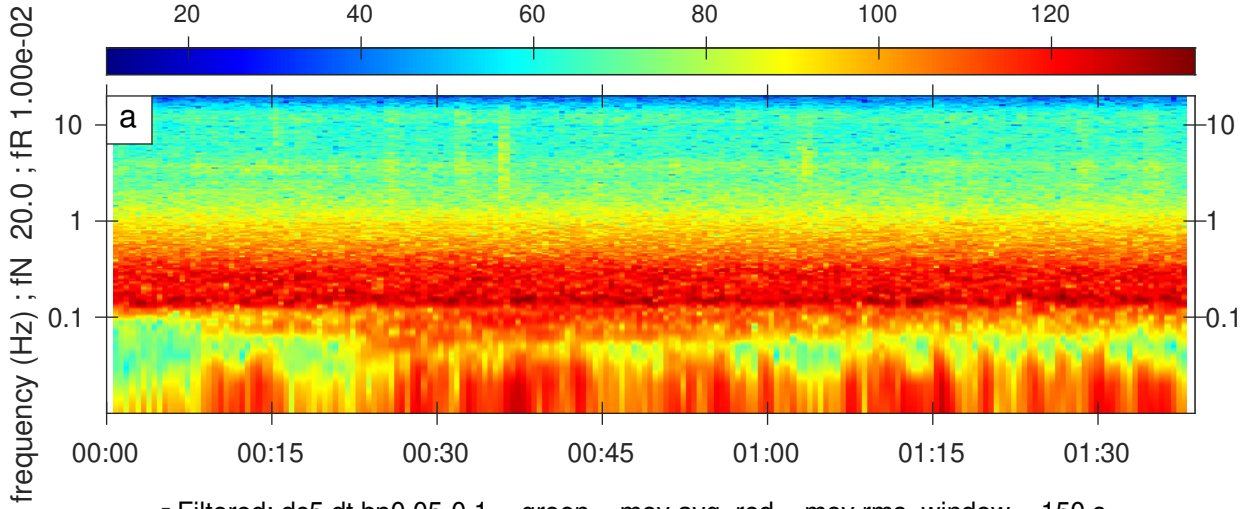


Figure S26. A full record of an earthquake classified as 3stars category.

Arrival: 2018-12-19T01:45:00.000000, ID: 10986932

Mww = 6.30, distance = 36.59 degrees, depth = 10.00 km  
92.77 - 93.53 percent

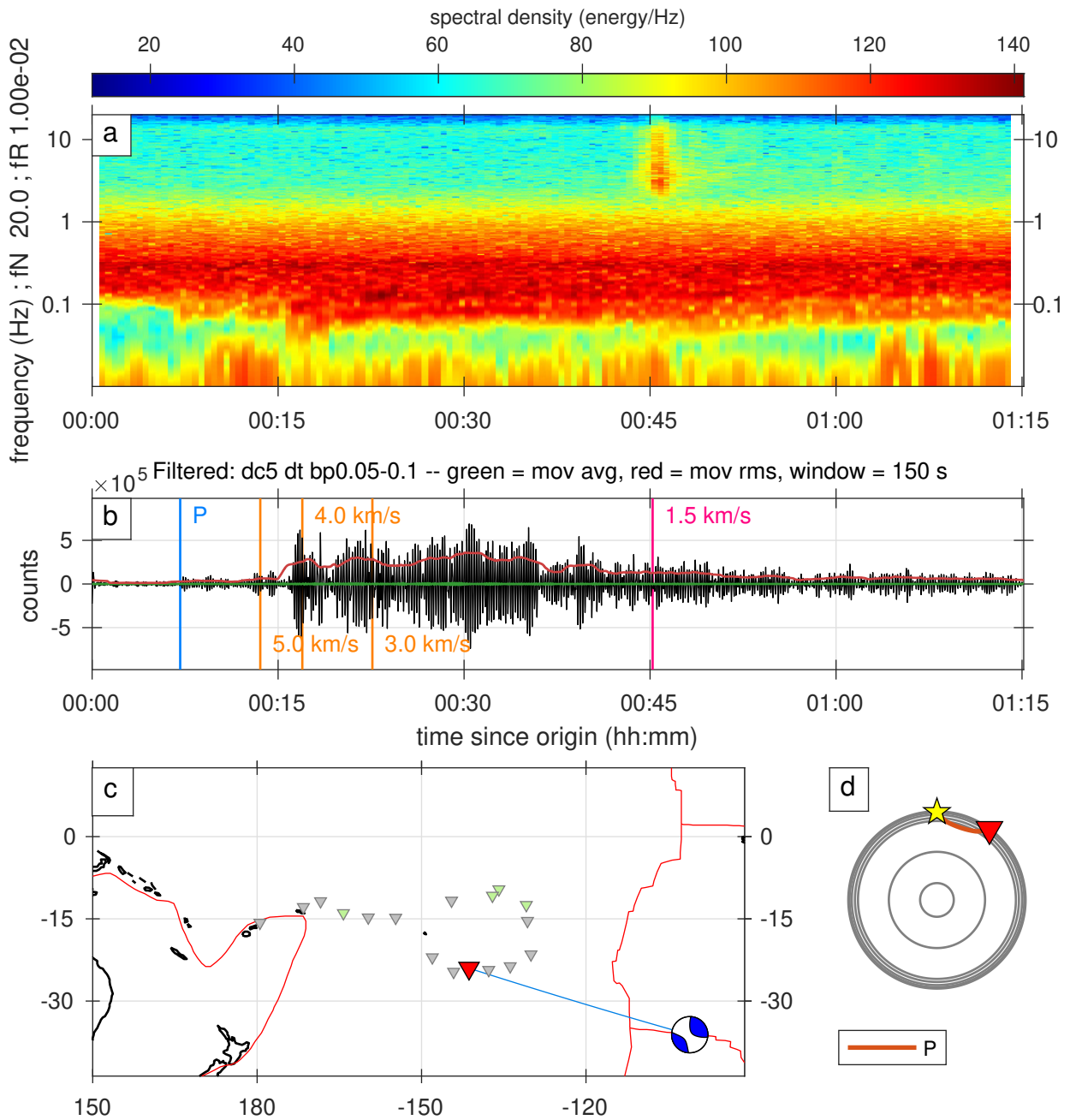


Figure S27. A full record of an earthquake classified as 3stars category.



Arrival: 2018-12-20T17:15:00.000000, ID: 10987513

mww = 7.30, distance = 91.50 degrees, depth = 16.56 km  
 14.00 - 22.80 percent

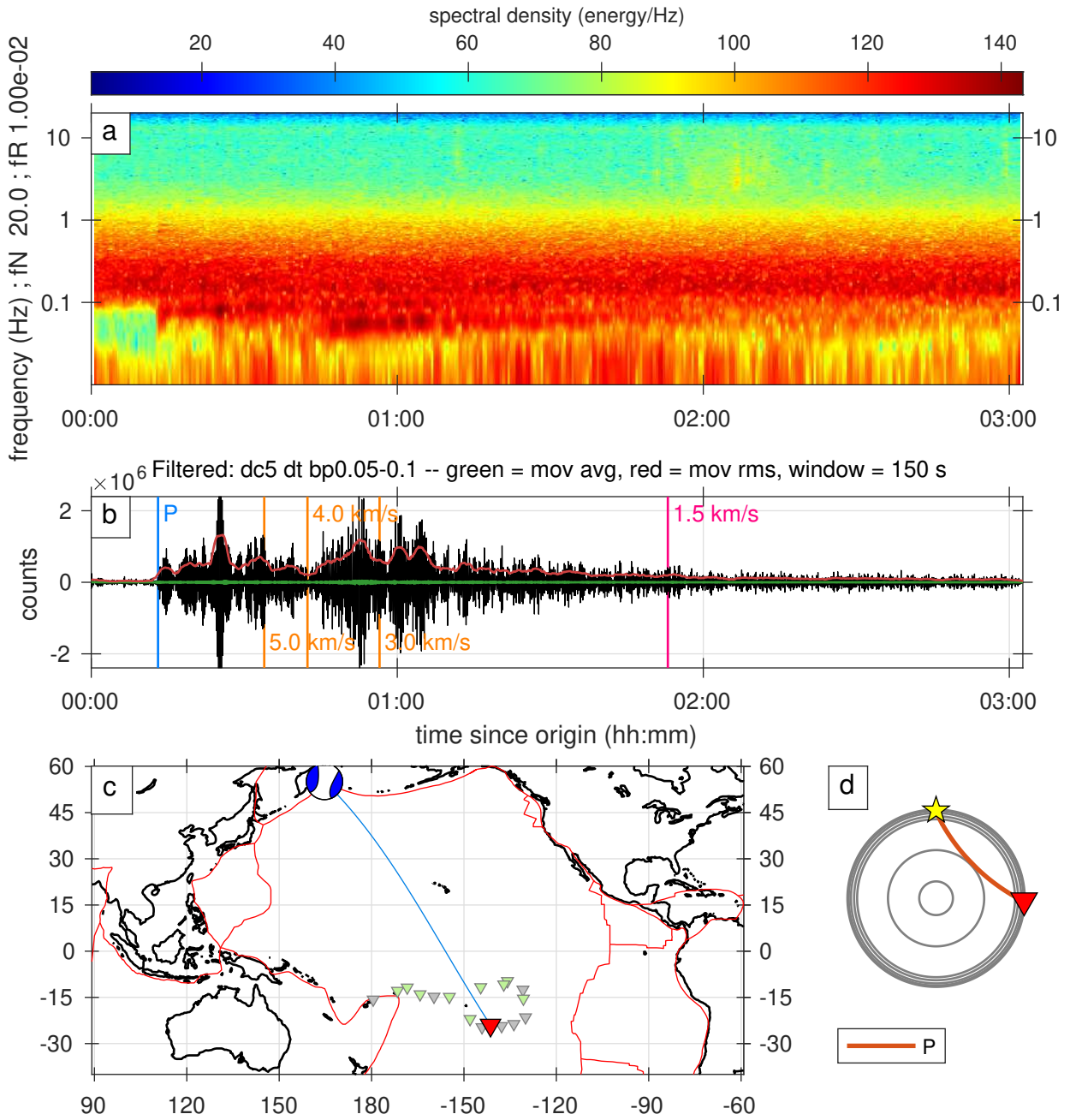


Figure S28. A full record of an earthquake classified as 3stars category.

Arrival: 2019-01-15T18:15:20.000000, ID: 10996154

mww = 6.60, distance = 49.36 degrees, depth = 35.00 km  
21.69 - 23.92 percent

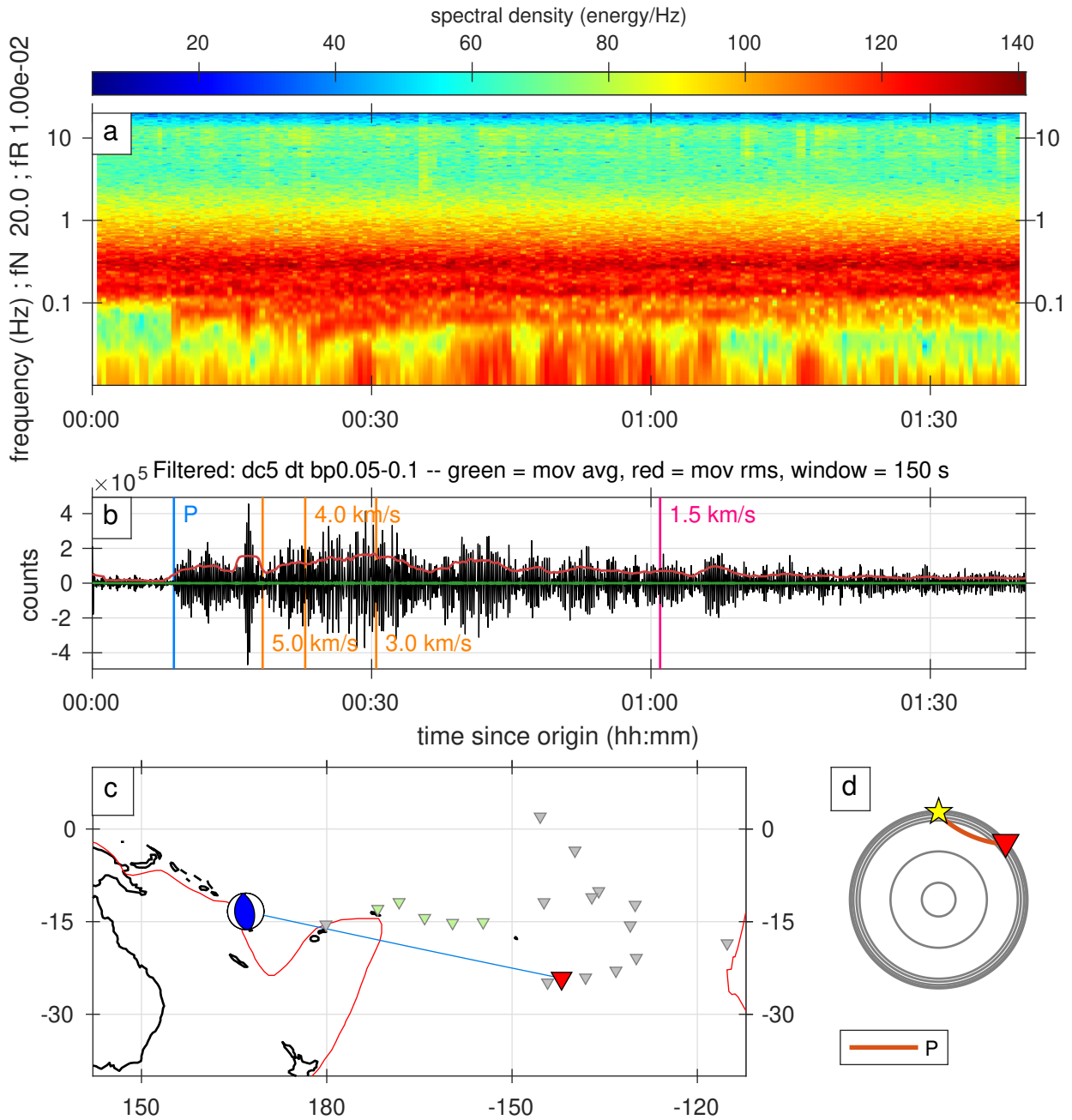


Figure S29. A full record of an earthquake classified as 3stars category.

Arrival: 2019-01-22T19:16:00.000000, ID: 10998373

Mww = 6.70, distance = 112.55 degrees, depth = 13.00 km  
 28.55 - 38.28 percent

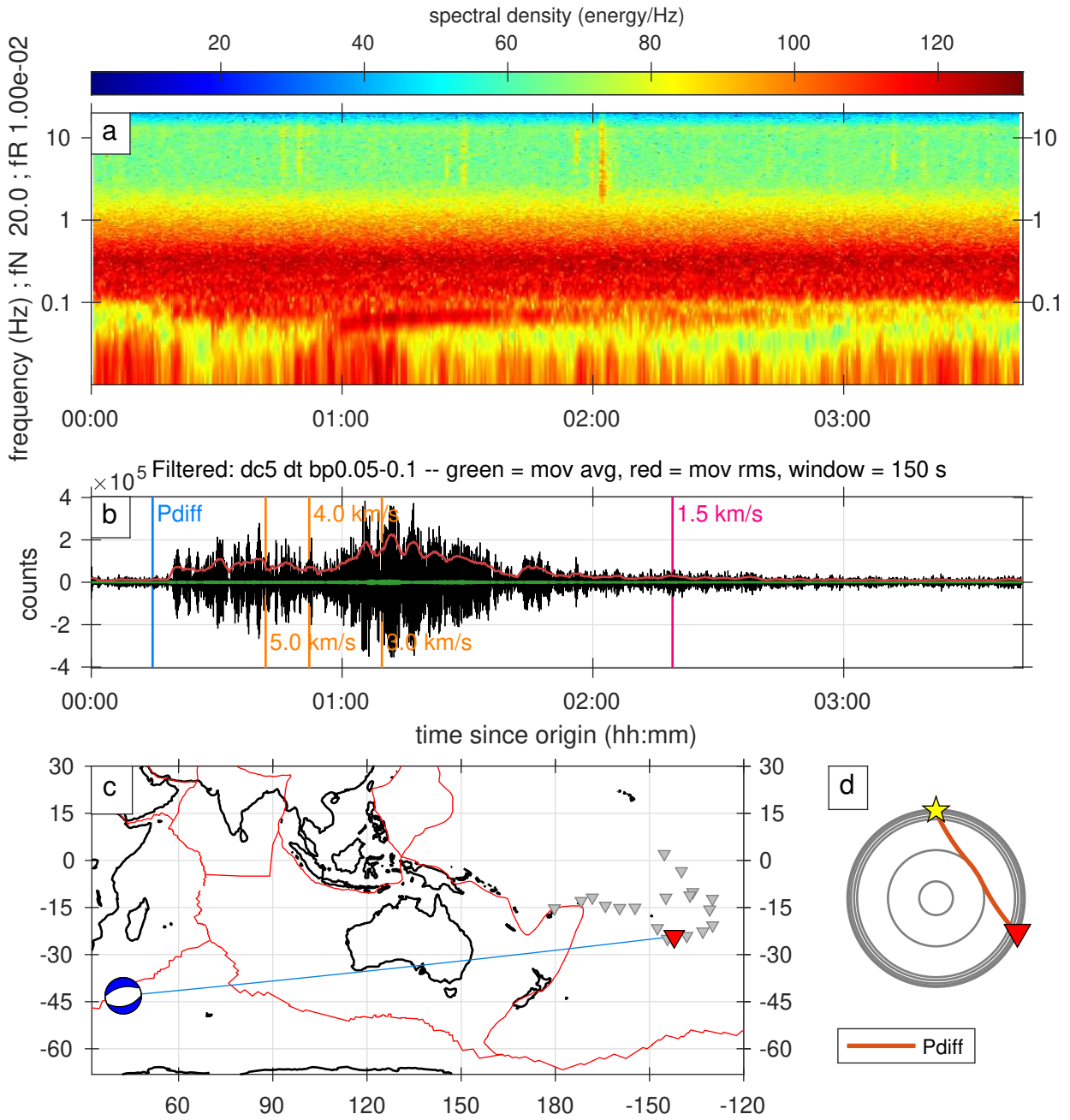


Figure S30. A full record of an earthquake classified as 3stars category.

Arrival: 2019-04-16T09:29:04.483737, ID: 11026352

Mww = 5.80, distance = 32.59 degrees, depth = 10.00 km  
32.45 - 33.13 percent

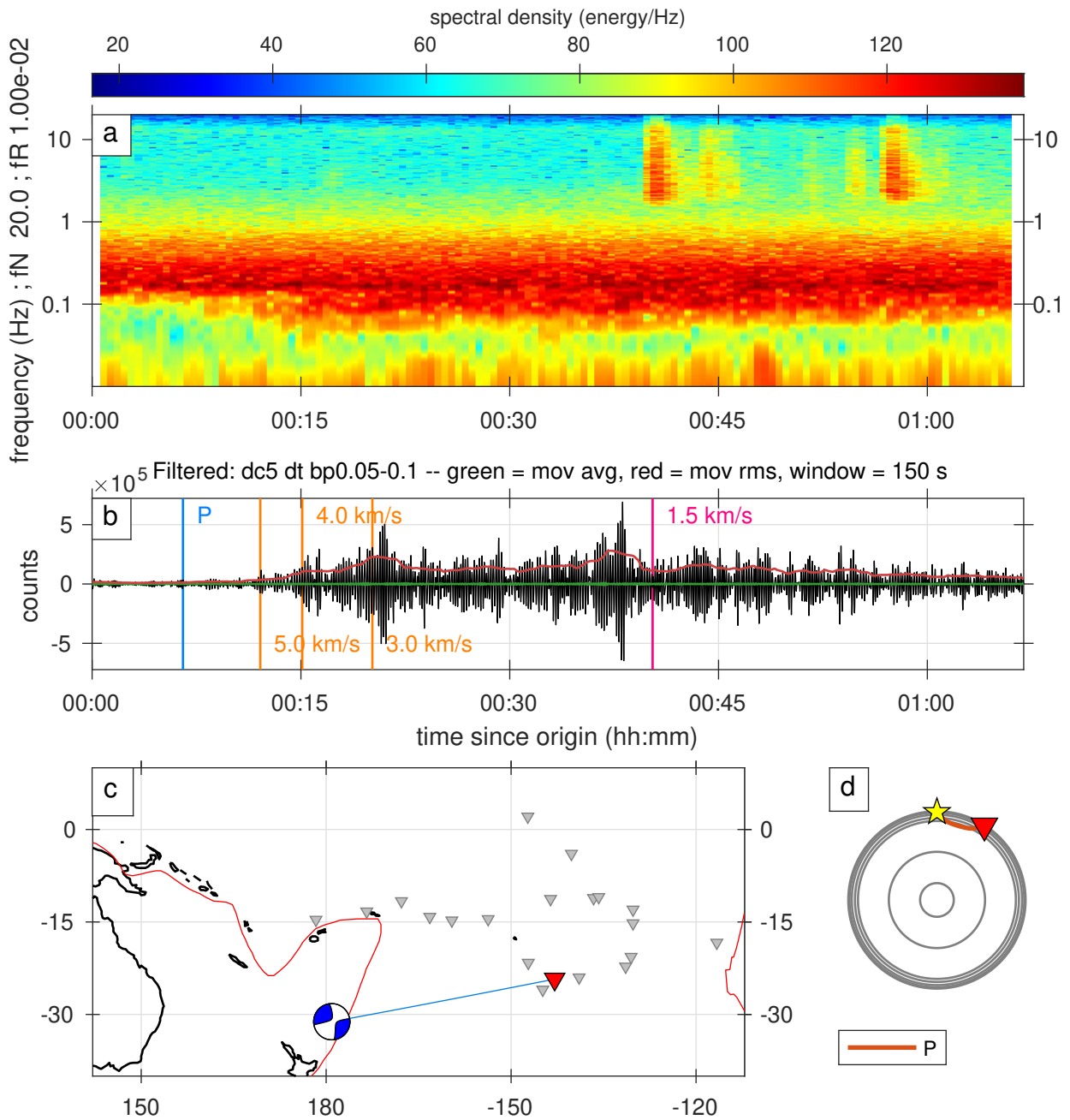


Figure S31. A full record of an earthquake classified as 3stars category.

Arrival: 2019-05-14T13:09:15.000000, ID: 11037207

Mww = 7.50, distance = 64.81 degrees, depth = 10.00 km  
81.55 - 84.02 percent

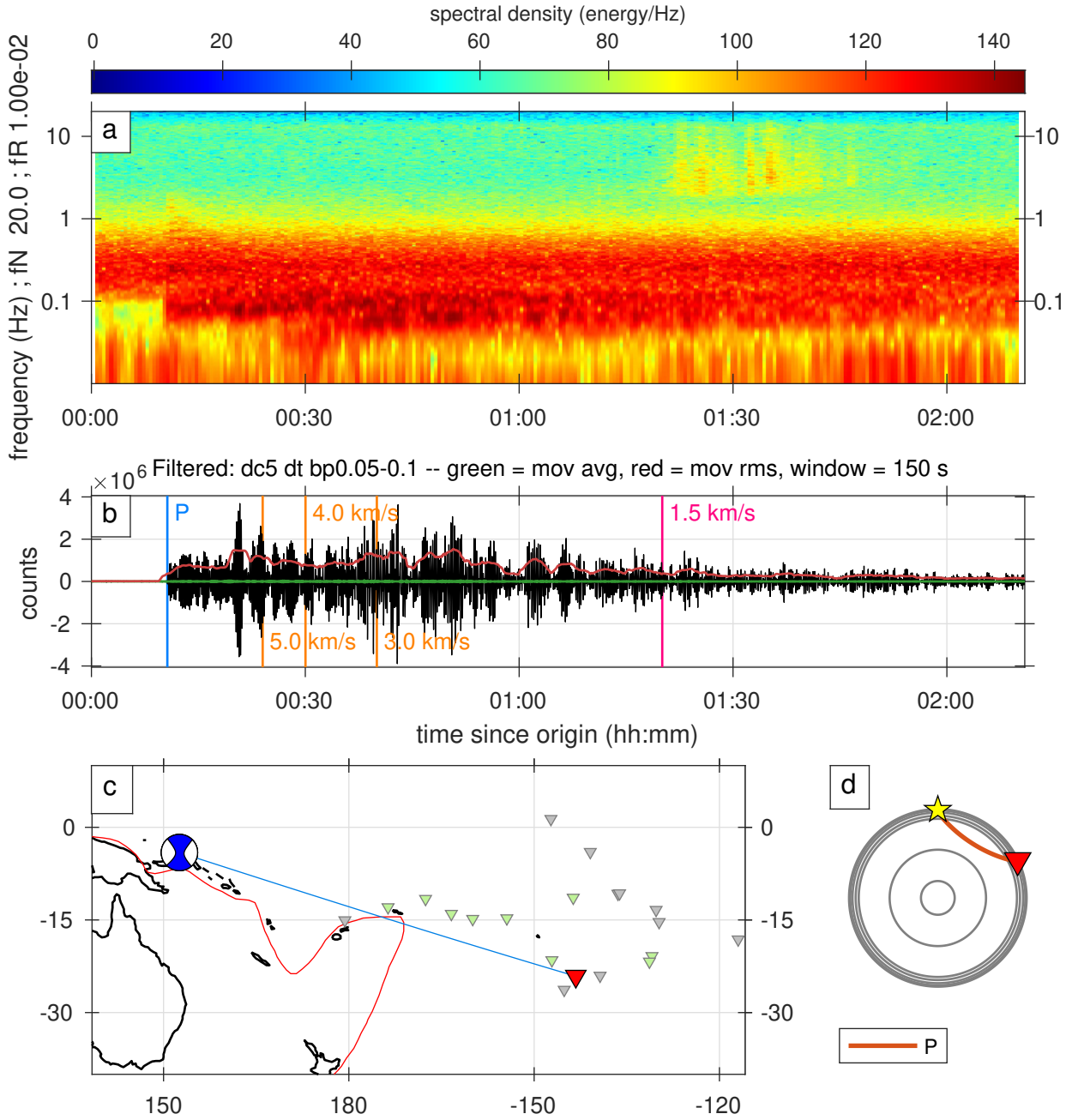


Figure S32. A full record of an earthquake classified as 3stars category.



Arrival: 2019-05-30T09:14:00.000000, ID: 11042482

Mww = 6.60, distance = 64.57 degrees, depth = 25.00 km  
45.96 - 47.41 percent

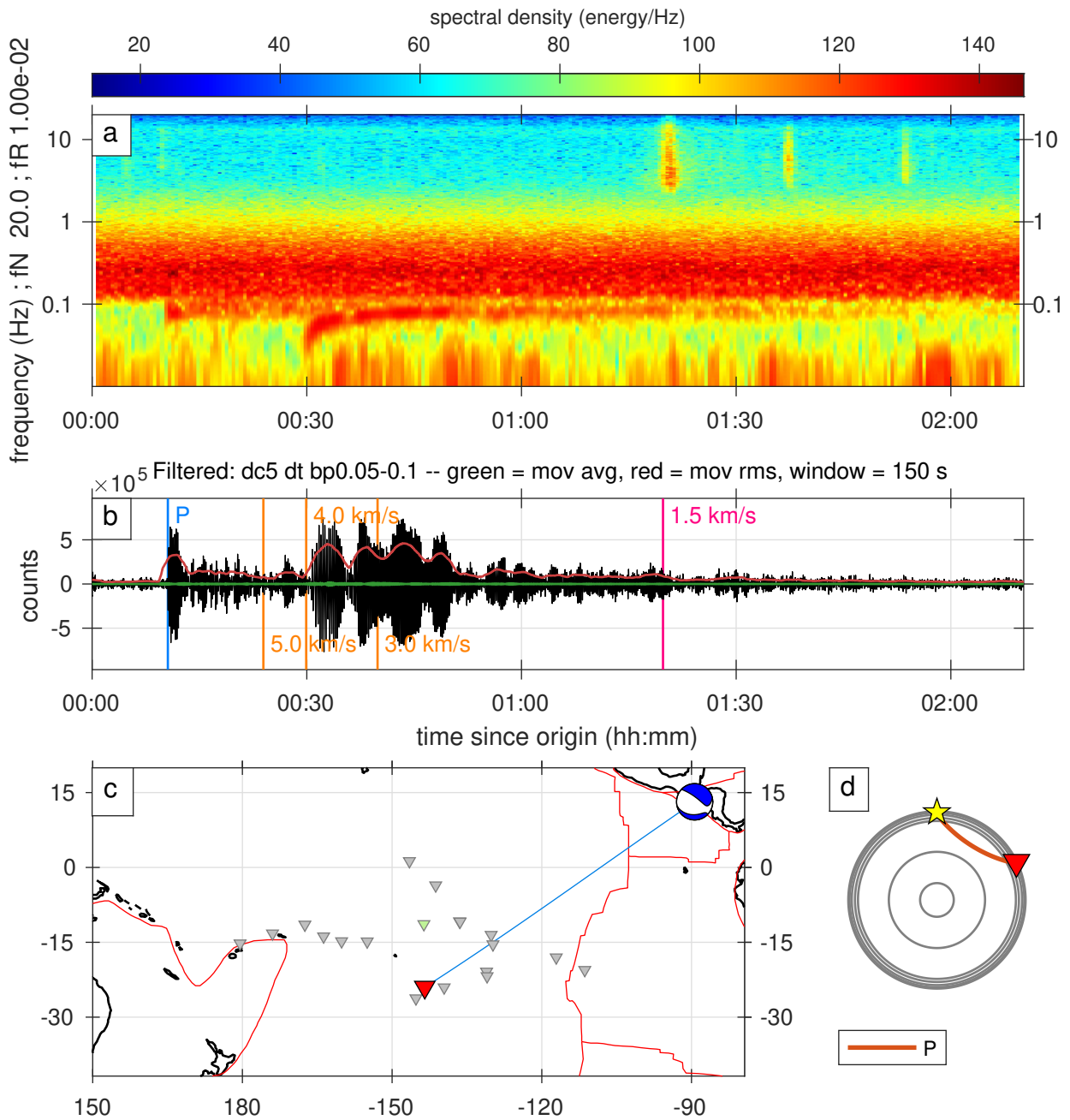


Figure S33. A full record of an earthquake classified as 3stars category.

Arrival: 2019-06-02T10:42:20.000000, ID: 11043682

Mww = 6.00, distance = 28.17 degrees, depth = 10.00 km  
 94.92 - 95.56 percent

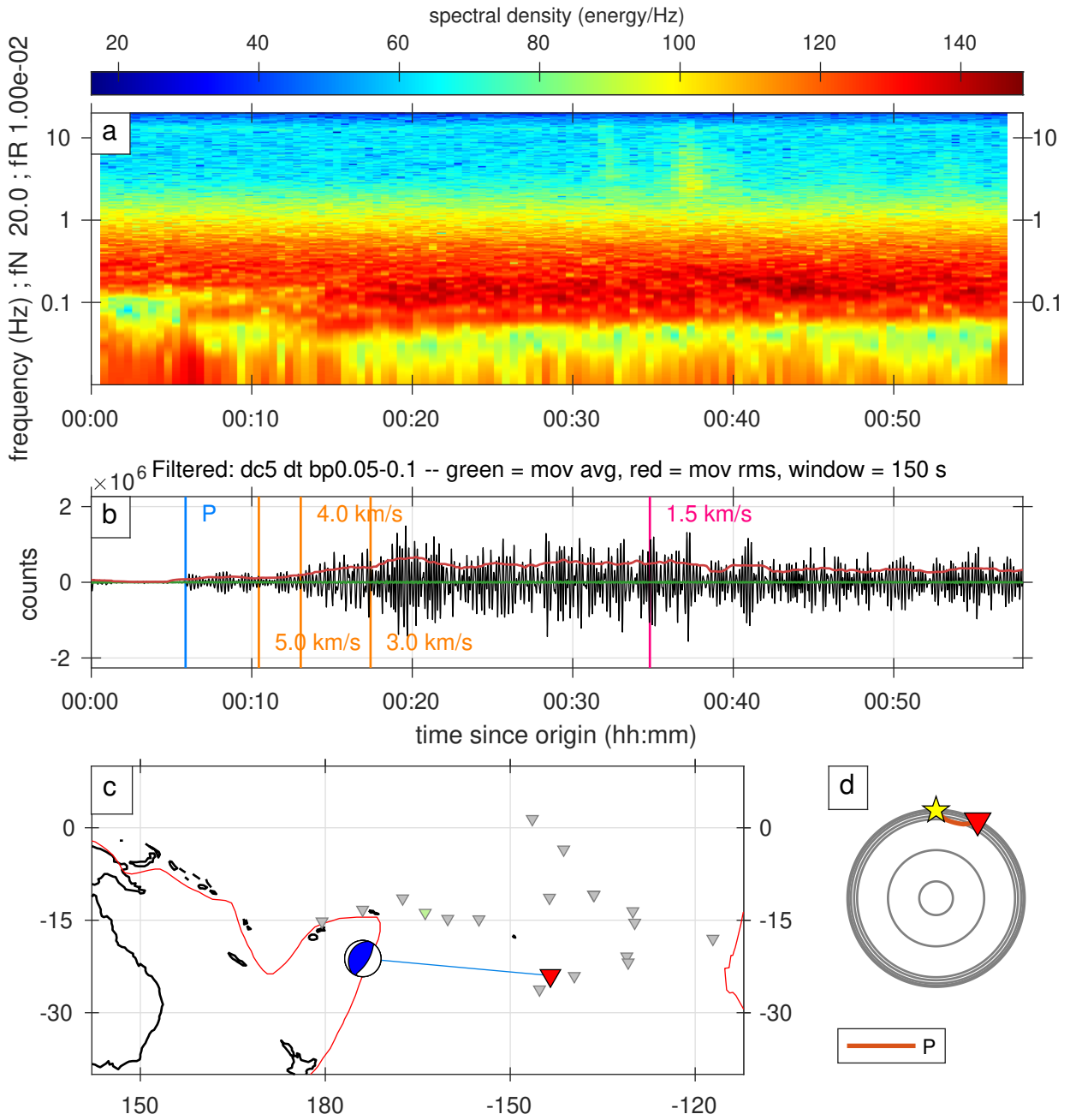


Figure S34. A full record of an earthquake classified as 3stars category.

Arrival: 2019-06-14T00:29:40.000000, ID: 11048697

Mww = 6.40, distance = 62.97 degrees, depth = 11.00 km  
28.63 - 31.81 percent

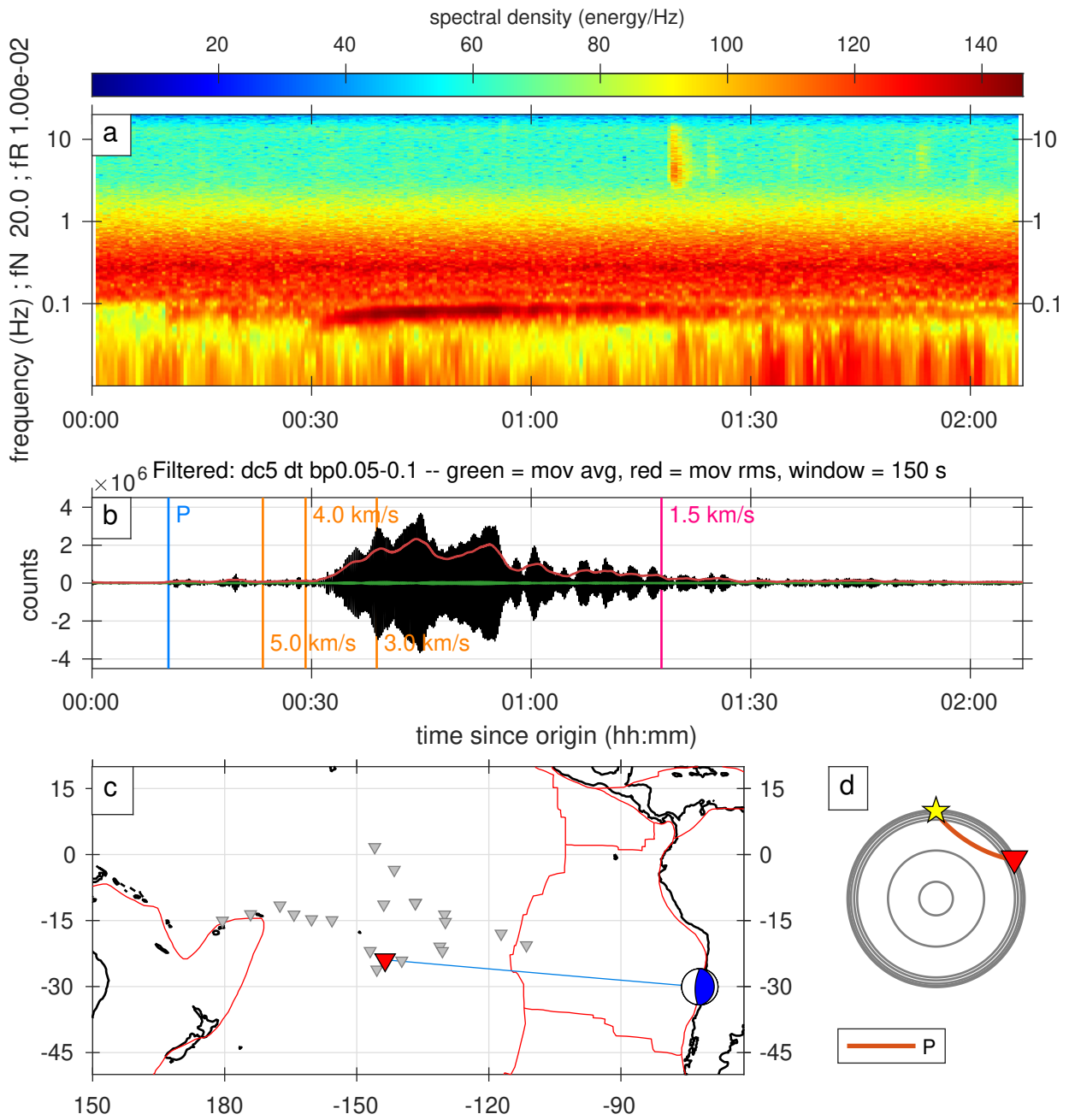


Figure S35. A full record of an earthquake classified as 3stars category.



Arrival: 2019-06-15T22:02:00.000000, ID: 11049511

Mww = 6.10, distance = 28.36 degrees, depth = 13.00 km  
 97.11 - 98.58 percent

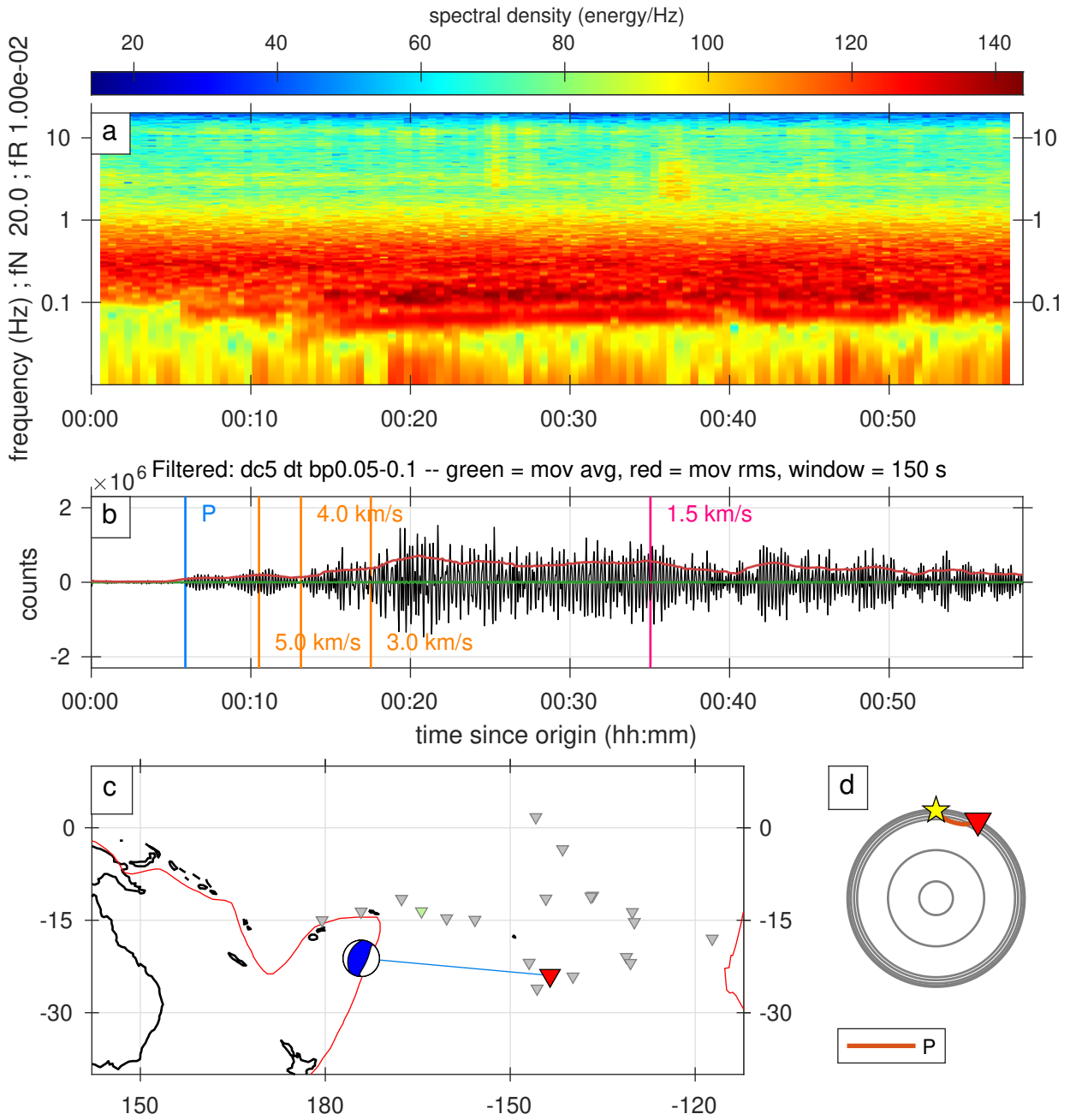


Figure S36. A full record of an earthquake classified as 3stars category.

Arrival: 2019-06-15T23:01:19.842640, ID: 11049517

mww = 7.30, distance = 31.31 degrees, depth = 46.00 km  
98.39 - 100.00 percent

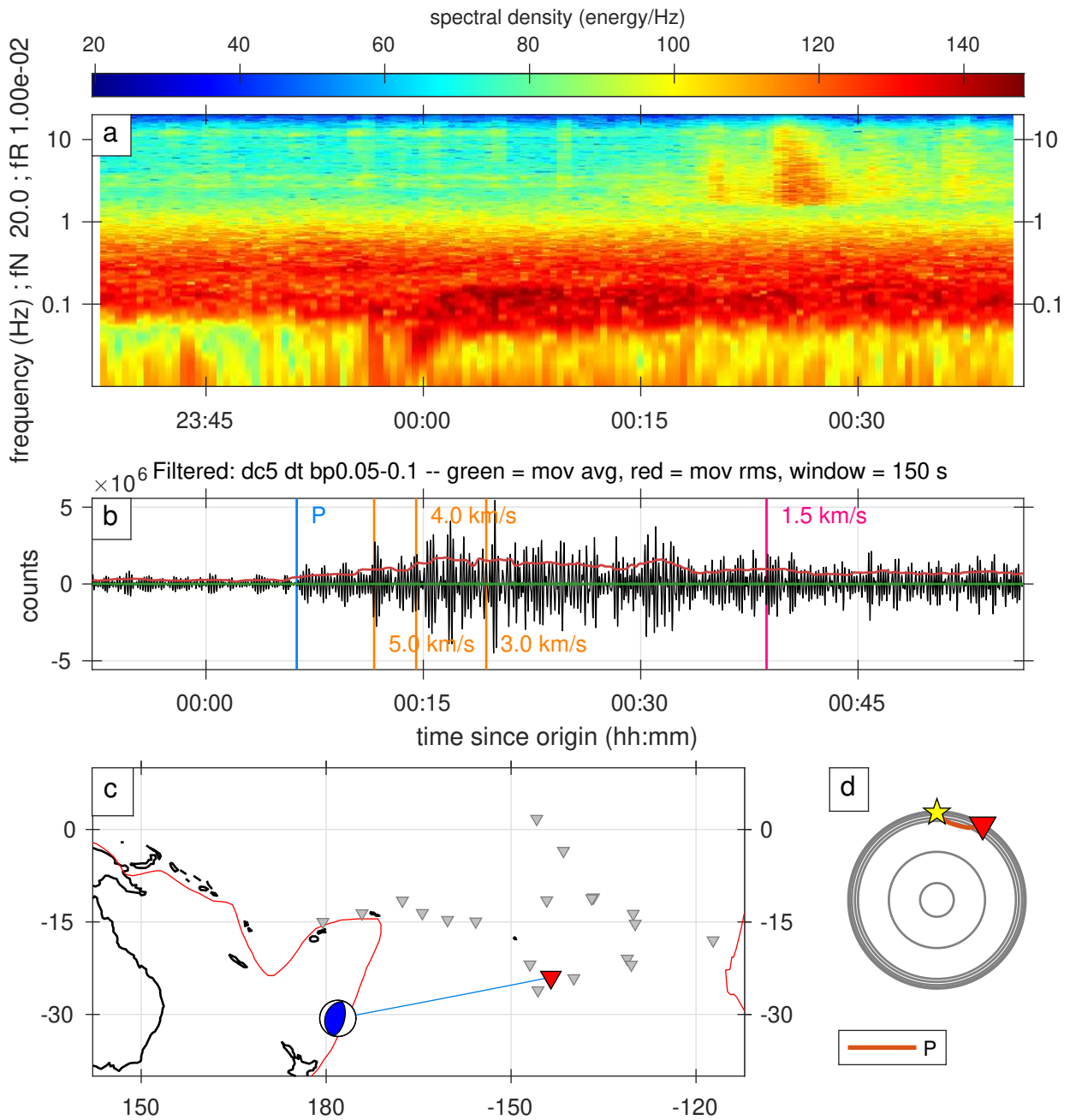


Figure S37. A full record of an earthquake classified as 3stars category.

Arrival: 2019-06-16T05:23:30.000000, ID: 11049599

Mww = 6.30, distance = 31.32 degrees, depth = 31.52 km  
4.84 - 5.80 percent

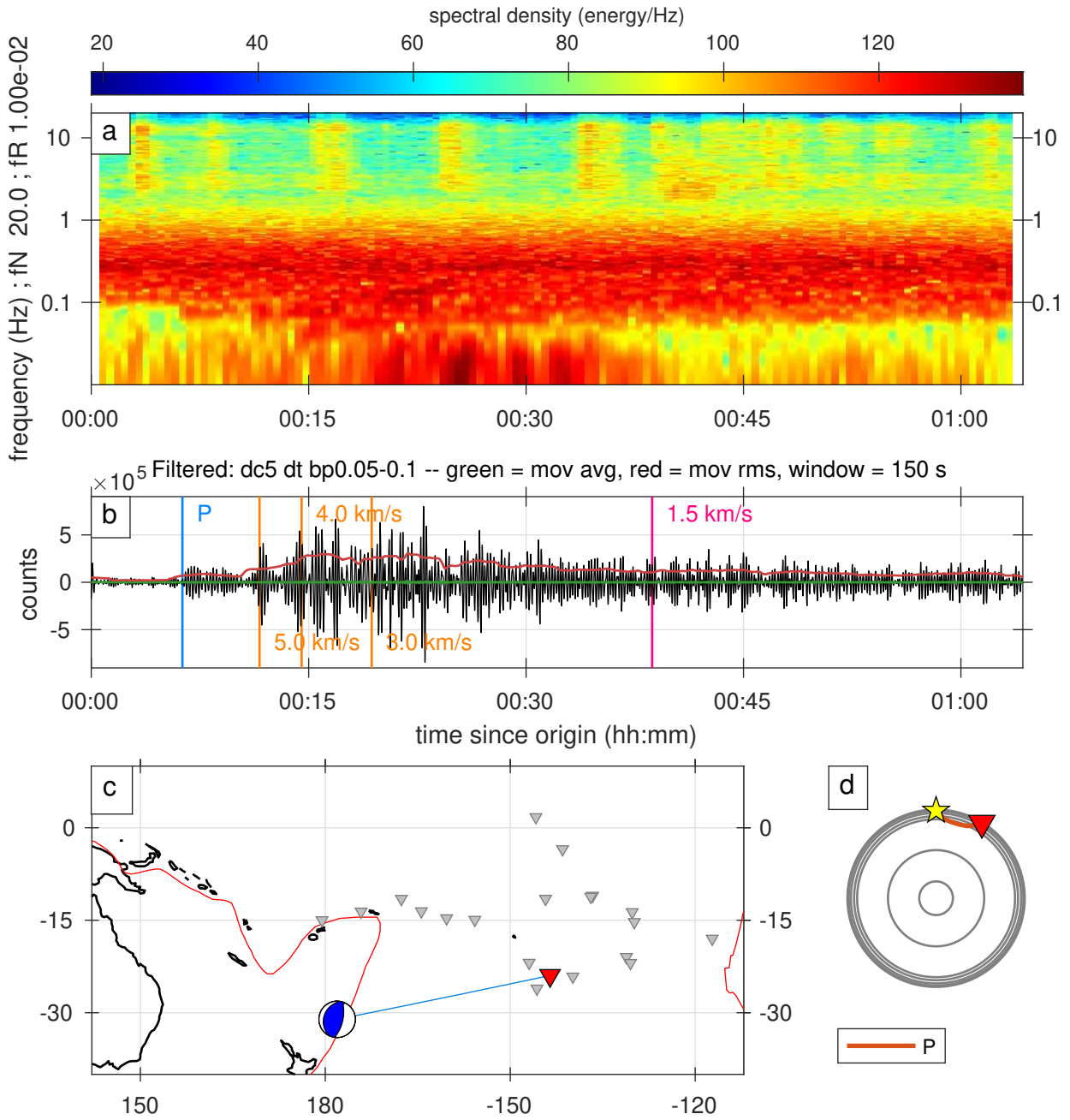


Figure S38. A full record of an earthquake classified as 3stars category.

Arrival: 2019-06-17T06:08:15.000000, ID: 11049903

Mww = 6.00, distance = 30.89 degrees, depth = 16.00 km

27.00 - 27.94 percent

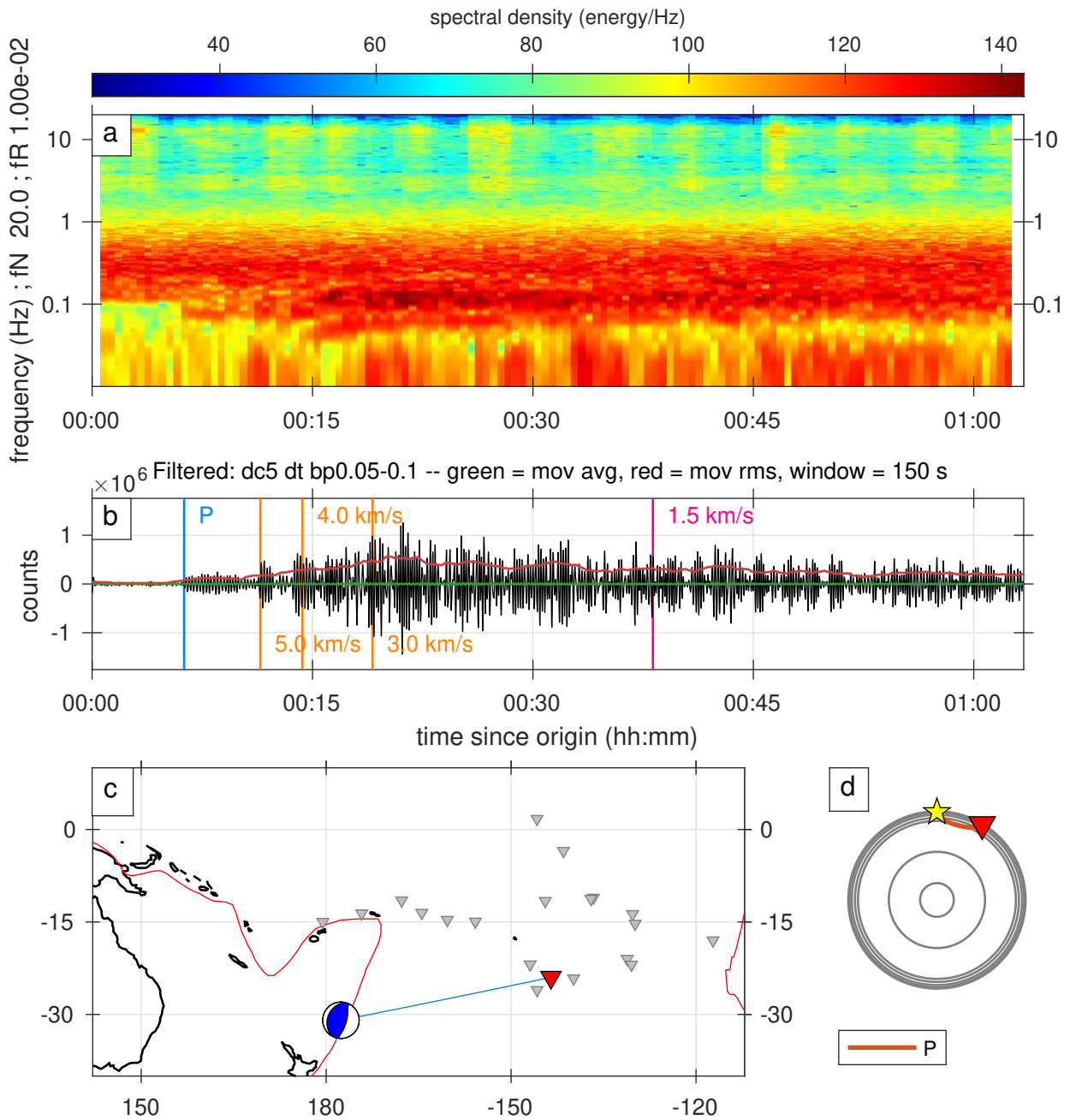


Figure S39. A full record of an earthquake classified as 3stars category.

Arrival: 2019-06-18T16:11:20.000000, ID: 11050483

Mww = 5.90, distance = 30.86 degrees, depth = 15.00 km  
57.48 - 58.42 percent

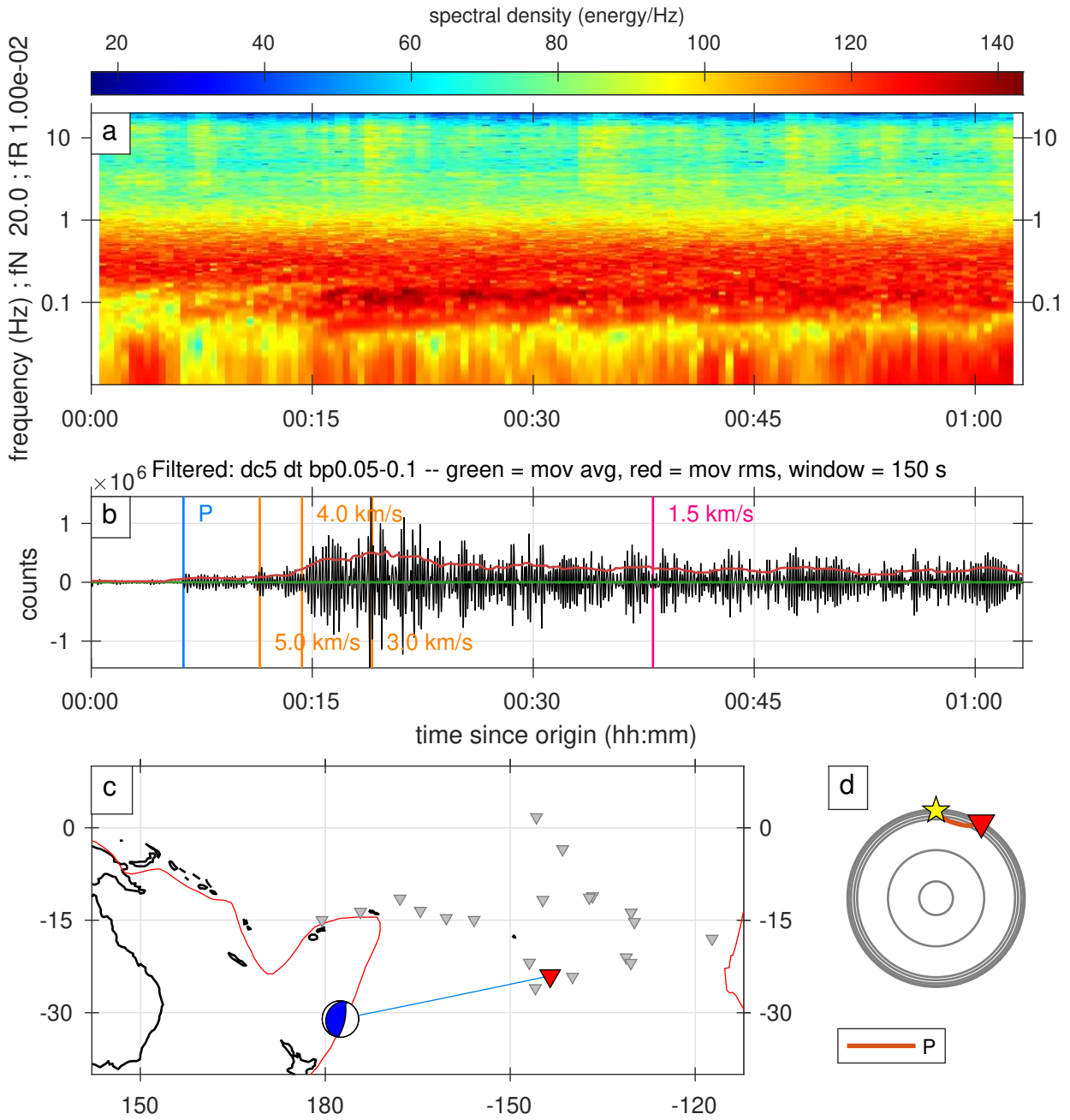


Figure S40. A full record of an earthquake classified as 3stars category.

Arrival: 2019-06-19T07:08:00.000000, ID: 11050823

Mww = 6.40, distance = 31.03 degrees, depth = 10.00 km  
70.85 - 71.80 percent

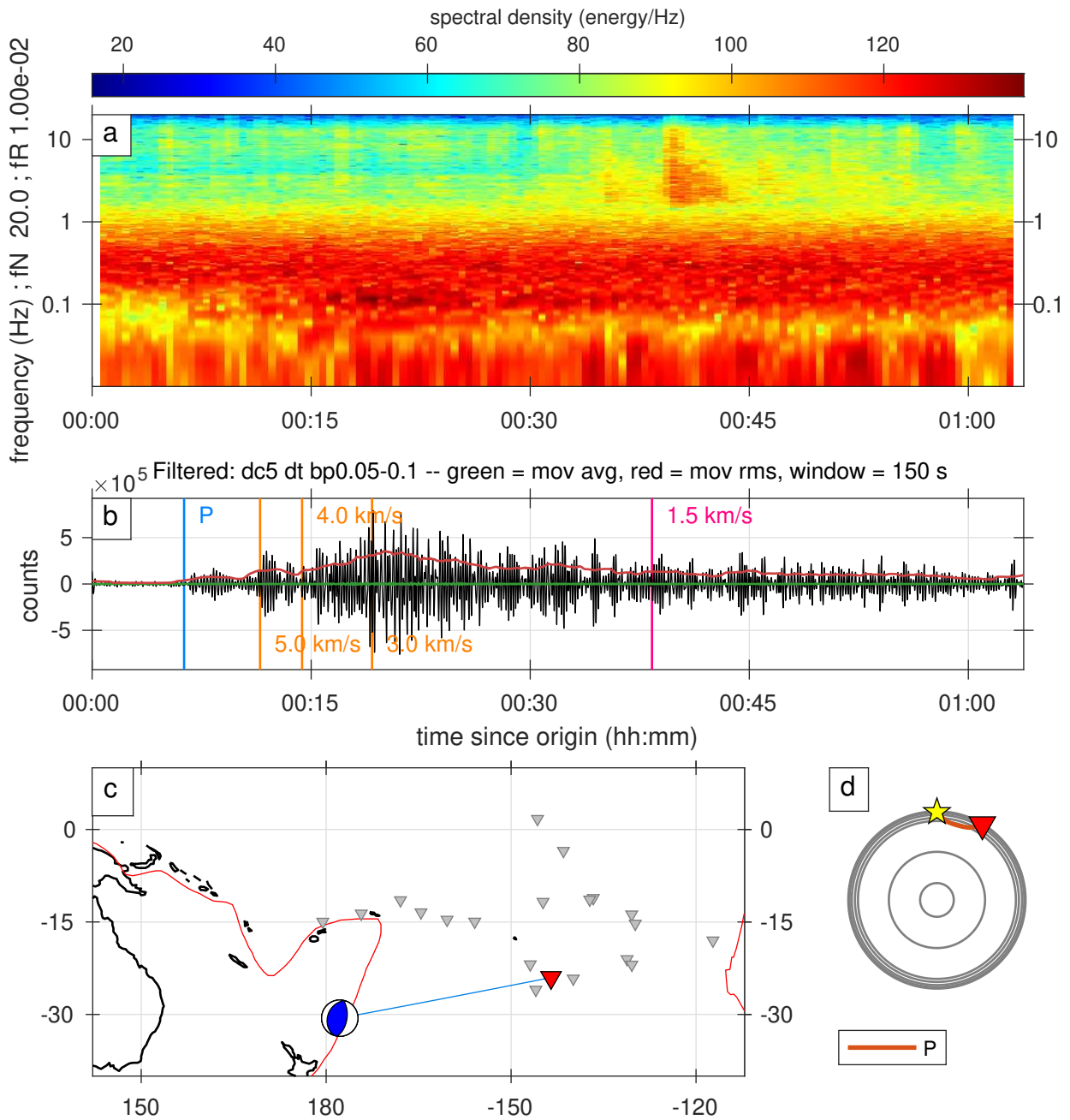


Figure S41. A full record of an earthquake classified as 3stars category.



Arrival: 2019-06-19T17:36:50.000000, ID: 11050987

Mww = 6.30, distance = 78.16 degrees, depth = 10.00 km  
80.15 - 82.49 percent

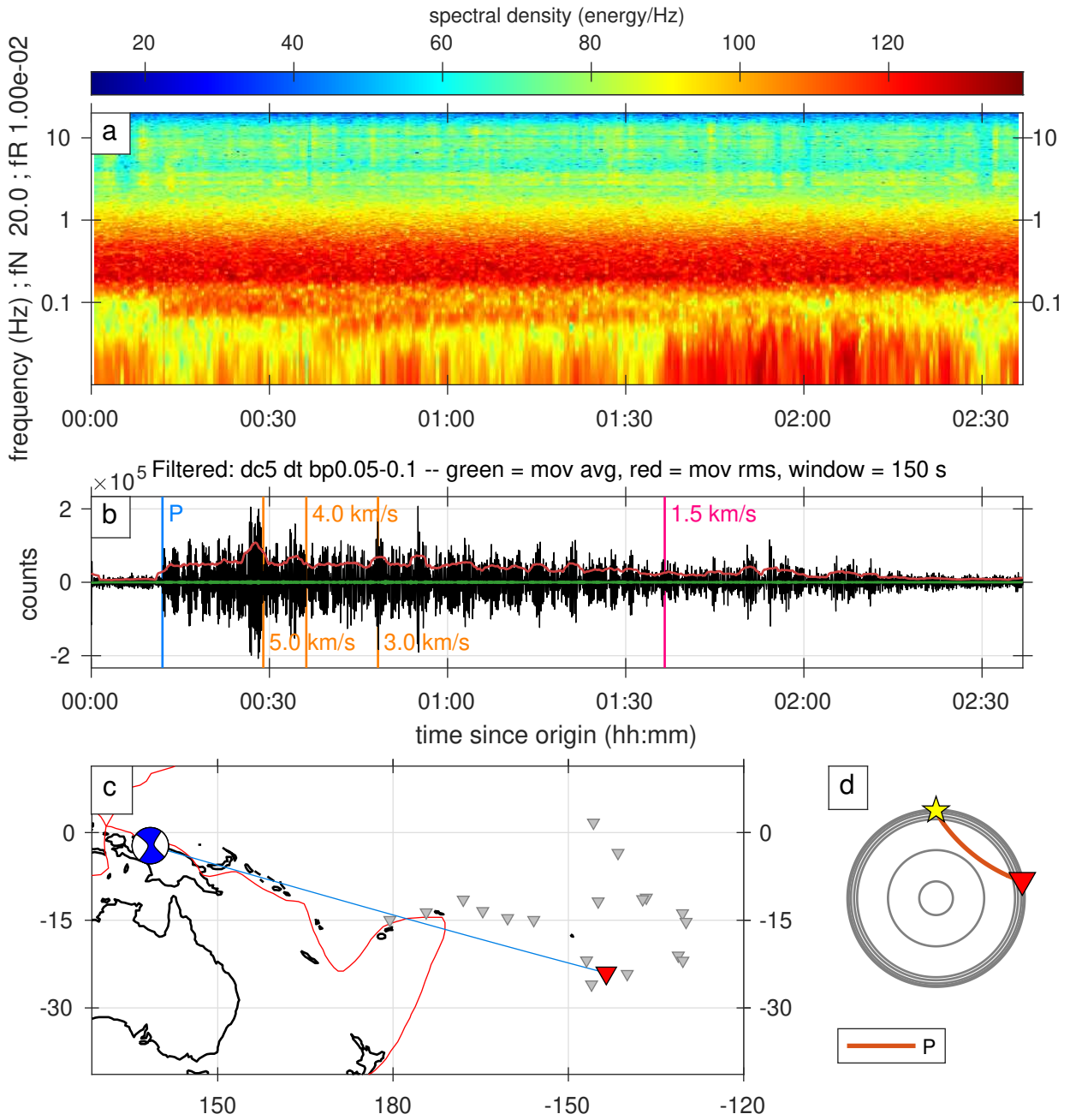


Figure S42. A full record of an earthquake classified as 3stars category.

Arrival: 2019-06-24T03:05:40.000000, ID: 11052554

mww = 7.30, distance = 84.96 degrees, depth = 212.00 km  
125.50 - 679.76 percent

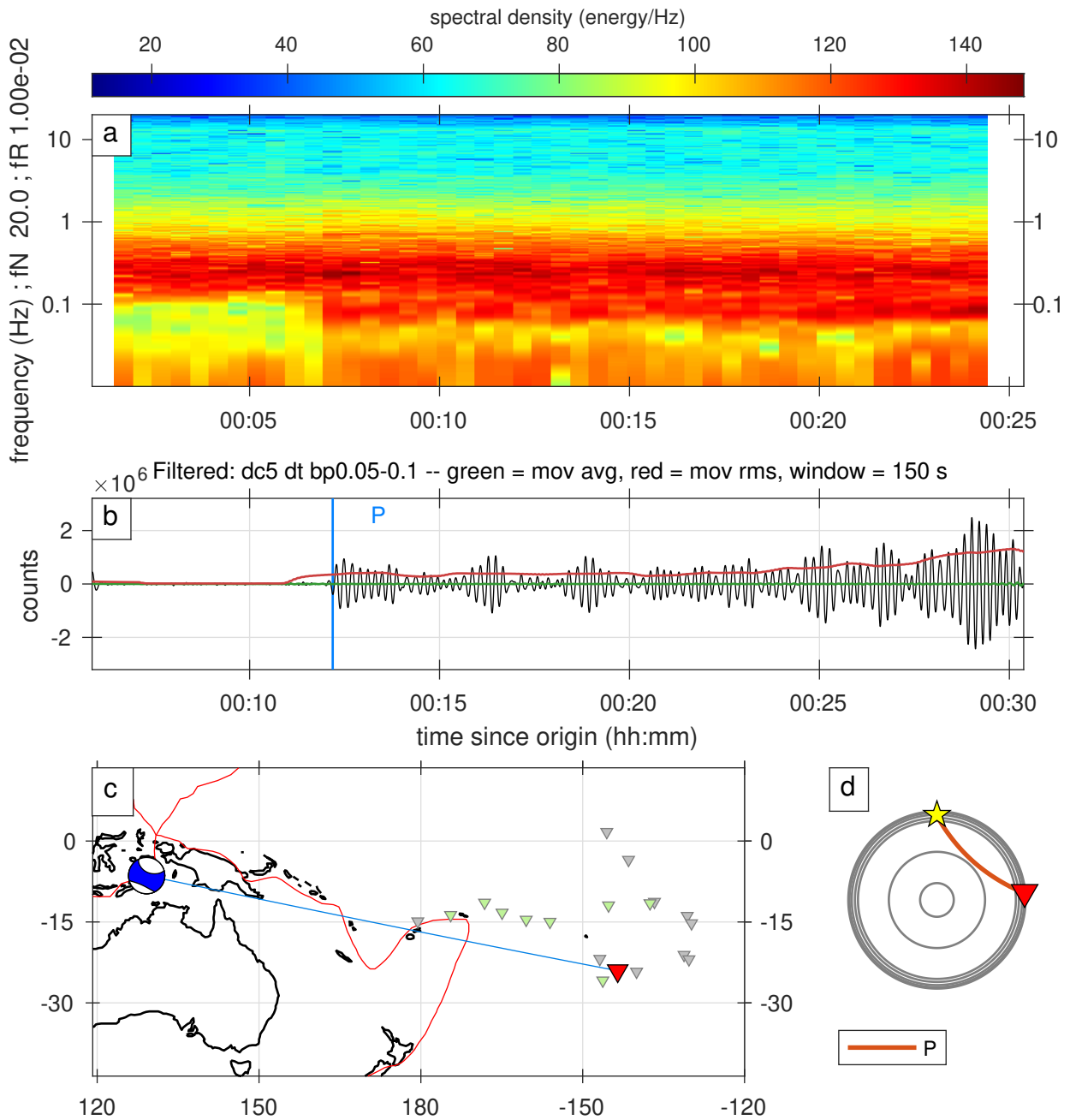


Figure S43. A full record of an earthquake classified as 3stars category.



Arrival: 2019-06-24T11:38:00.000000, ID: 11052627

Mww = 5.90, distance = 30.66 degrees, depth = 10.00 km  
18.66 - 20.97 percent

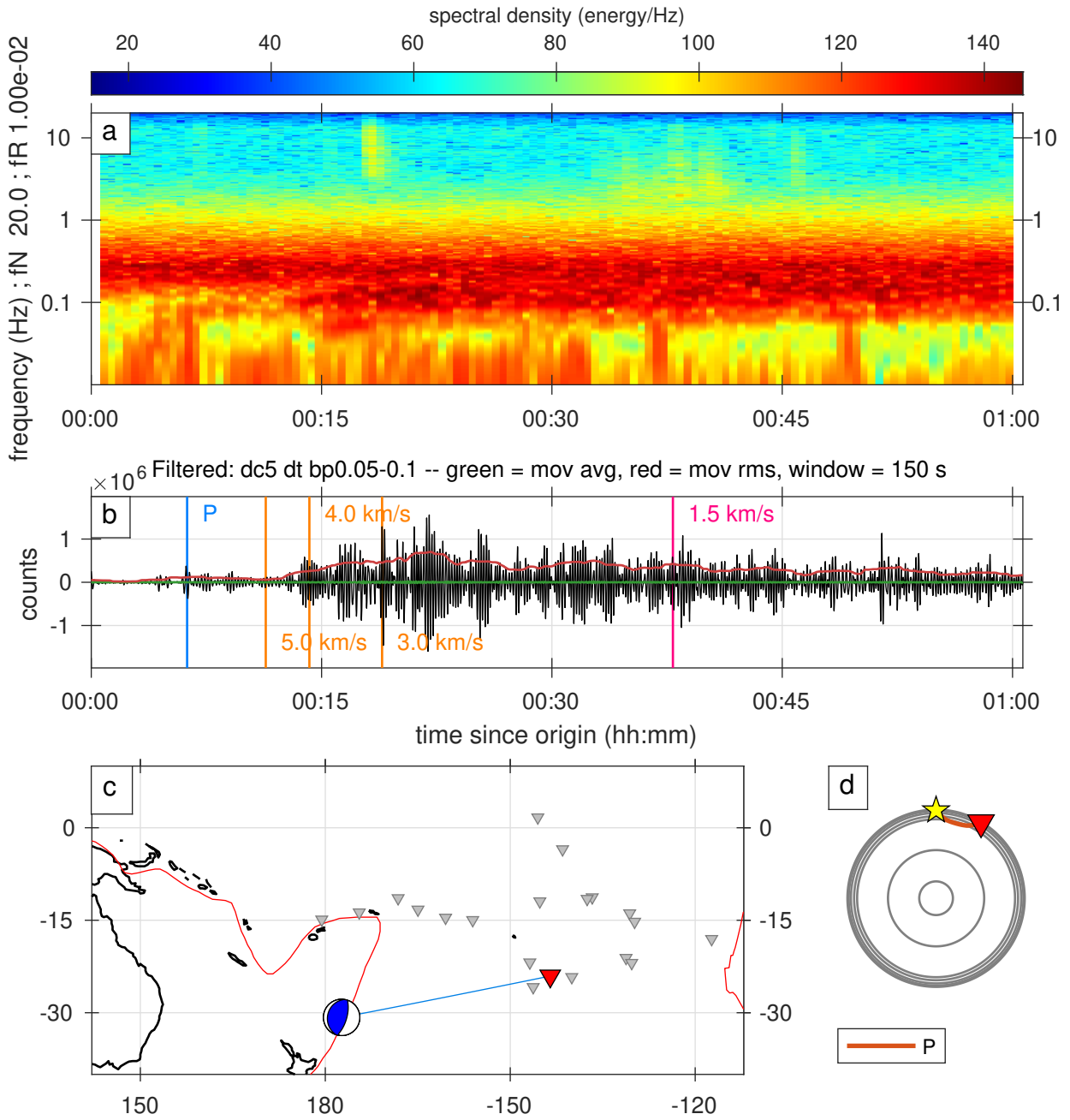


Figure S44. A full record of an earthquake classified as 3stars category.

Arrival: 2019-06-27T11:11:25.576885, ID: 11053874

Mww = 6.30, distance = 32.25 degrees, depth = 10.00 km  
37.94 - 39.11 percent

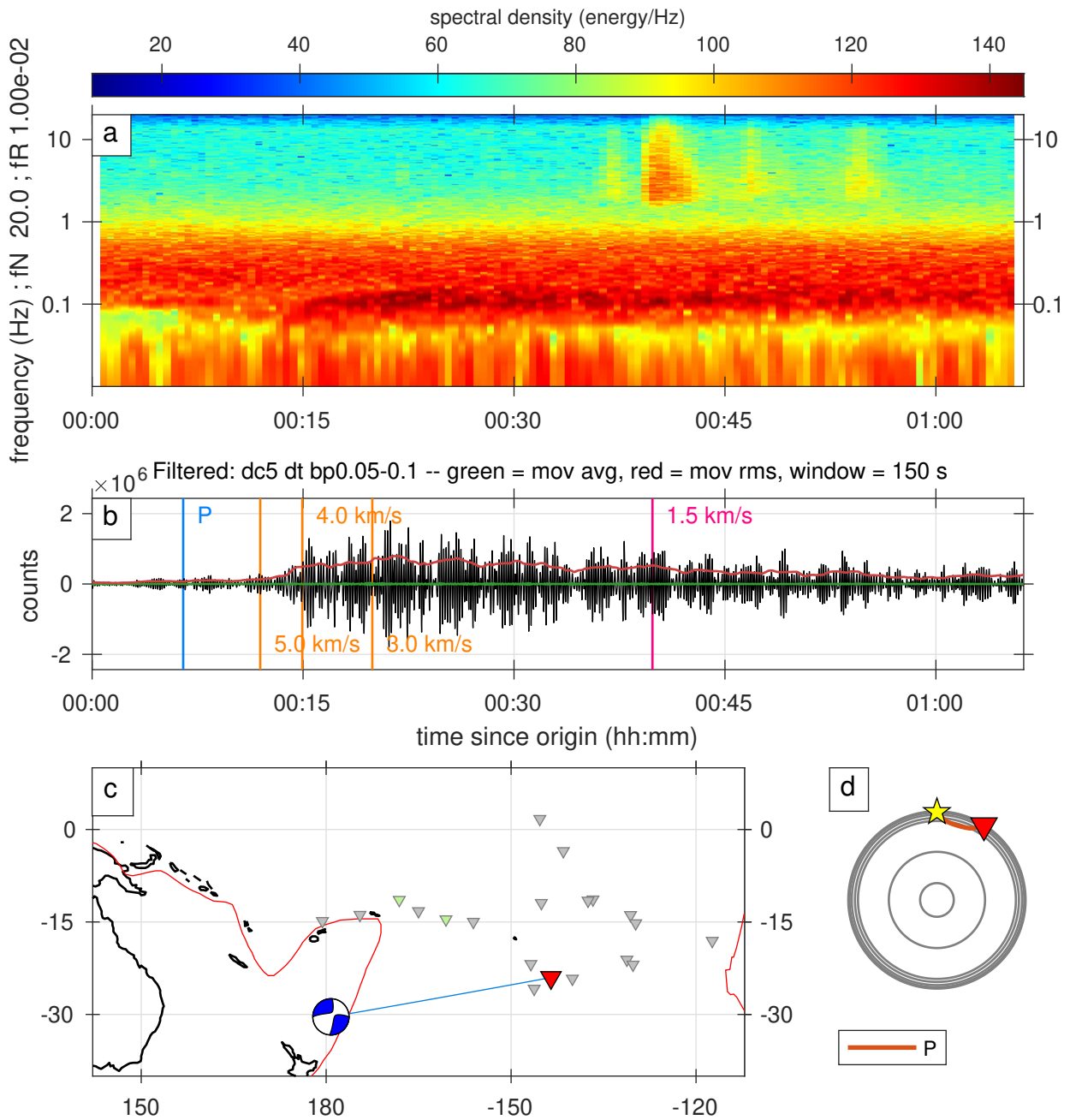


Figure S45. A full record of an earthquake classified as 3stars category.

Arrival: 2019-07-04T17:45:00.000000, ID: 11056847

mw = 6.40, distance = 64.56 degrees, depth = 10.71 km  
 27.44 - 34.85 percent

spectral density (energy/Hz)

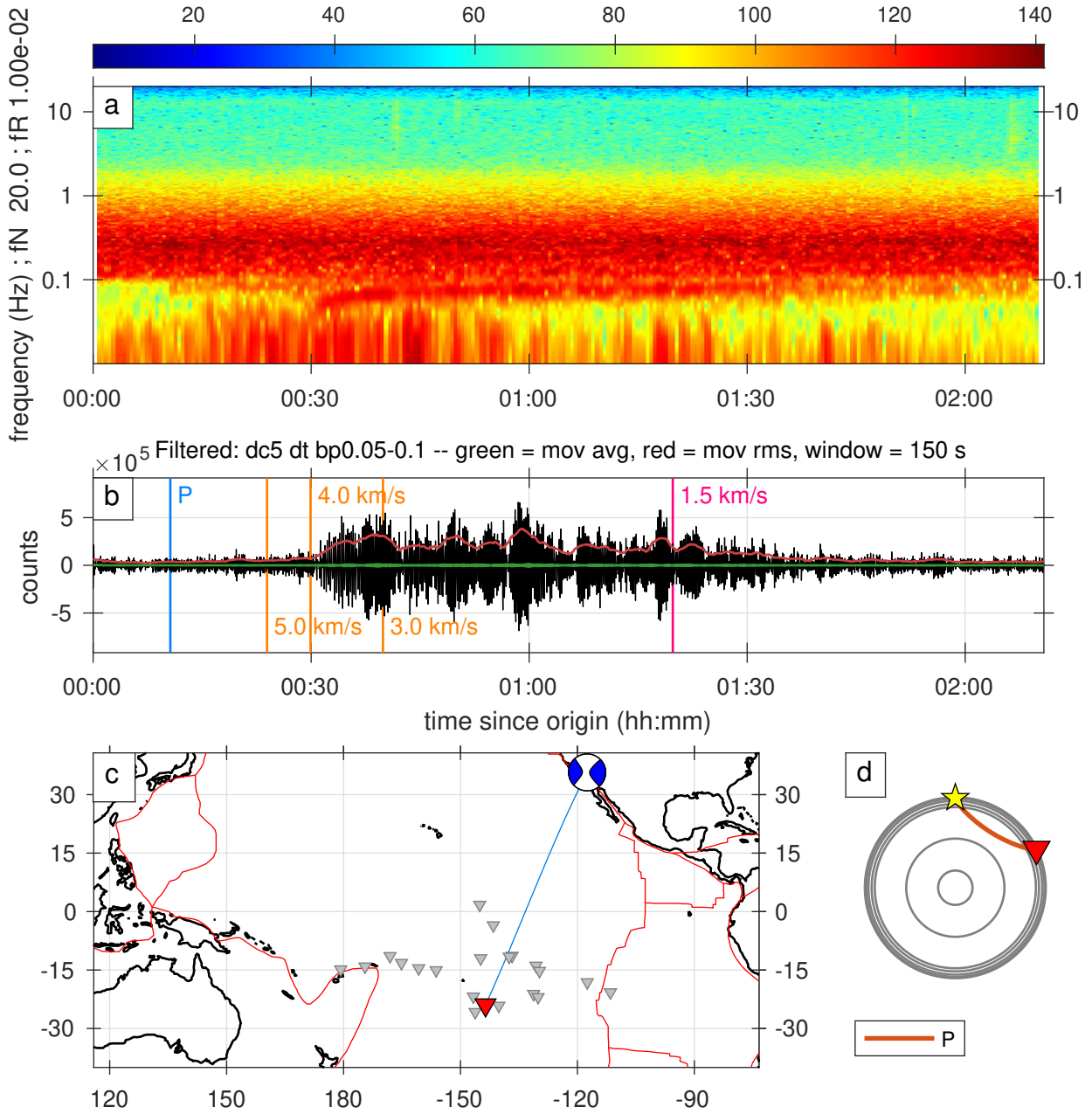


Figure S46. A full record of an earthquake classified as 3stars category.

Arrival: 2019-07-06T03:30:30.000000, ID: 11058875

mw = 7.10, distance = 64.58 degrees, depth = 8.00 km  
36.19 - 42.53 percent

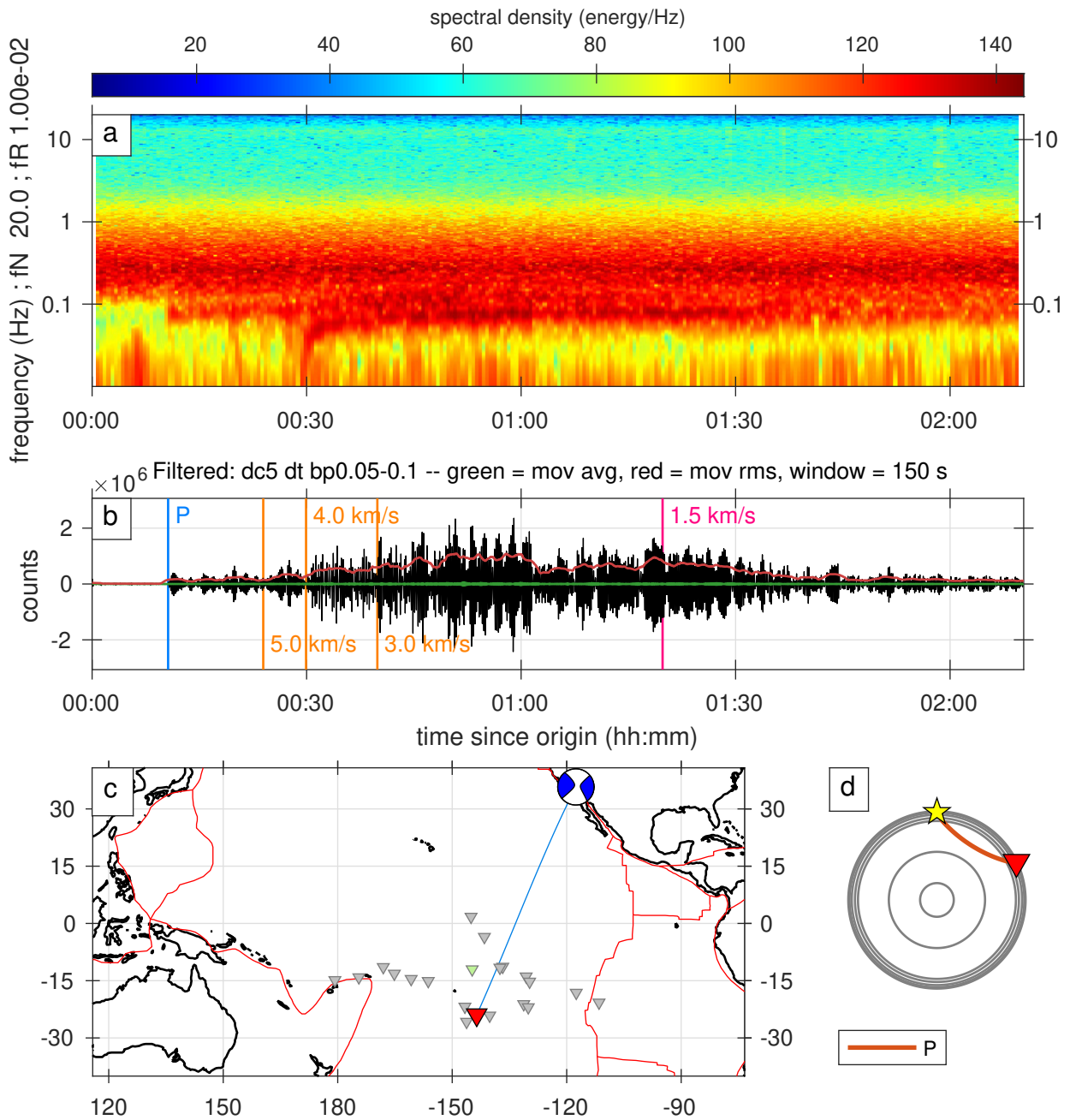


Figure S47. A full record of an earthquake classified as 3stars category.

Arrival: 2019-07-06T06:38:02.430051, ID: 11058978

mb = 5.50, distance = 29.49 degrees, depth = 10.00 km  
45.54 - 48.49 percent

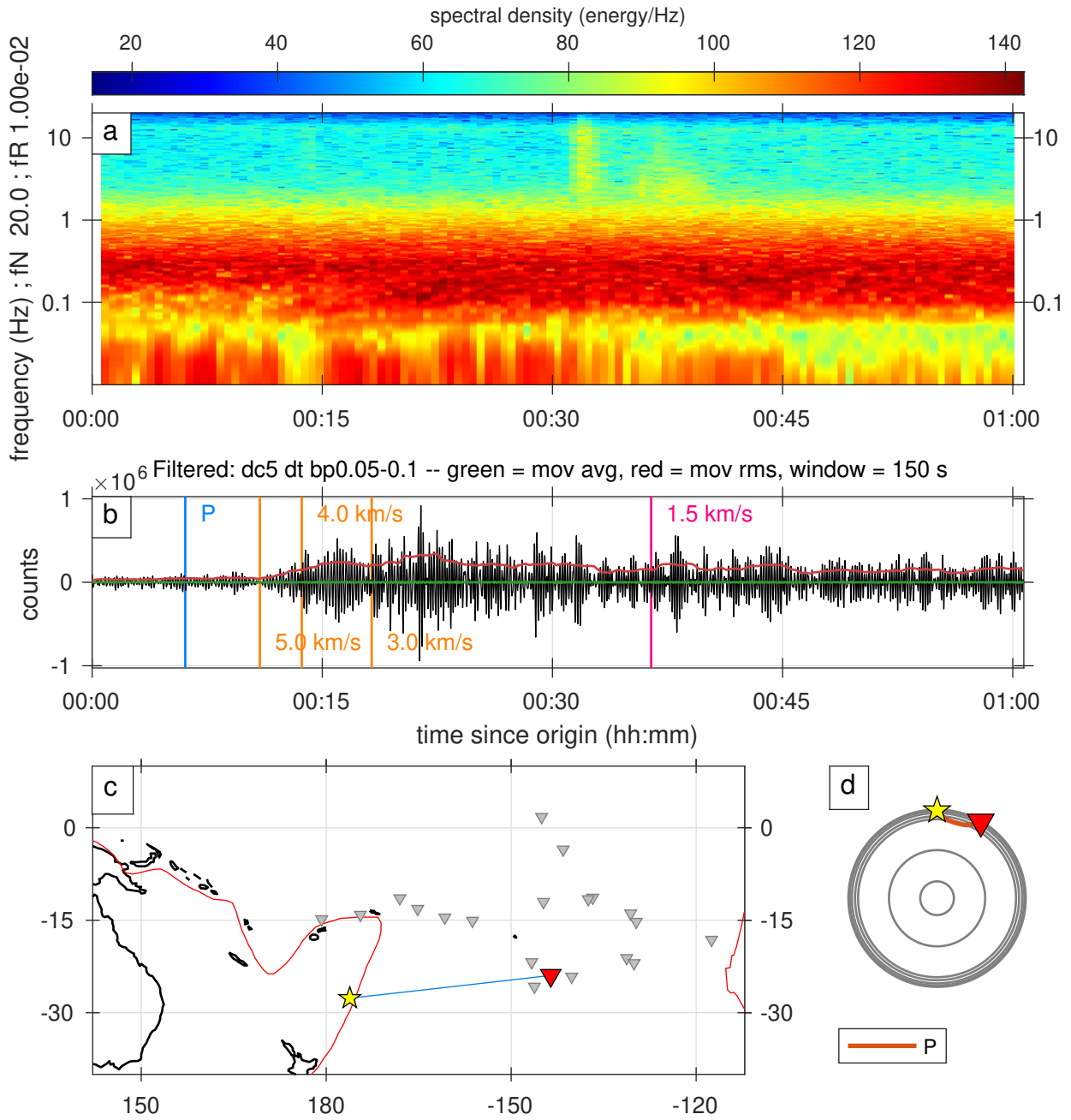


Figure S48. A full record of an earthquake classified as 3stars category.

Arrival: 2019-07-14T09:23:40.000000, ID: 11073718

Mww = 7.30, distance = 88.24 degrees, depth = 10.00 km  
43.62 - 46.33 percent

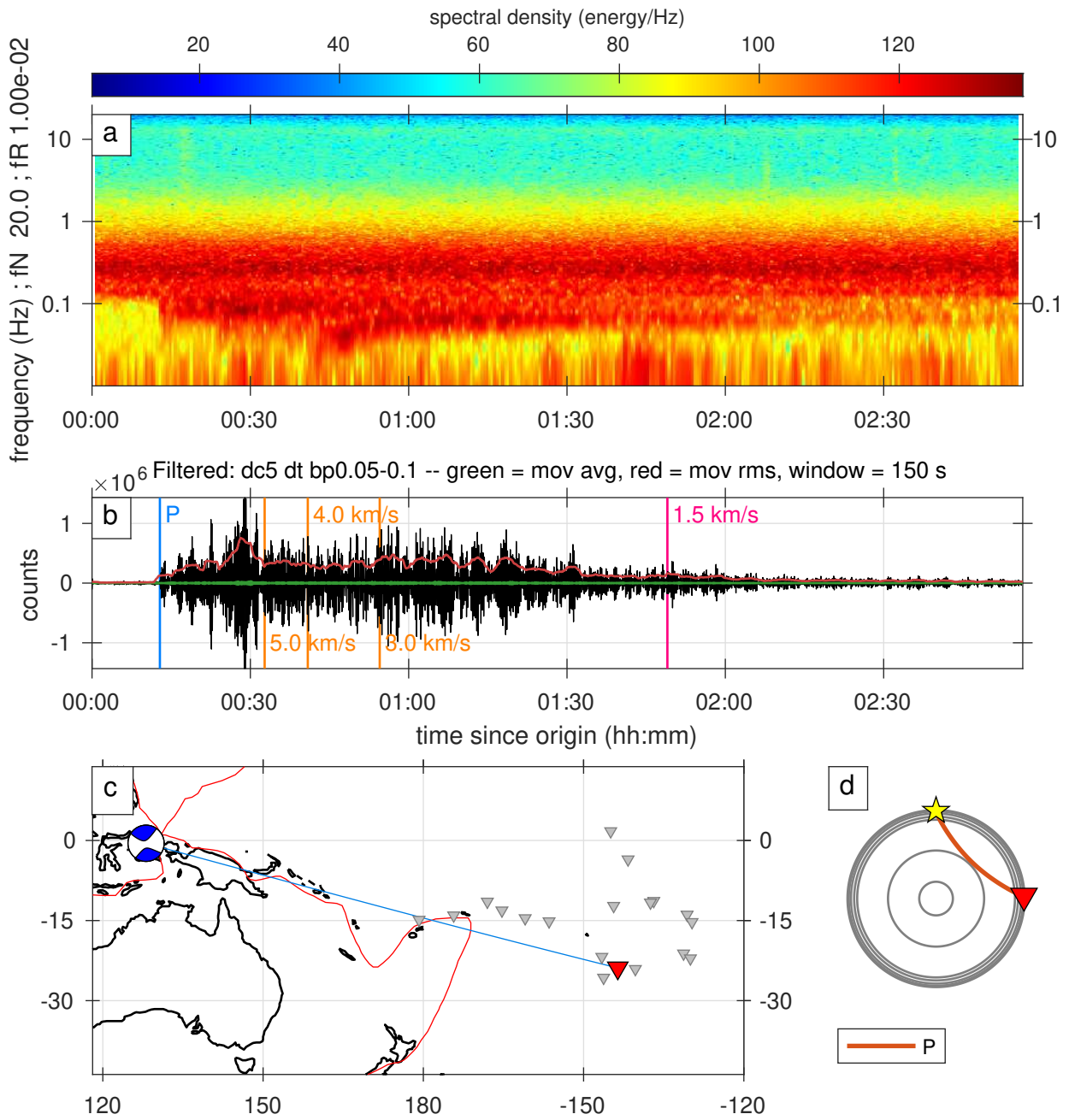


Figure S49. A full record of an earthquake classified as 3stars category.



Arrival: 2019-07-31T15:10:30.000000, ID: 11089506

mww = 6.60, distance = 45.99 degrees, depth = 181.00 km  
 12.53 - 16.79 percent

spectral density (energy/Hz)

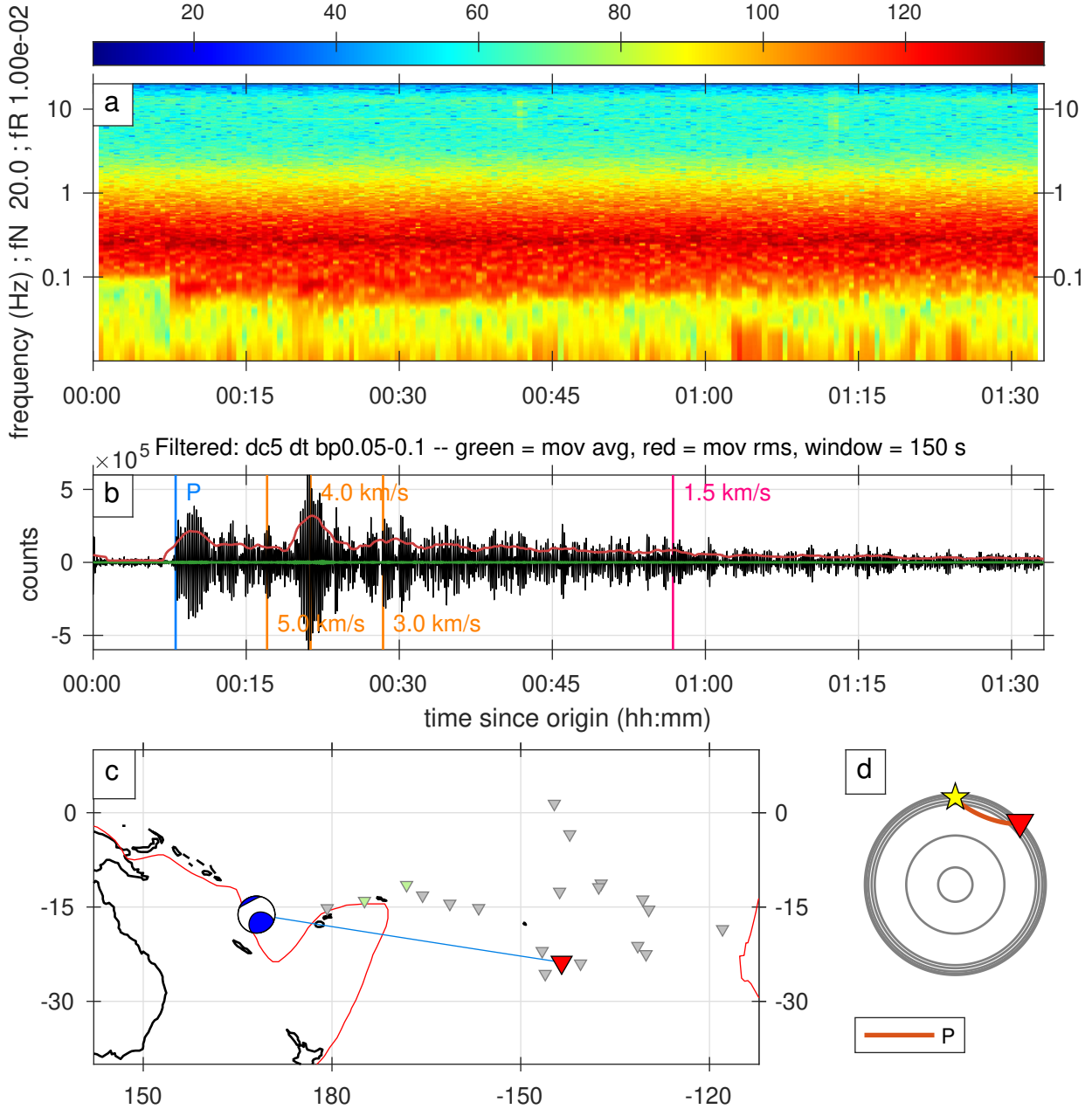


Figure S50. A full record of an earthquake classified as 3stars category.

Arrival: 2019-08-01T18:38:30.000000, ID: 11090197

mww = 6.80, distance = 61.91 degrees, depth = 25.00 km

87.65 - 93.36 percent

spectral density (energy/Hz)

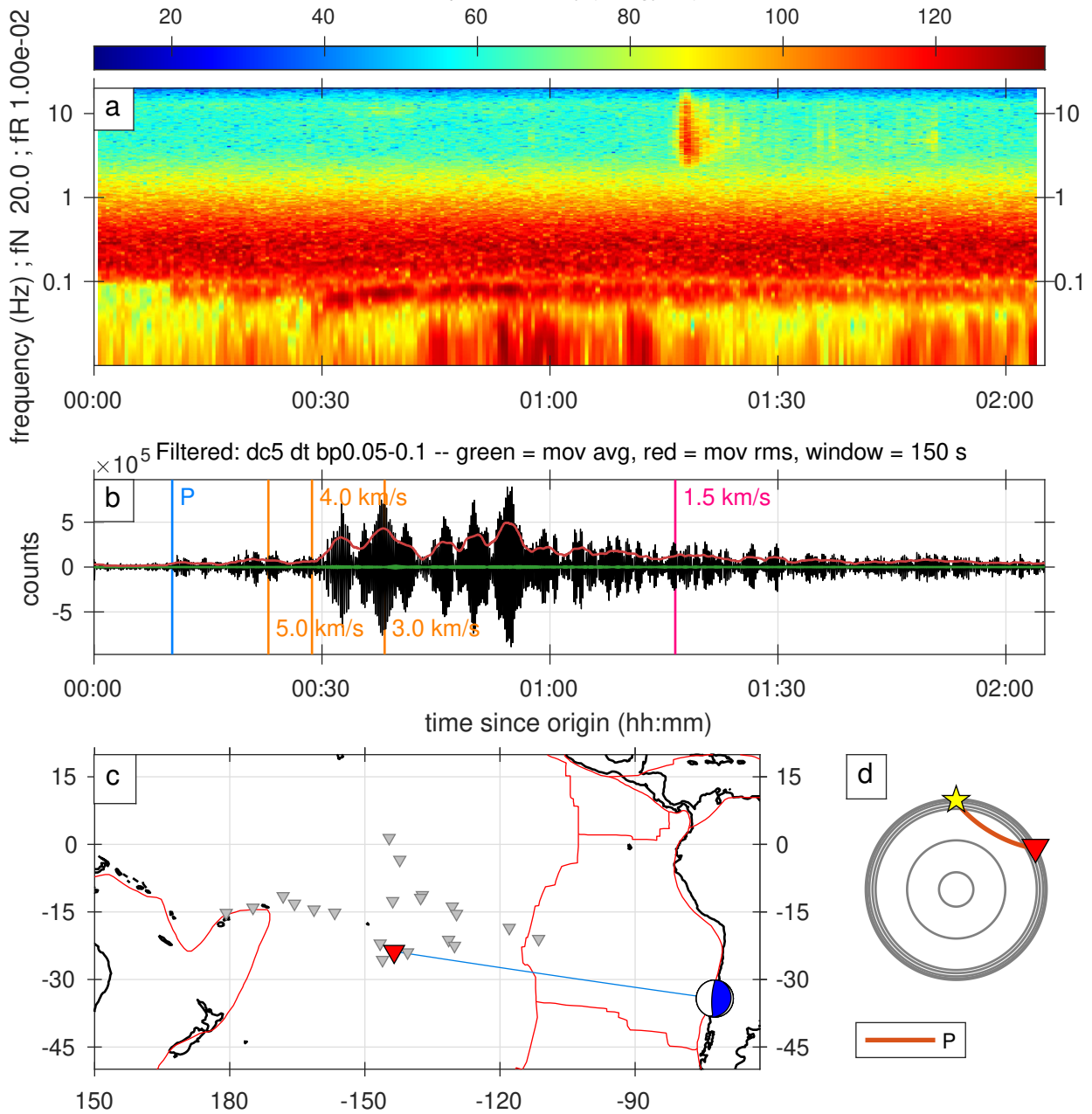


Figure S51. A full record of an earthquake classified as 3stars category.



Arrival: 2018-09-26T17:45:00.000000, ID: 10952325

Mww = 5.70, distance = 30.82 degrees, depth = 10.00 km  
61.82 - 69.69 percent

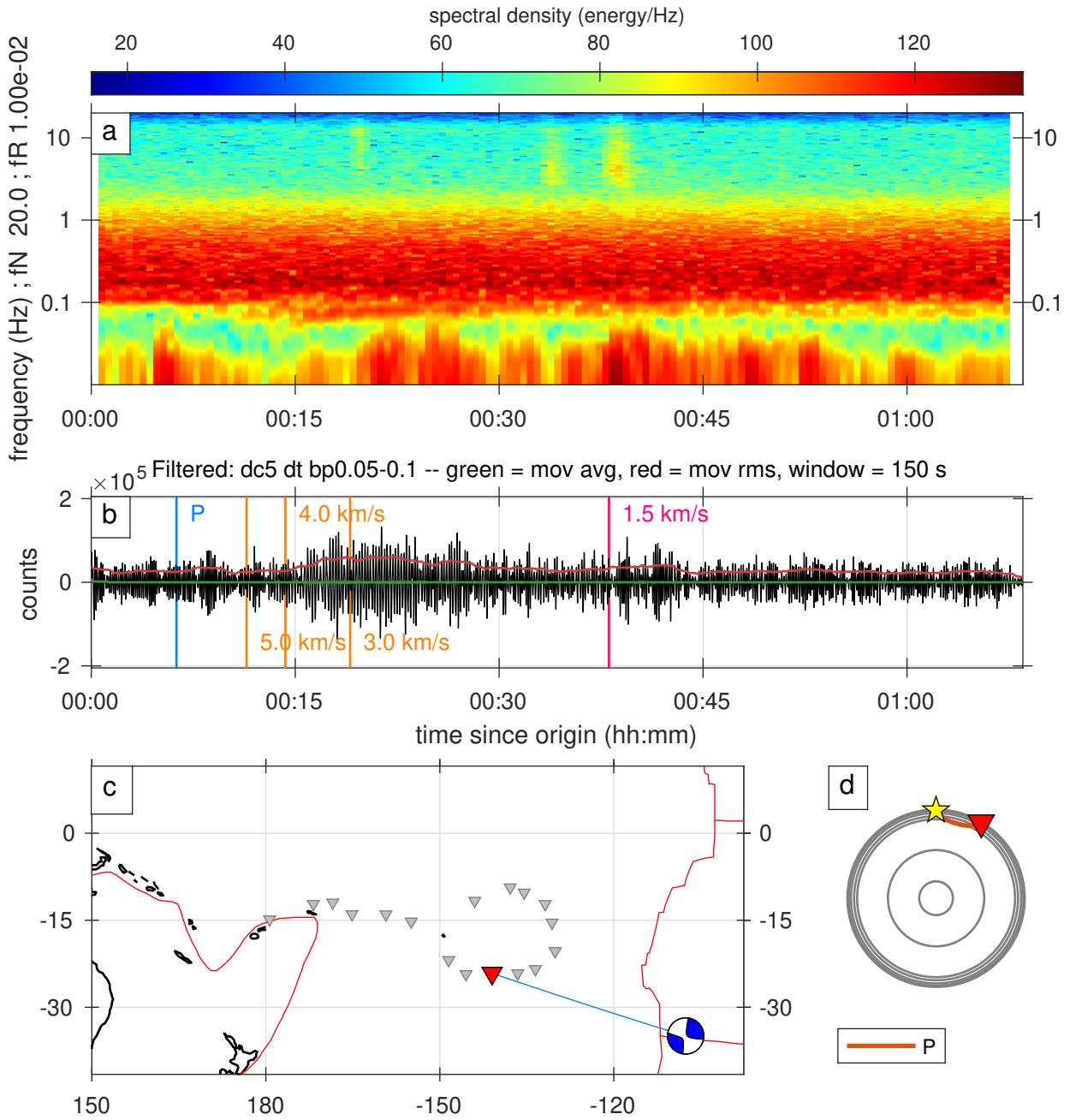


Figure S52. A full record of an earthquake classified as 2stars category.

Arrival: 2018-10-09T08:00:00.000000, ID: 10957286

Mww = 6.10, distance = 92.19 degrees, depth = 20.00 km

6.97 - 11.41 percent

spectral density (energy/Hz)

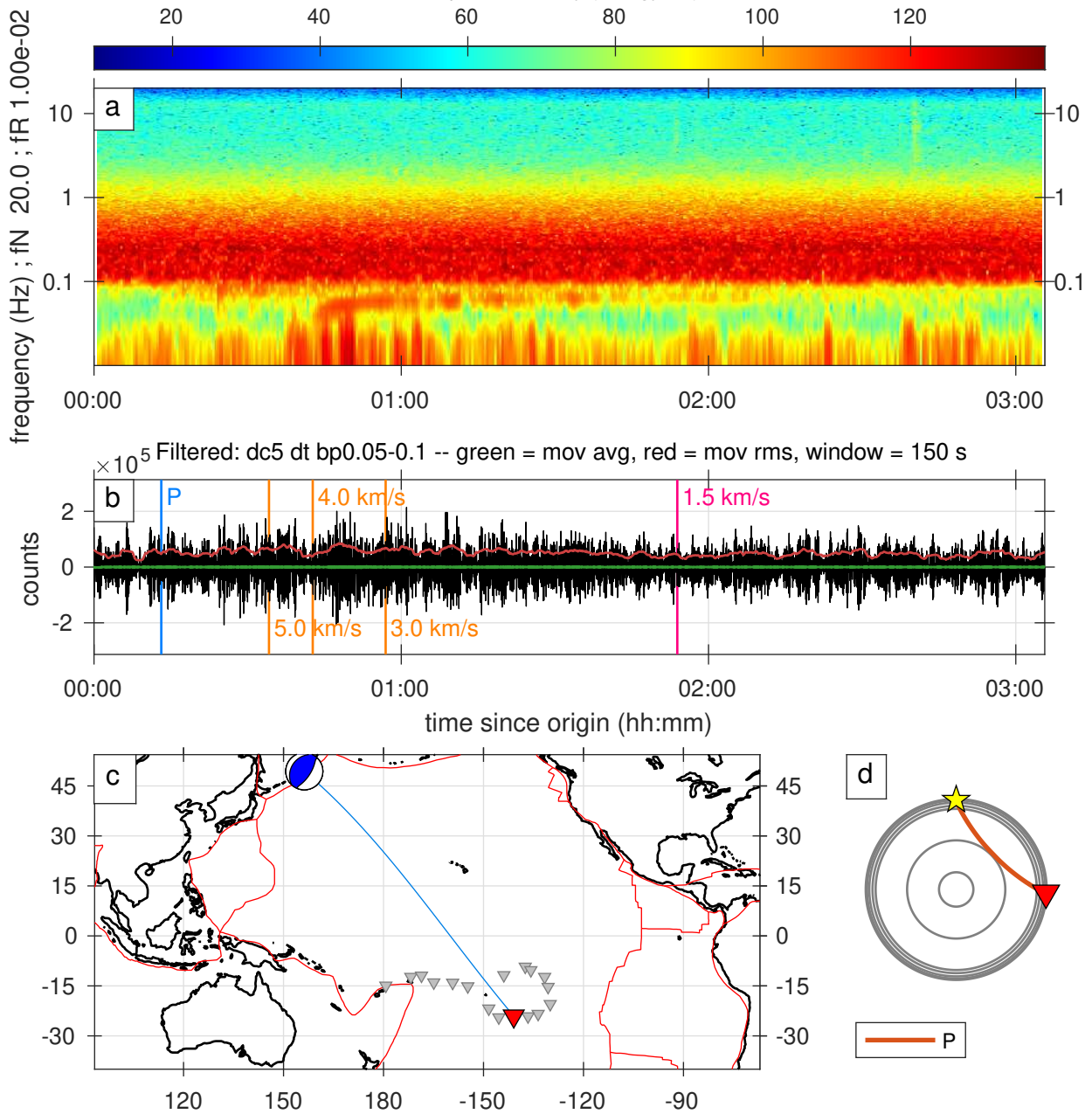


Figure S53. A full record of an earthquake classified as 2stars category.

Arrival: 2018-10-13T11:24:40.000000, ID: 10958985

Mww = 6.70, distance = 95.67 degrees, depth = 461.00 km  
 13.33 - 22.51 percent

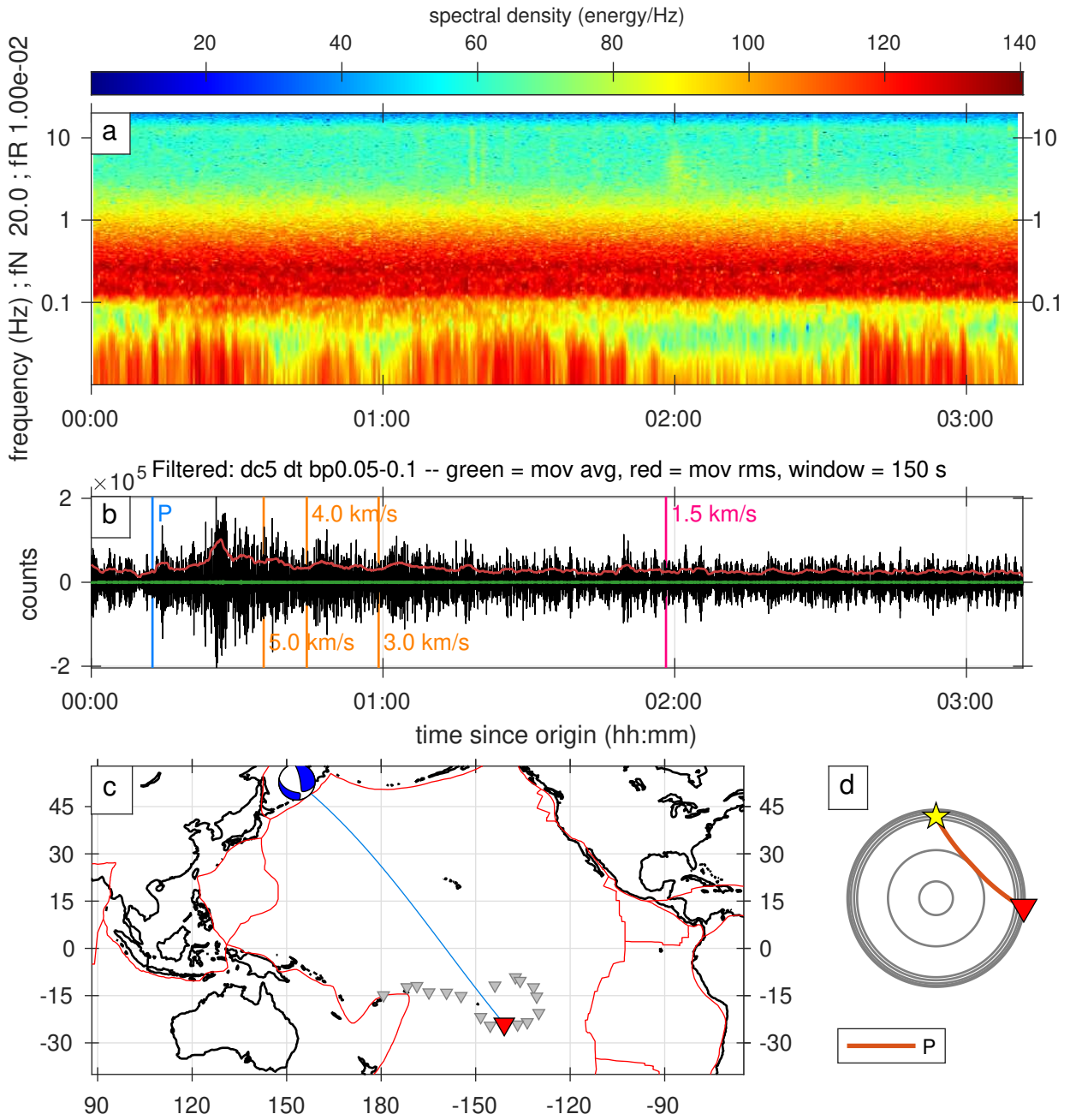


Figure S54. A full record of an earthquake classified as 2stars category.

Arrival: 2018-10-29T07:04:40.000000, ID: 10965132

Mww = 6.30, distance = 61.71 degrees, depth = 10.00 km

43.75 - 44.90 percent

spectral density (energy/Hz)

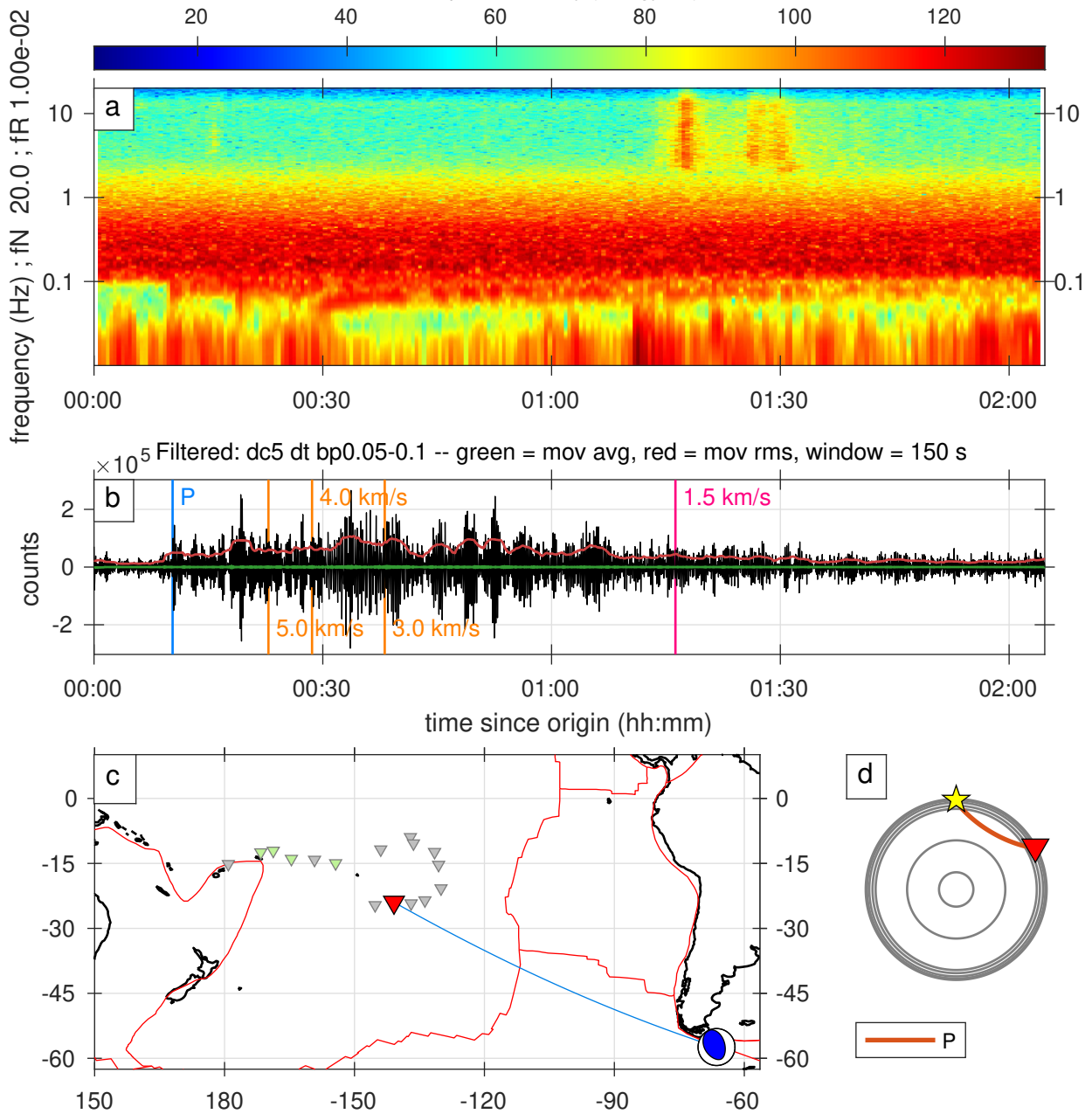


Figure S55. A full record of an earthquake classified as 2stars category.

Arrival: 2018-10-29T20:27:00.000000, ID: 10965319

Mww = 5.80, distance = 61.76 degrees, depth = 10.00 km  
51.18 - 52.33 percent

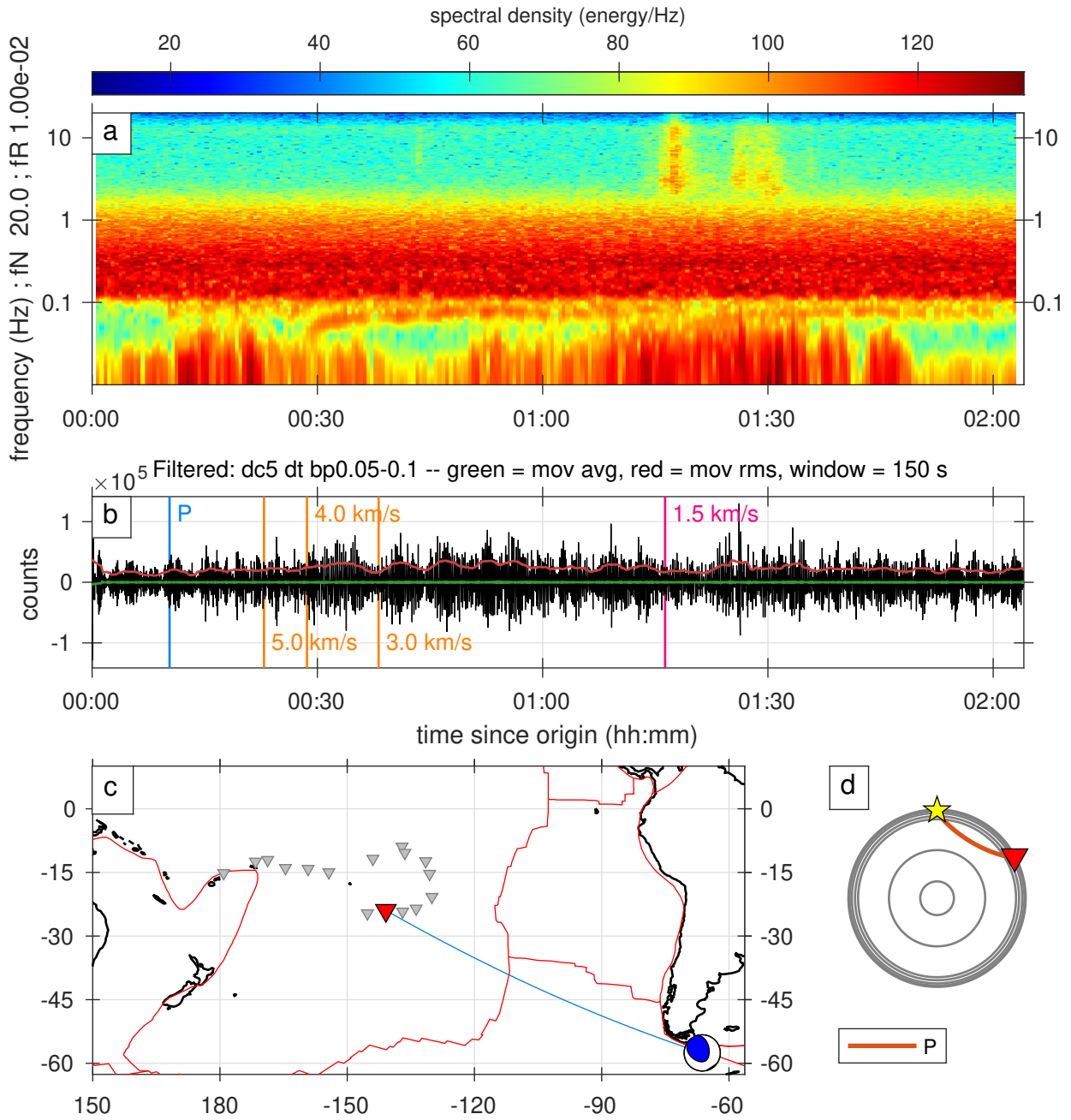


Figure S56. A full record of an earthquake classified as 2stars category.



Arrival: 2018-10-29T23:35:00.000000, ID: 10965401

Mww = 5.80, distance = 38.85 degrees, depth = 10.00 km

52.93 - 53.68 percent

spectral density (energy/Hz)

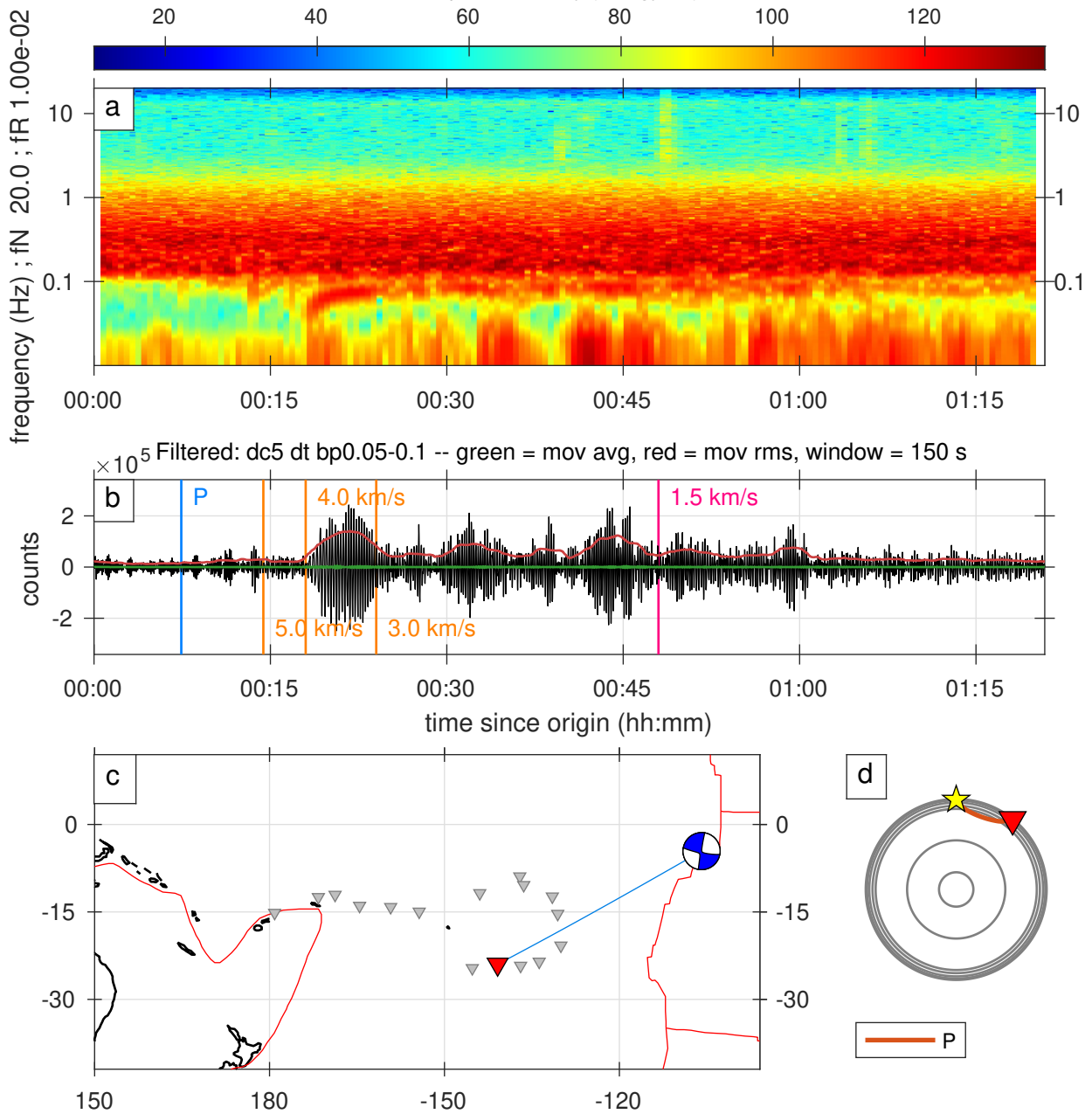


Figure S57. A full record of an earthquake classified as 2stars category.

Arrival: 2018-10-30T02:21:00.000000, ID: 10965448

Mww = 6.10, distance = 40.08 degrees, depth = 227.28 km  
54.48 - 55.24 percent

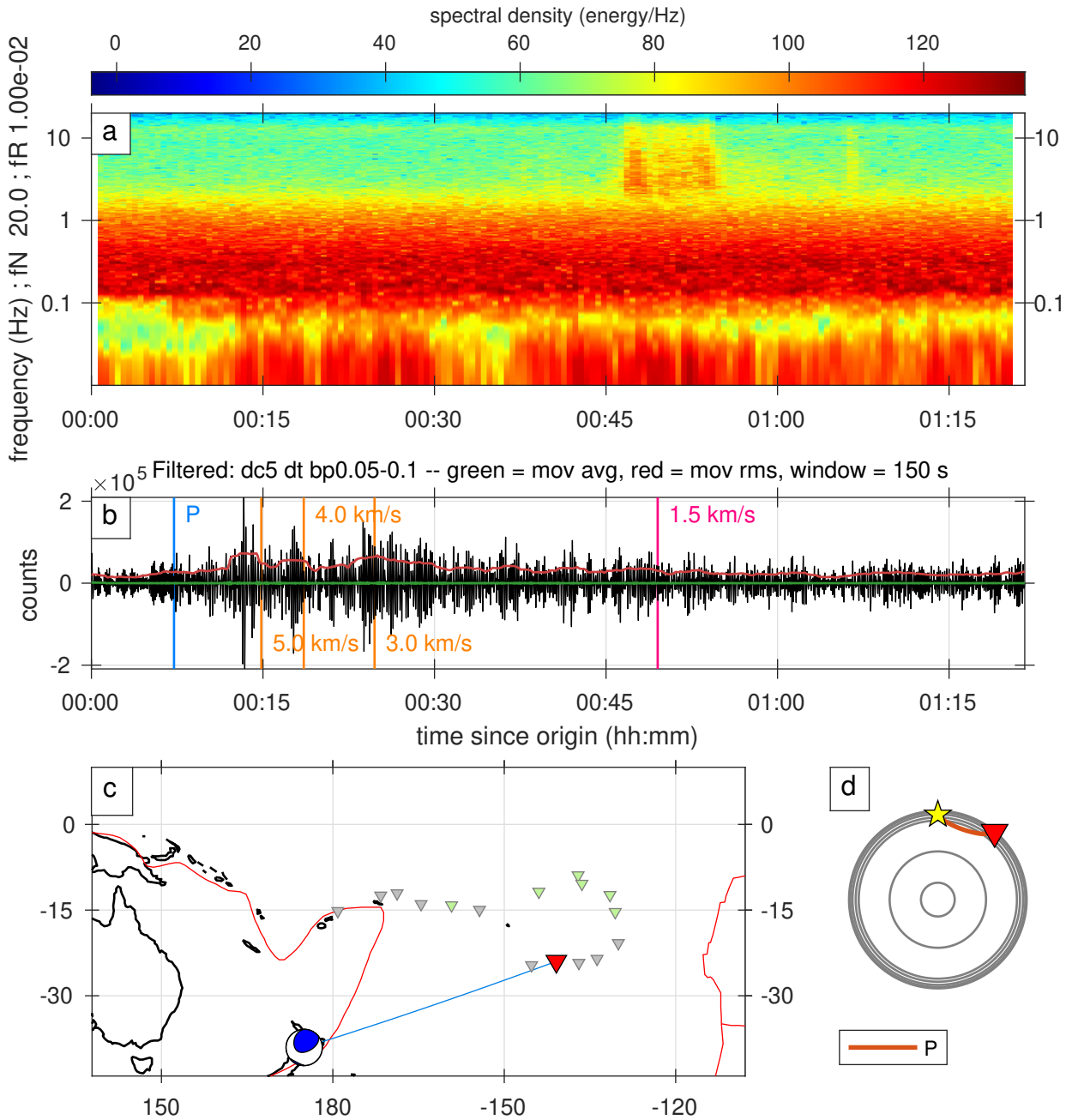


Figure S58. A full record of an earthquake classified as 2stars category.

Arrival: 2018-11-01T22:30:20.000000, ID: 10966680

Mww = 6.20, distance = 65.93 degrees, depth = 102.00 km  
92.32 - 93.54 percent

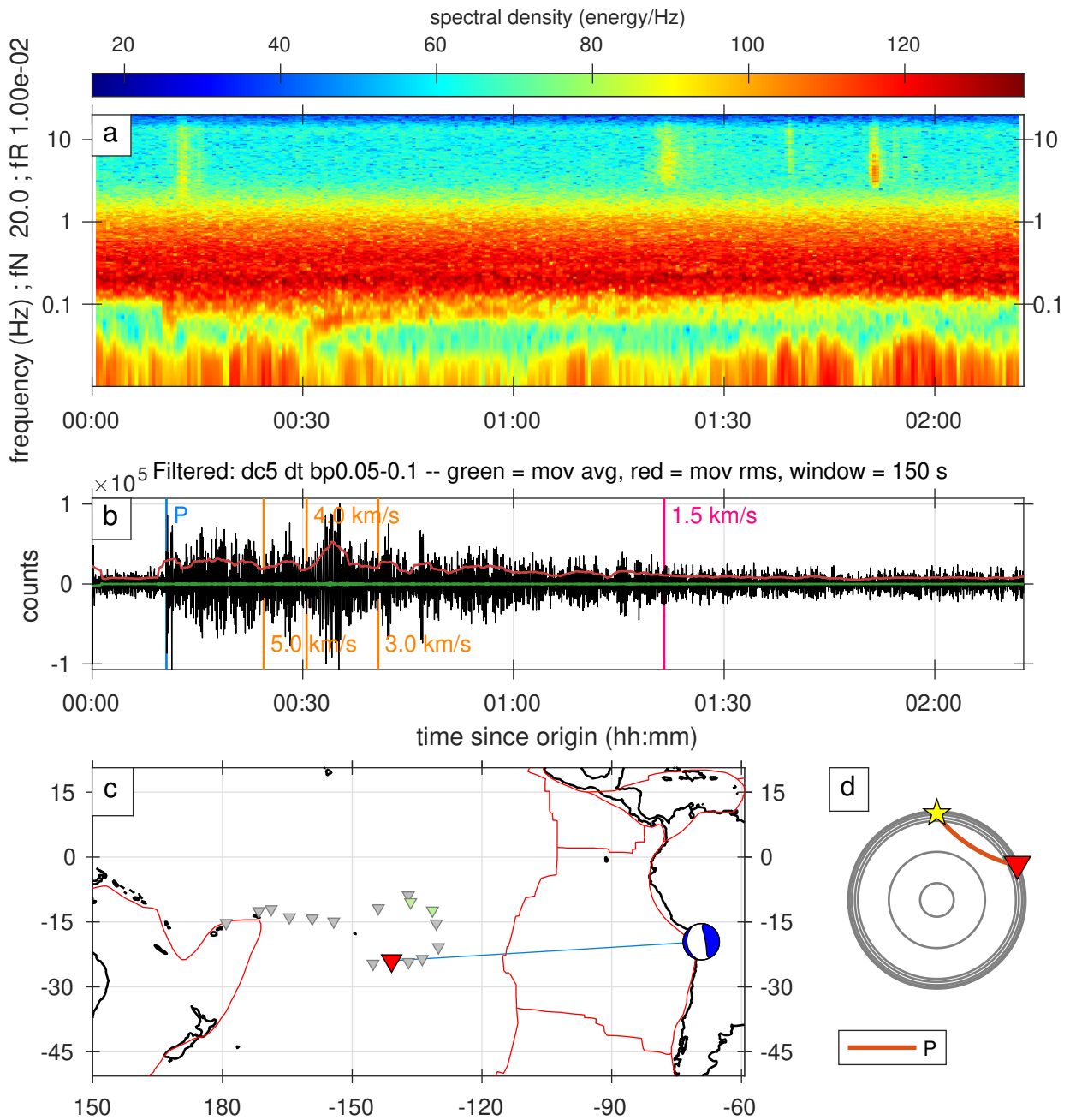


Figure S59. A full record of an earthquake classified as 2stars category.



Arrival: 2018-11-06T16:17:30.000000, ID: 10968334

Mww = 5.50, distance = 30.92 degrees, depth = 10.00 km  
36.73 - 37.38 percent

spectral density (energy/Hz)

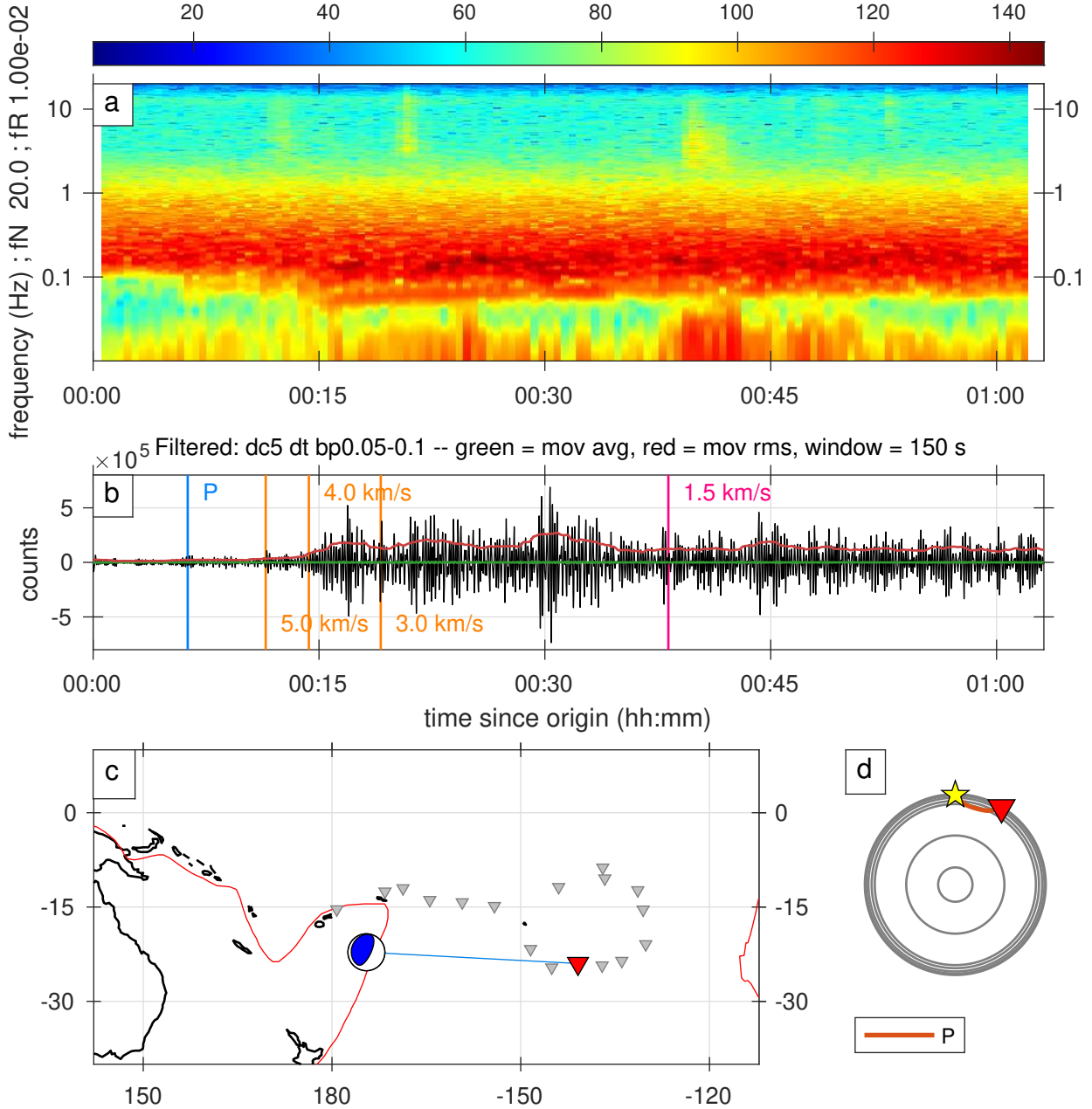


Figure S60. A full record of an earthquake classified as 2stars category.

Arrival: 2018-11-10T08:38:25.000000, ID: 10969935

Mww = 6.10, distance = 30.78 degrees, depth = 35.00 km

91.20 - 91.84 percent

spectral density (energy/Hz)

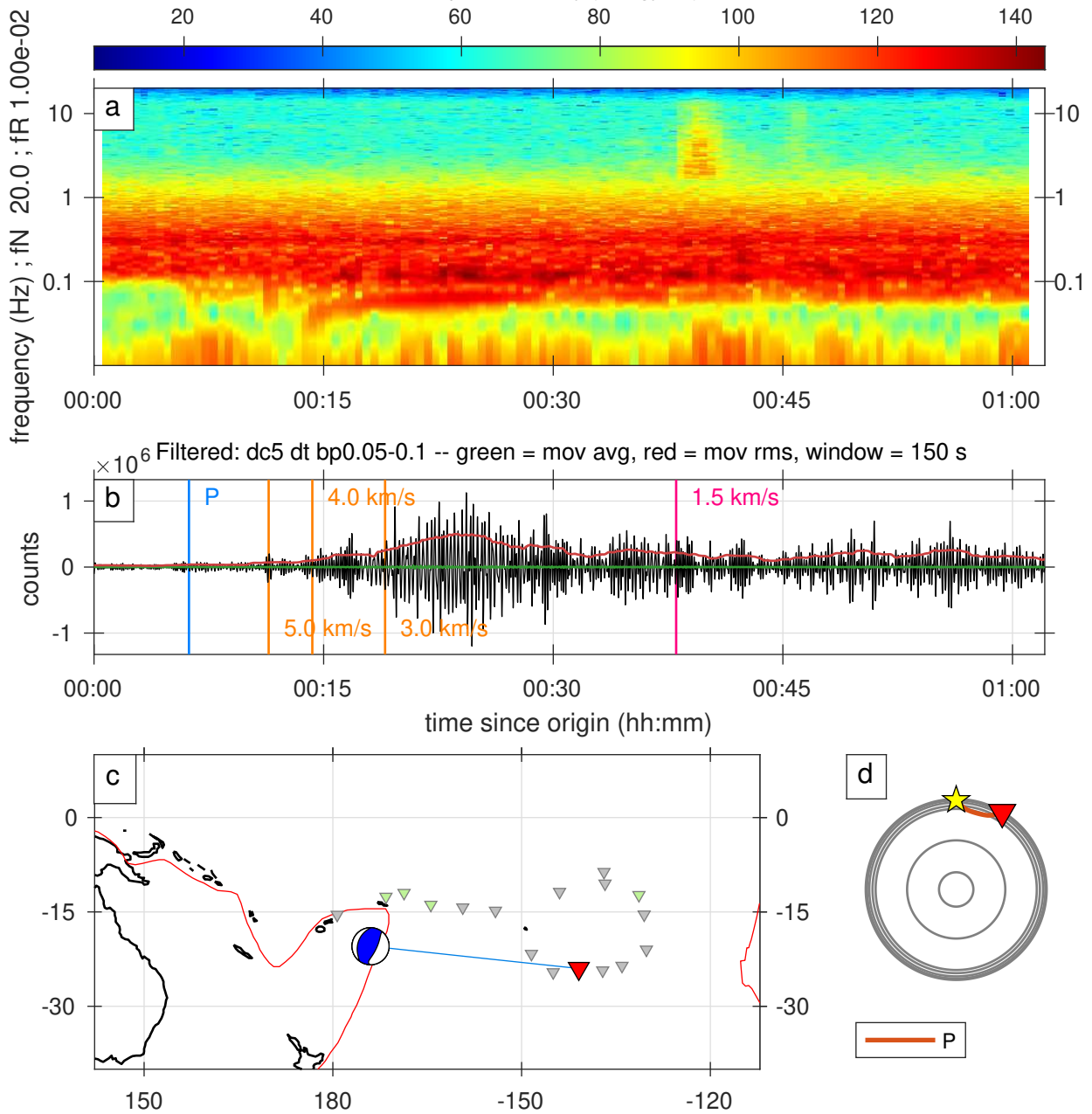


Figure S61. A full record of an earthquake classified as 2stars category.

Arrival: 2018-11-12T22:51:30.000000, ID: 10970552

Mww = 5.60, distance = 41.81 degrees, depth = 10.00 km  
 27.48 - 29.66 percent

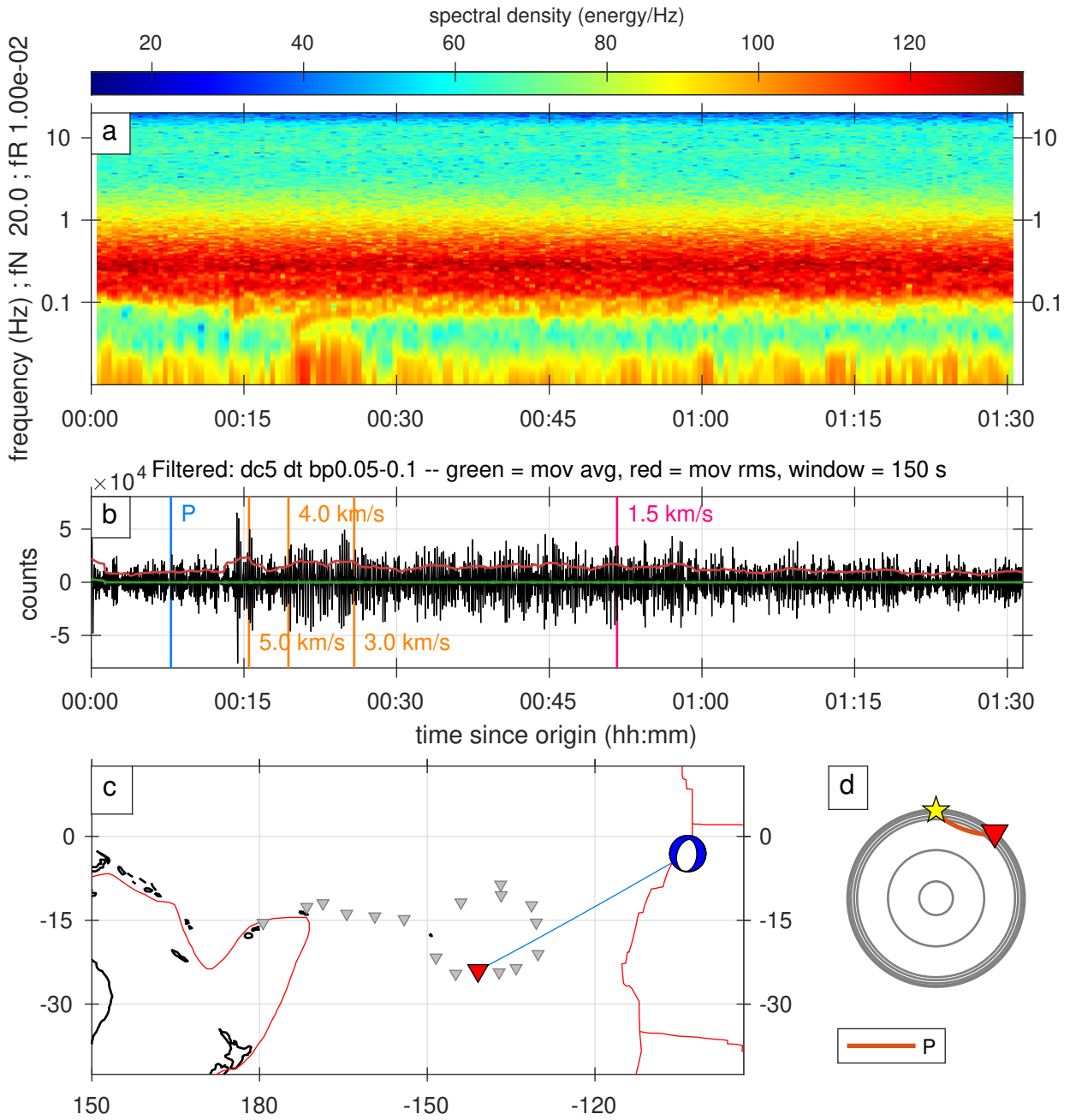


Figure S62. A full record of an earthquake classified as 2stars category.

Arrival: 2018-11-14T21:35:00.000000, ID: 10971336

Mww = 6.10, distance = 93.18 degrees, depth = 50.21 km  
94.22 - 98.65 percent

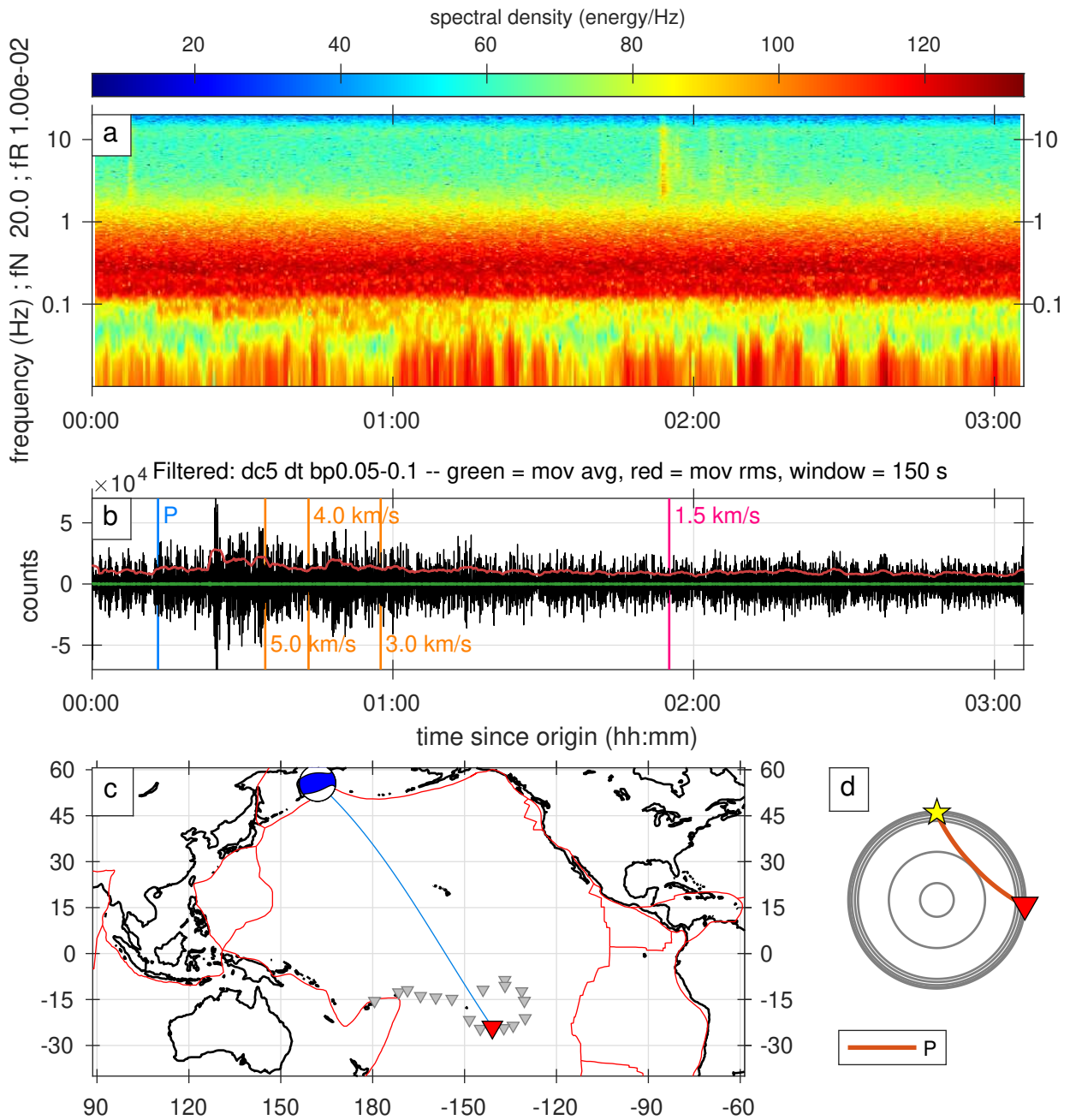


Figure S63. A full record of an earthquake classified as 2stars category.

Arrival: 2018-11-16T03:36:00.000000, ID: 10971960

mww = 6.10, distance = 54.69 degrees, depth = 8.84 km

12.04 - 15.56 percent

spectral density (energy/Hz)

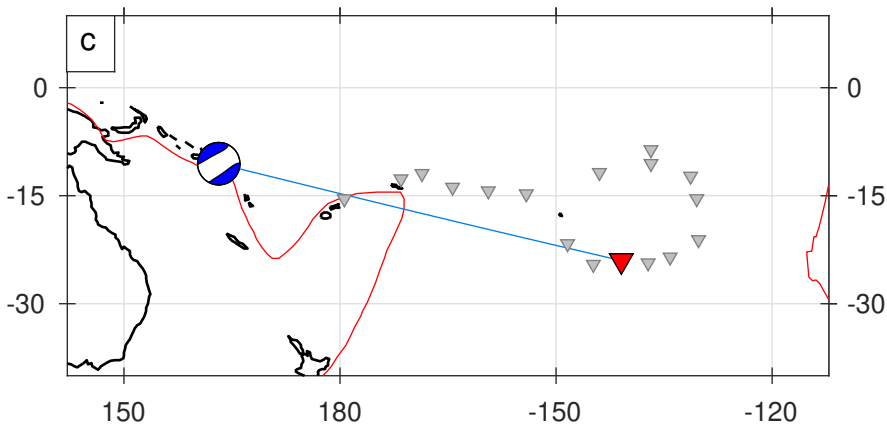
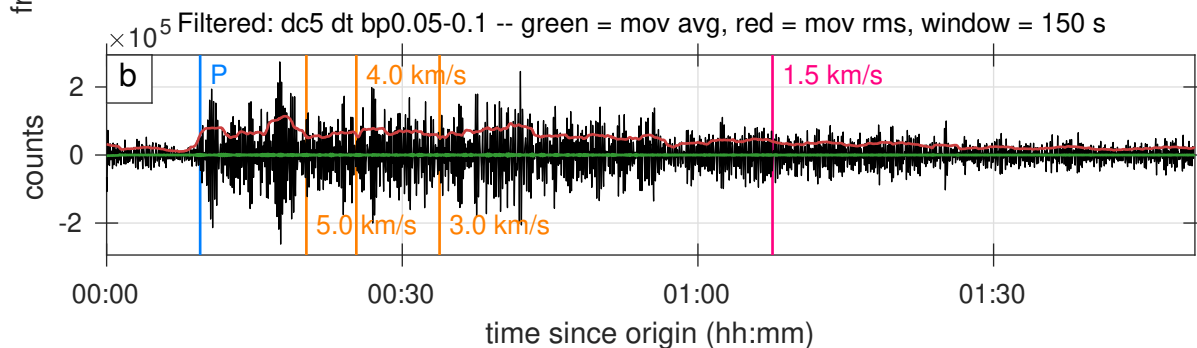
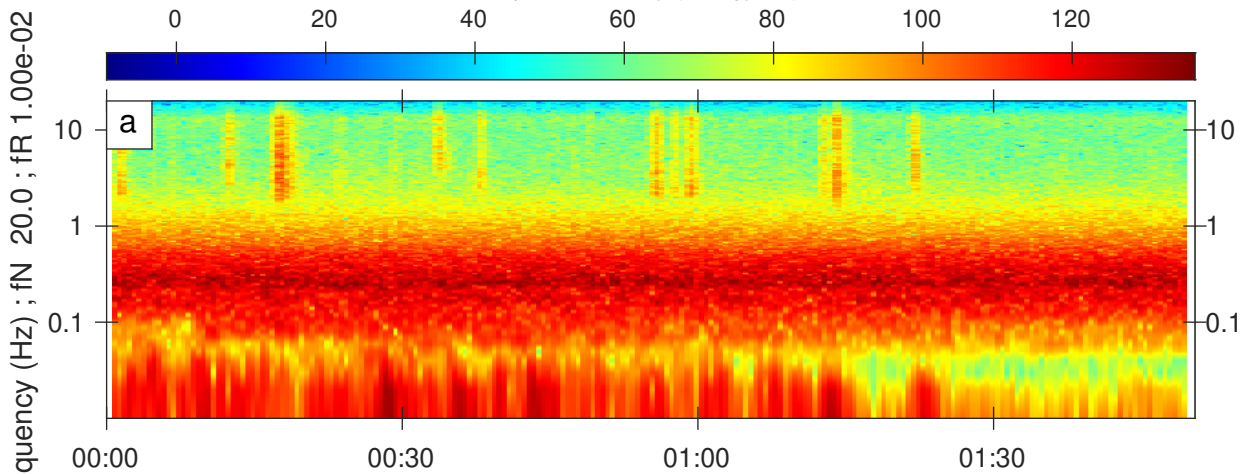


Figure S64. A full record of an earthquake classified as 2stars category.



Arrival: 2018-11-24T15:50:00.000000, ID: 10974188

Mww = 5.40, distance = 31.93 degrees, depth = 10.00 km  
25.09 - 26.41 percent

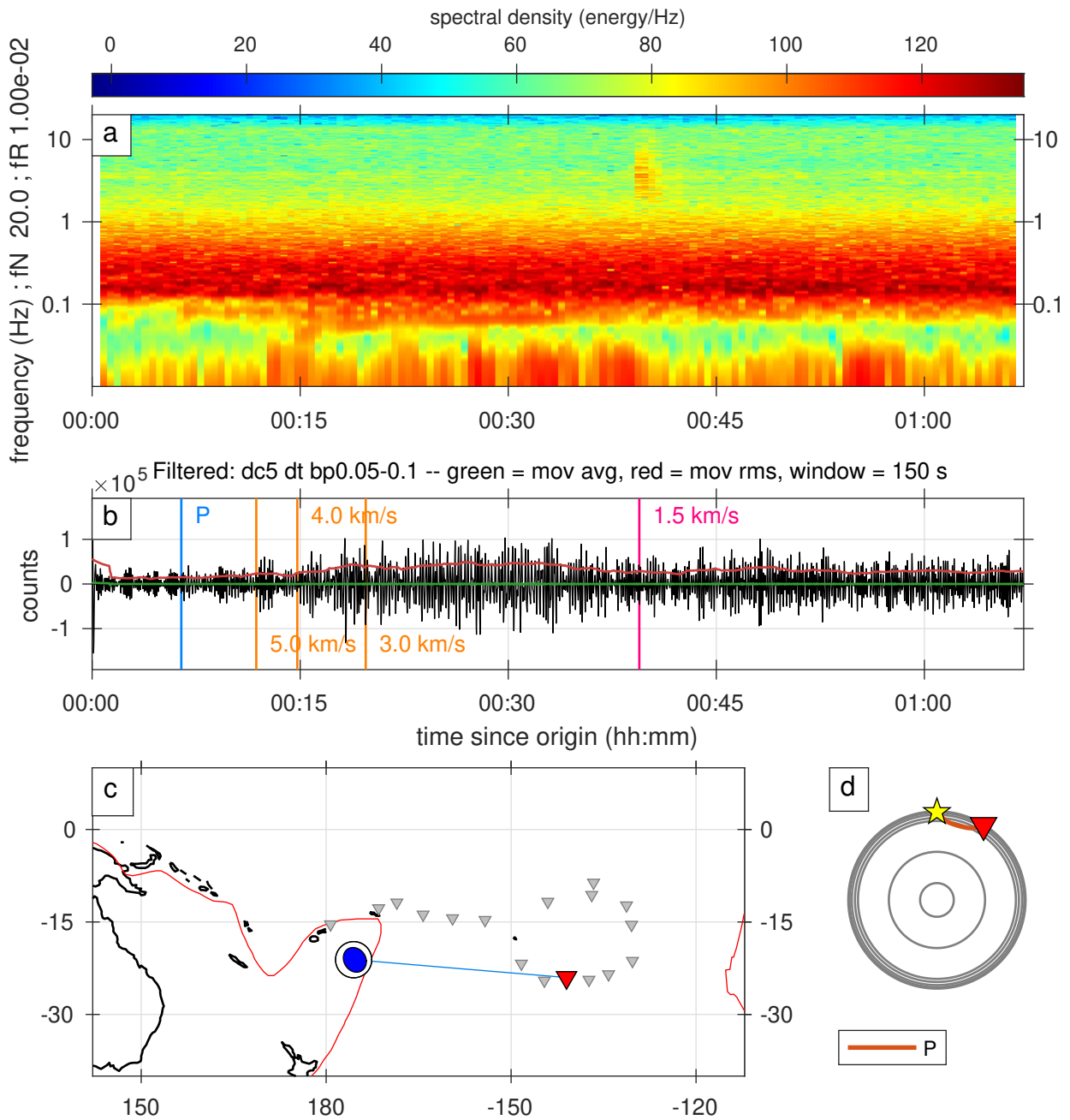


Figure S65. A full record of an earthquake classified as 2stars category.

Arrival: 2018-11-25T03:54:00.000000, ID: 10974301

Mww = 6.00, distance = 69.33 degrees, depth = 10.00 km  
39.26 - 42.05 percent

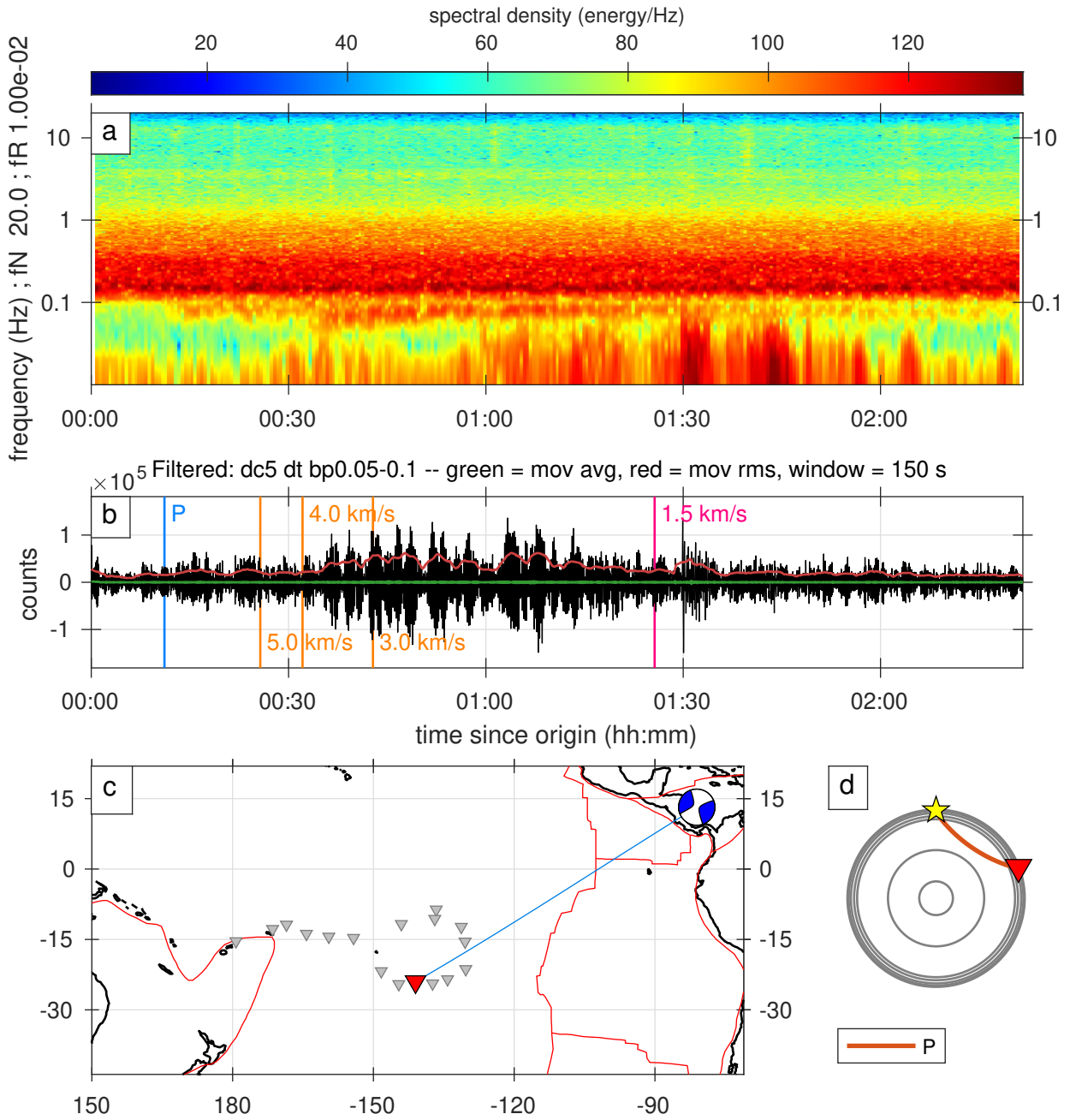


Figure S66. A full record of an earthquake classified as 2stars category.

Arrival: 2018-11-25T06:21:00.000000, ID: 10974322

Mww = 5.60, distance = 32.72 degrees, depth = 38.00 km

42.29 - 43.61 percent

spectral density (energy/Hz)

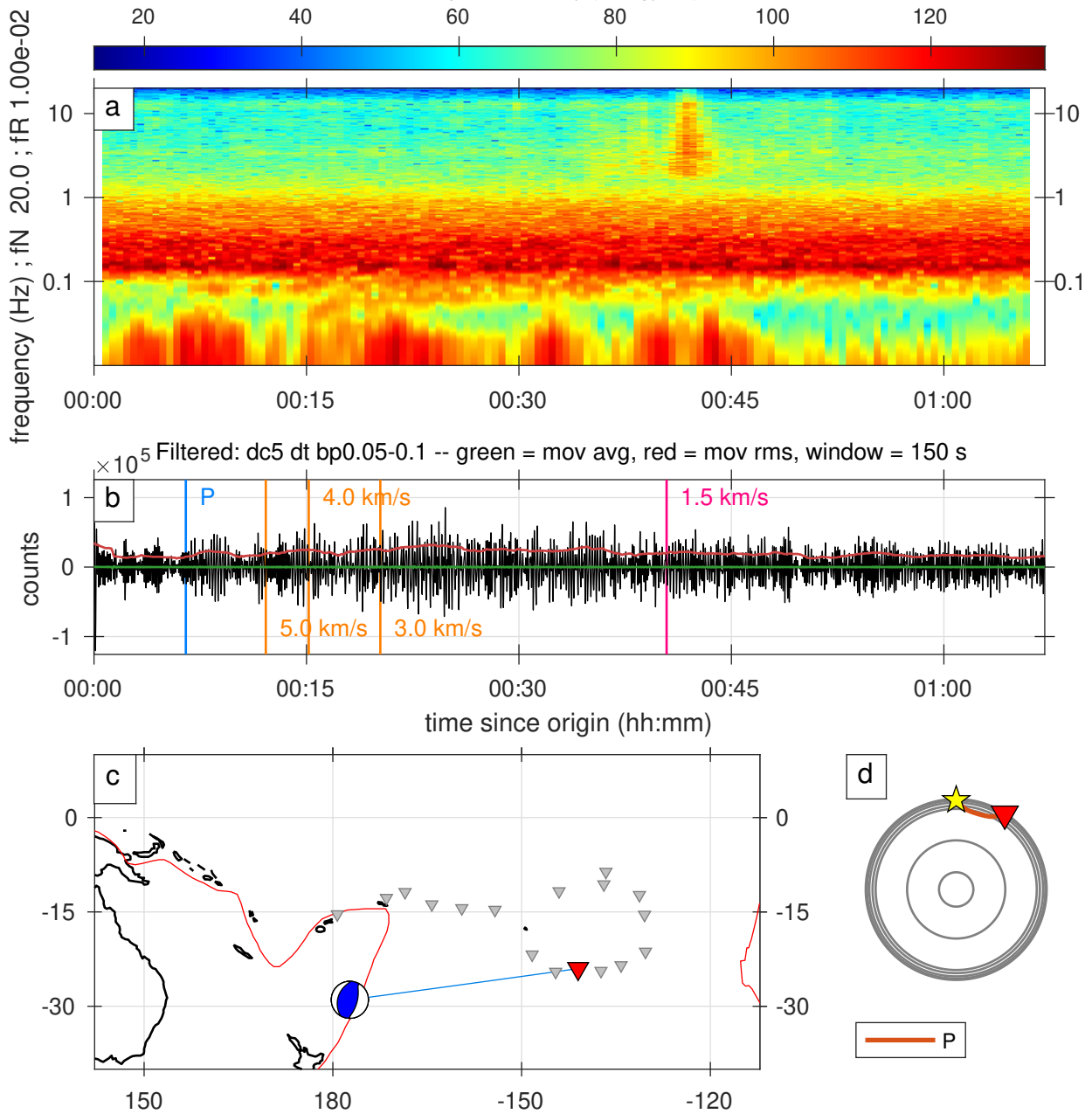


Figure S67. A full record of an earthquake classified as 2stars category.



Arrival: 2018-11-25T16:57:00.000000, ID: 10974404

Mww = 6.30, distance = 168.10 degrees, depth = 18.00 km  
54.57 - 61.10 percent

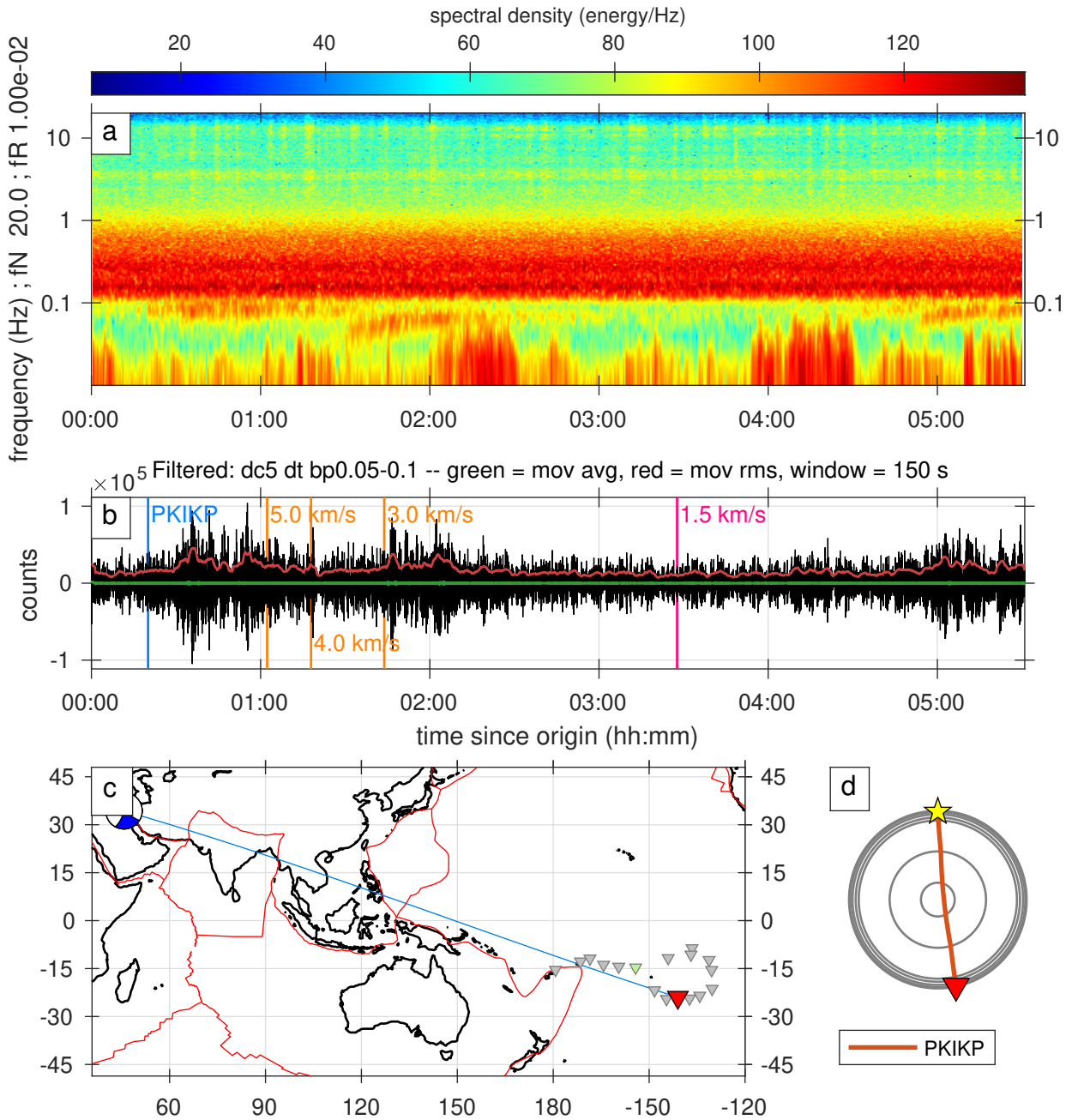


Figure S68. A full record of an earthquake classified as 2stars category.

Arrival: 2018-11-26T00:30:00.000000, ID: 10974477

mb = 5.30, distance = 30.28 degrees, depth = 10.00 km

63.78 - 65.00 percent

spectral density (energy/Hz)

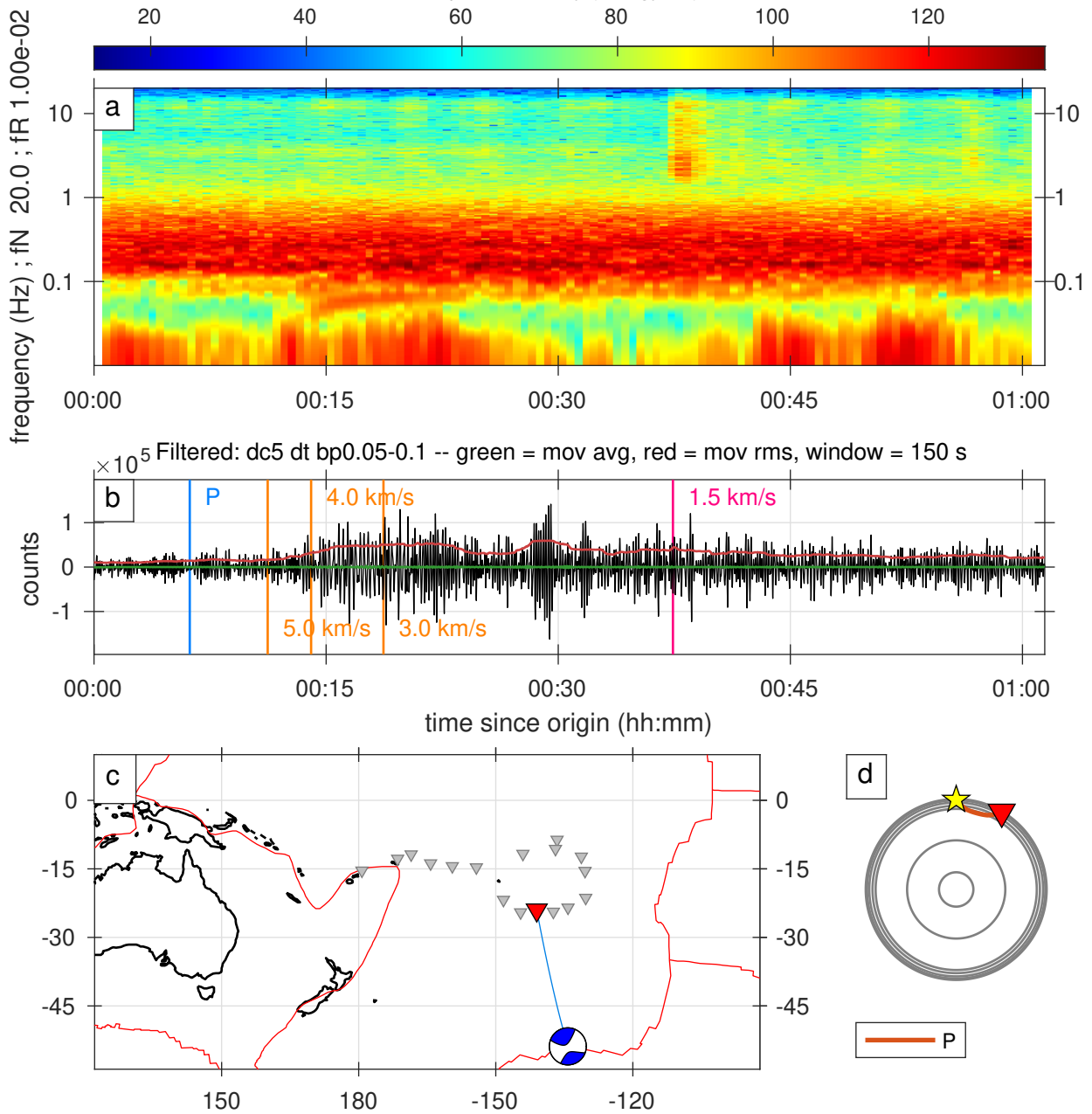


Figure S69. A full record of an earthquake classified as 2stars category.

Arrival: 2018-12-06T23:35:20.000000, ID: 10981467

Mww = 5.90, distance = 45.00 degrees, depth = 9.00 km  
50.23 - 54.00 percent

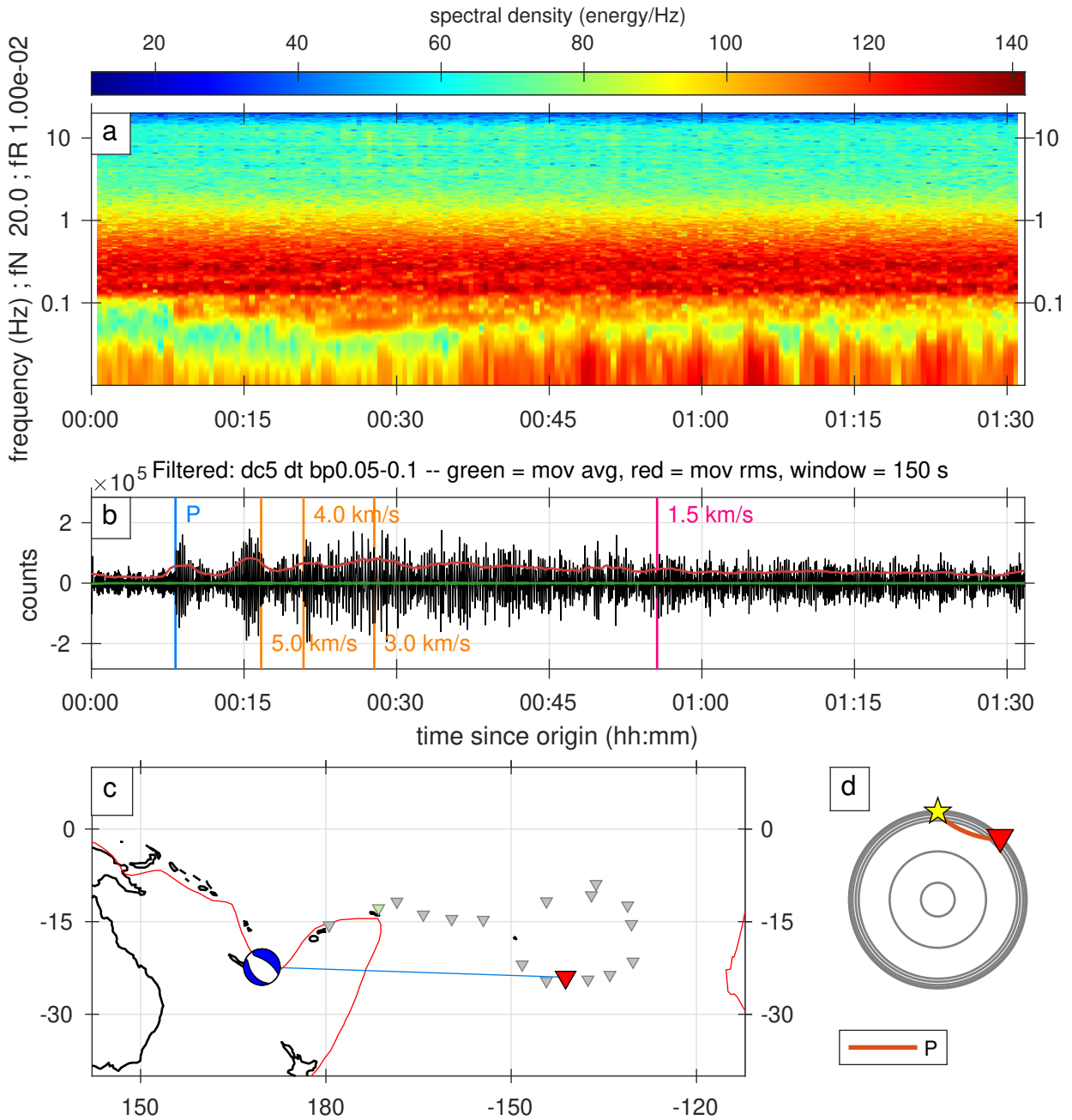


Figure S70. A full record of an earthquake classified as 2stars category.

Arrival: 2018-12-12T13:22:00.000000, ID: 10984273

Mww = 6.30, distance = 32.99 degrees, depth = 10.00 km

80.86 - 88.86 percent

spectral density (energy/Hz)

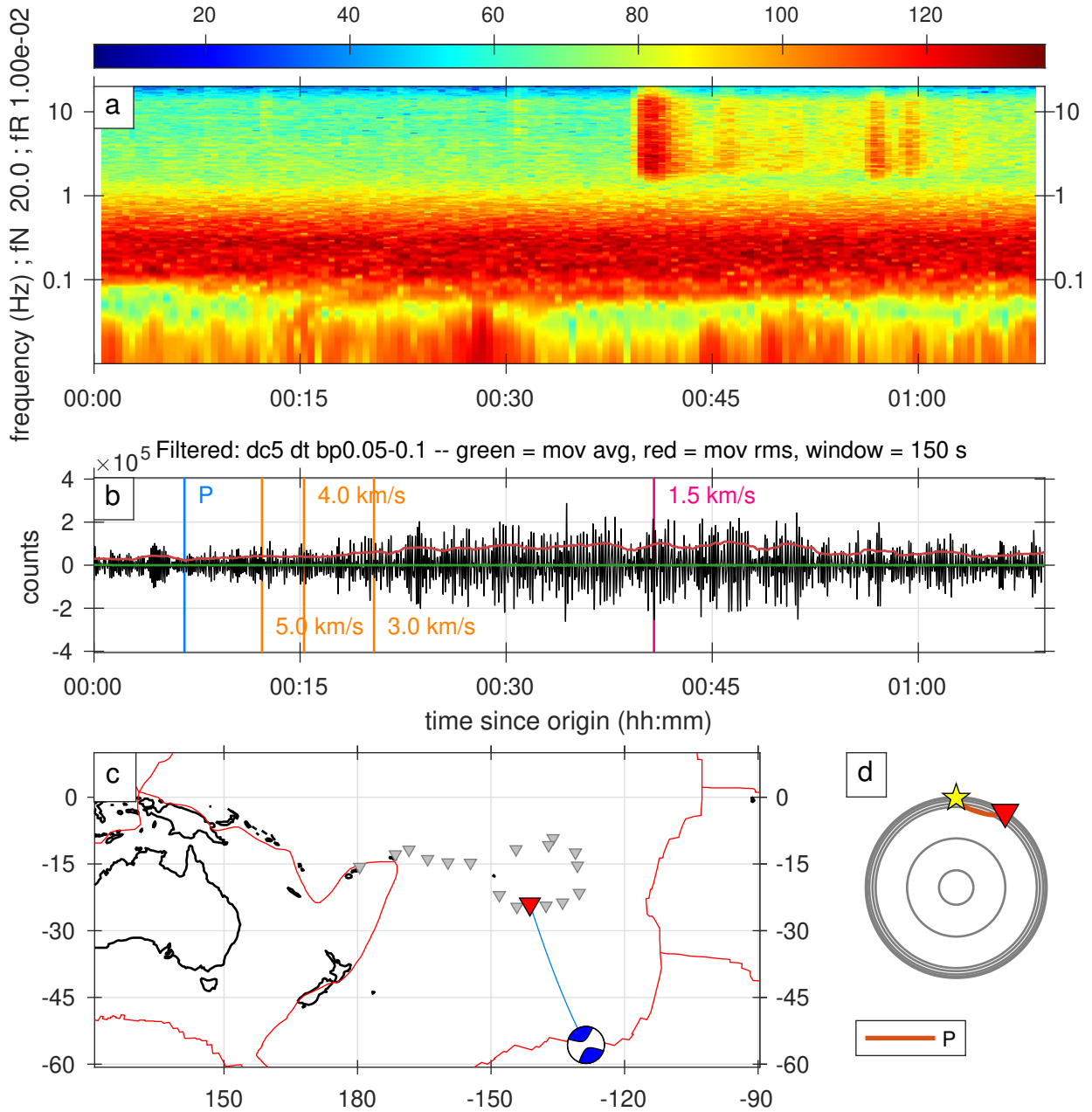


Figure S71. A full record of an earthquake classified as 2stars category.

Arrival: 2018-12-26T14:17:30.000000, ID: 10989514

Mww = 5.70, distance = 31.08 degrees, depth = 120.00 km  
 95.11 - 99.14 percent

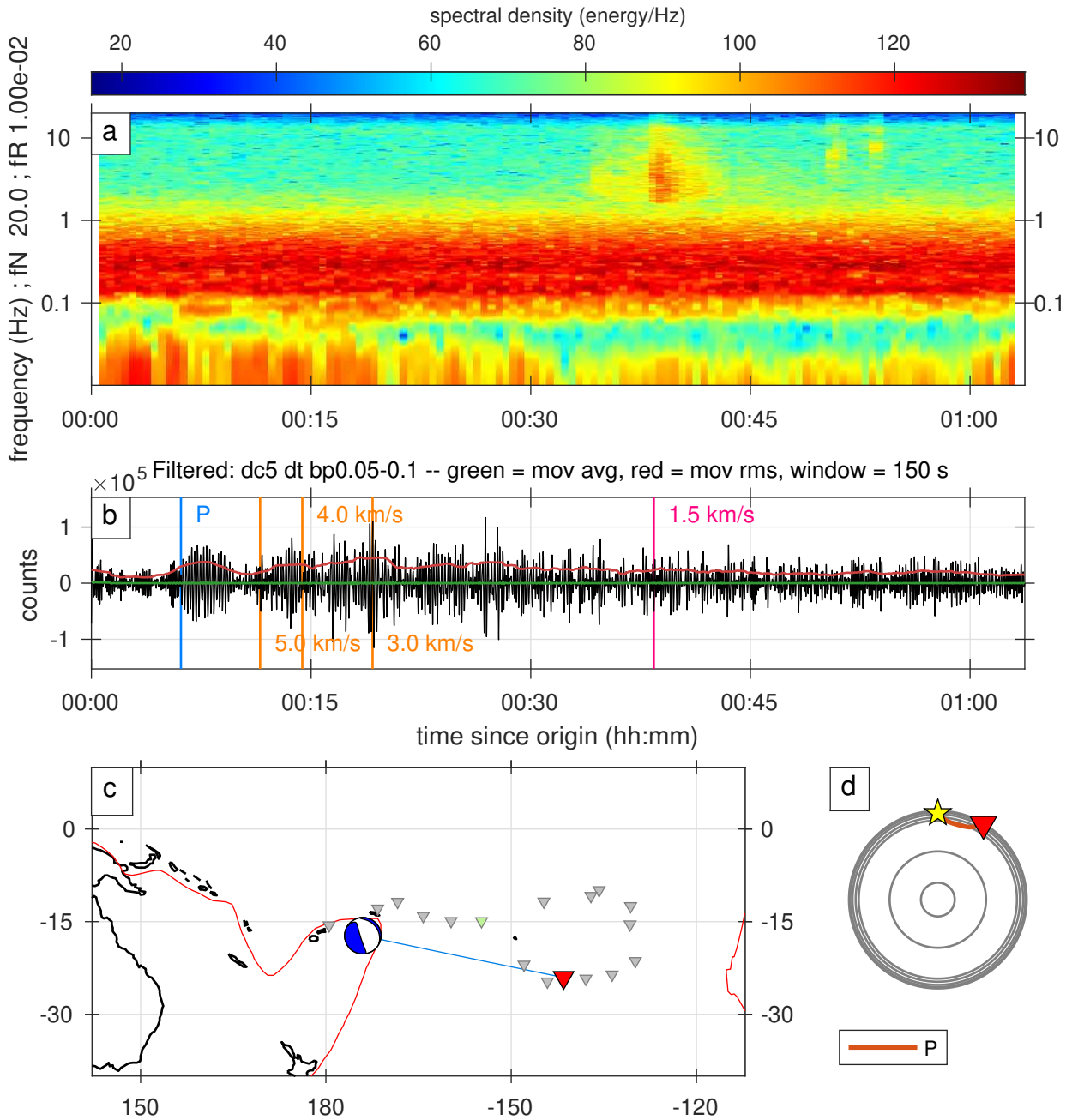


Figure S72. A full record of an earthquake classified as 2stars category.



Arrival: 2018-12-31T02:48:00.000000, ID: 10991212

Mww = 6.00, distance = 80.34 degrees, depth = 31.00 km

49.32 - 53.65 percent

spectral density (energy/Hz)

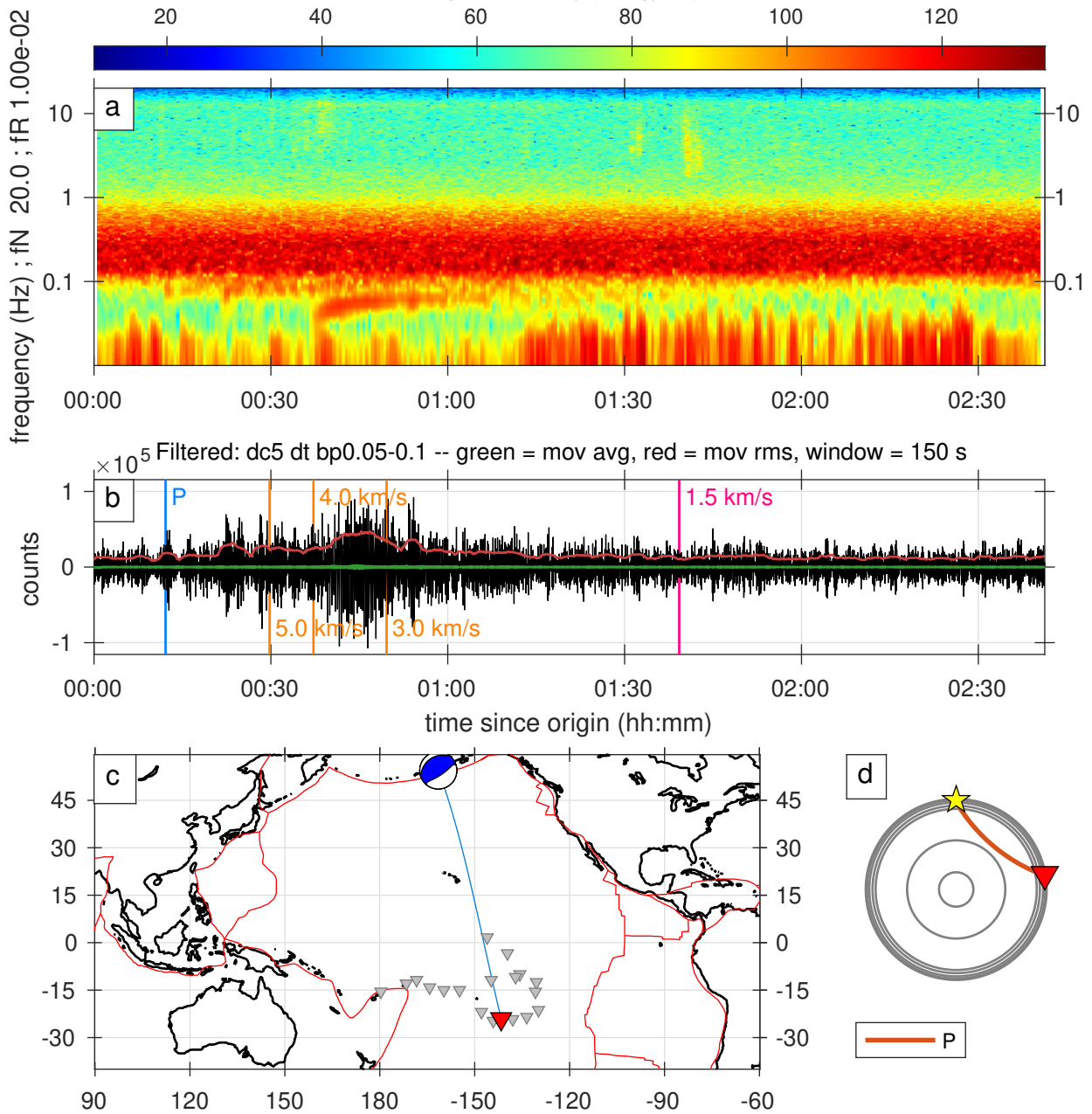


Figure S73. A full record of an earthquake classified as 2stars category.

Arrival: 2019-01-08T12:53:00.000000, ID: 10993586

Mww = 6.30, distance = 99.72 degrees, depth = 35.00 km  
46.05 - 51.62 percent

spectral density (energy/Hz)

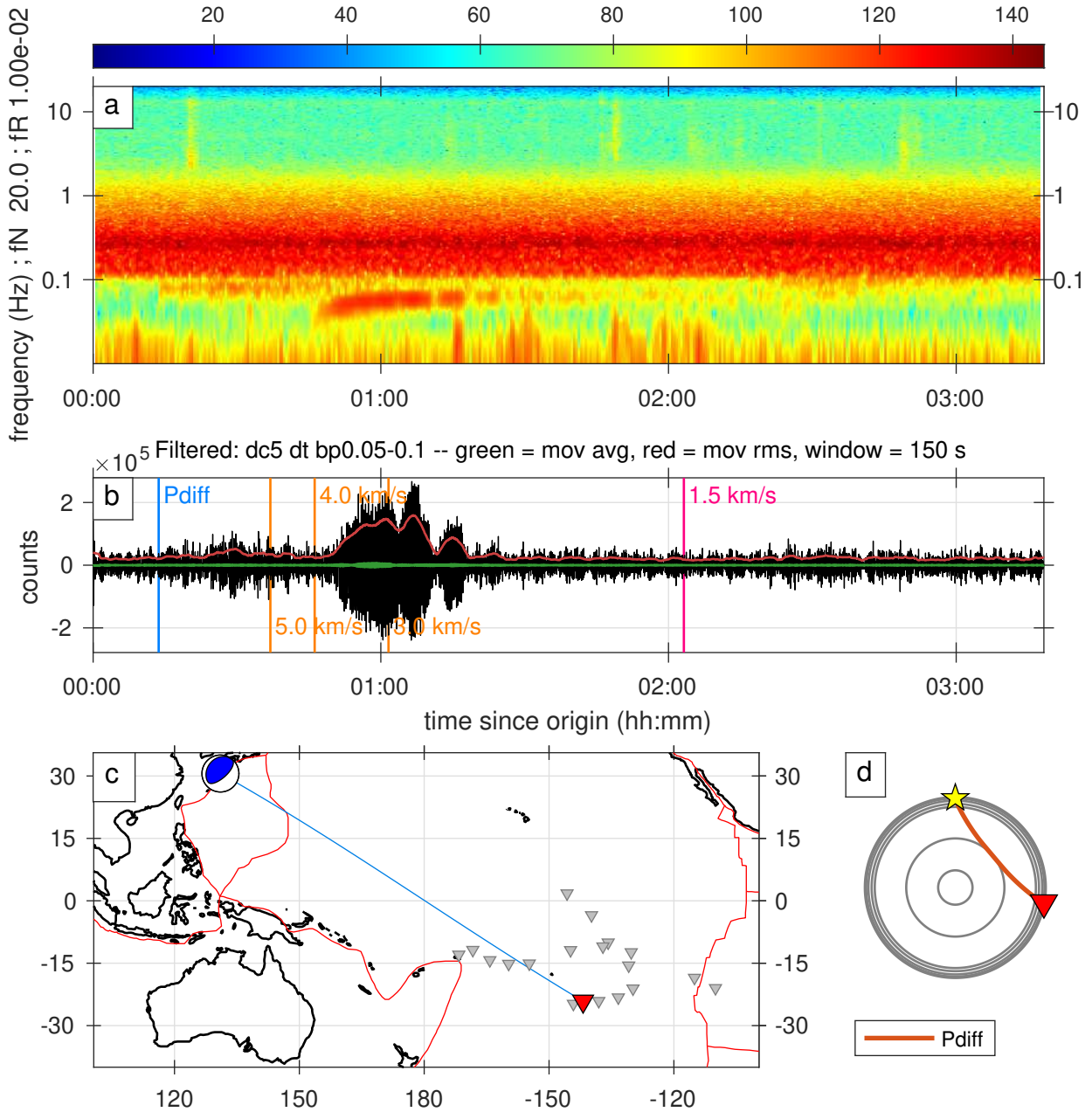


Figure S74. A full record of an earthquake classified as 2stars category.

Arrival: 2019-01-11T06:04:40.000000, ID: 10994409

Mww = 5.20, distance = 29.67 degrees, depth = 10.00 km  
10.34 - 11.34 percent

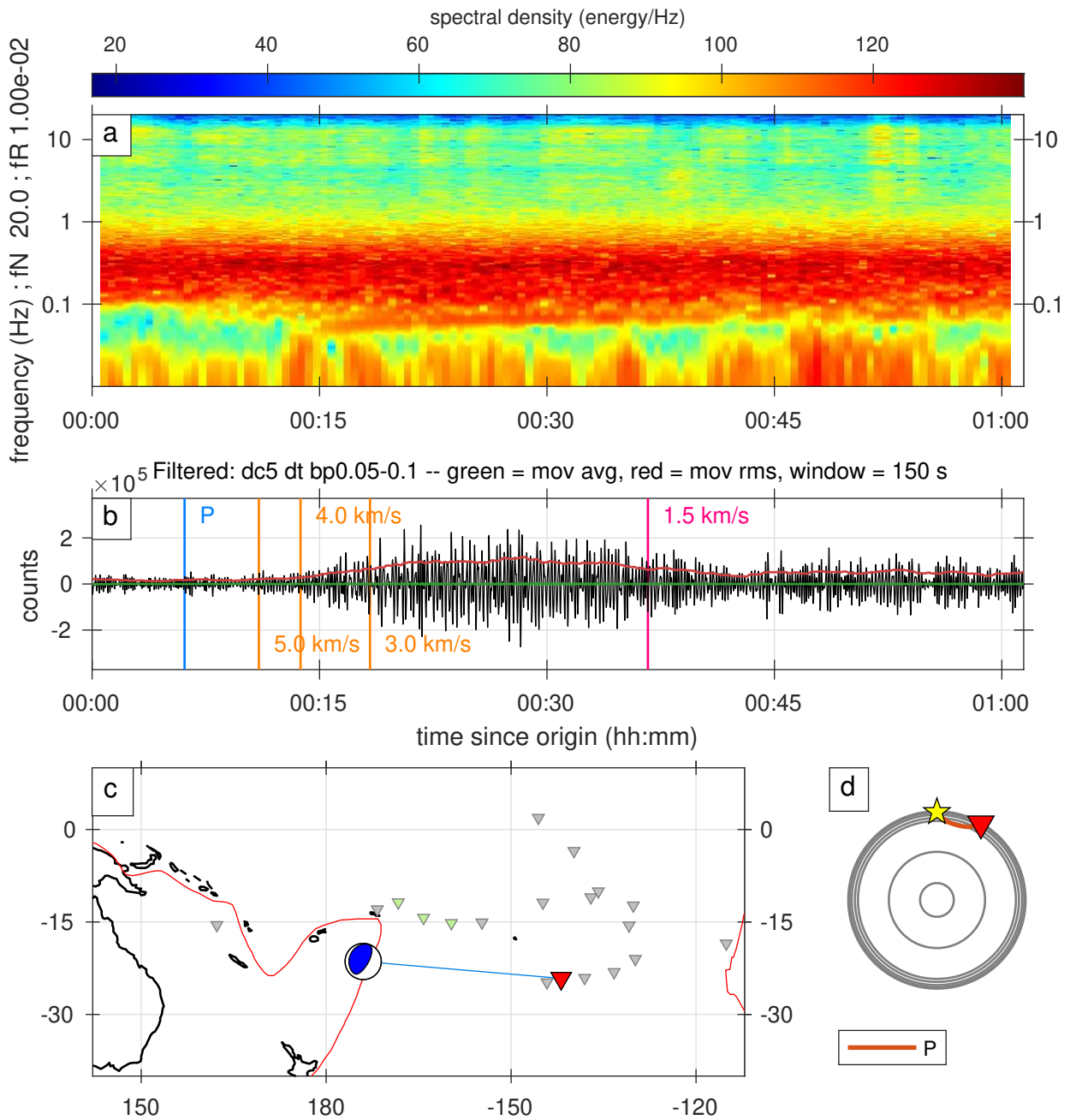


Figure S75. A full record of an earthquake classified as 2stars category.



Arrival: 2019-01-21T01:45:00.000000, ID: 10997852

Mww = 5.70, distance = 44.65 degrees, depth = 9.00 km  
82.82 - 85.72 percent

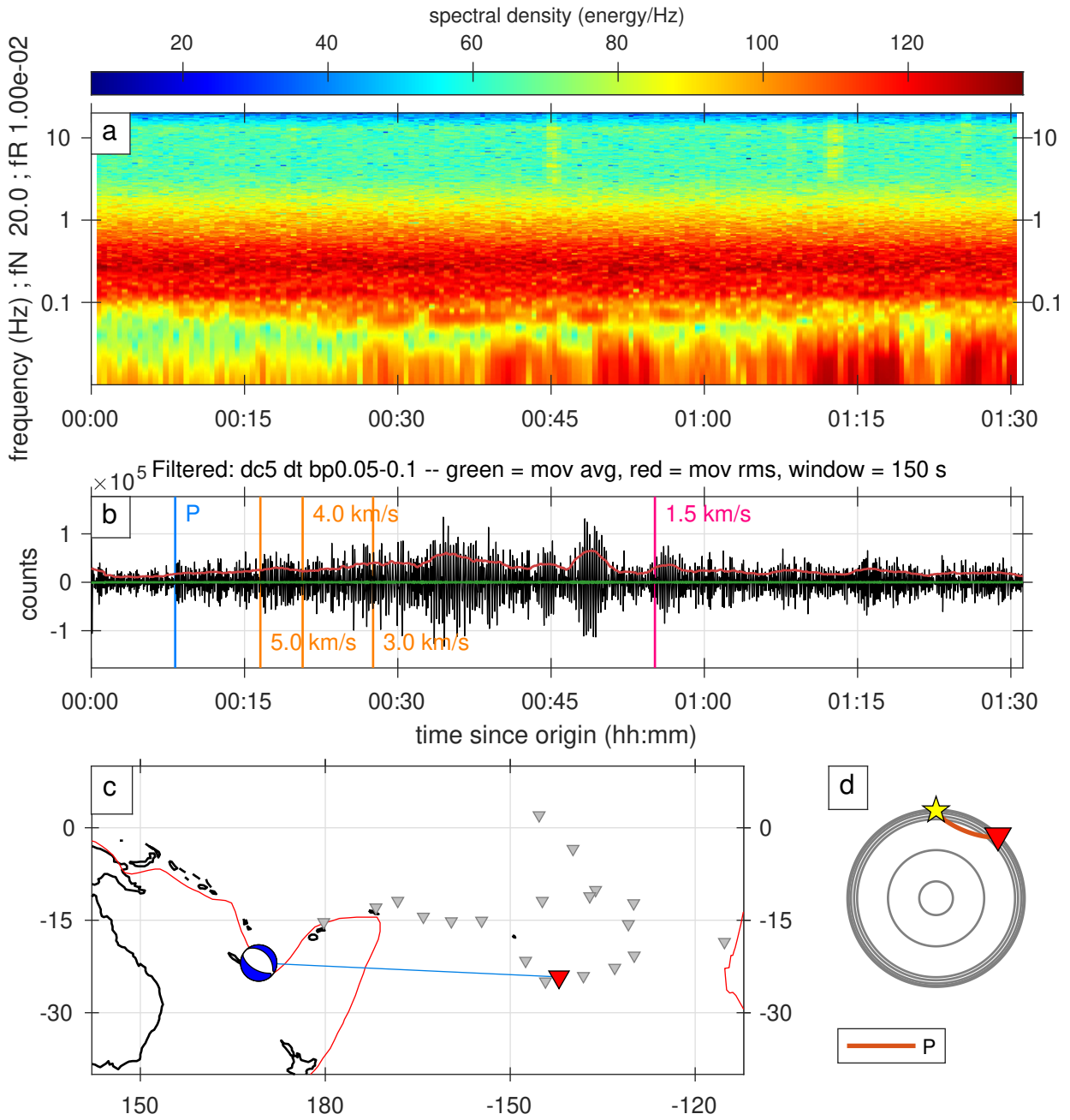


Figure S76. A full record of an earthquake classified as 2stars category.

Arrival: 2019-01-21T12:08:00.000000, ID: 10997943

Mww = 5.70, distance = 60.99 degrees, depth = 29.00 km  
6.33 - 16.23 percent

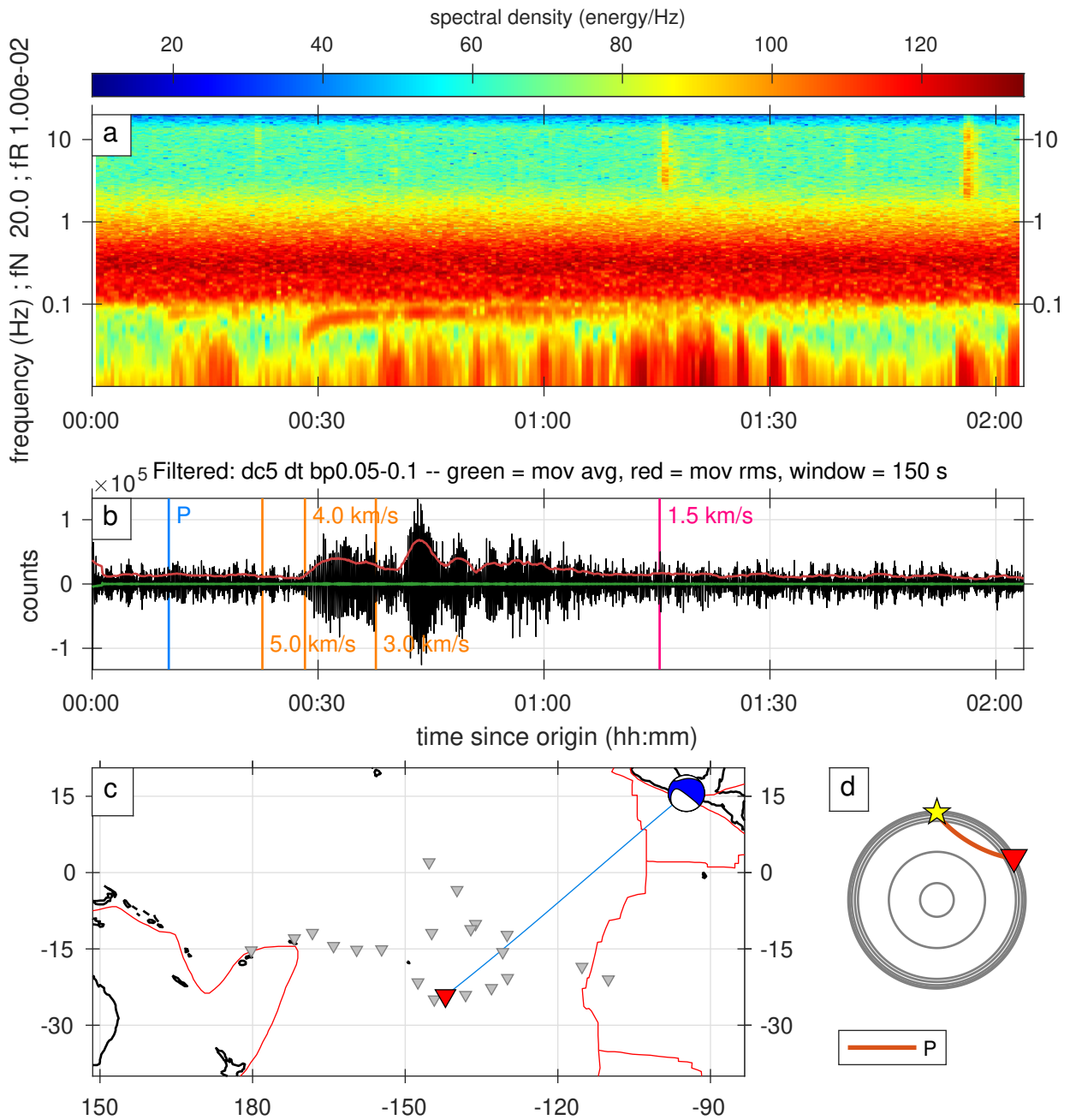


Figure S77. A full record of an earthquake classified as 2stars category.

Arrival: 2019-01-22T00:14:00.000000, ID: 10998098

Mww = 6.00, distance = 93.62 degrees, depth = 16.77 km  
64.09 - 79.14 percent

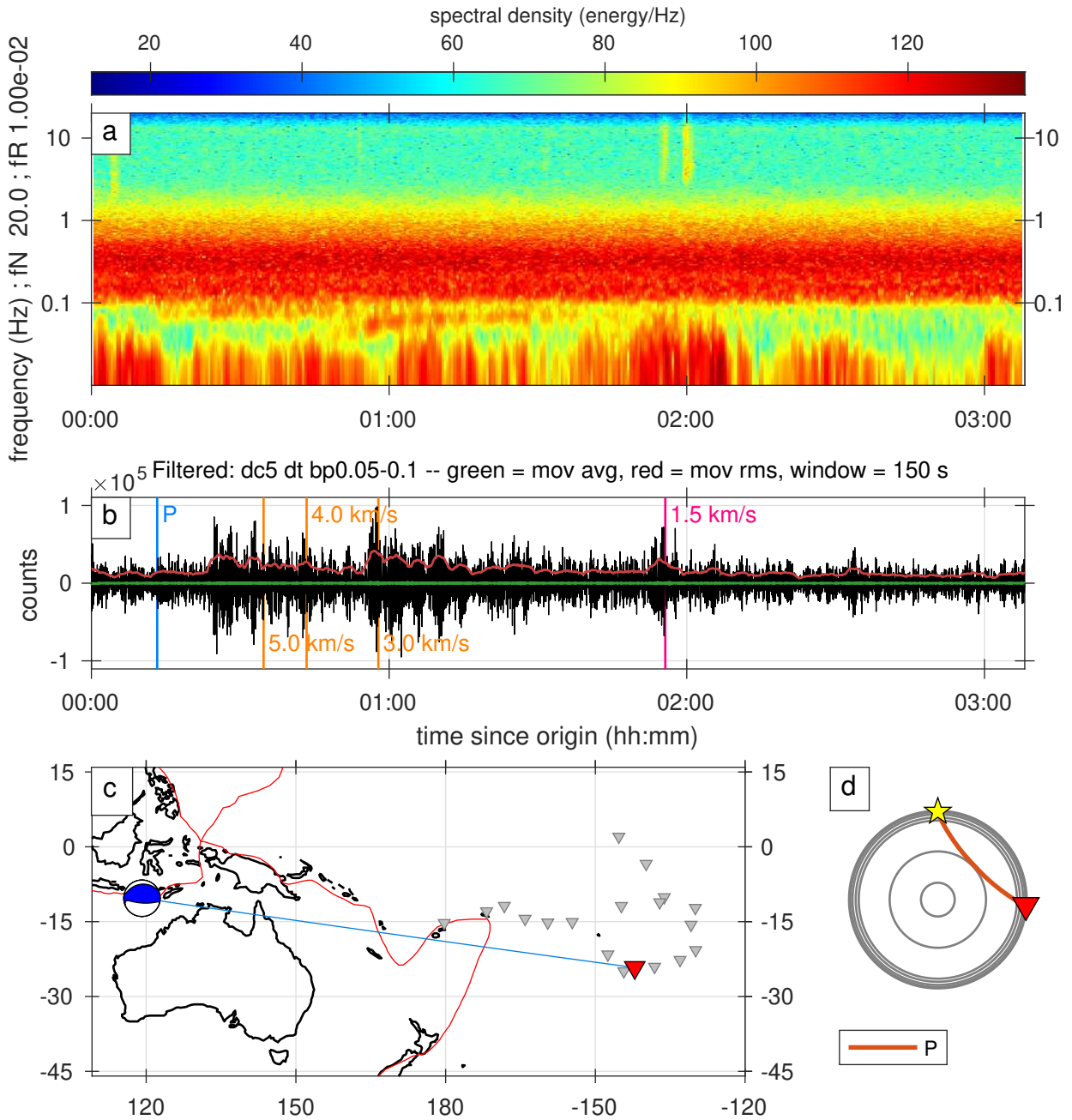


Figure S78. A full record of an earthquake classified as 2stars category.

Arrival: 2019-01-26T04:01:00.000000, ID: 10999596

Mww = 6.20, distance = 61.20 degrees, depth = 361.92 km

78.00 - 81.19 percent

spectral density (energy/Hz)

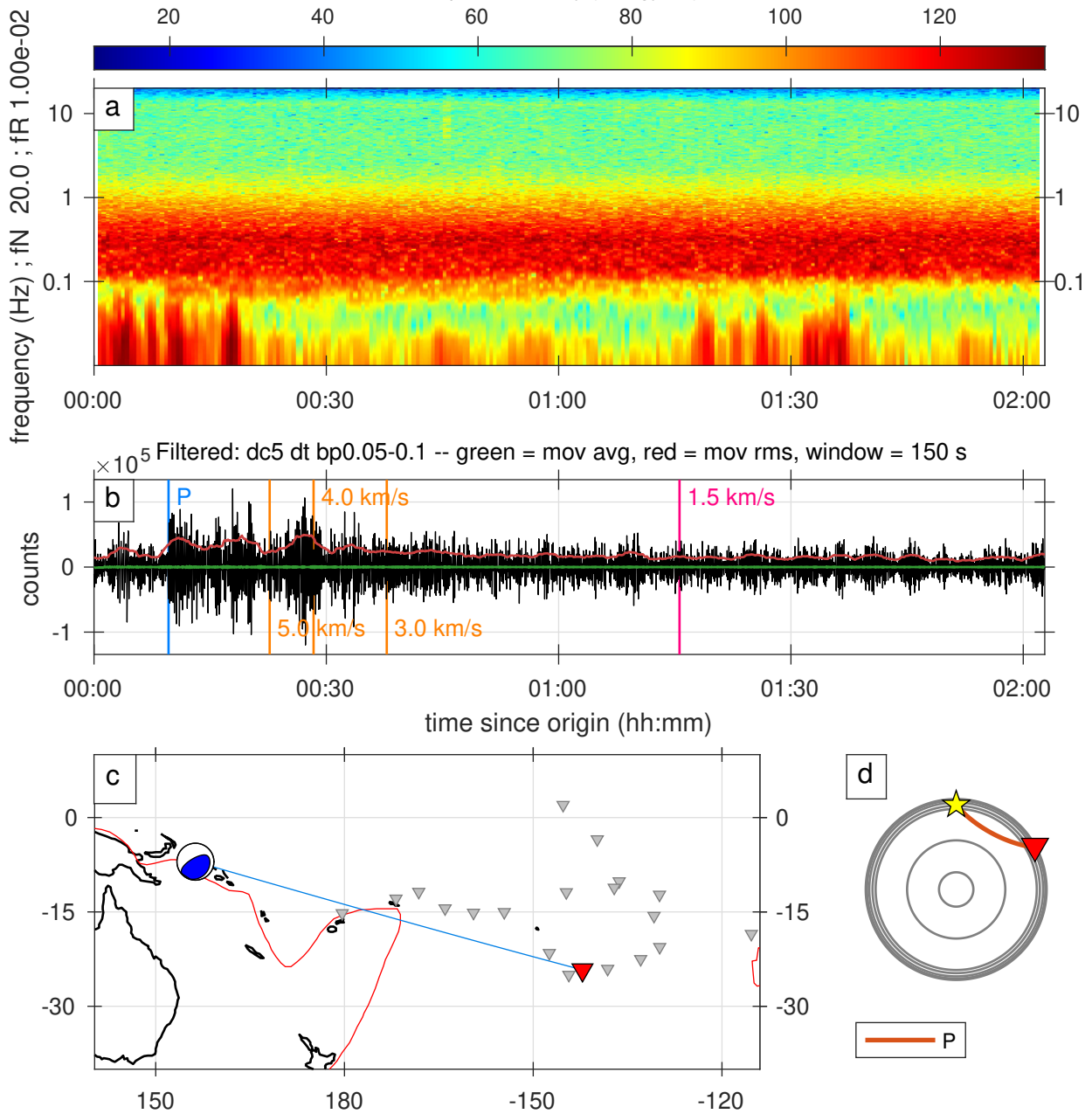


Figure S79. A full record of an earthquake classified as 2stars category.

Arrival: 2019-01-26T08:25:00.000000, ID: 10999641

Mww = 5.90, distance = 82.34 degrees, depth = 10.00 km  
84.78 - 89.06 percent

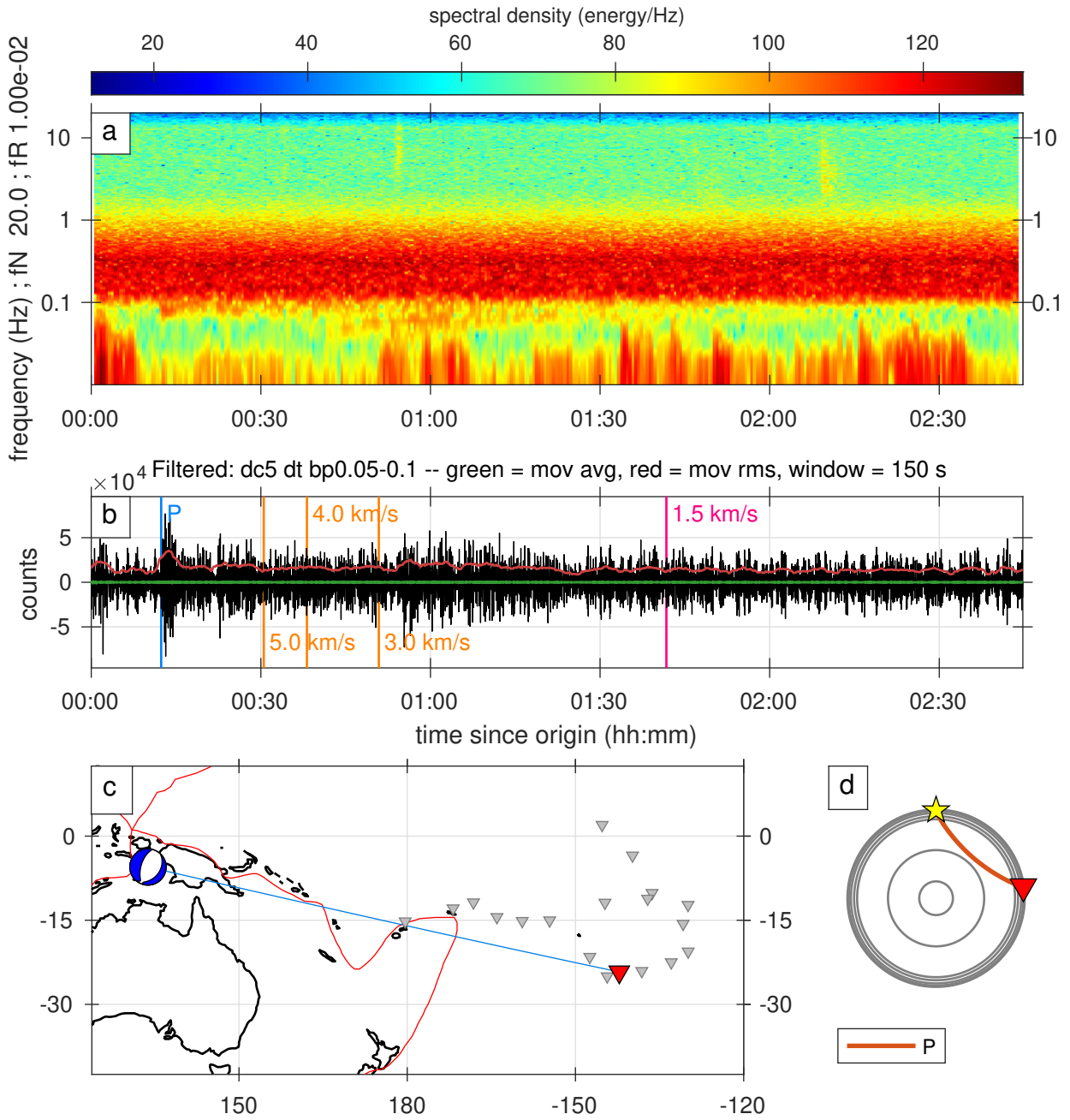


Figure S80. A full record of an earthquake classified as 2stars category.



Arrival: 2019-01-30T15:45:20.000000, ID: 11001050

Mww = 5.90, distance = 40.42 degrees, depth = 10.00 km

33.05 - 38.36 percent

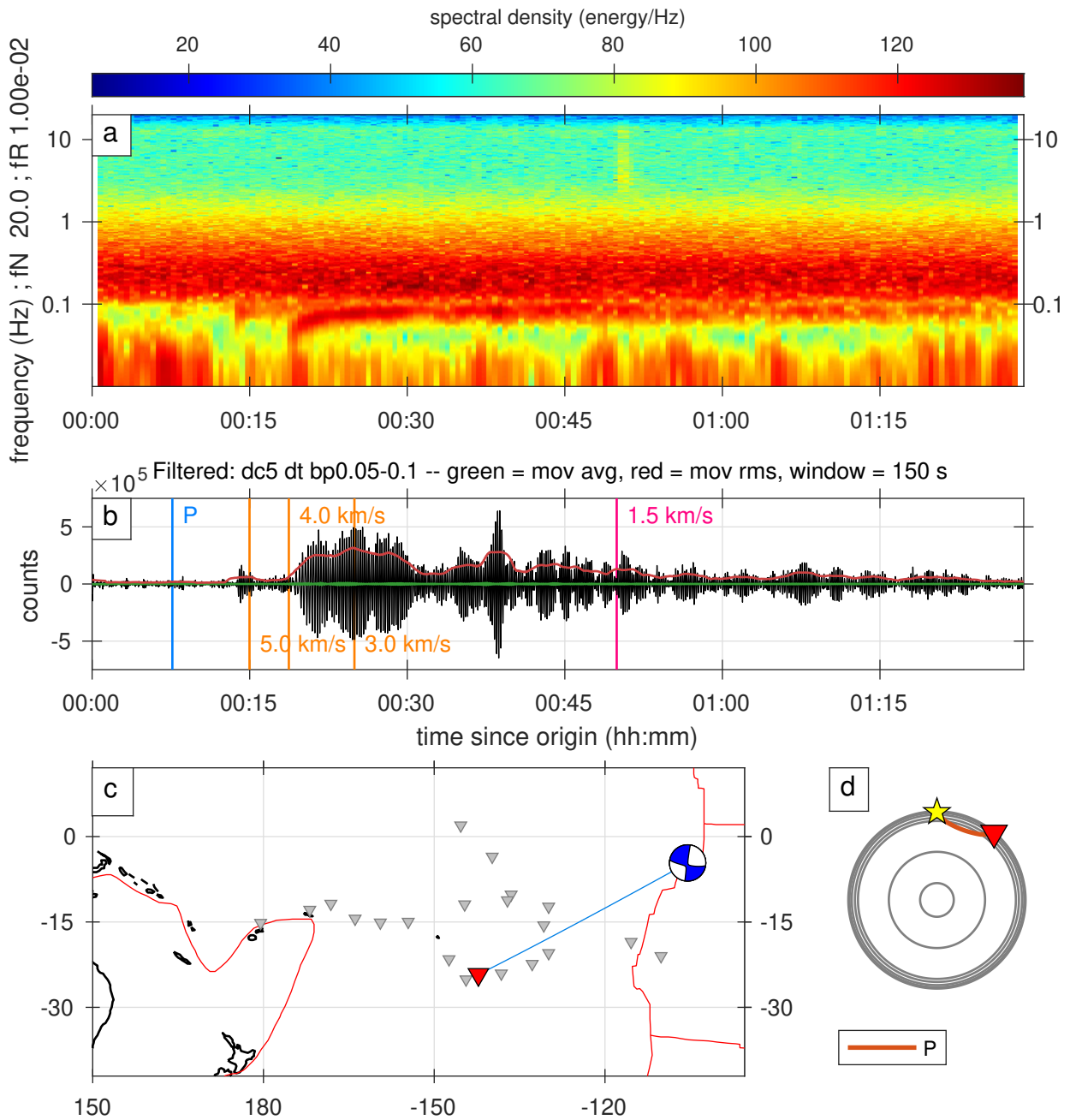


Figure S81. A full record of an earthquake classified as 2stars category.

Arrival: 2019-02-27T02:50:59.141764, ID: 11009267

mb = 5.10, distance = 32.34 degrees, depth = 10.00 km  
58.12 - 58.97 percent

spectral density (energy/Hz)

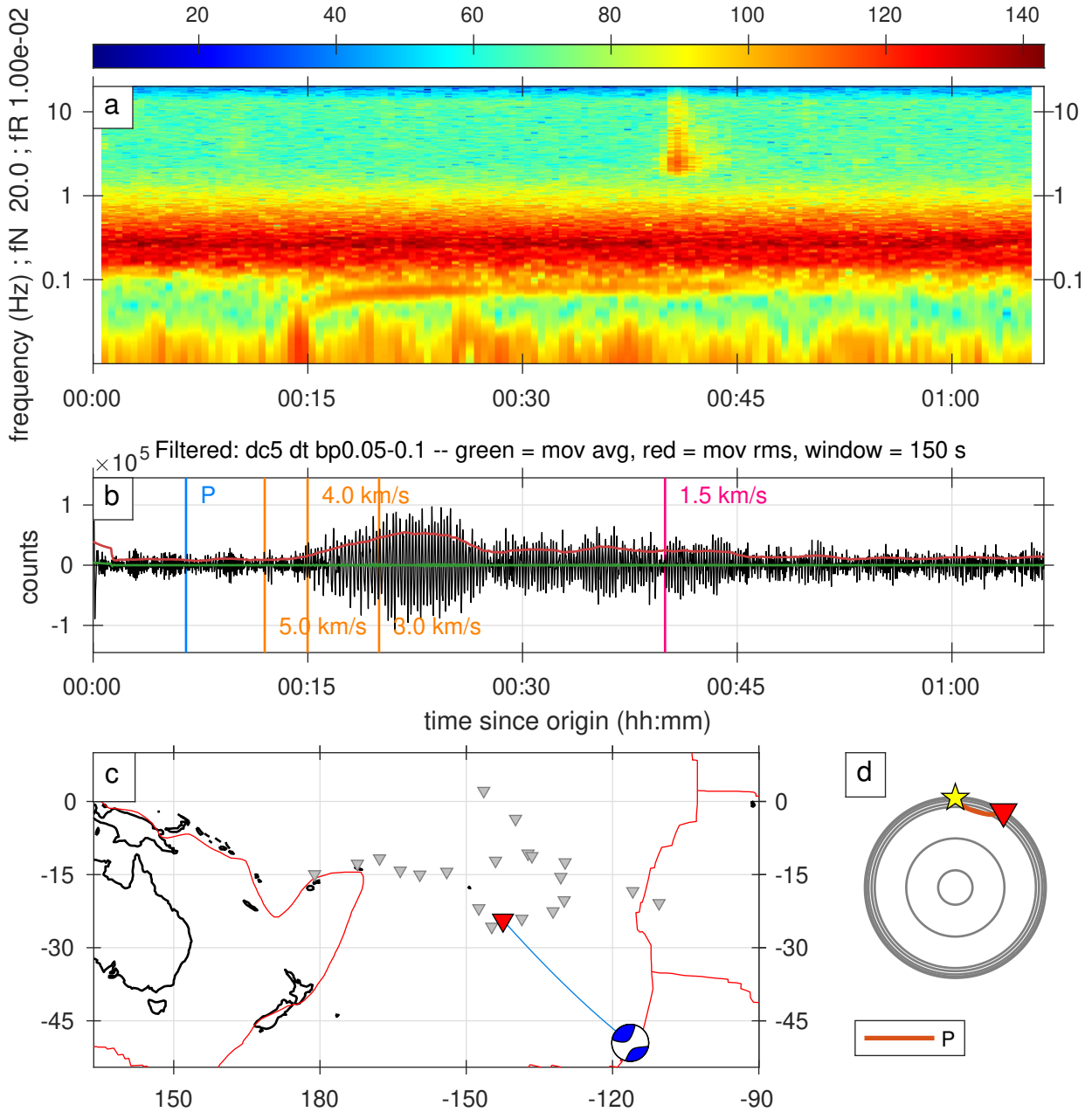


Figure S82. A full record of an earthquake classified as 2stars category.

Arrival: 2019-03-01T01:10:00.000000, ID: 11010051

Mww = 5.70, distance = 51.72 degrees, depth = 10.00 km

93.81 - 95.14 percent

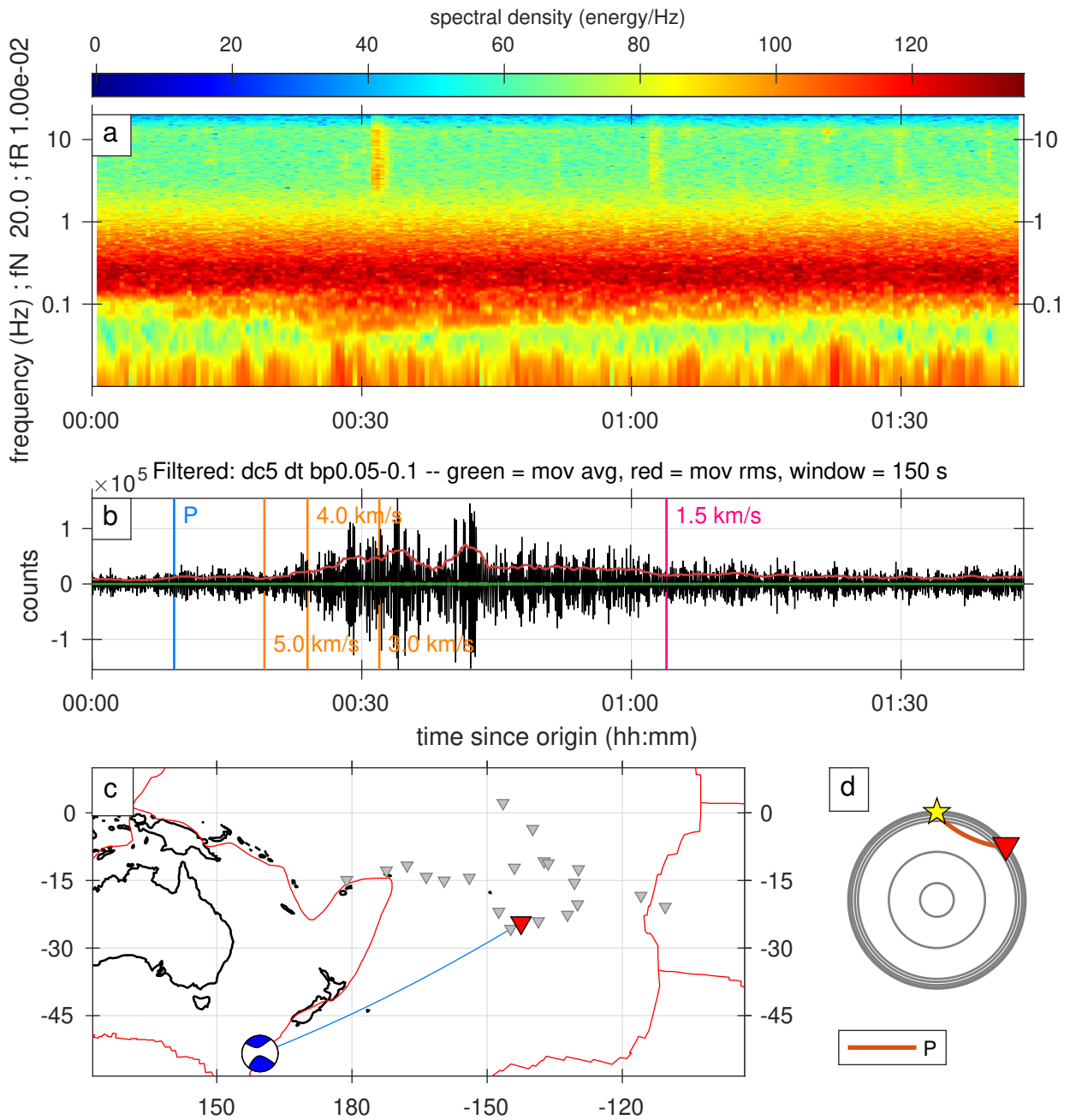


Figure S83. A full record of an earthquake classified as 2stars category.



Arrival: 2019-03-06T20:26:30.000000, ID: 11011957

Mww = 5.80, distance = 31.84 degrees, depth = 11.18 km  
93.10 - 94.11 percent

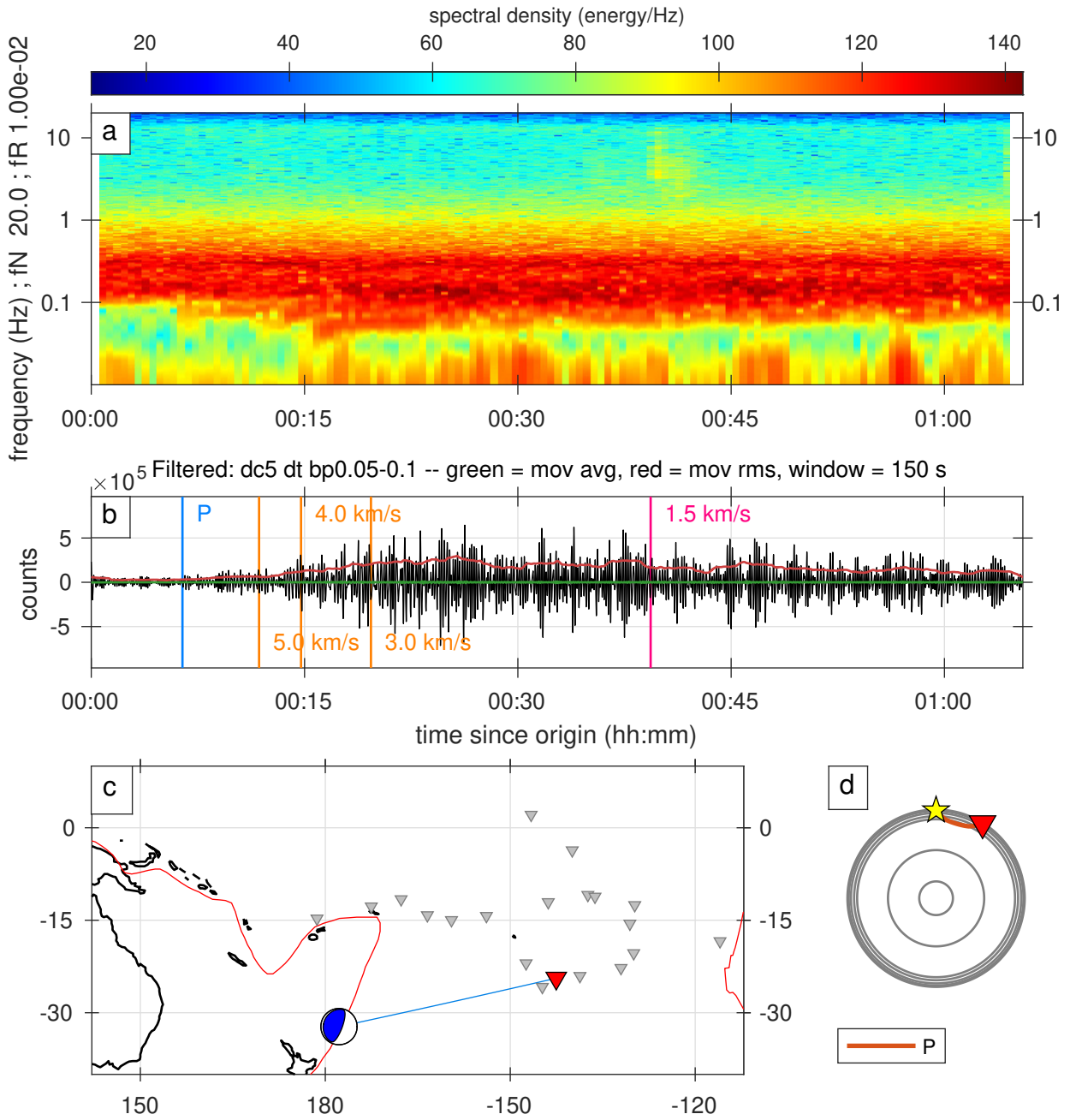


Figure S84. A full record of an earthquake classified as 2stars category.

Arrival: 2019-03-07T15:35:00.000000, ID: 11012420

Mww = 5.50, distance = 31.15 degrees, depth = 10.00 km  
33.98 - 37.41 percent

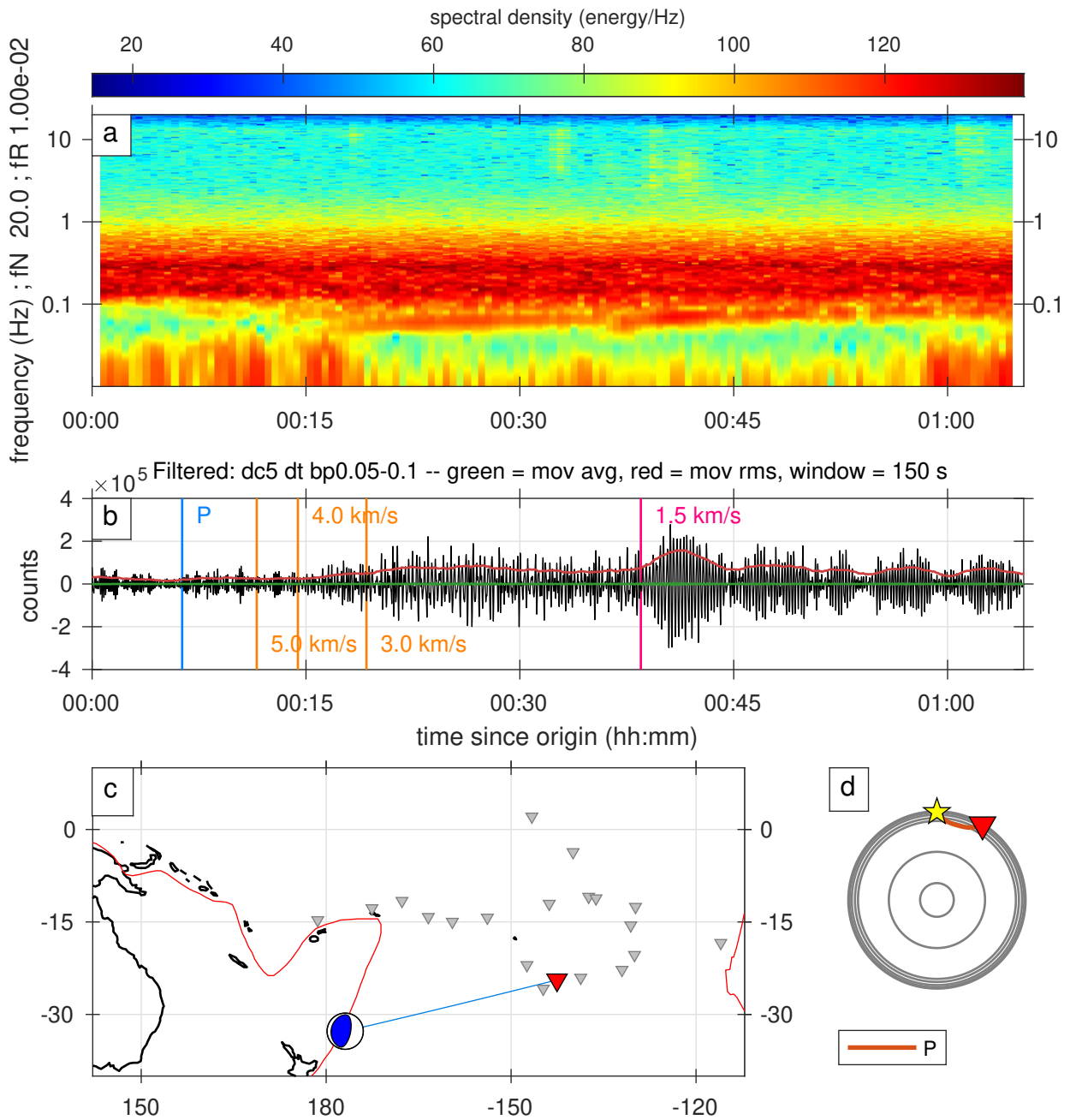


Figure S85. A full record of an earthquake classified as 2stars category.

Arrival: 2019-03-07T16:35:37.367699, ID: 11012435

Mww = 5.70, distance = 32.38 degrees, depth = 20.80 km  
37.23 - 40.71 percent

spectral density (energy/Hz)

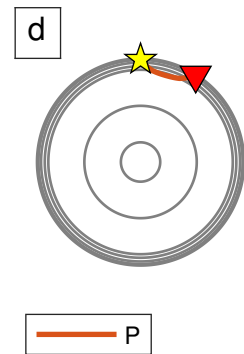
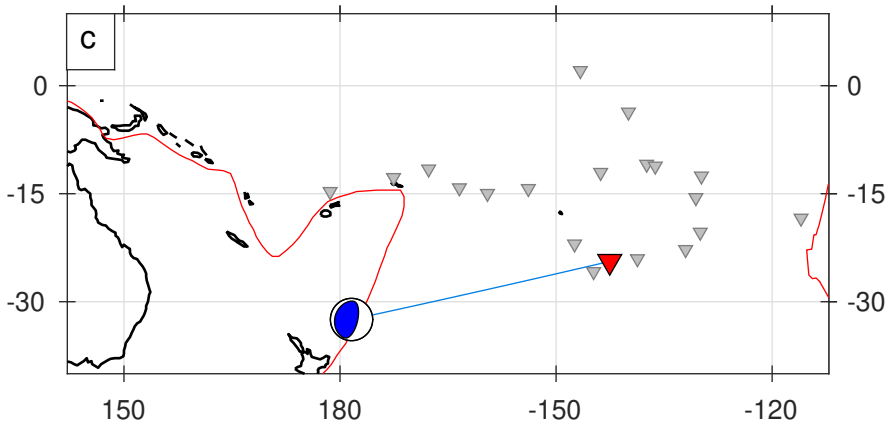
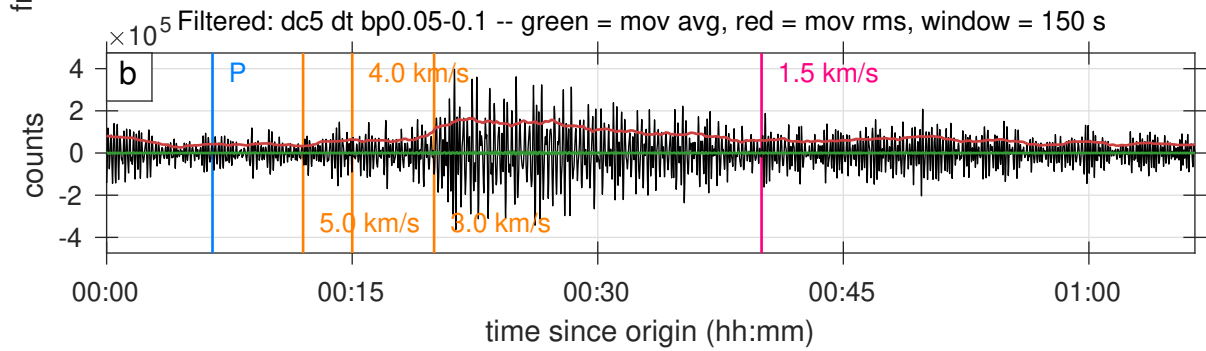
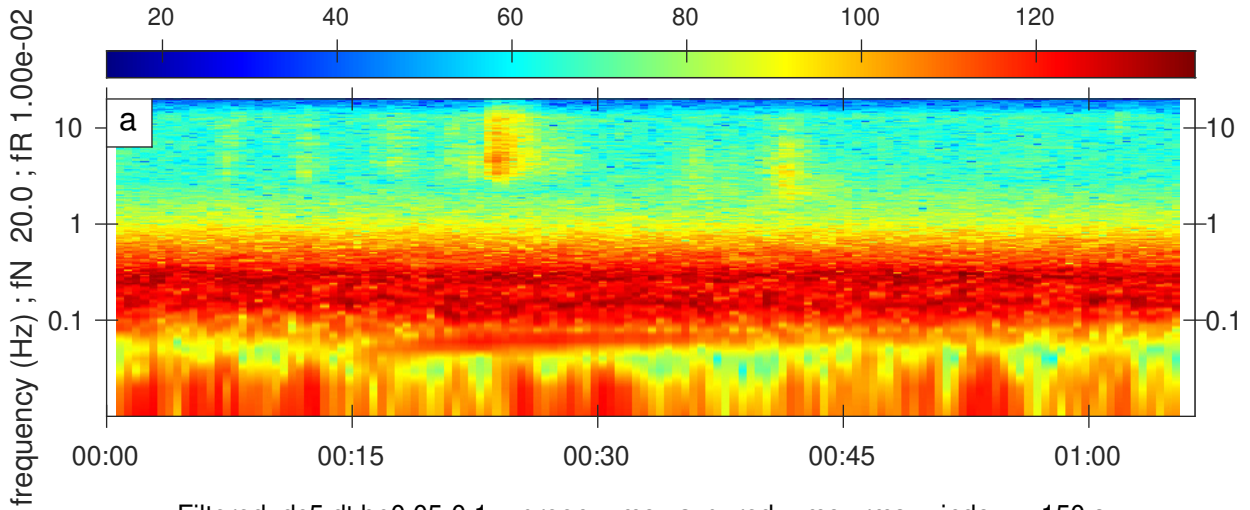


Figure S86. A full record of an earthquake classified as 2stars category.

Arrival: 2019-03-17T00:52:00.000000, ID: 11015463

Mww = 5.10, distance = 28.96 degrees, depth = 10.00 km

83.84 - 88.33 percent

spectral density (energy/Hz)

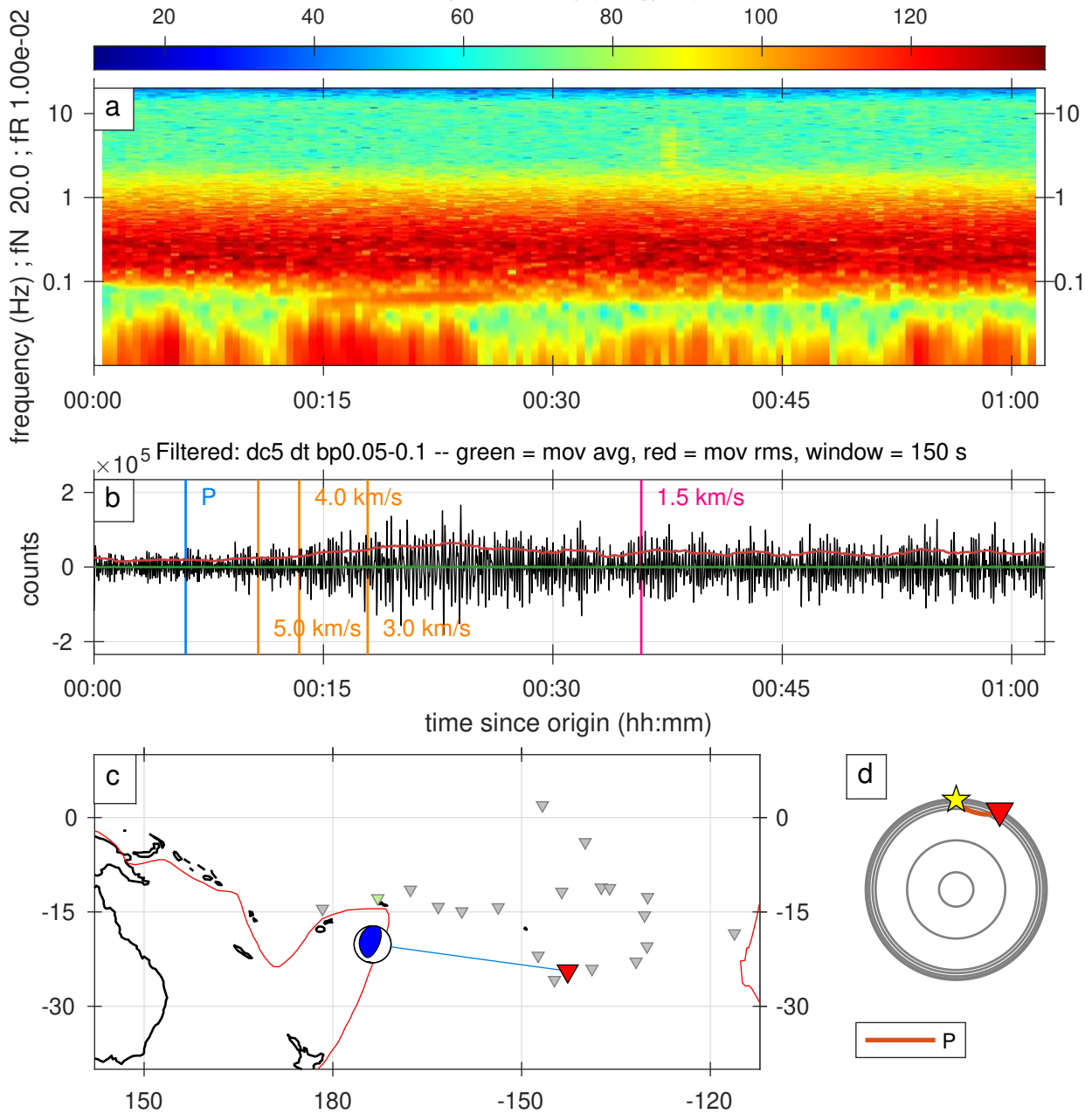


Figure S87. A full record of an earthquake classified as 2stars category.

Arrival: 2019-03-20T15:32:20.000000, ID: 11016677

Mww = 6.30, distance = 47.23 degrees, depth = 119.00 km  
67.55 - 70.69 percent

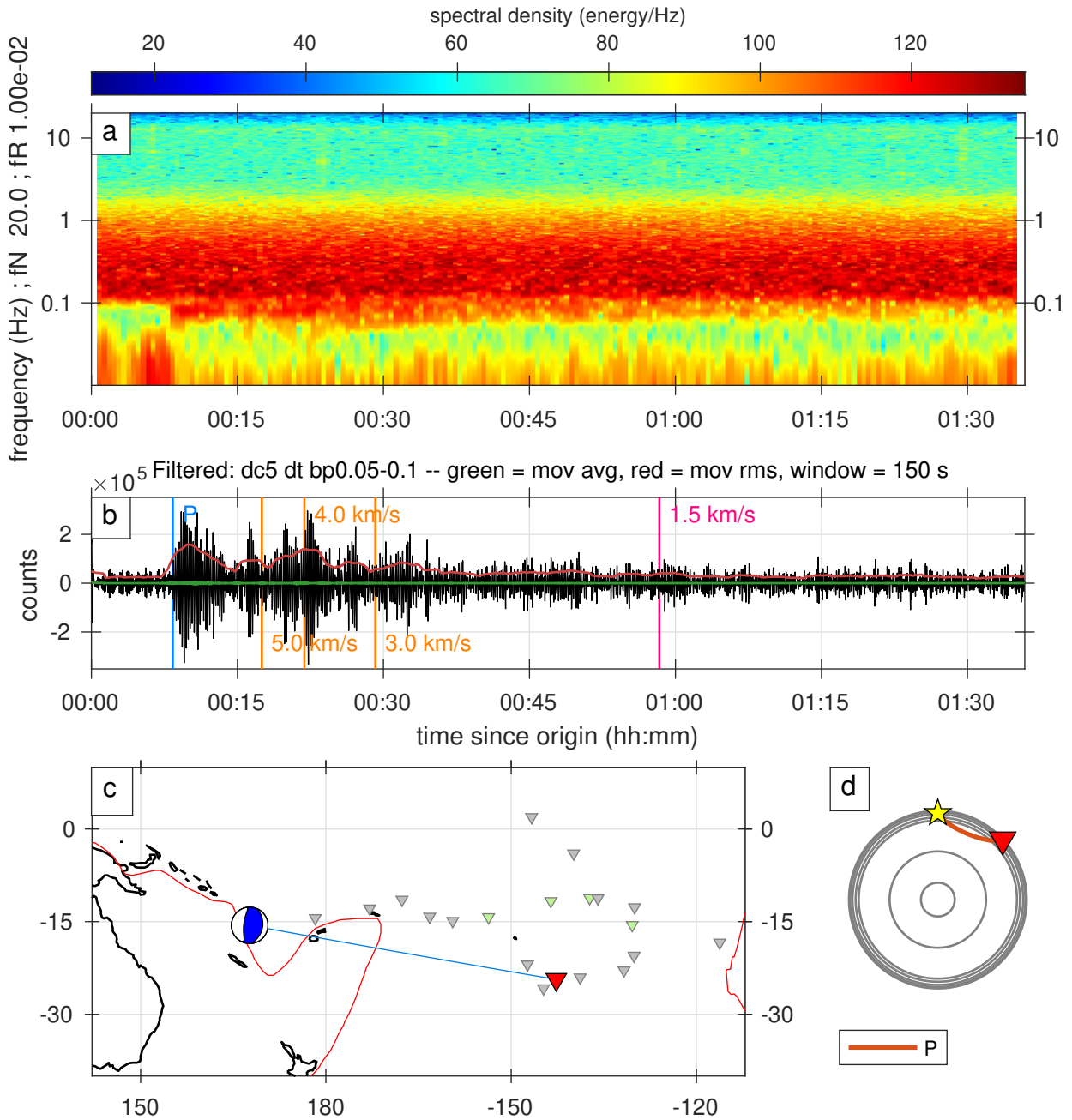


Figure S88. A full record of an earthquake classified as 2stars category.



Arrival: 2019-03-26T12:12:20.972782, ID: 11018667

Mww = 5.60, distance = 63.90 degrees, depth = 10.00 km  
88.43 - 93.42 percent

spectral density (energy/Hz)

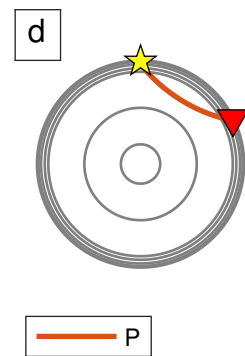
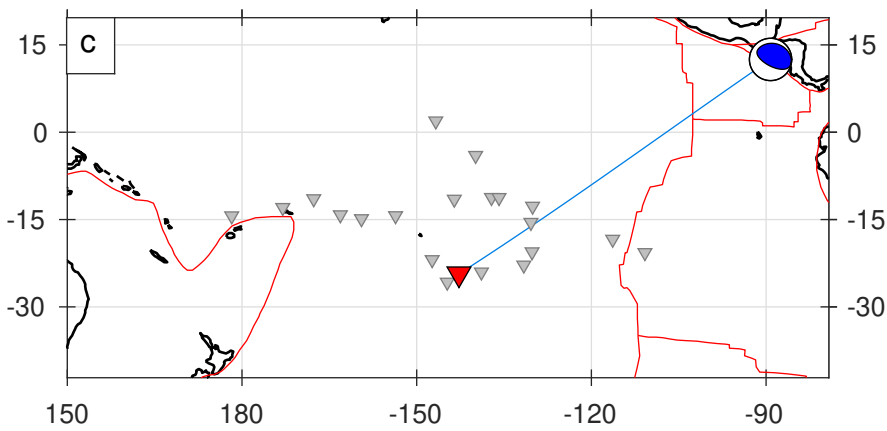
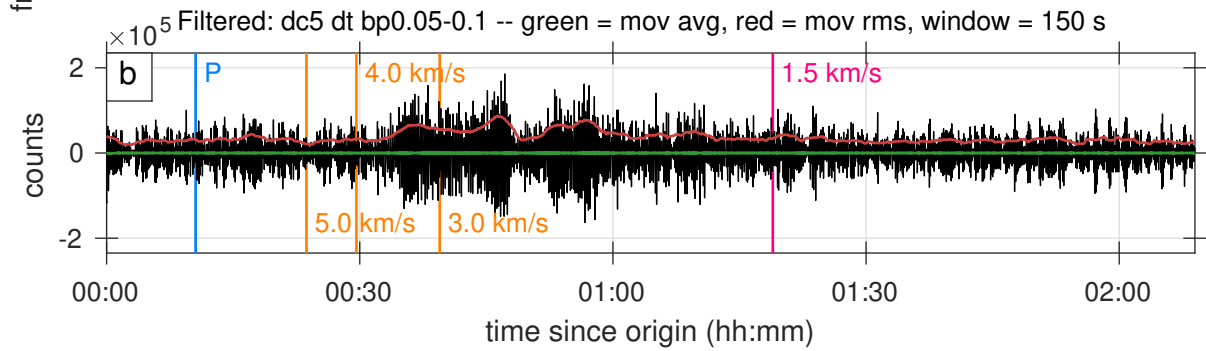
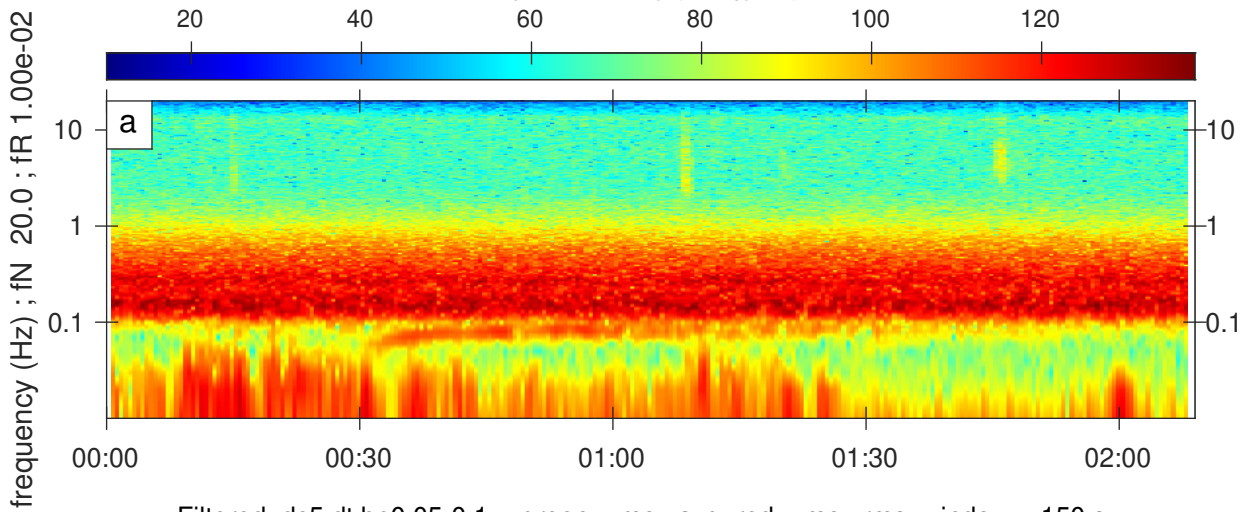


Figure S89. A full record of an earthquake classified as 2stars category.

Arrival: 2019-03-28T22:20:00.000000, ID: 11019798

Mww = 6.20, distance = 90.26 degrees, depth = 8.96 km  
47.75 - 52.45 percent

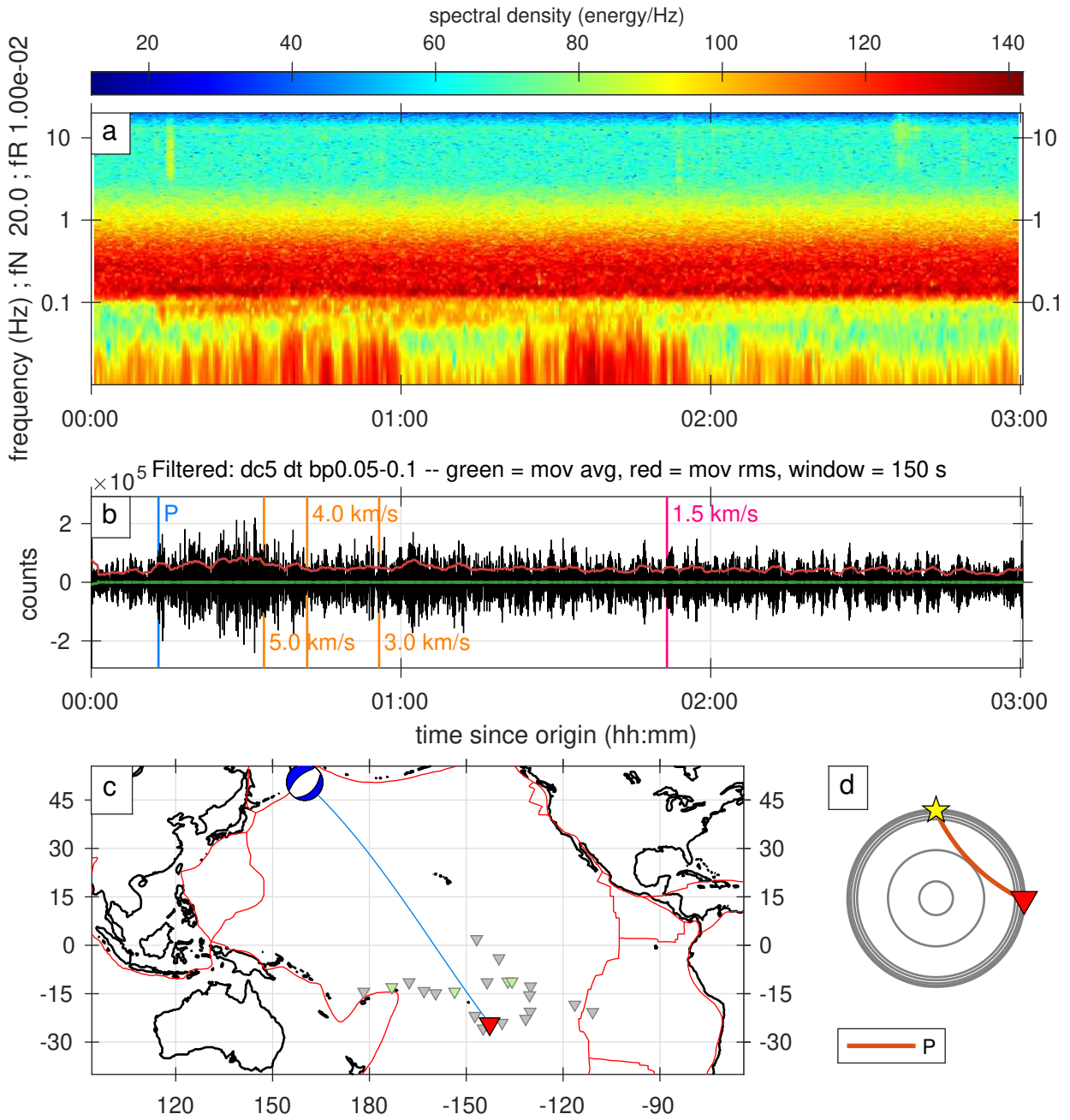


Figure S90. A full record of an earthquake classified as 2stars category.

Arrival: 2019-03-31T07:14:15.000000, ID: 11020682

Mww = 6.20, distance = 63.76 degrees, depth = 18.00 km

55.99 - 62.44 percent

spectral density (energy/Hz)

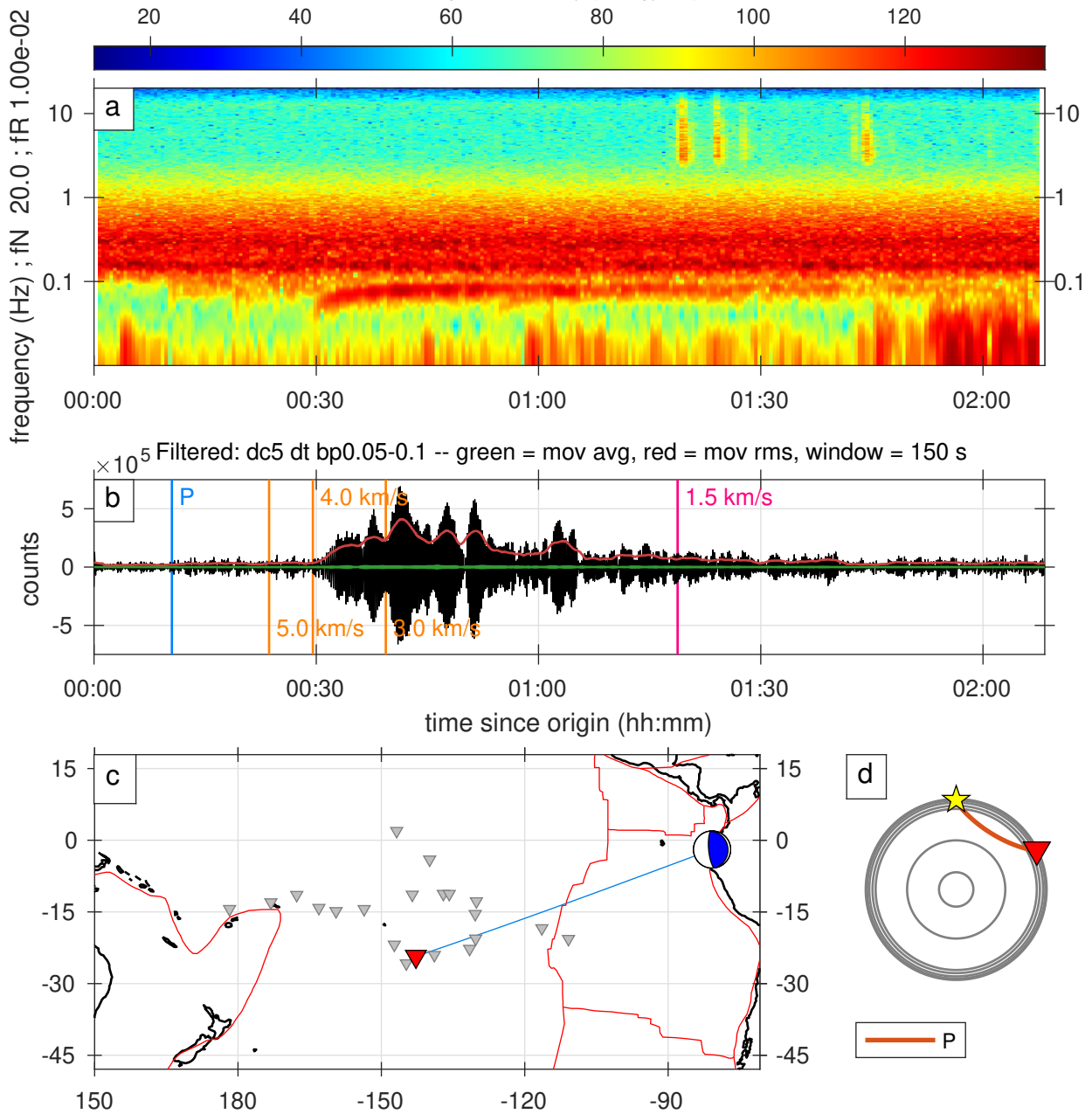


Figure S91. A full record of an earthquake classified as 2stars category.



Arrival: 2019-04-05T18:56:58.914245, ID: 11022811

Mww = 5.80, distance = 61.40 degrees, depth = 10.00 km  
 17.07 - 19.17 percent

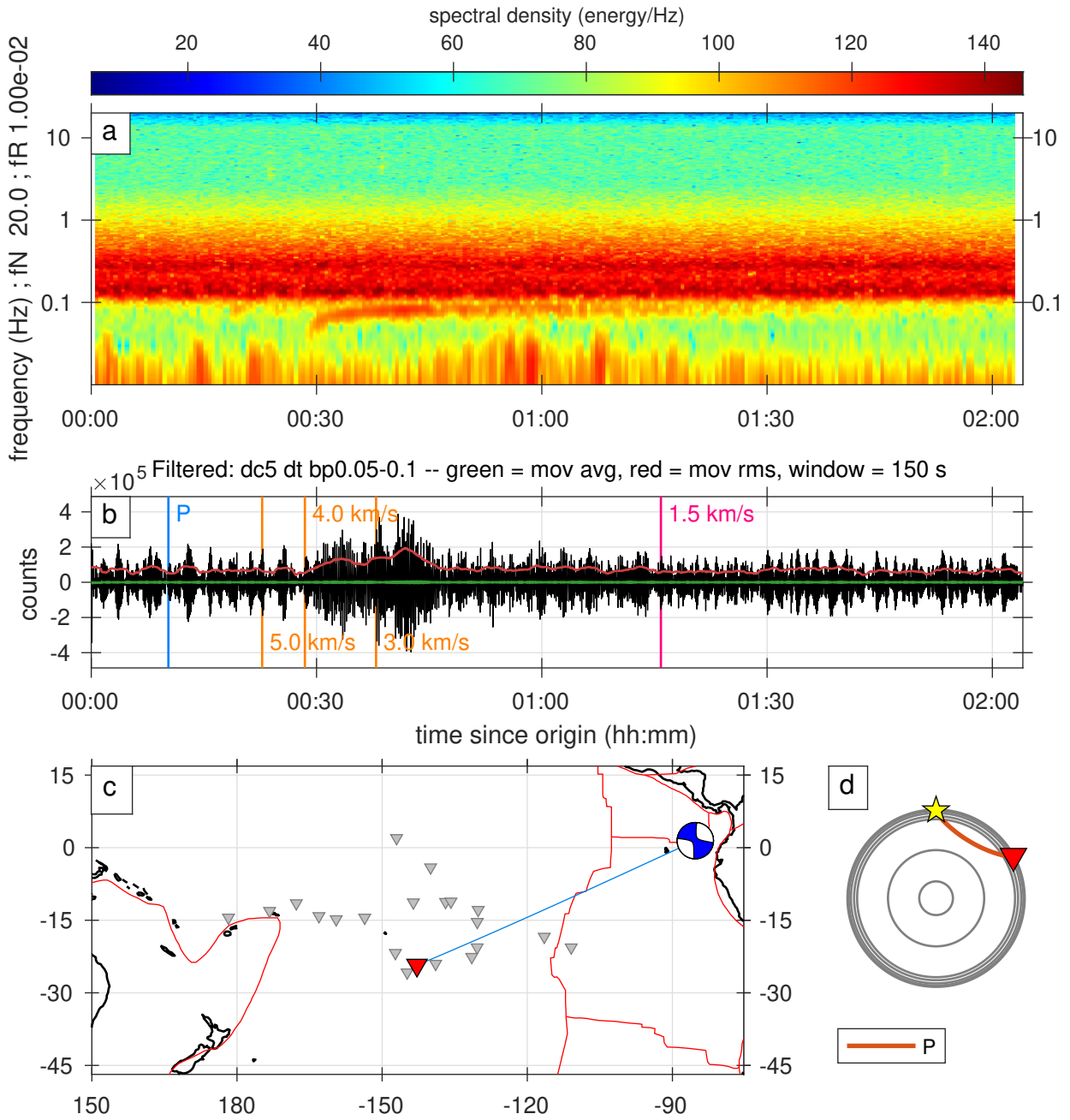


Figure S92. A full record of an earthquake classified as 2stars category.

Arrival: 2019-04-07T15:53:52.500440, ID: 11023279

Mww = 5.70, distance = 48.63 degrees, depth = 7.09 km  
62.82 - 64.50 percent

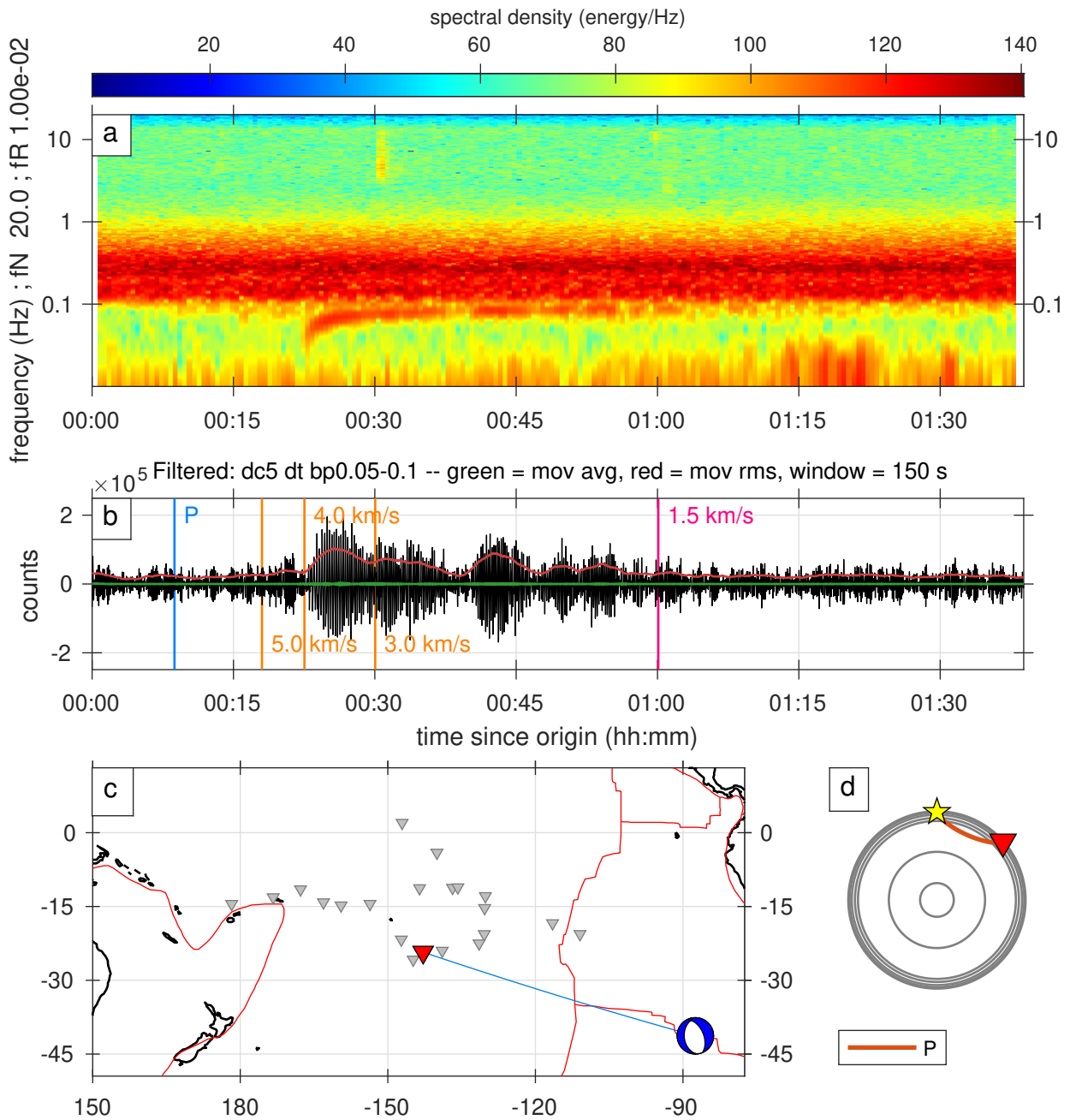


Figure S93. A full record of an earthquake classified as 2stars category.

Arrival: 2019-04-09T18:06:15.000000, ID: 11024052

Mww = 6.50, distance = 82.47 degrees, depth = 44.83 km  
 16.63 - 20.00 percent

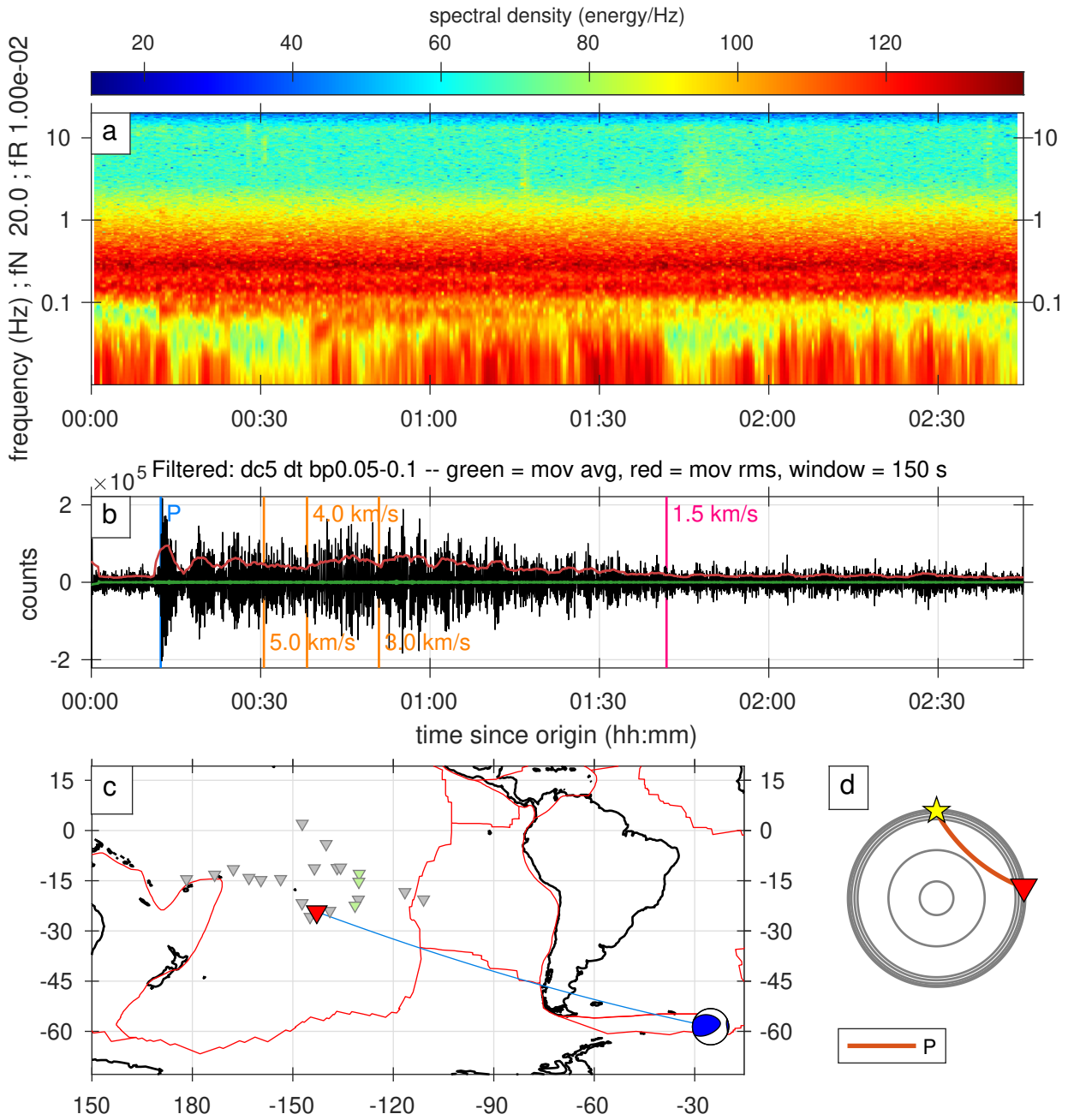


Figure S94. A full record of an earthquake classified as 2stars category.

Arrival: 2019-04-12T11:54:00.000000, ID: 11024890

Mww = 6.80, distance = 93.40 degrees, depth = 17.48 km  
 96.20 - 100.00 percent

spectral density (energy/Hz)

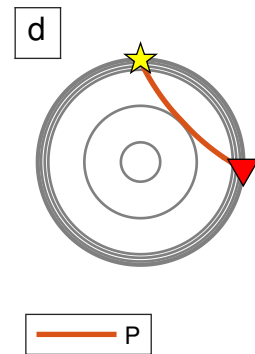
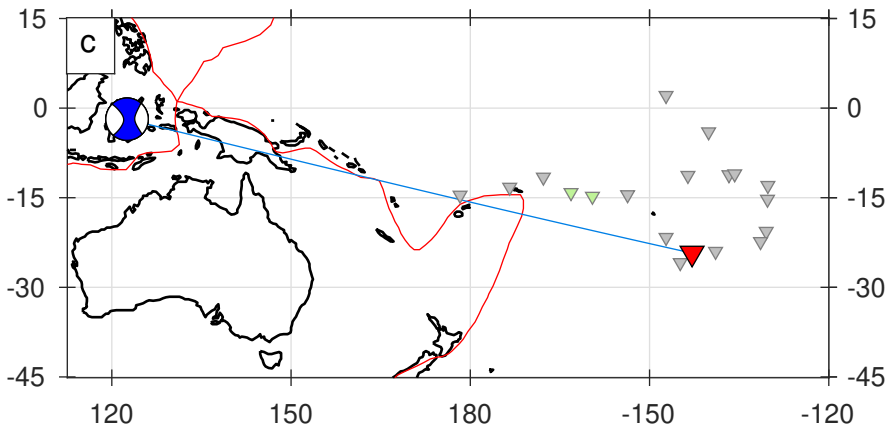
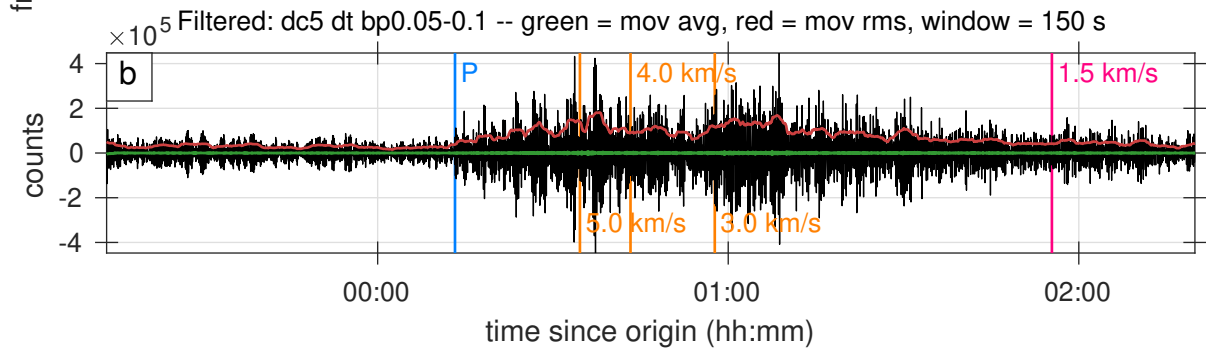
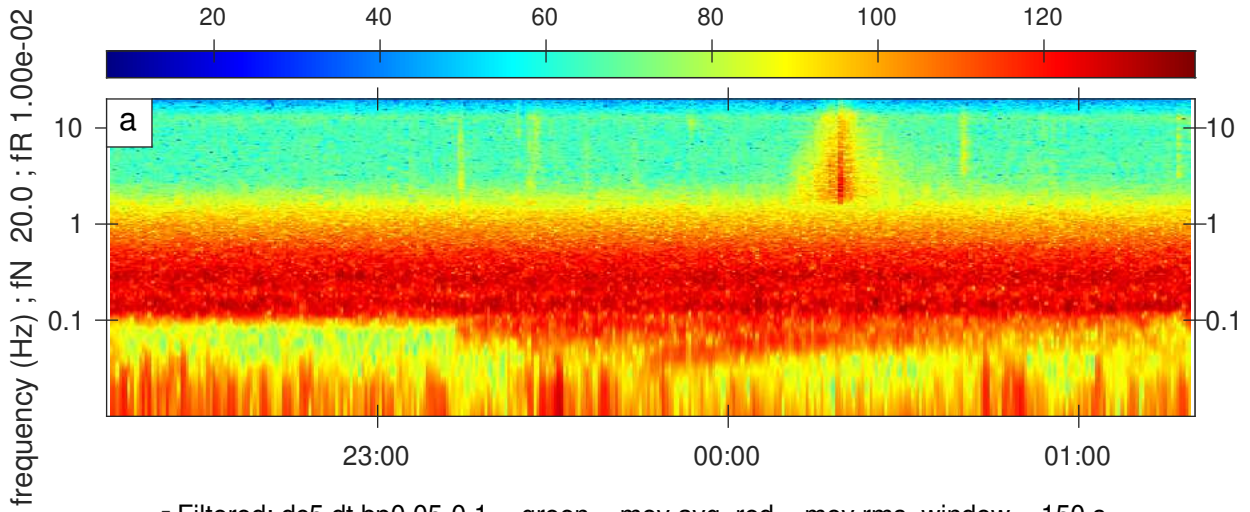


Figure S95. A full record of an earthquake classified as 2stars category.

Arrival: 2019-04-18T14:56:30.000000, ID: 11027275

Mww = 6.50, distance = 63.69 degrees, depth = 10.00 km  
64.83 - 66.13 percent

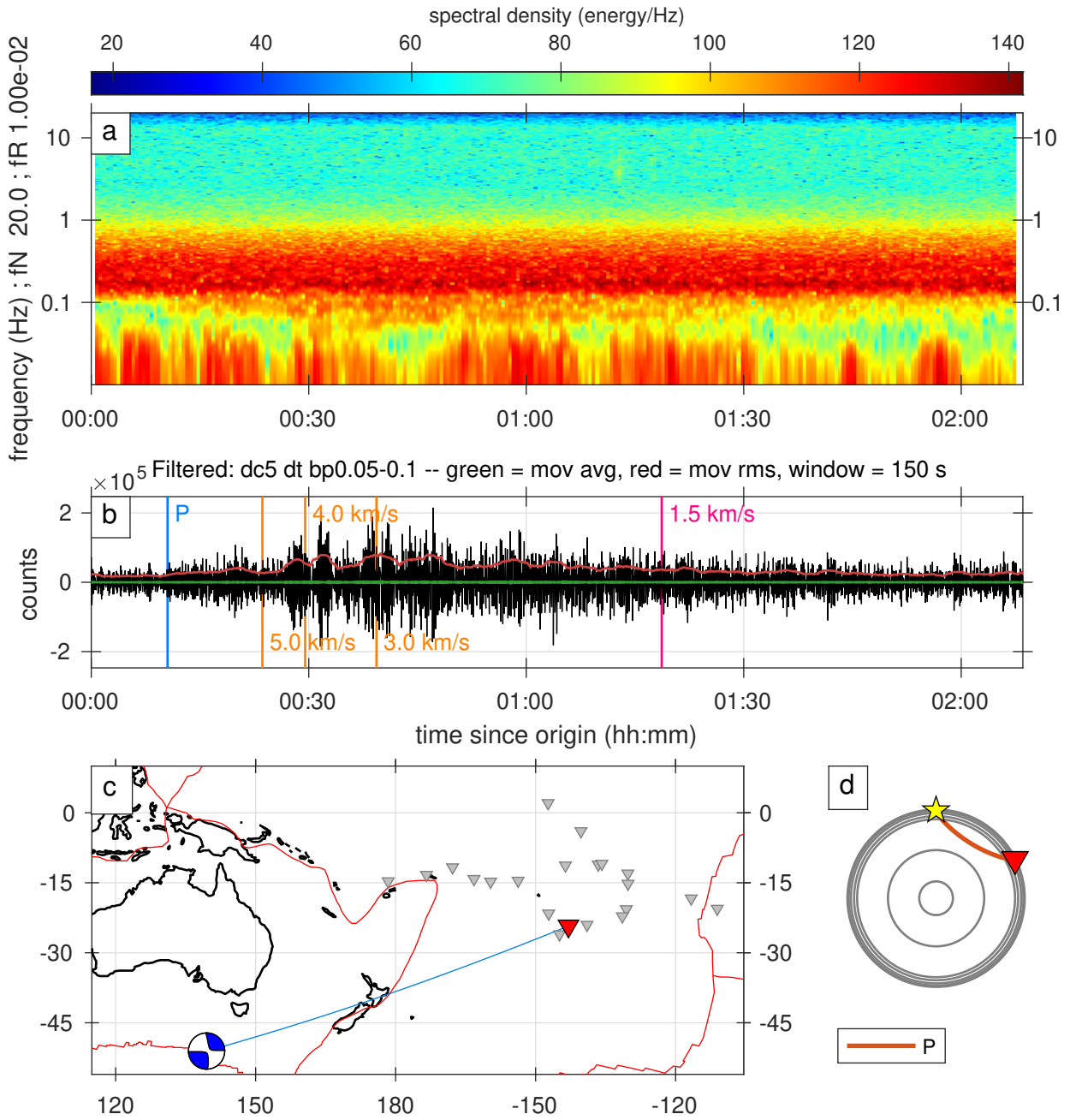


Figure S96. A full record of an earthquake classified as 2stars category.



Arrival: 2019-04-23T05:50:00.000000, ID: 11028997

Mww = 6.40, distance = 96.44 degrees, depth = 54.00 km  
61.04 - 72.26 percent

spectral density (energy/Hz)

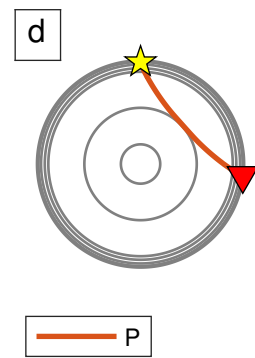
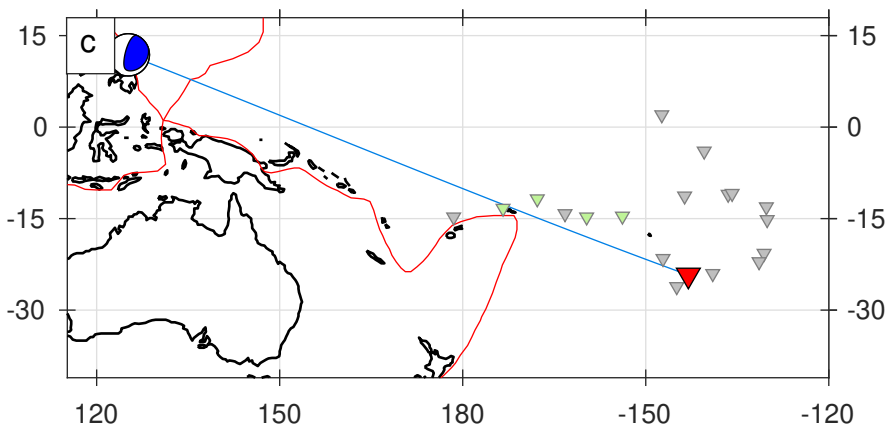
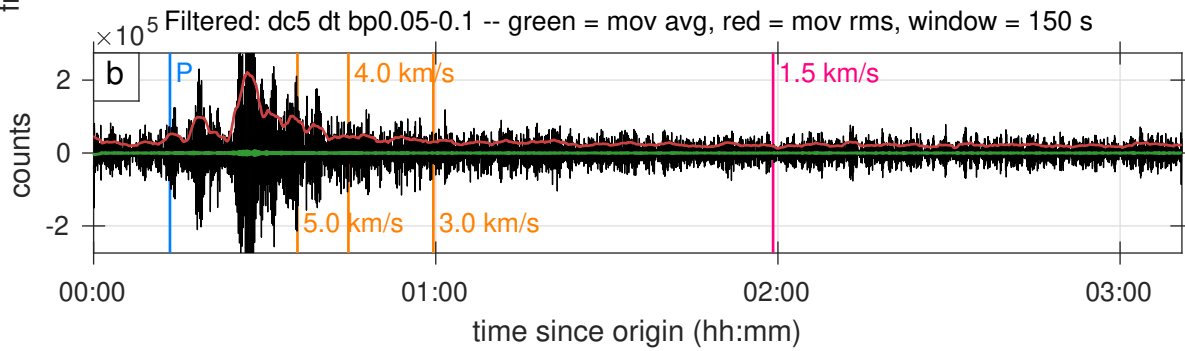
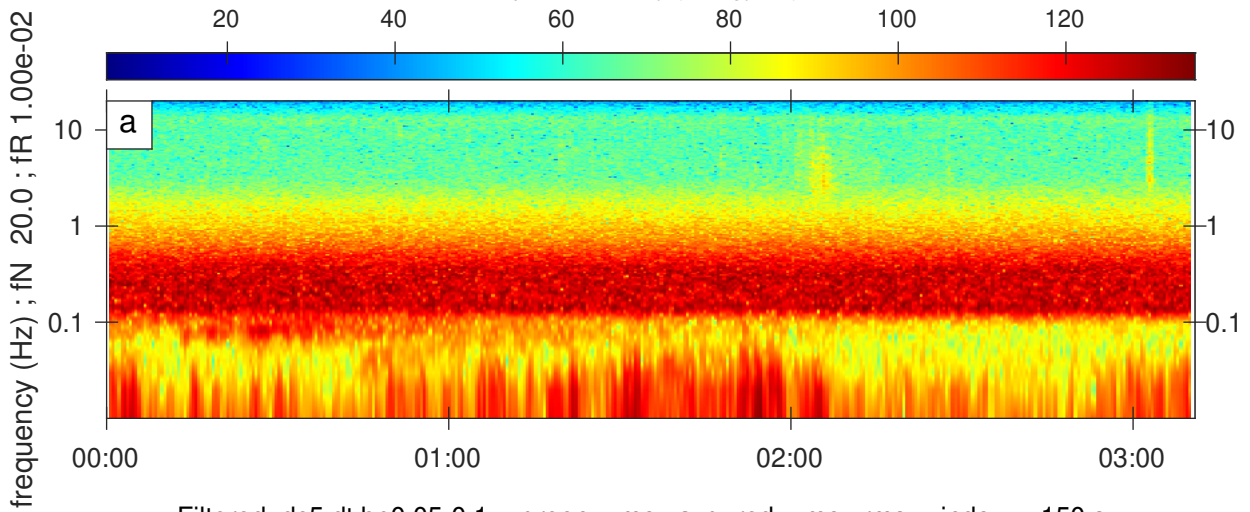


Figure S97. A full record of an earthquake classified as 2stars category.

Arrival: 2019-04-23T14:26:20.000000, ID: 11029096

Mww = 6.00, distance = 32.43 degrees, depth = 385.58 km  
 91.76 - 95.65 percent

spectral density (energy/Hz)

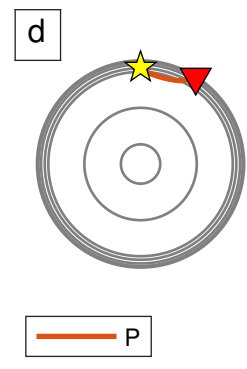
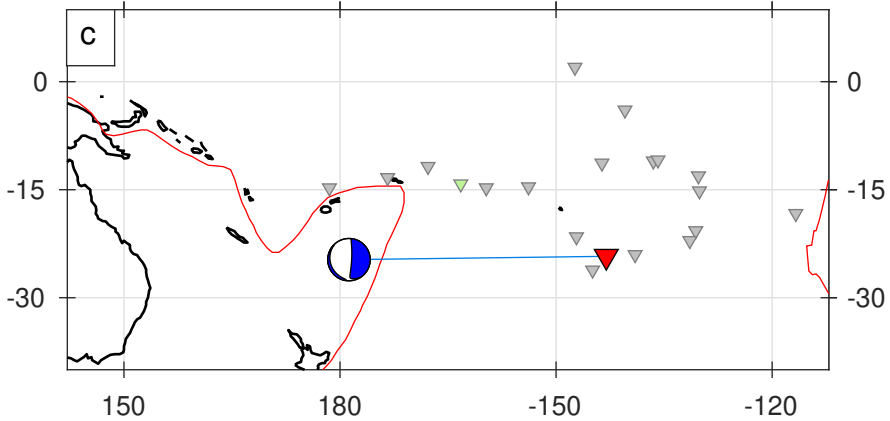
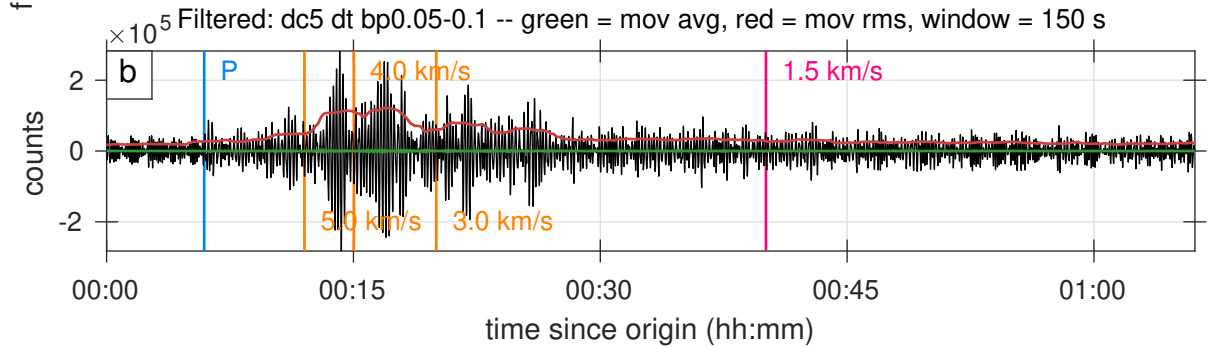
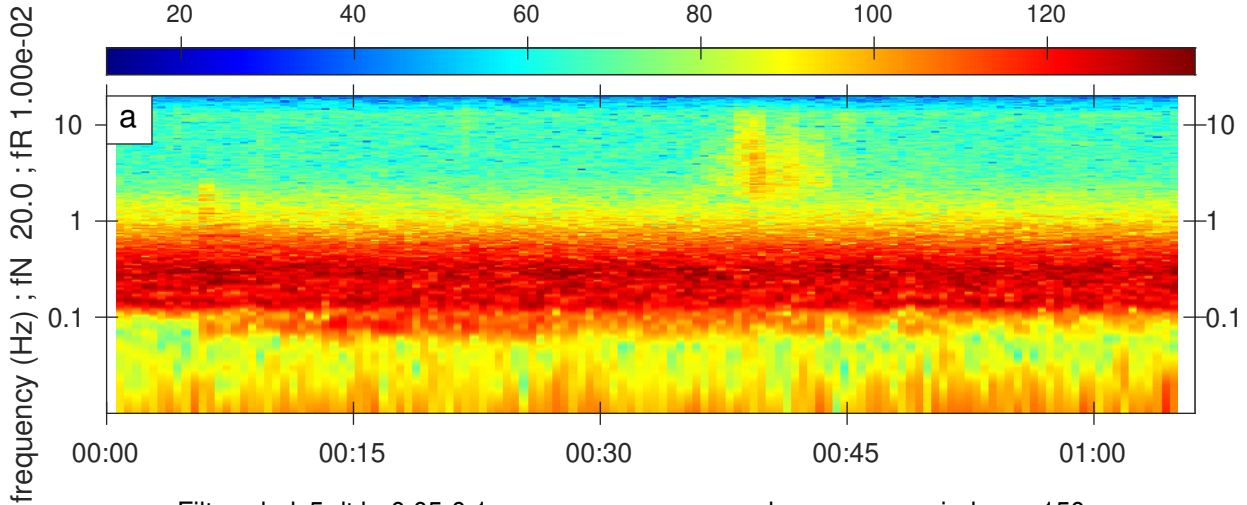


Figure S98. A full record of an earthquake classified as 2stars category.

Arrival: 2019-05-03T07:00:49.270502, ID: 11033150

mb = 5.00, distance = 24.77 degrees, depth = 10.00 km  
25.66 - 26.39 percent

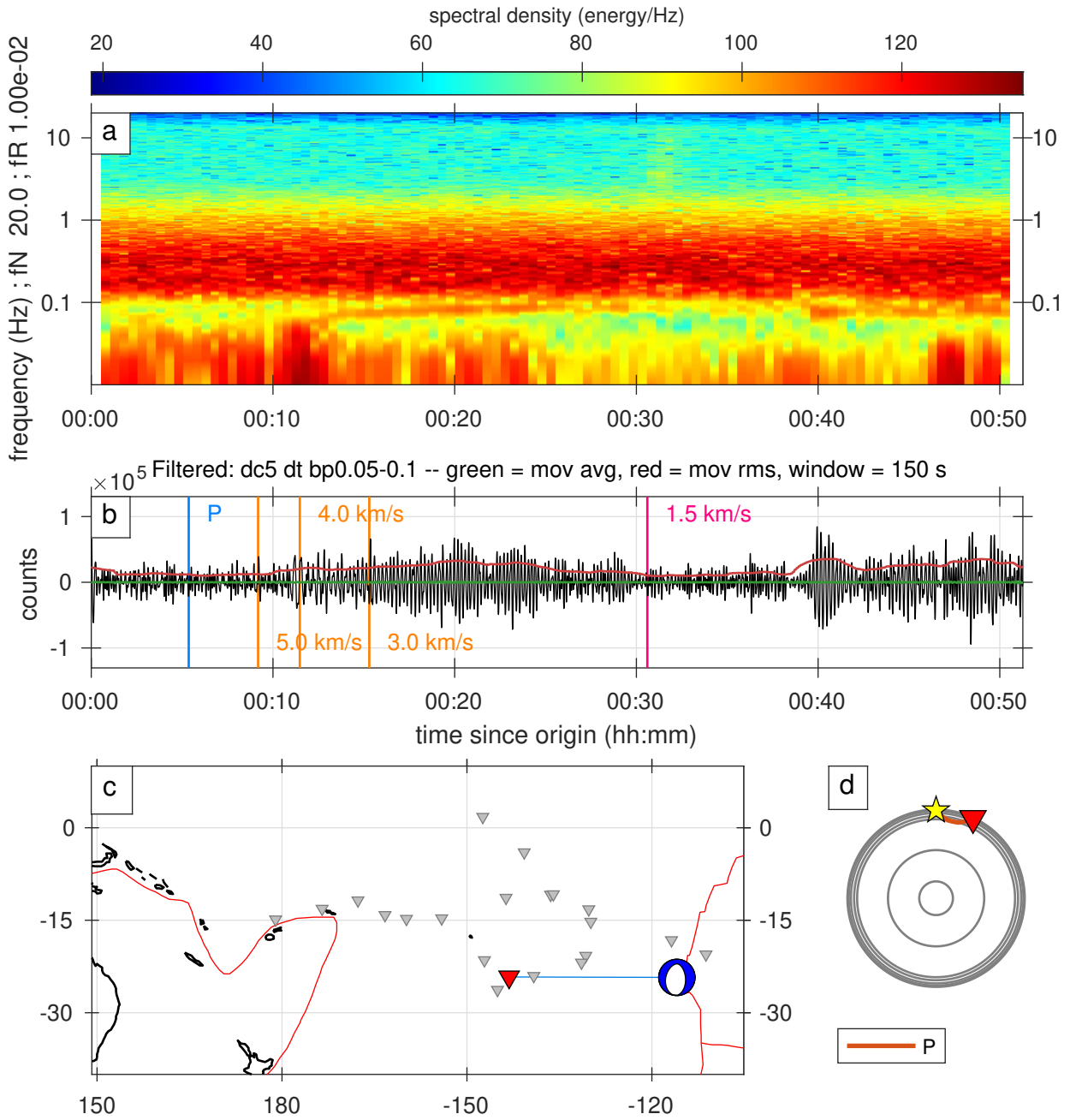


Figure S99. A full record of an earthquake classified as 2stars category.



Arrival: 2019-05-03T07:35:00.000000, ID: 11033154

Mww = 6.20, distance = 56.87 degrees, depth = 10.00 km  
 26.09 - 27.73 percent

spectral density (energy/Hz)

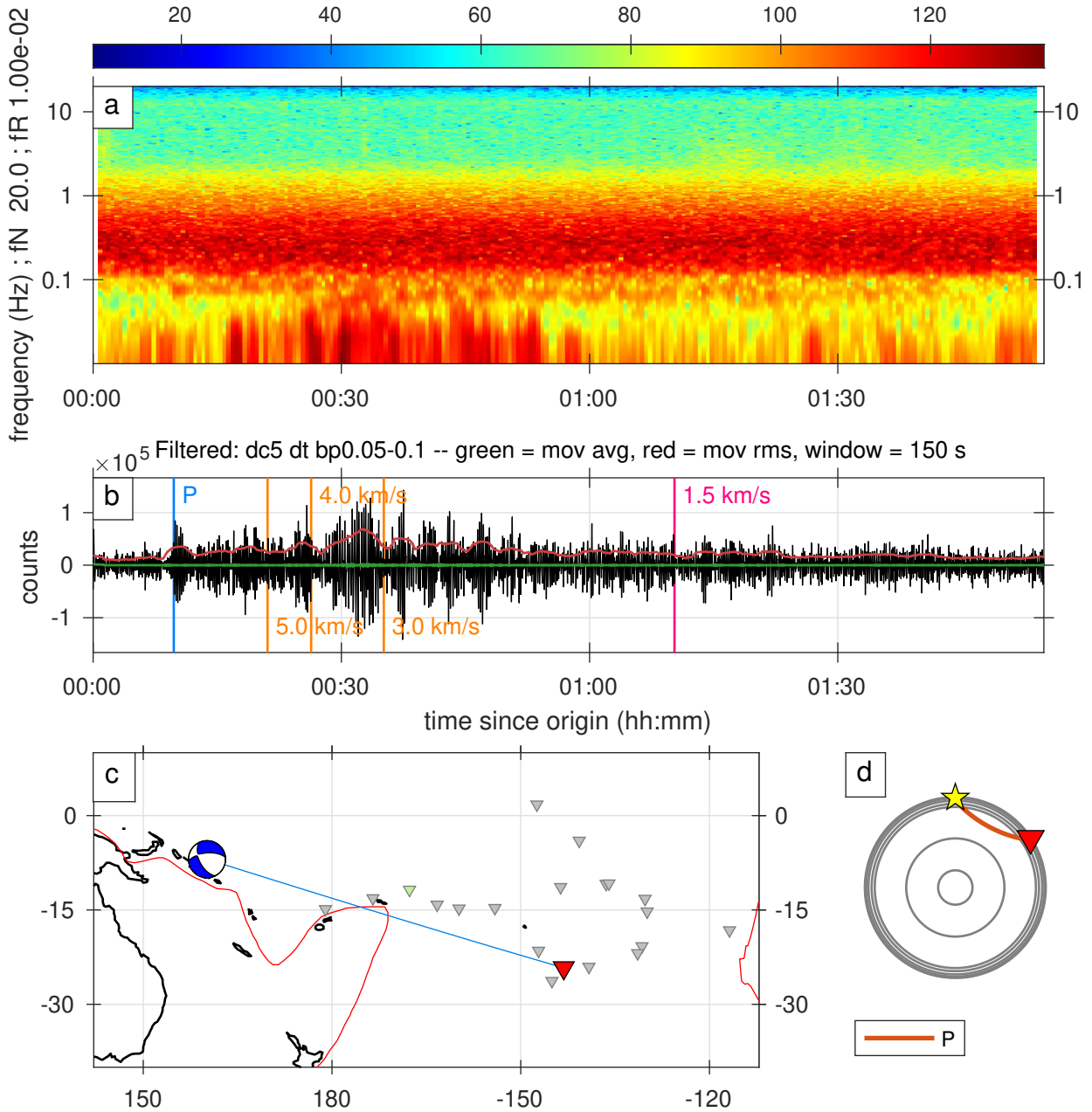


Figure S100. A full record of an earthquake classified as 2stars category.

Arrival: 2019-05-04T00:13:09.800537, ID: 11033418

Mww = 5.40, distance = 24.87 degrees, depth = 10.00 km  
 40.42 - 41.16 percent

spectral density (energy/Hz)

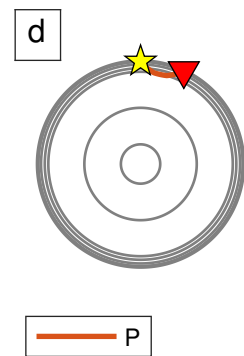
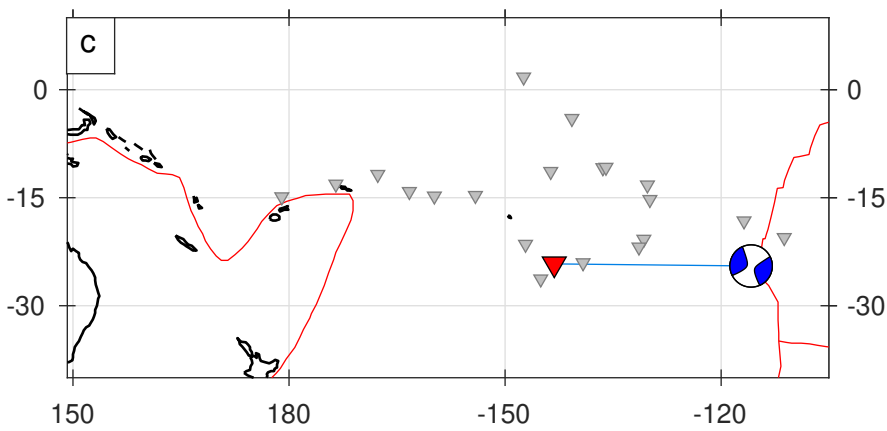
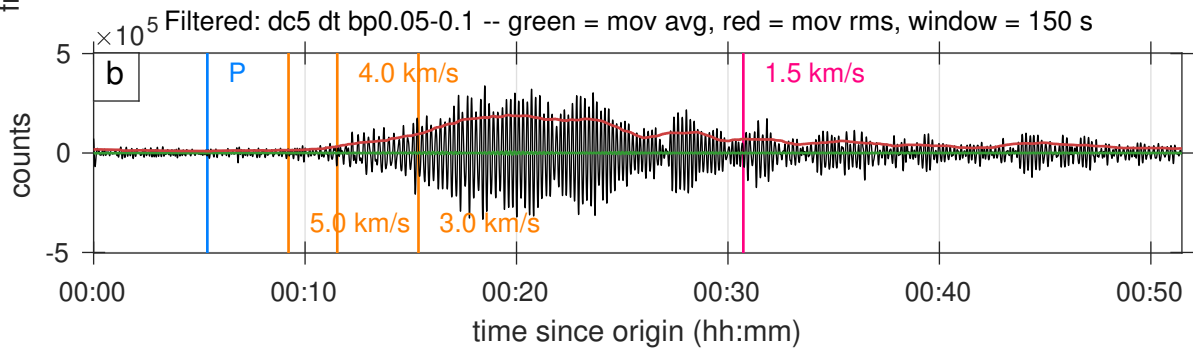
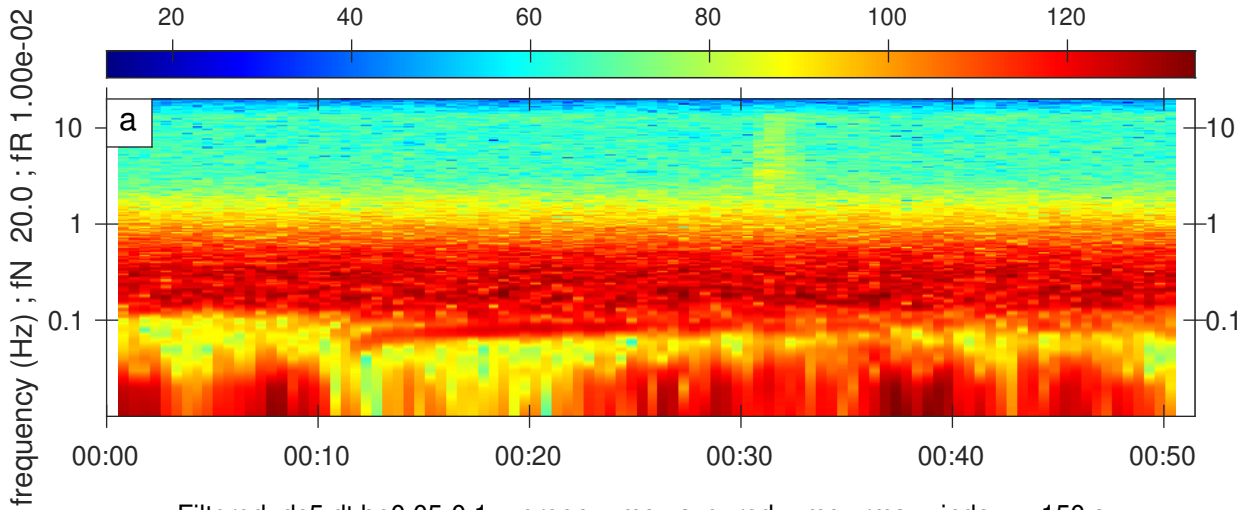


Figure S101. A full record of an earthquake classified as 2stars category.

Arrival: 2019-05-08T13:57:52.413588, ID: 11035010

Mww = 5.70, distance = 64.00 degrees, depth = 15.34 km  
34.10 - 38.27 percent

spectral density (energy/Hz)

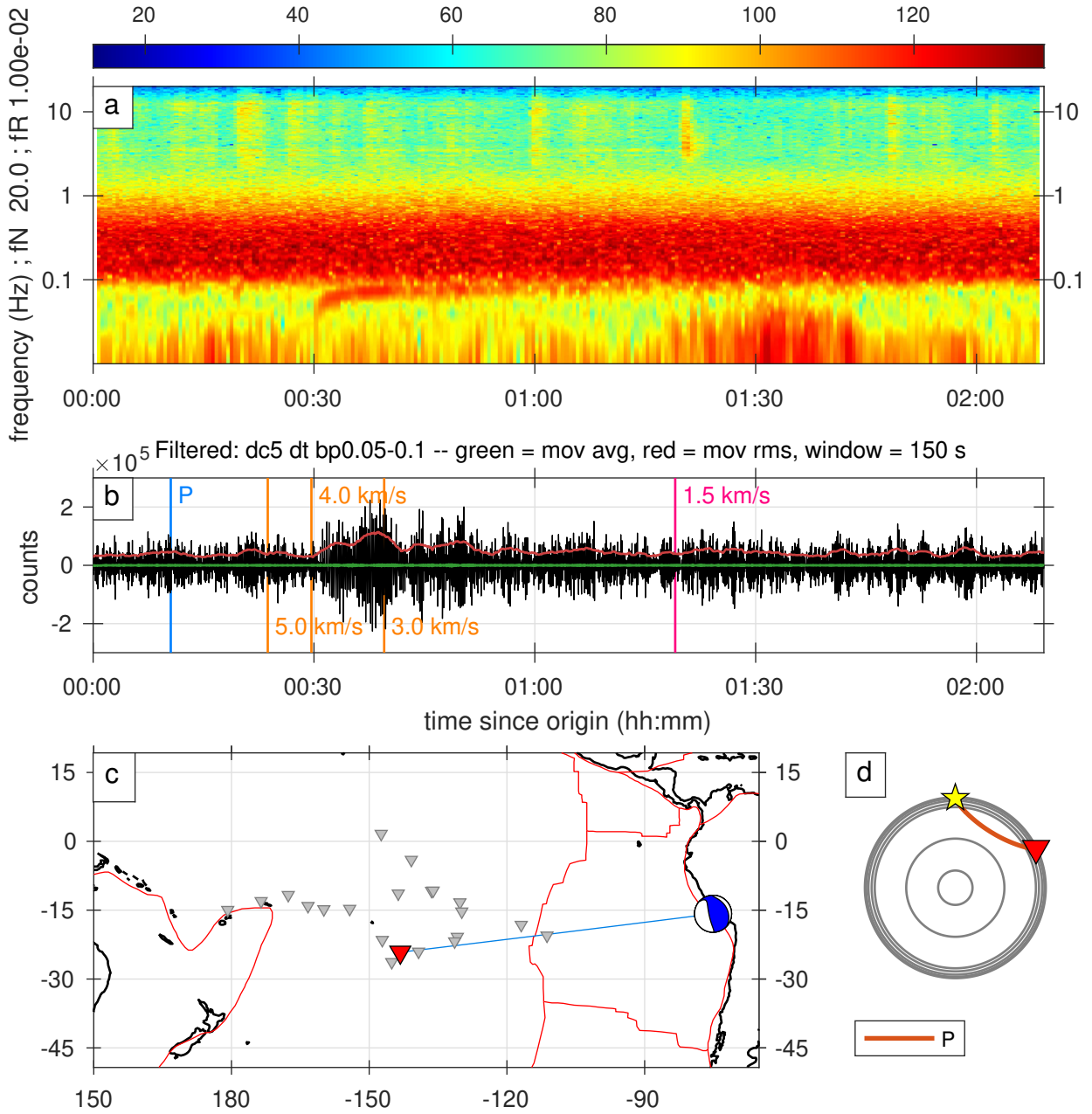


Figure S102. A full record of an earthquake classified as 2stars category.

Arrival: 2019-05-10T03:30:00.000000, ID: 11035792

Mww = 5.70, distance = 30.29 degrees, depth = 10.00 km  
 9.68 - 12.50 percent

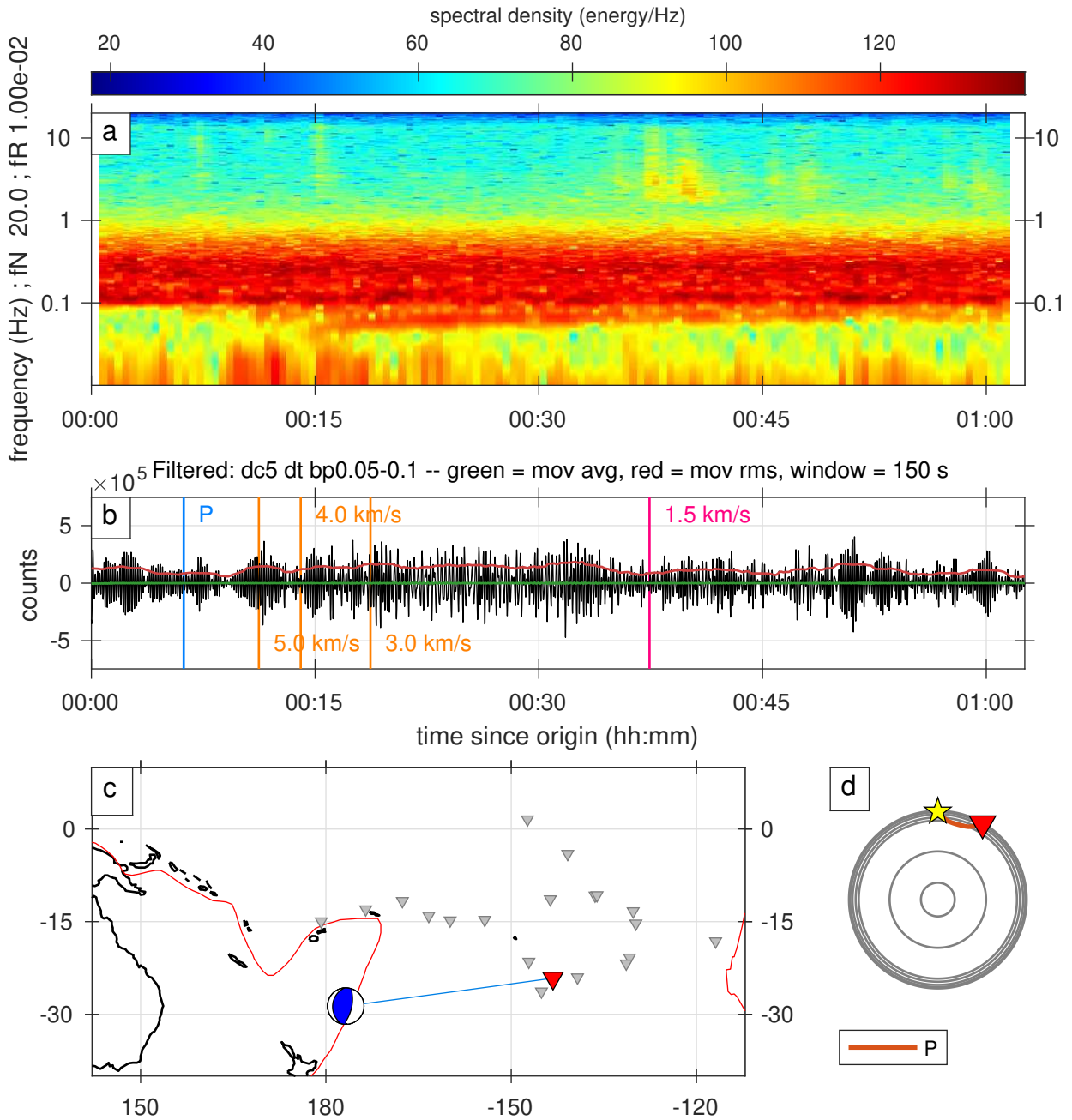


Figure S103. A full record of an earthquake classified as 2stars category.

Arrival: 2019-05-12T19:35:00.000000, ID: 11036537

Mww = 6.00, distance = 67.40 degrees, depth = 19.00 km  
 34.57 - 37.11 percent

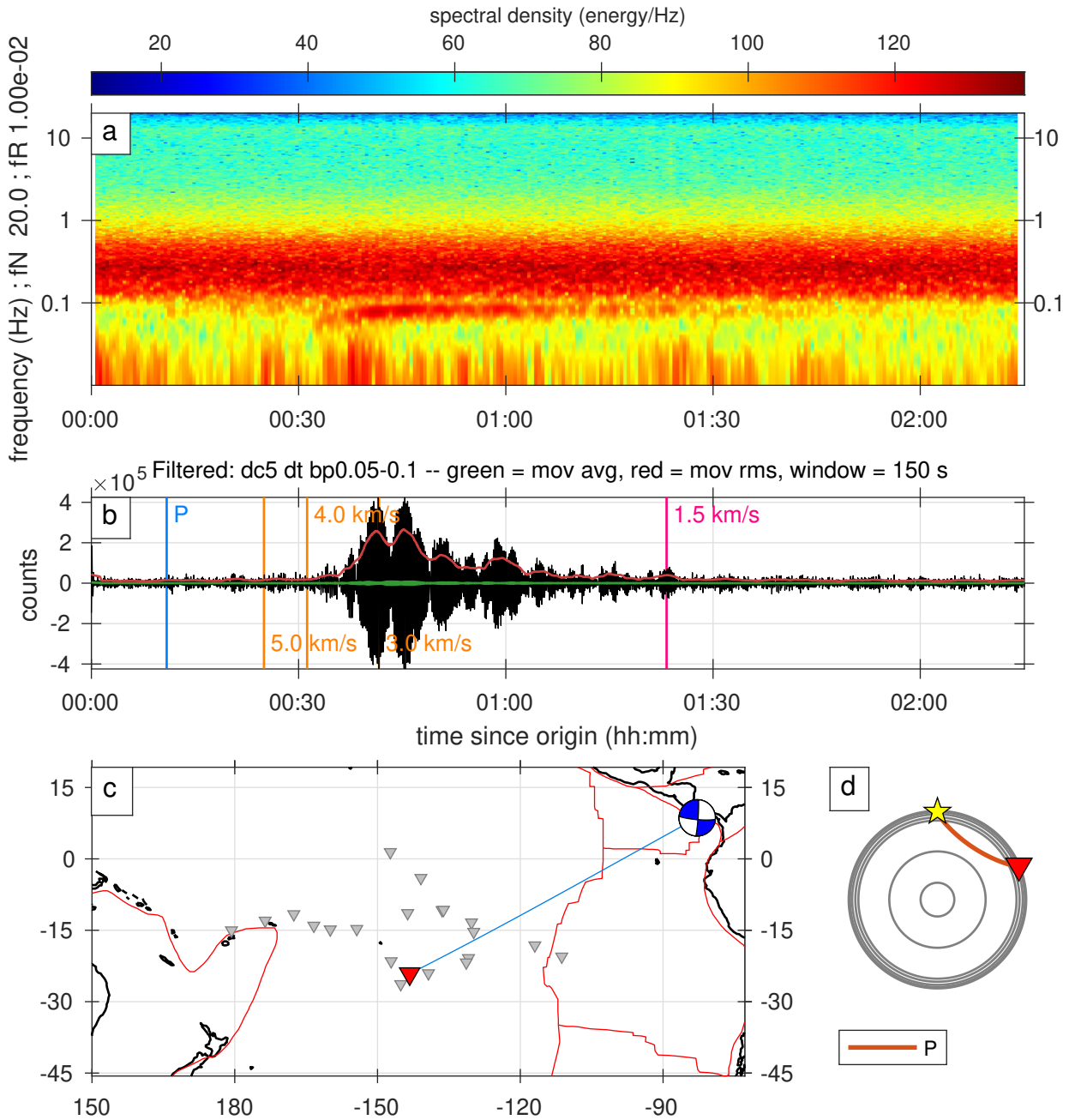


Figure S104. A full record of an earthquake classified as 2stars category.



Arrival: 2019-05-16T22:41:29.371620, ID: 11038220

mb = 4.80, distance = 64.07 degrees, depth = 10.00 km

86.87 - 100.00 percent

spectral density (energy/Hz)

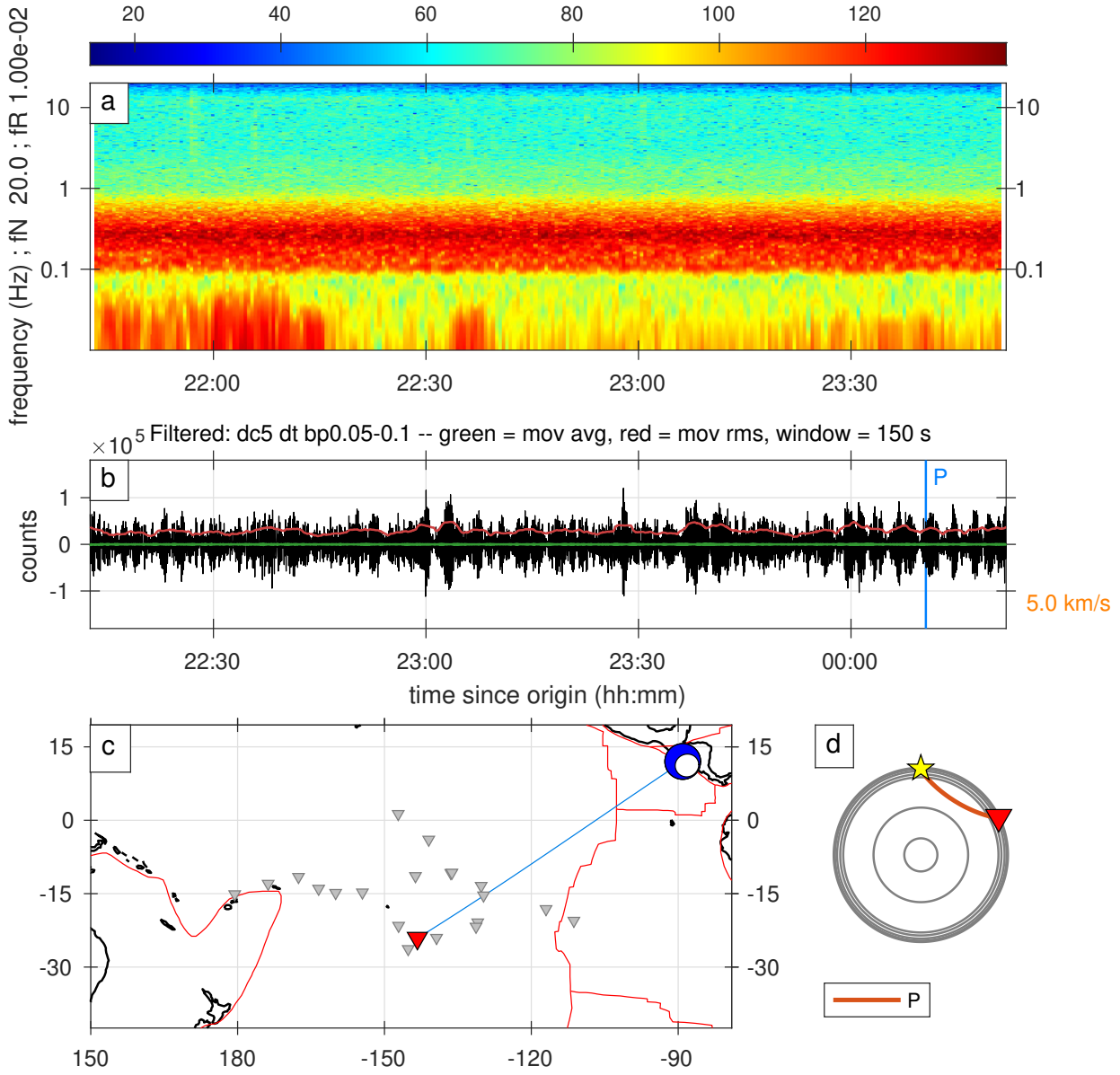


Figure S105. A full record of an earthquake classified as 2stars category.

Arrival: 2019-05-19T01:31:20.000000, ID: 11039010

mww = 6.30, distance = 43.10 degrees, depth = 20.00 km  
92.53 - 100.00 percent

spectral density (energy/Hz)

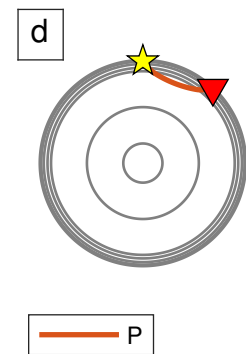
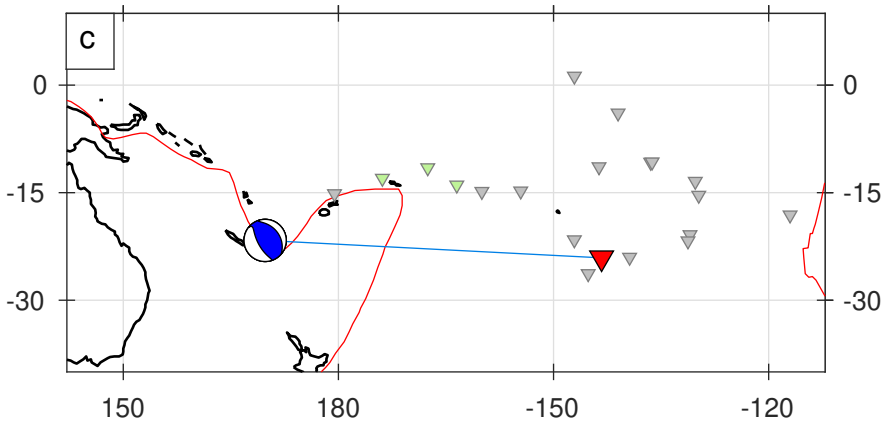
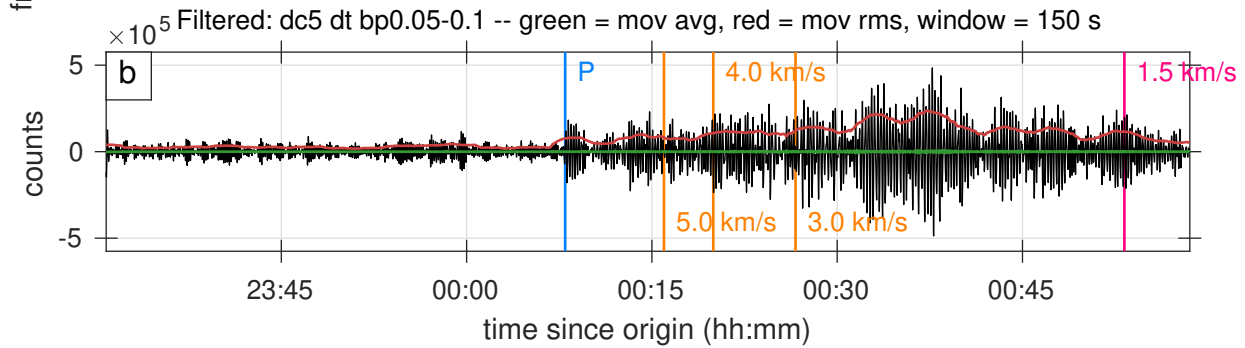
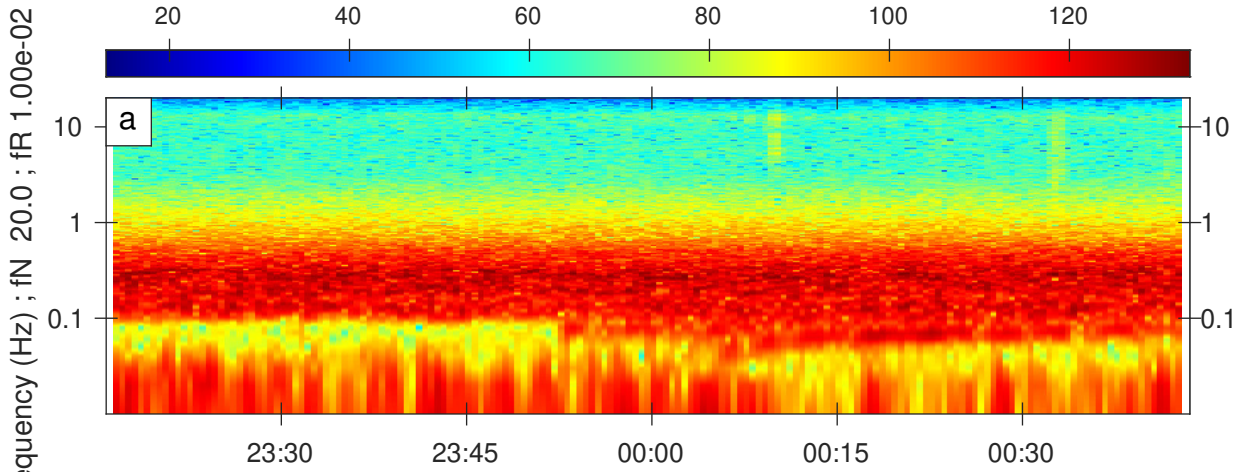


Figure S106. A full record of an earthquake classified as 2stars category.

Arrival: 2019-05-19T14:35:00.000000, ID: 11039134

Mww = 6.00, distance = 43.27 degrees, depth = 19.95 km  
13.68 - 15.44 percent

spectral density (energy/Hz)

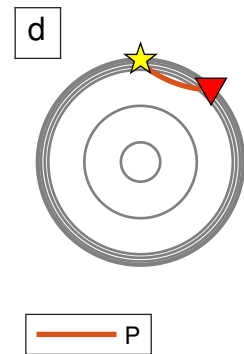
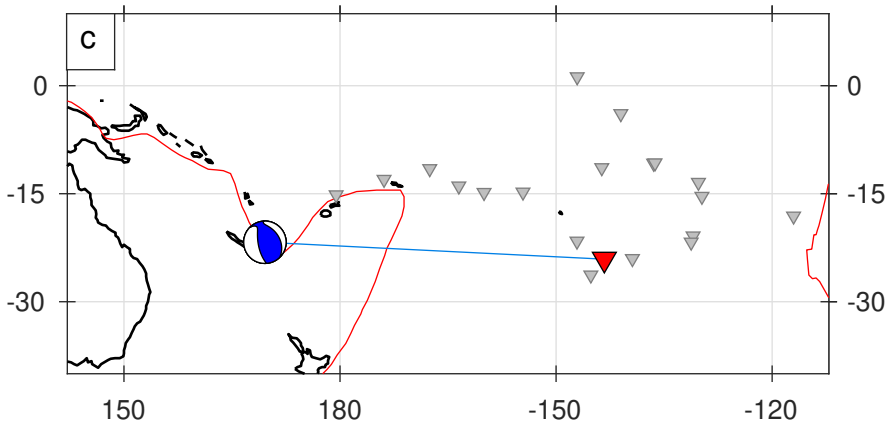
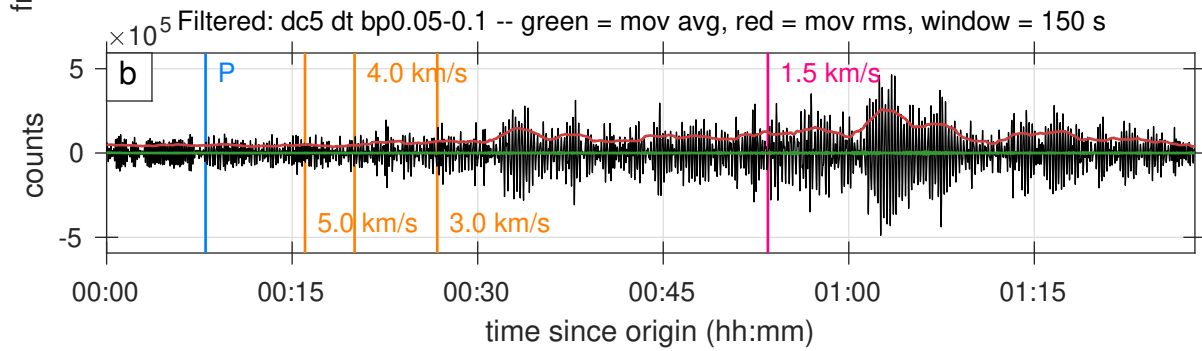
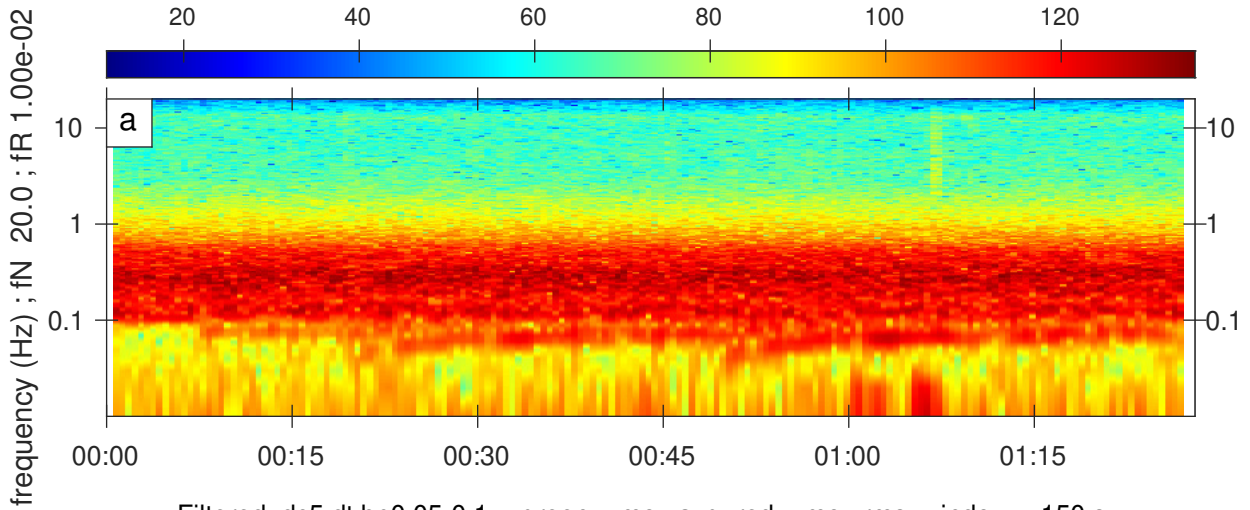


Figure S107. A full record of an earthquake classified as 2stars category.



Arrival: 2019-05-19T15:04:51.751033, ID: 11039137

mww = 6.30, distance = 43.39 degrees, depth = 20.00 km  
14.27 - 16.05 percent

spectral density (energy/Hz)

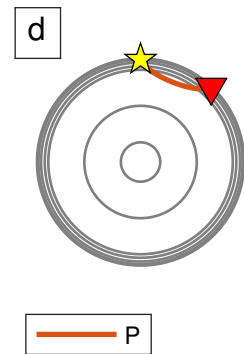
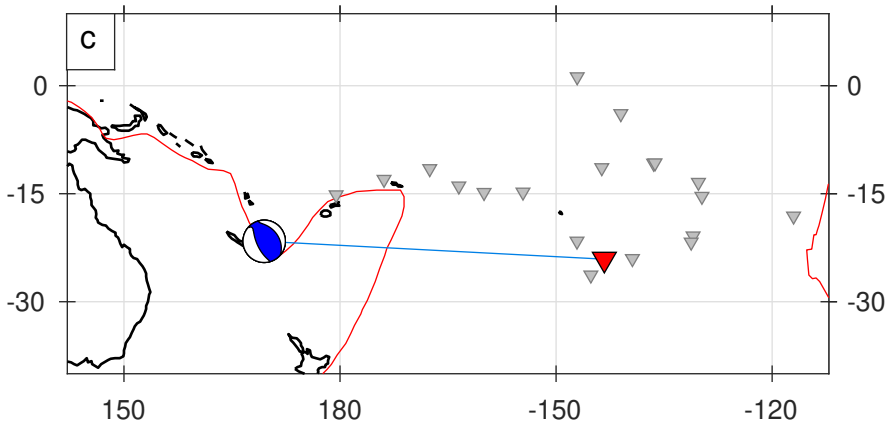
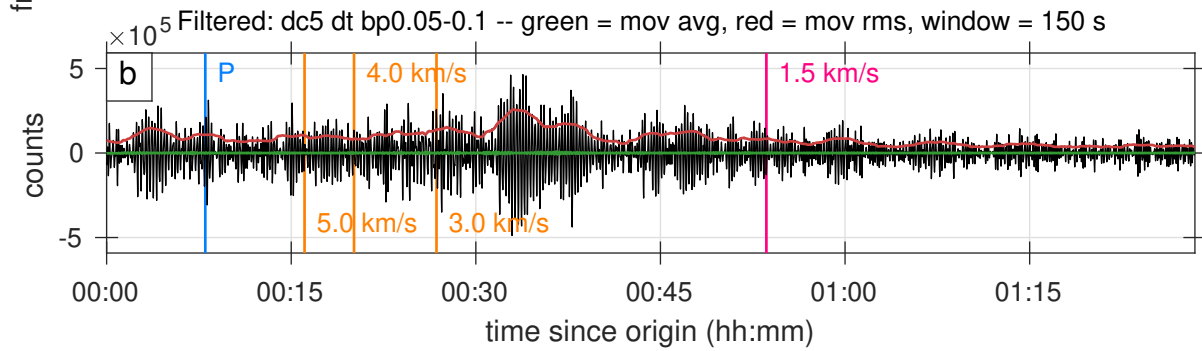
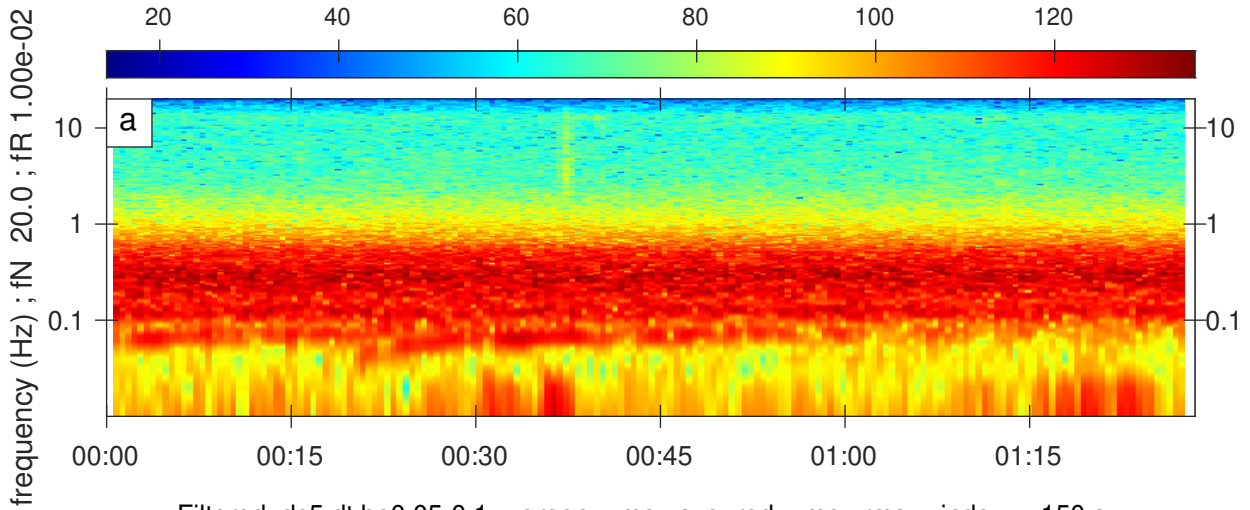


Figure S108. A full record of an earthquake classified as 2stars category.

Arrival: 2019-05-30T15:43:55.899351, ID: 11042571

Mww = 6.00, distance = 30.30 degrees, depth = 177.85 km

50.34 - 51.03 percent

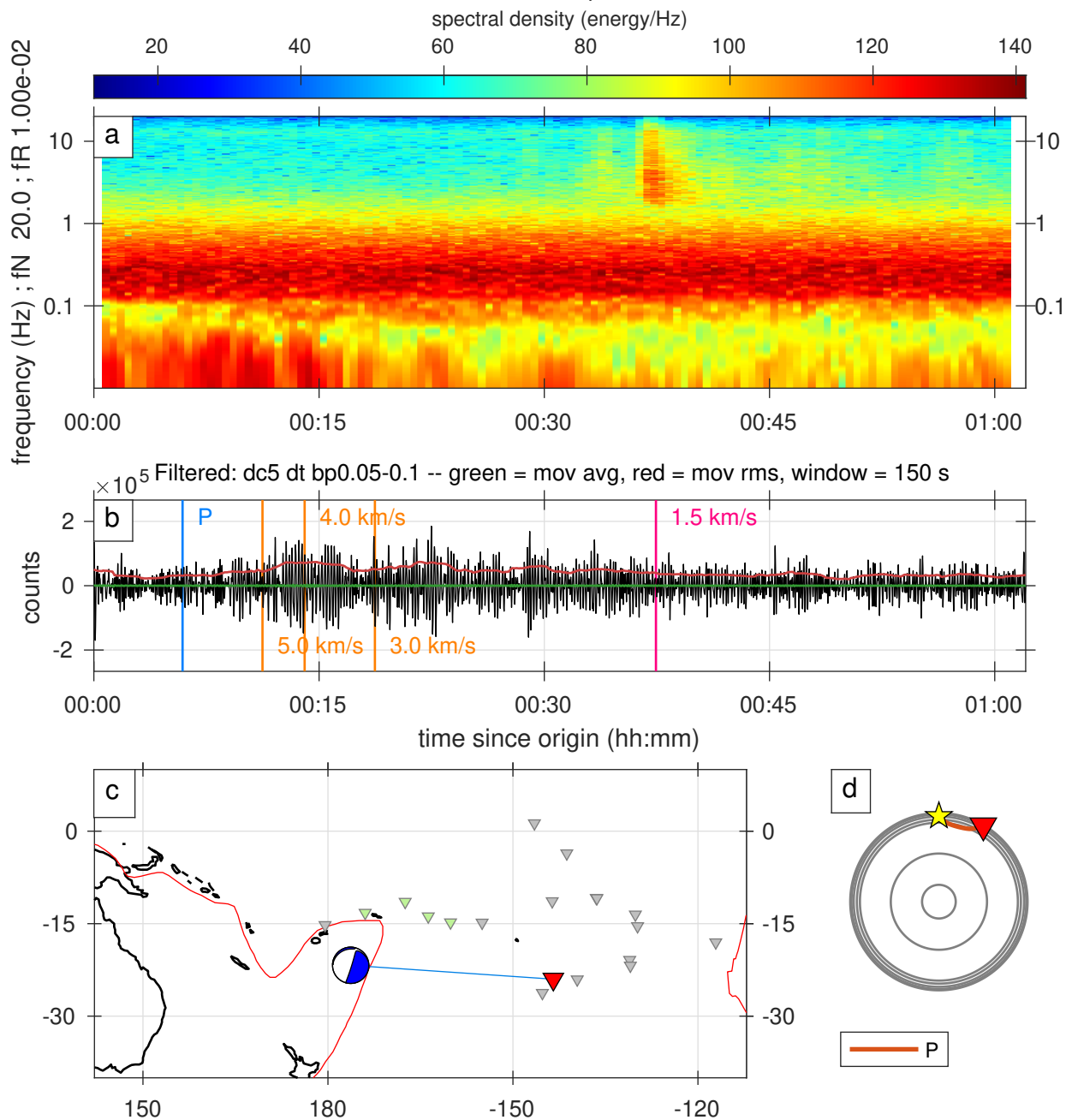


Figure S109. A full record of an earthquake classified as 2stars category.

Arrival: 2019-06-14T04:00:00.000000, ID: 11048737

Mww = 5.40, distance = 28.24 degrees, depth = 10.00 km  
33.99 - 35.46 percent

spectral density (energy/Hz)

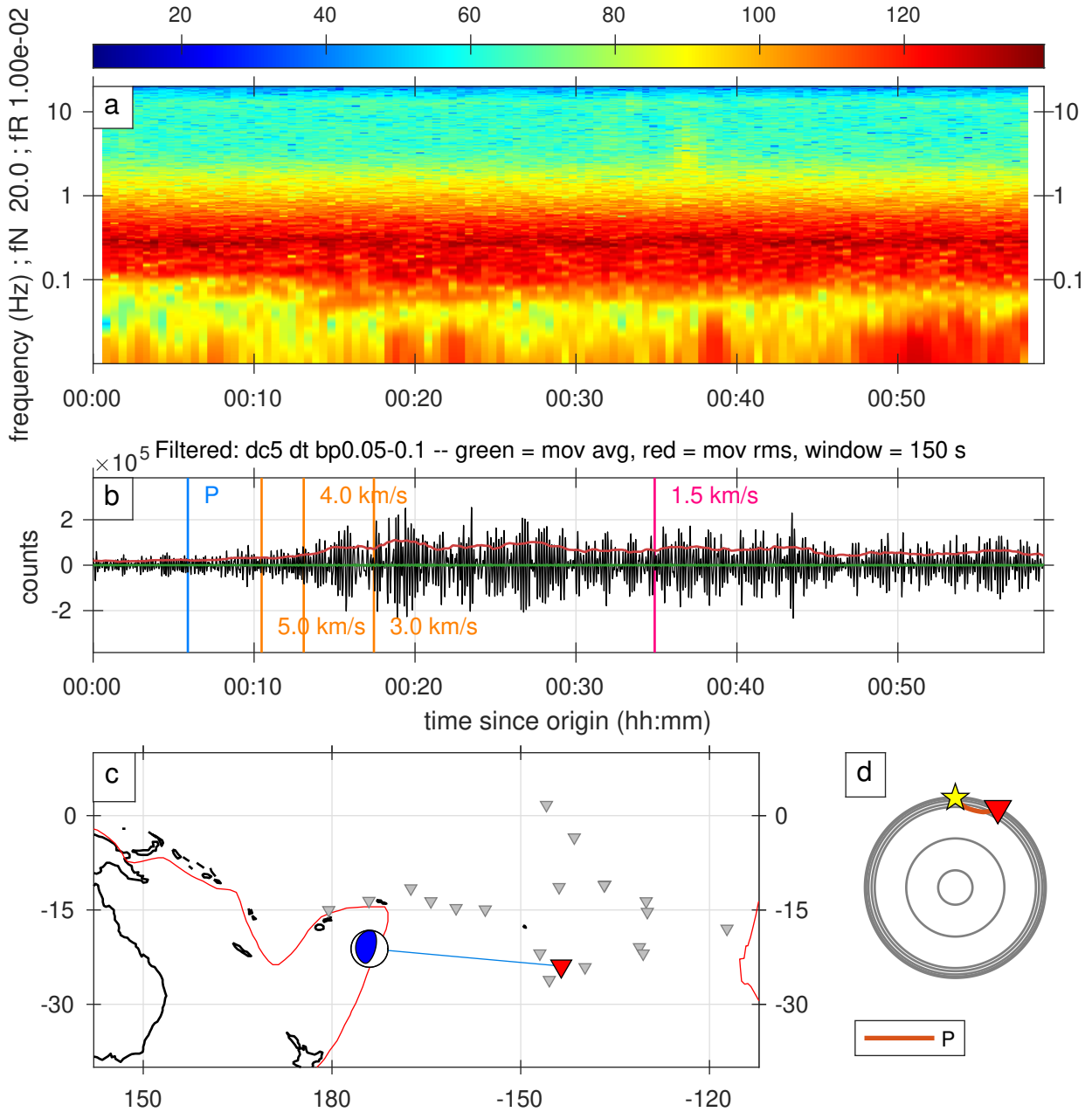
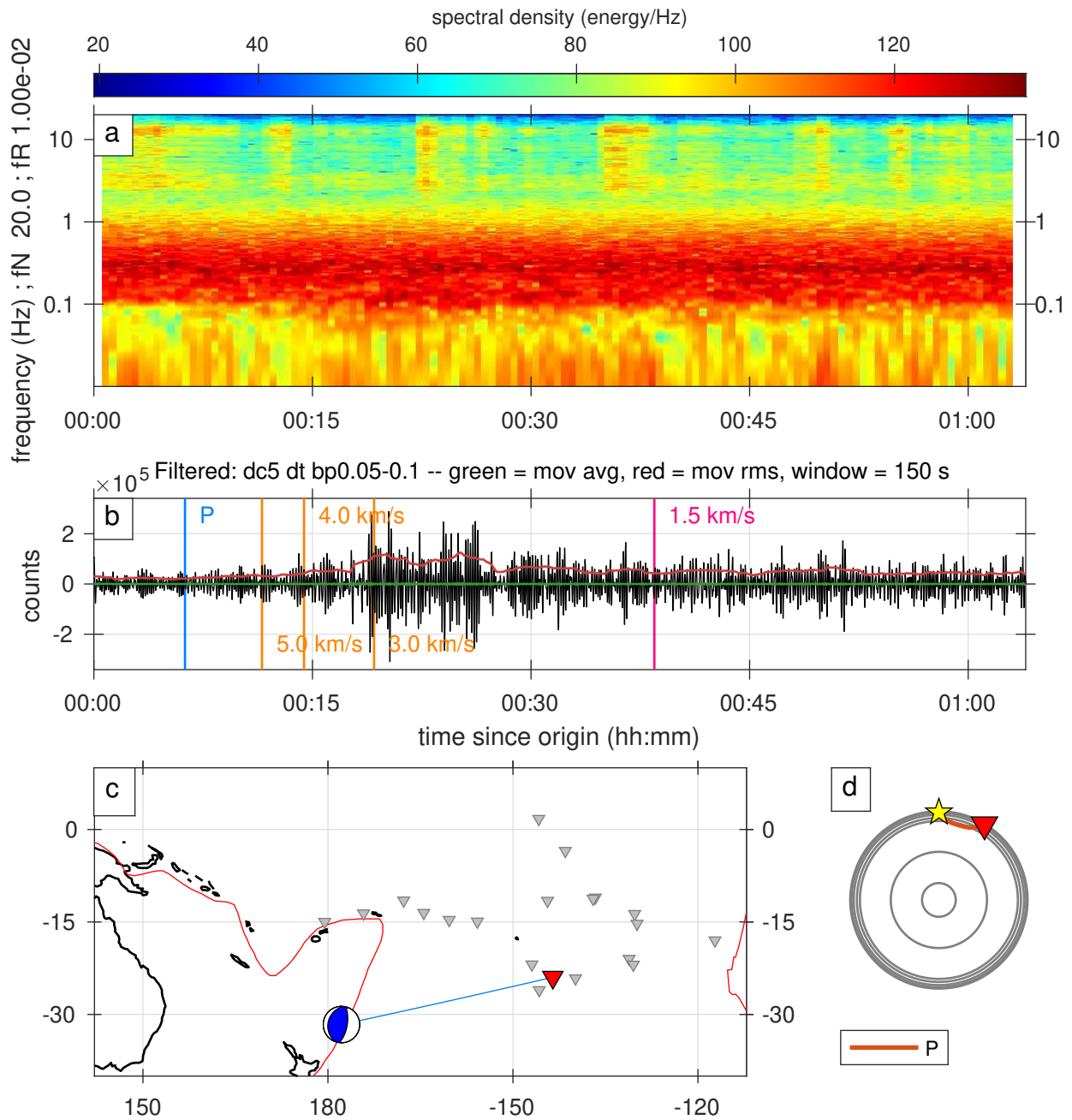


Figure S110. A full record of an earthquake classified as 2stars category.

Arrival: 2019-06-16T21:04:41.224833, ID: 11049804

Mww = 5.60, distance = 31.13 degrees, depth = 35.00 km  
18.88 - 19.84 percent



Arrival: 2019-06-17T16:59:10.000000, ID: 11050099

Mww = 5.50, distance = 30.79 degrees, depth = 17.41 km  
36.71 - 37.65 percent

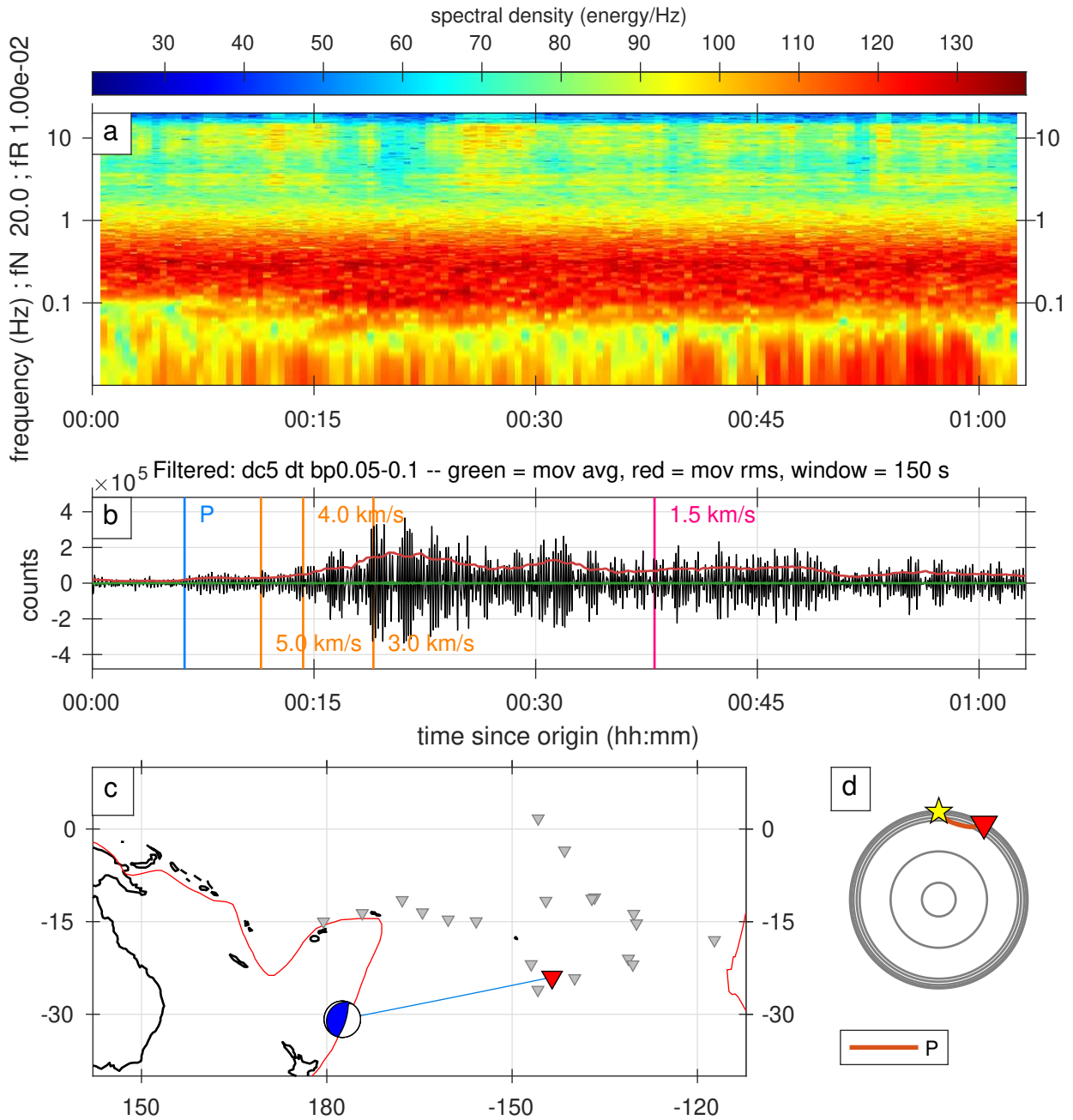


Figure S112. A full record of an earthquake classified as 2stars category.

Arrival: 2019-06-18T13:35:45.000000, ID: 11050447

Mww = 6.40, distance = 95.36 degrees, depth = 12.00 km  
55.05 - 57.88 percent

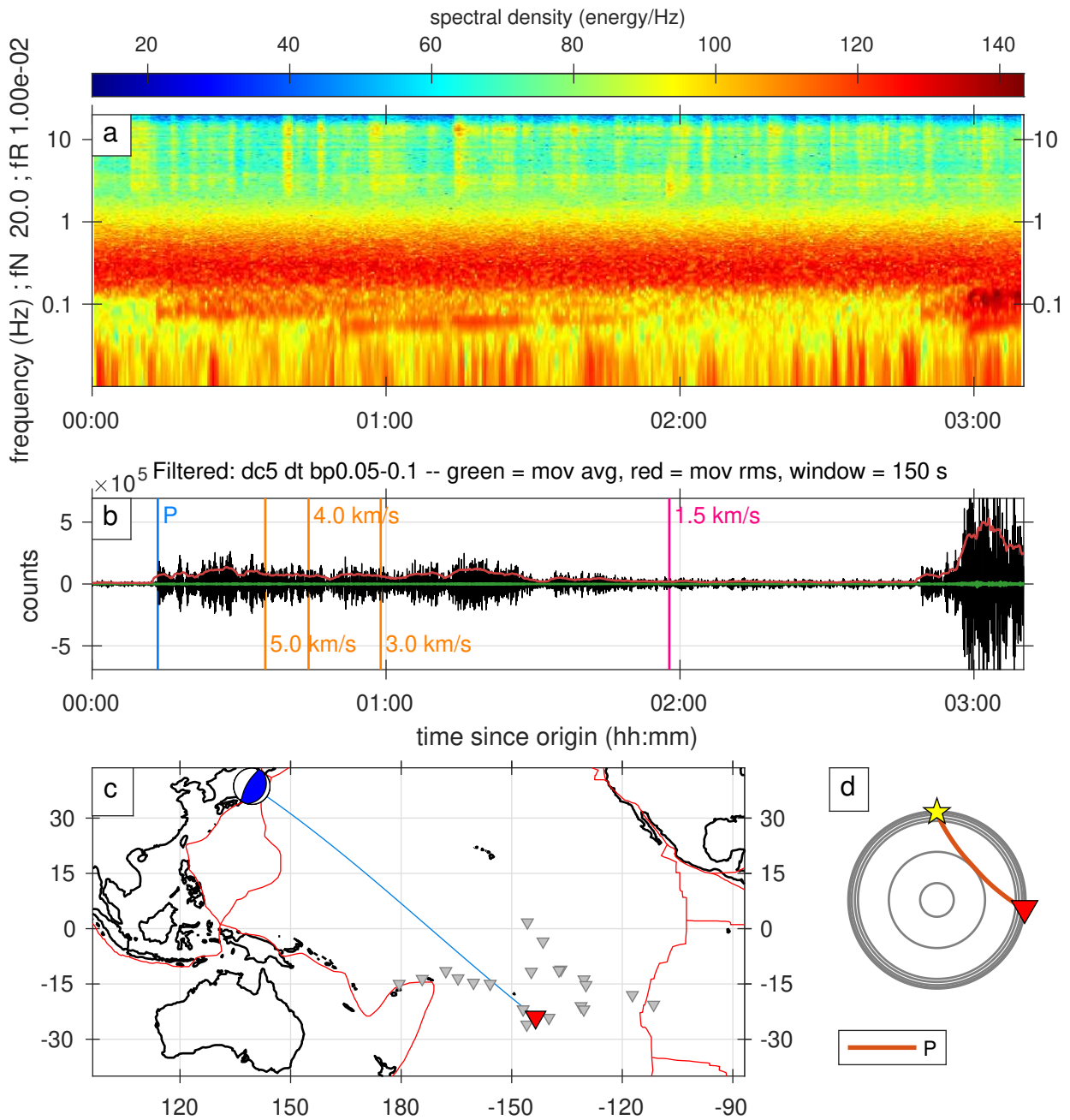


Figure S113. A full record of an earthquake classified as 2stars category.



Arrival: 2019-06-19T23:21:40.000000, ID: 11051149

Mww = 4.90, distance = 67.86 degrees, depth = 108.03 km  
85.19 - 87.35 percent

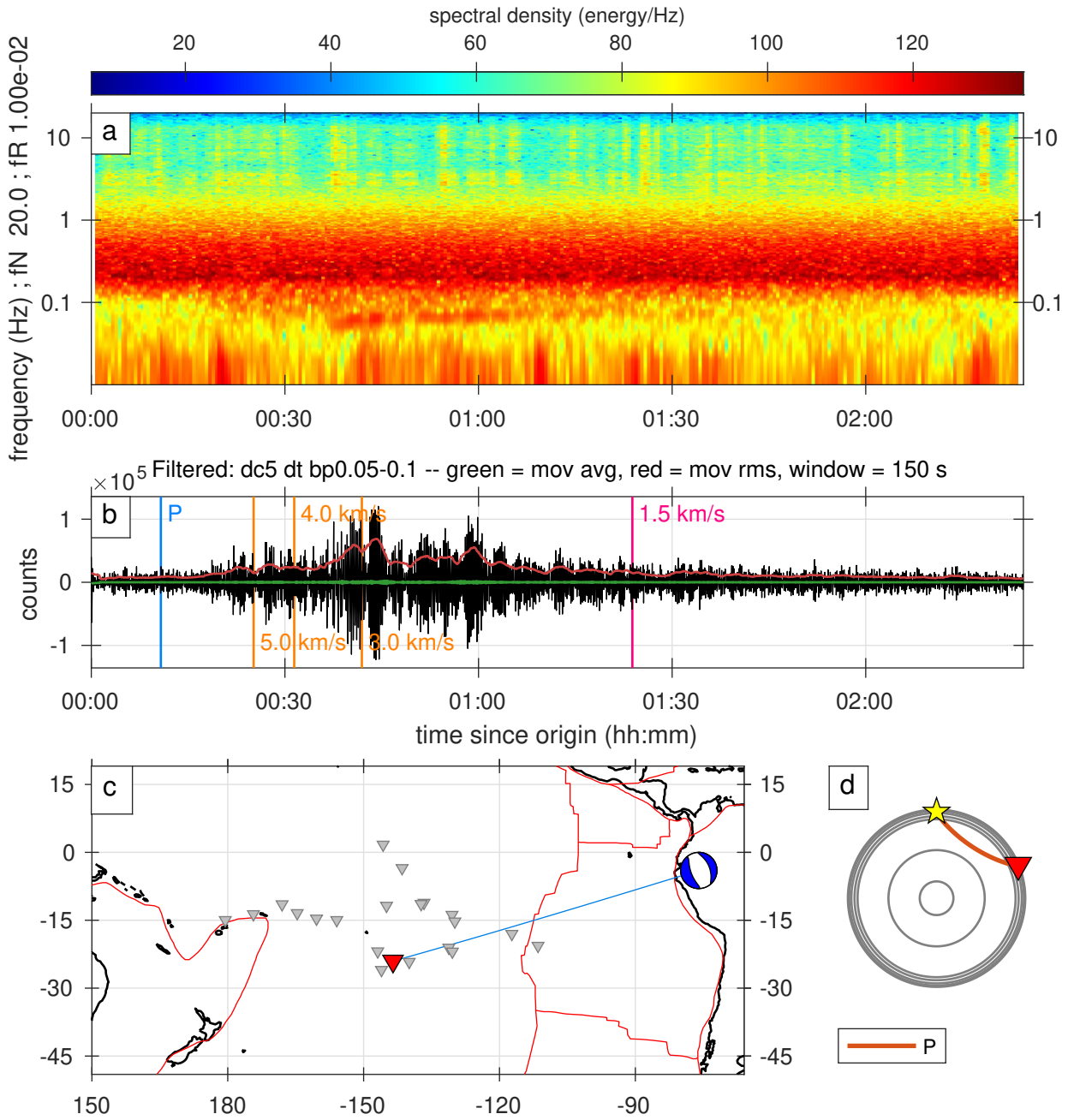


Figure S114. A full record of an earthquake classified as 2stars category.

Arrival: 2019-06-19T23:21:40.000000, ID: 11051151

Mww = 5.70, distance = 48.75 degrees, depth = 10.00 km

85.37 - 86.82 percent

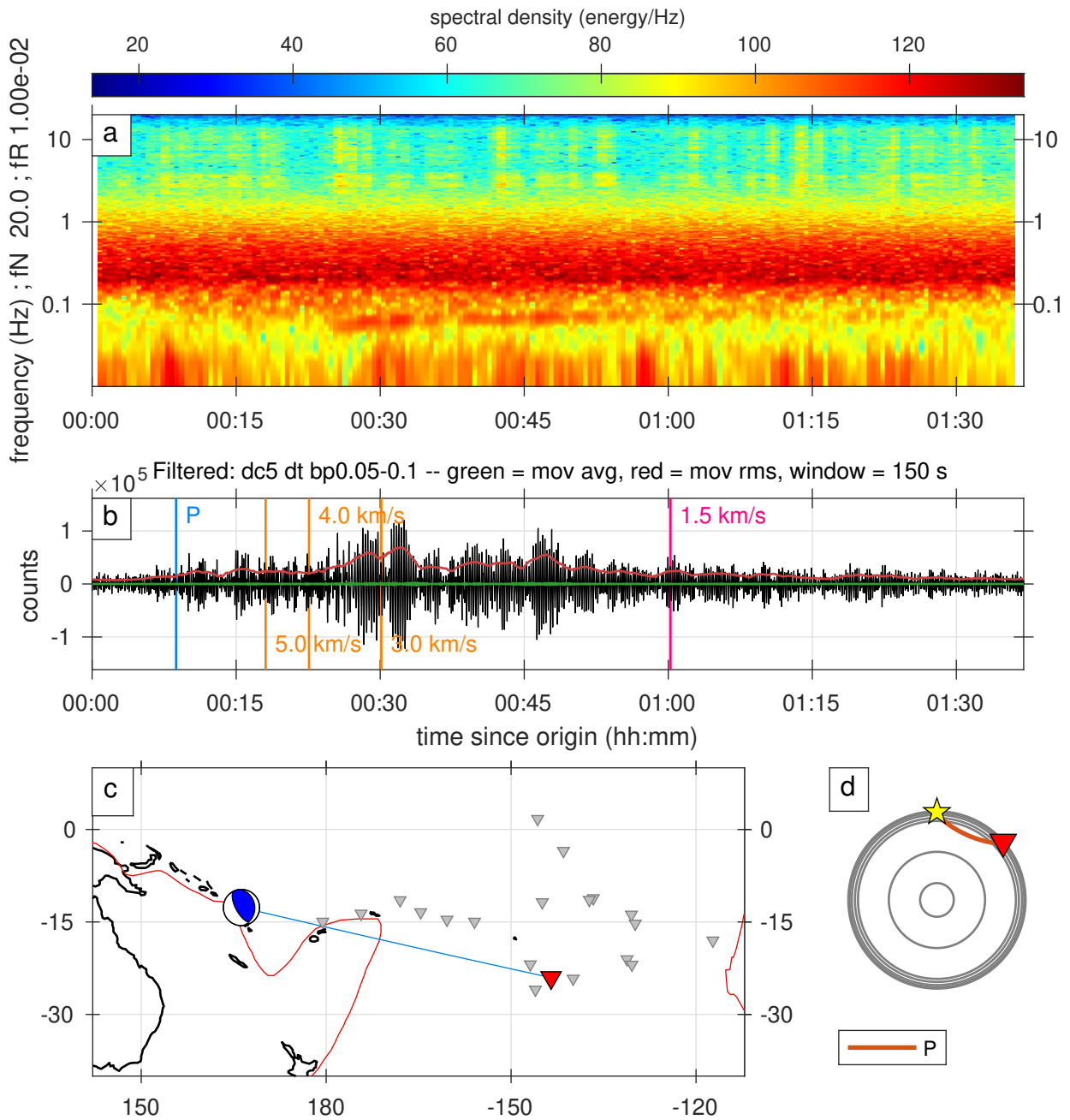


Figure S115. A full record of an earthquake classified as 2stars category.



Arrival: 2019-06-26T02:31:15.000000, ID: 11053269

Mww = 6.30, distance = 91.60 degrees, depth = 10.00 km  
 3.36 - 6.57 percent

spectral density (energy/Hz)

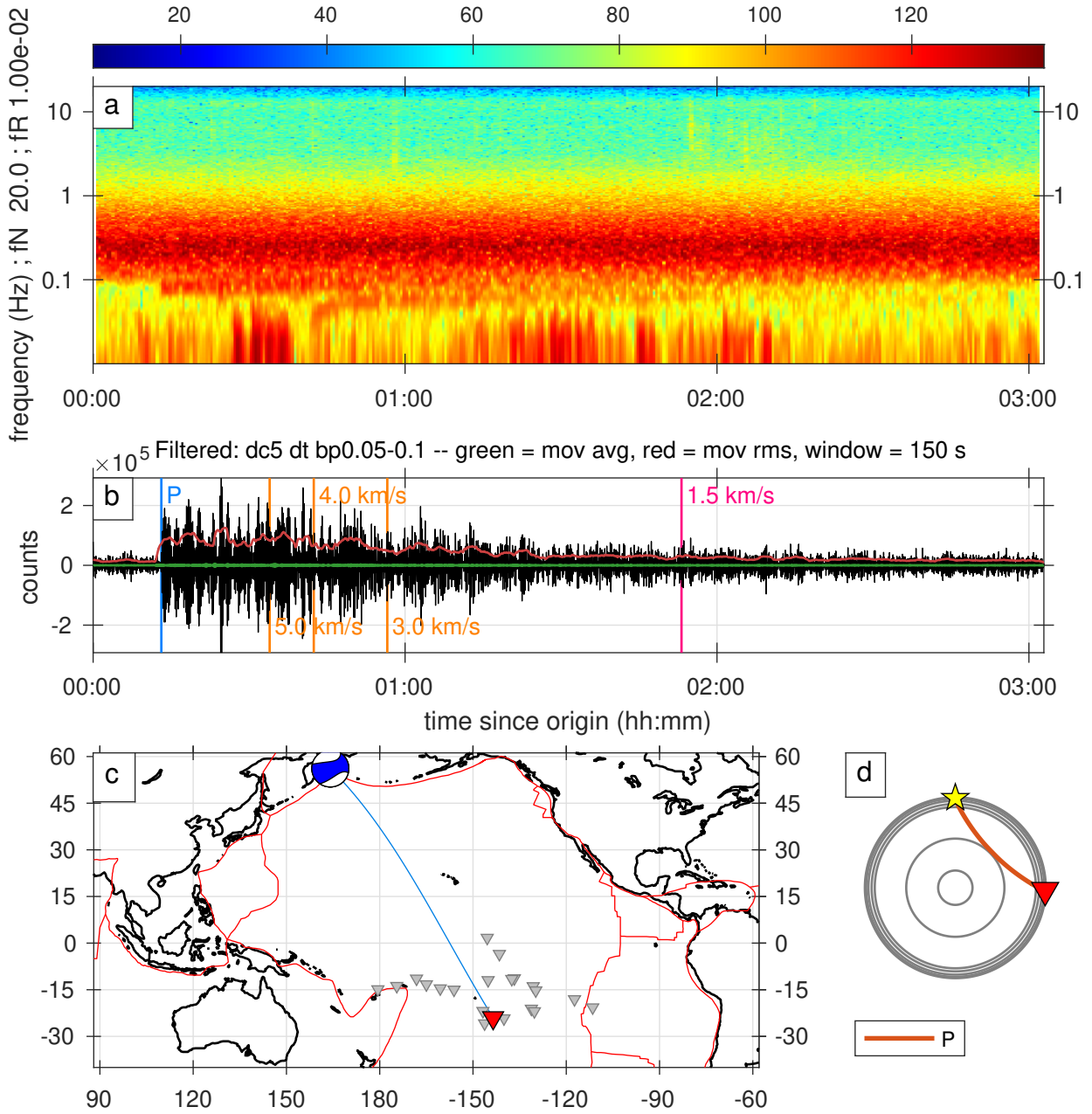


Figure S116. A full record of an earthquake classified as 2stars category.

Arrival: 2019-06-26T18:14:00.000000, ID: 11053541

Mww = 5.30, distance = 30.65 degrees, depth = 10.00 km  
20.03 - 21.16 percent

spectral density (energy/Hz)

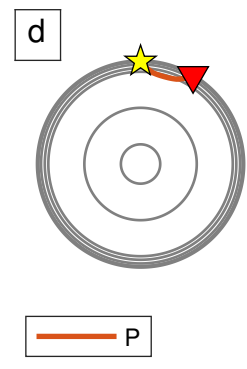
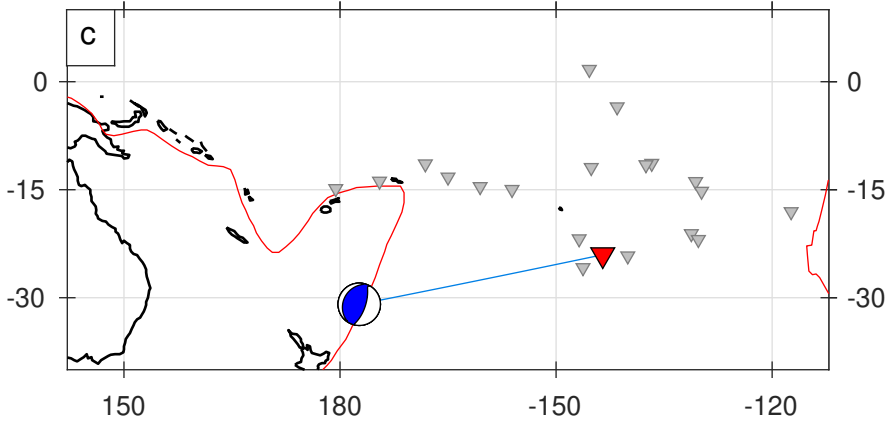
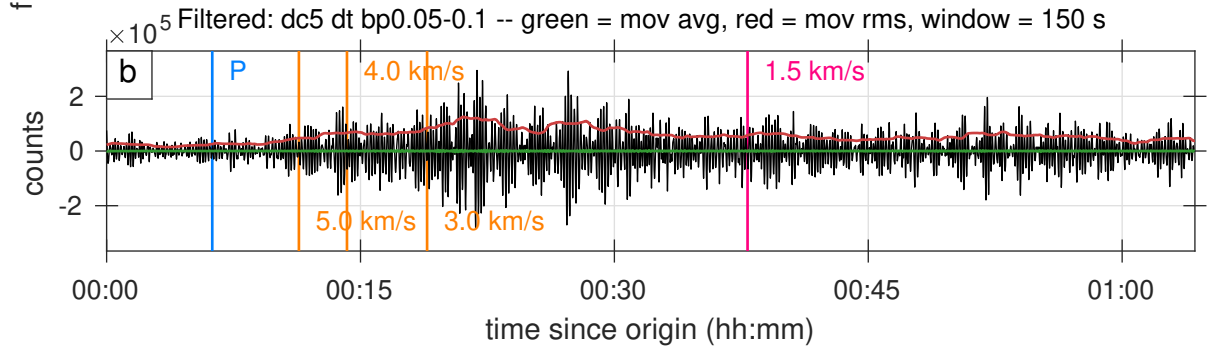
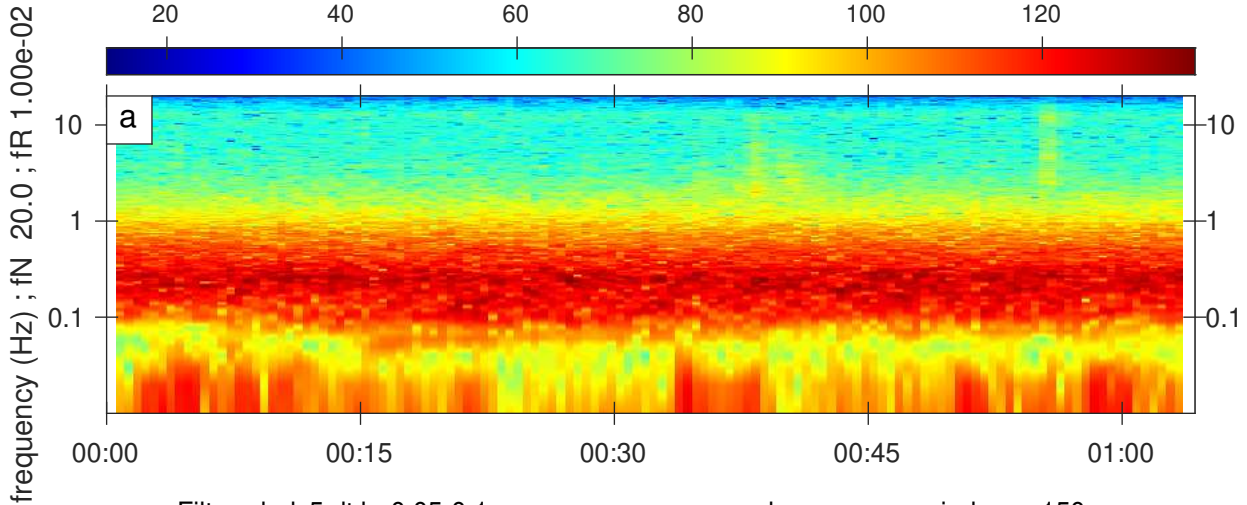


Figure S117. A full record of an earthquake classified as 2stars category.

Arrival: 2019-07-01T17:22:00.000000, ID: 11055406

Mww = 6.00, distance = 46.62 degrees, depth = 97.09 km  
 19.71 - 22.29 percent

spectral density (energy/Hz)

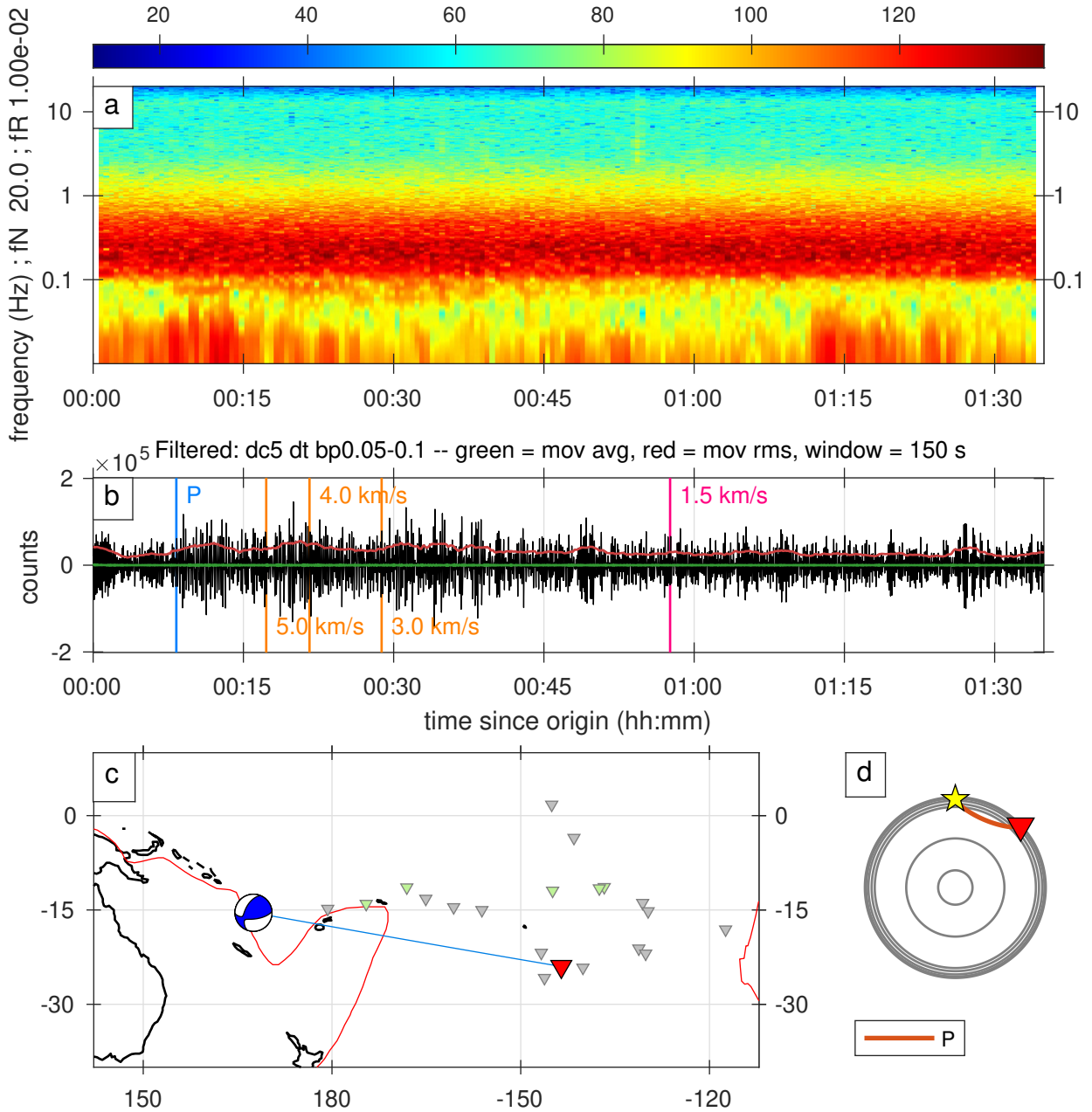


Figure S118. A full record of an earthquake classified as 2stars category.

Arrival: 2019-07-02T04:15:00.000000, ID: 11055619

mb = 5.20, distance = 29.04 degrees, depth = 10.00 km  
37.45 - 39.12 percent

spectral density (energy/Hz)

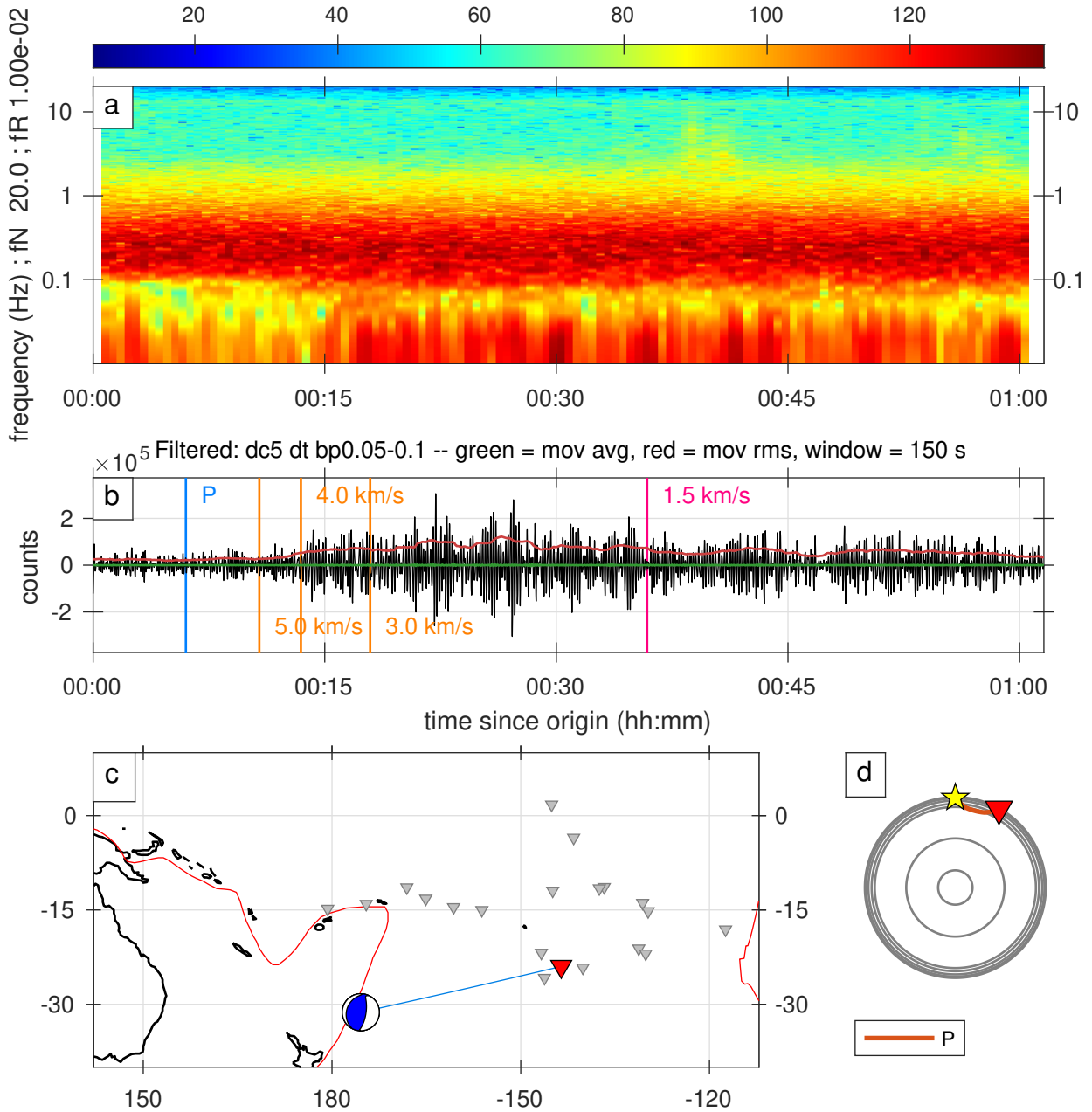


Figure S119. A full record of an earthquake classified as 2stars category.

Arrival: 2019-07-04T04:42:31.944878, ID: 11056637

Mww = 6.20, distance = 76.06 degrees, depth = 10.00 km  
44.18 - 90.52 percent

spectral density (energy/Hz)

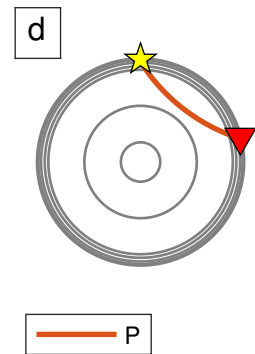
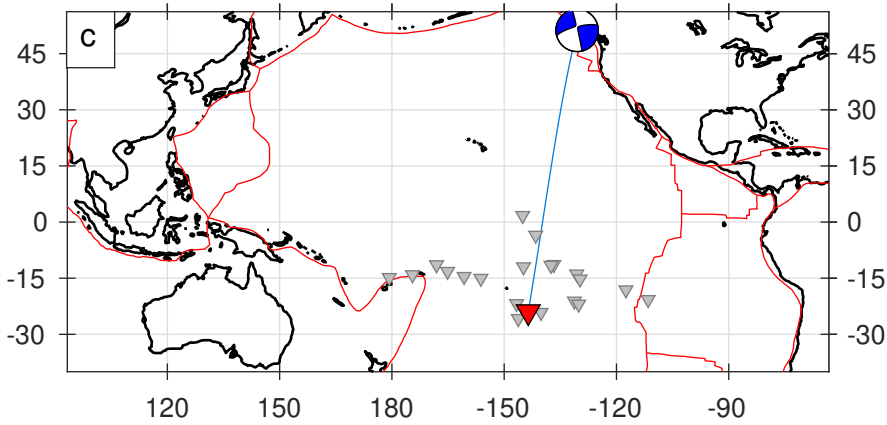
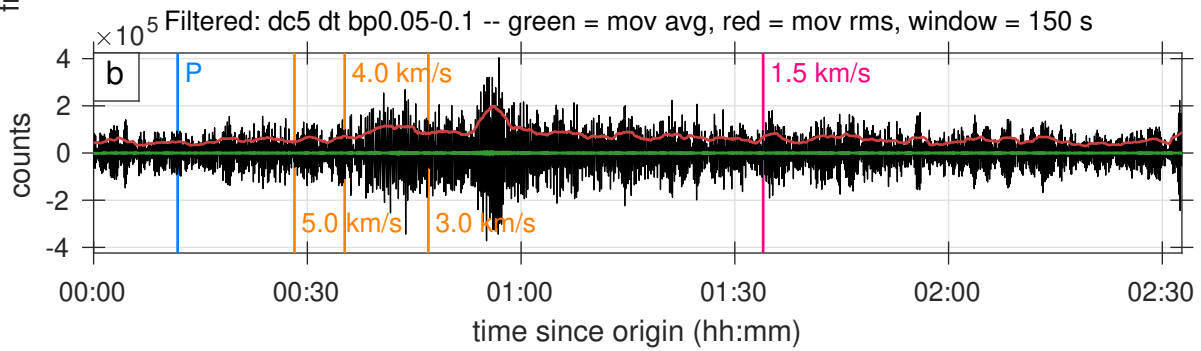
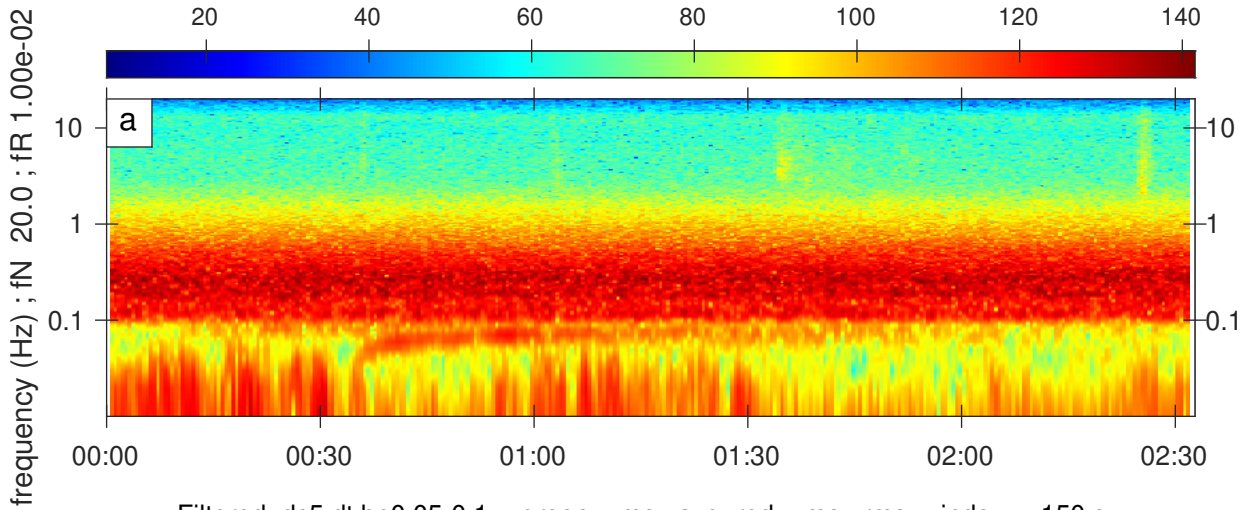


Figure S120. A full record of an earthquake classified as 2stars category.



Arrival: 2019-07-07T15:21:50.000000, ID: 11061463

Mww = 6.90, distance = 90.41 degrees, depth = 35.00 km  
50.28 - 61.29 percent

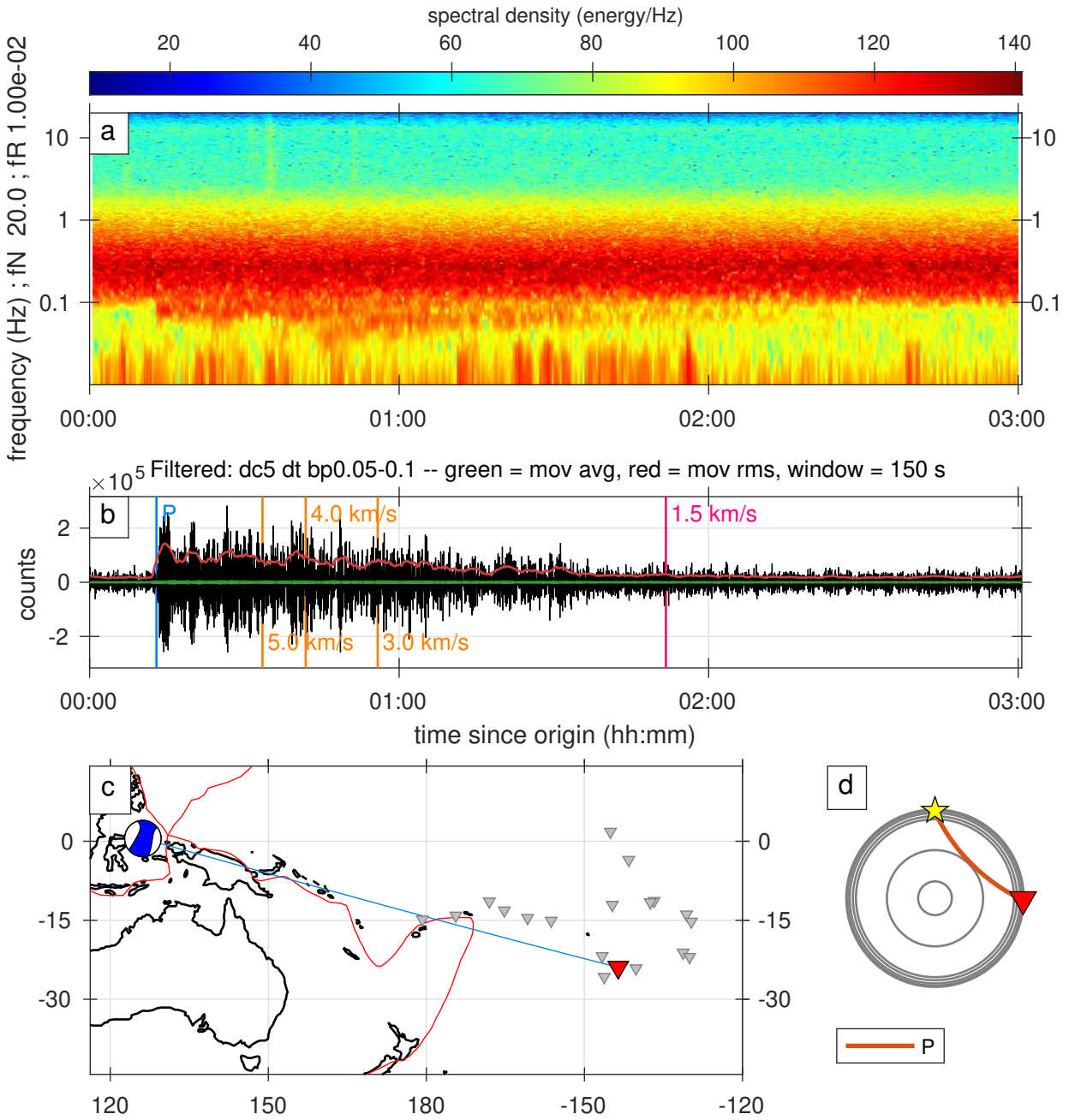


Figure S121. A full record of an earthquake classified as 2stars category.

Arrival: 2019-07-13T08:06:09.843279, ID: 11072684

Mww = 5.80, distance = 33.13 degrees, depth = 10.00 km  
 20.42 - 21.46 percent

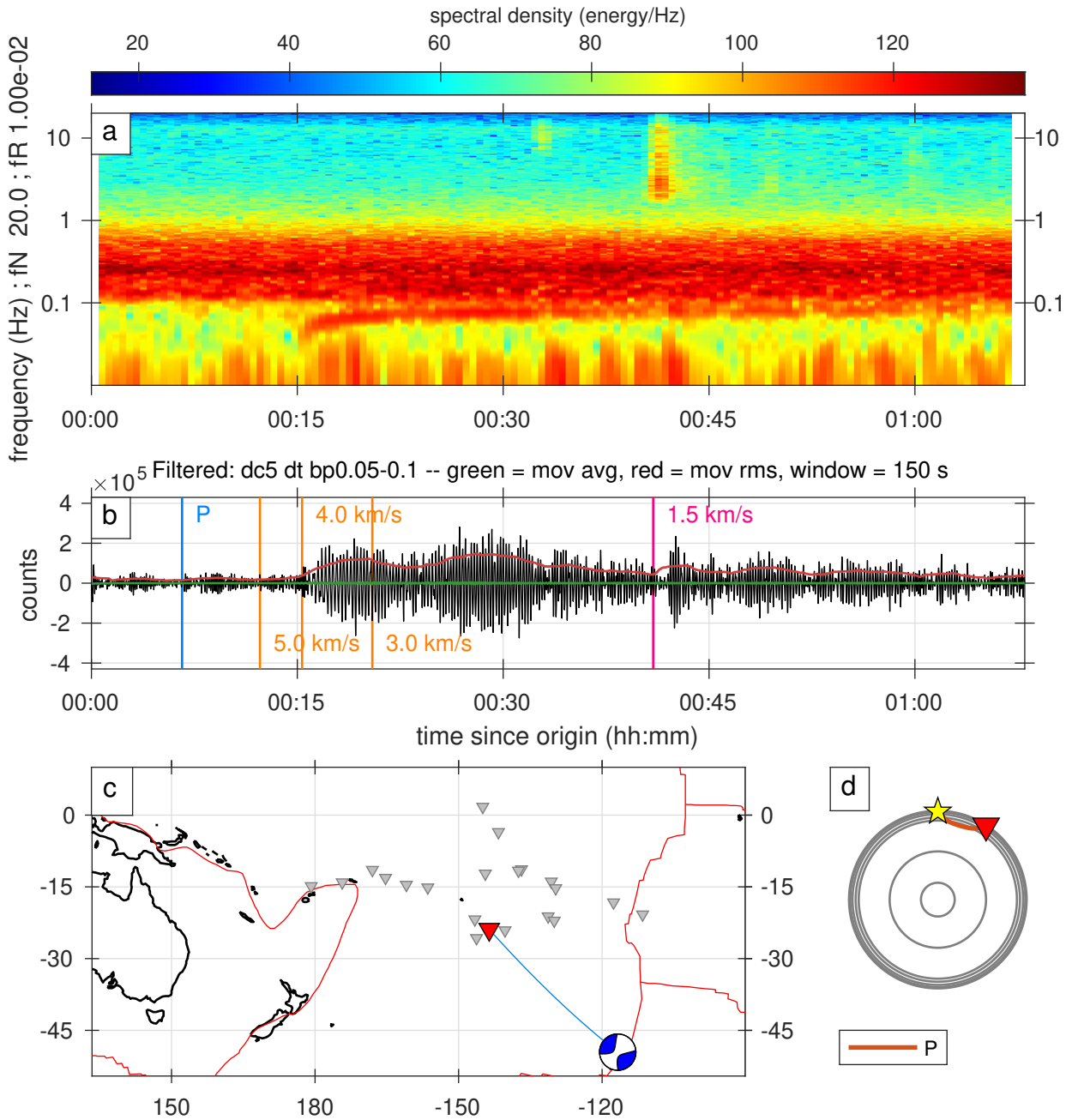


Figure S122. A full record of an earthquake classified as 2stars category.

Arrival: 2019-07-14T05:52:30.000000, ID: 11073569

Mww = 6.60, distance = 87.99 degrees, depth = 10.00 km  
40.38 - 43.08 percent

spectral density (energy/Hz)

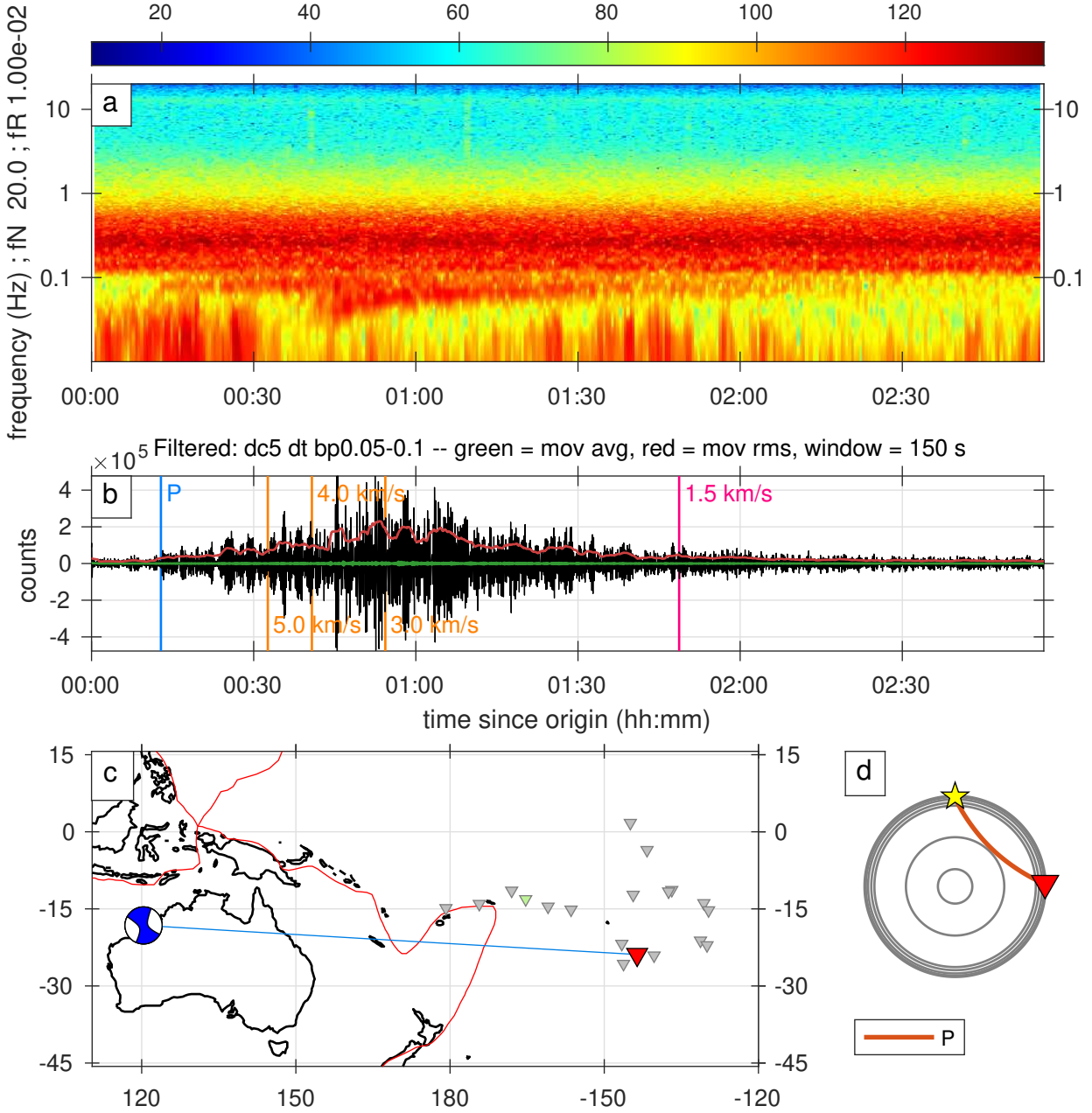


Figure S123. A full record of an earthquake classified as 2stars category.



Arrival: 2019-07-15T08:32:20.000000, ID: 11074626

Mww = 6.20, distance = 66.44 degrees, depth = 58.97 km  
64.98 - 67.03 percent

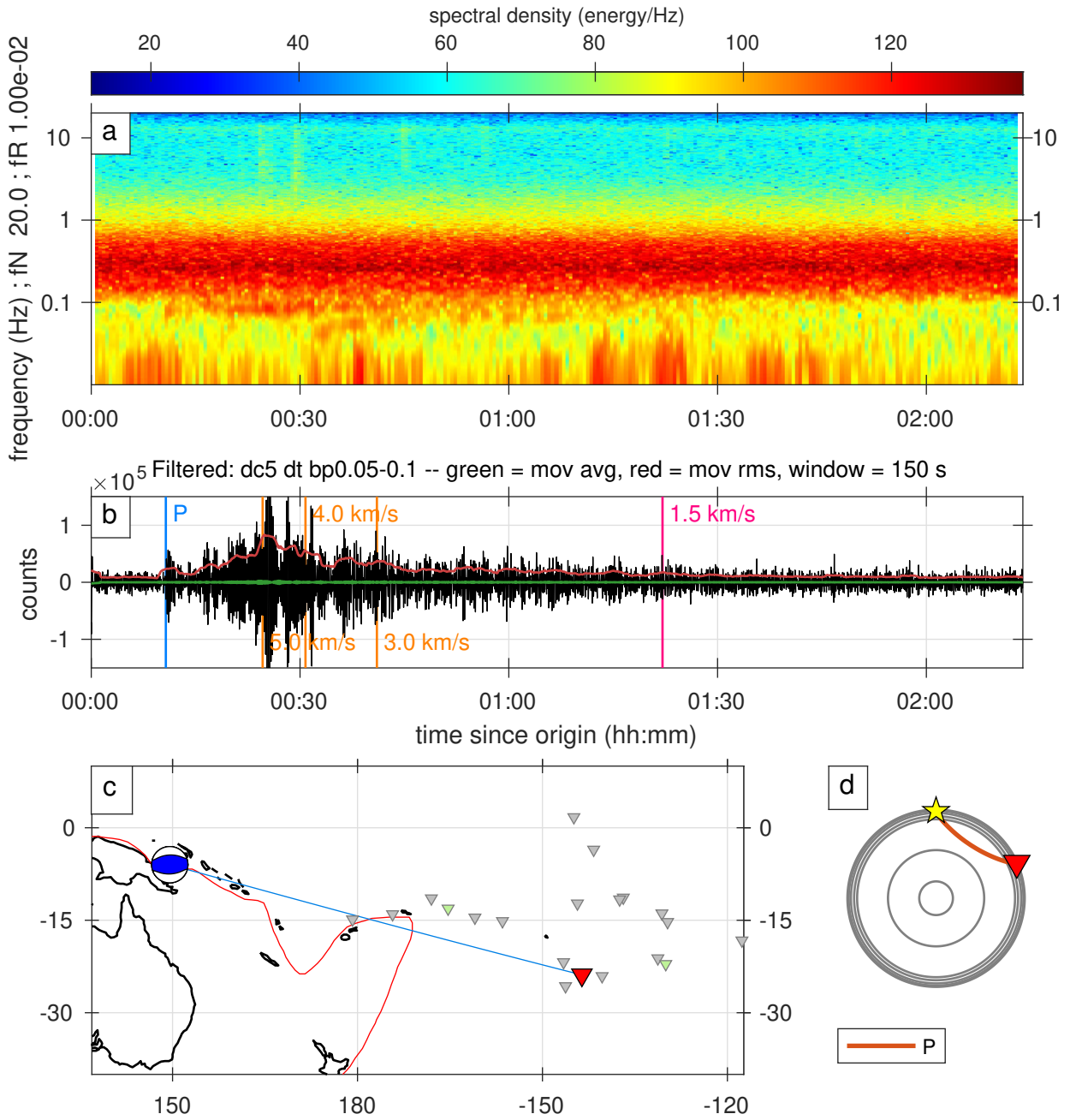


Figure S124. A full record of an earthquake classified as 2stars category.

Arrival: 2019-07-18T01:26:54.029281, ID: 11077729

Mww = 5.40, distance = 57.06 degrees, depth = 10.00 km  
 64.40 - 100.00 percent

spectral density (energy/Hz)

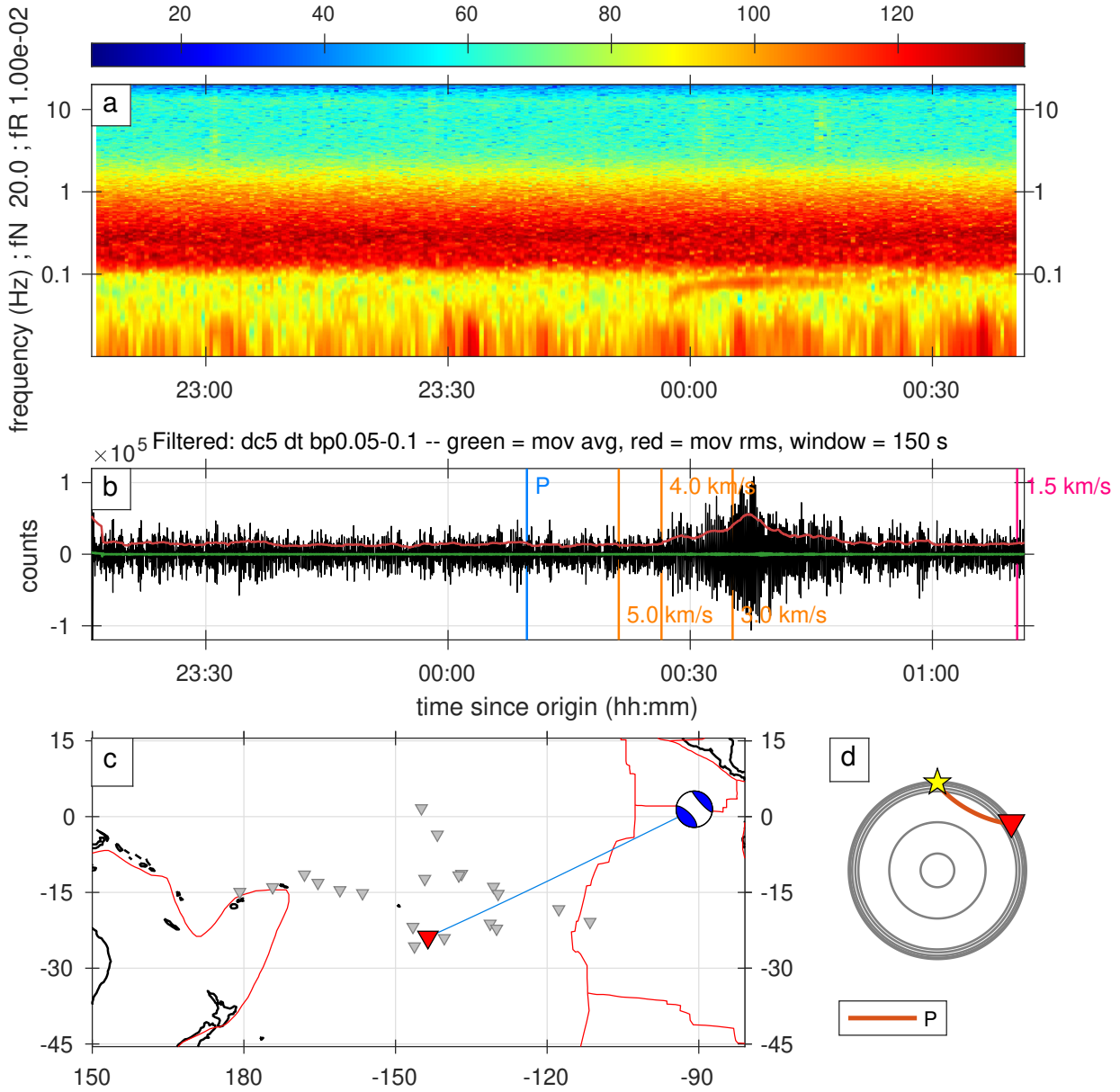


Figure S125. A full record of an earthquake classified as 2stars category.

Arrival: 2019-07-20T18:29:55.994222, ID: 11080390

mb = 5.10, distance = 29.20 degrees, depth = 10.00 km  
71.93 - 74.67 percent

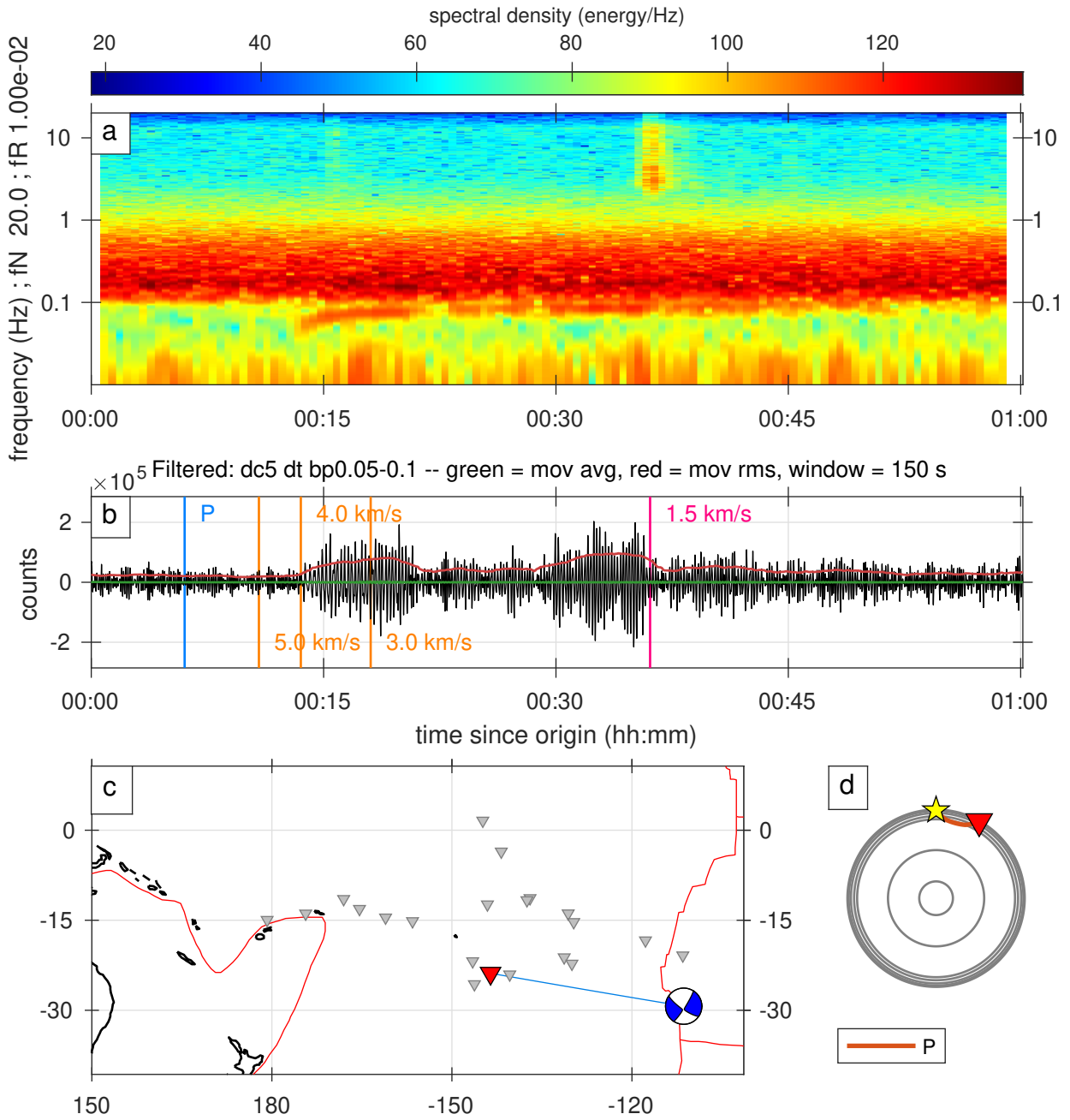


Figure S126. A full record of an earthquake classified as 2stars category.

Arrival: 2019-07-27T10:02:11.123557, ID: 11086279

Mww = 5.70, distance = 36.21 degrees, depth = 10.00 km  
 25.89 - 27.24 percent

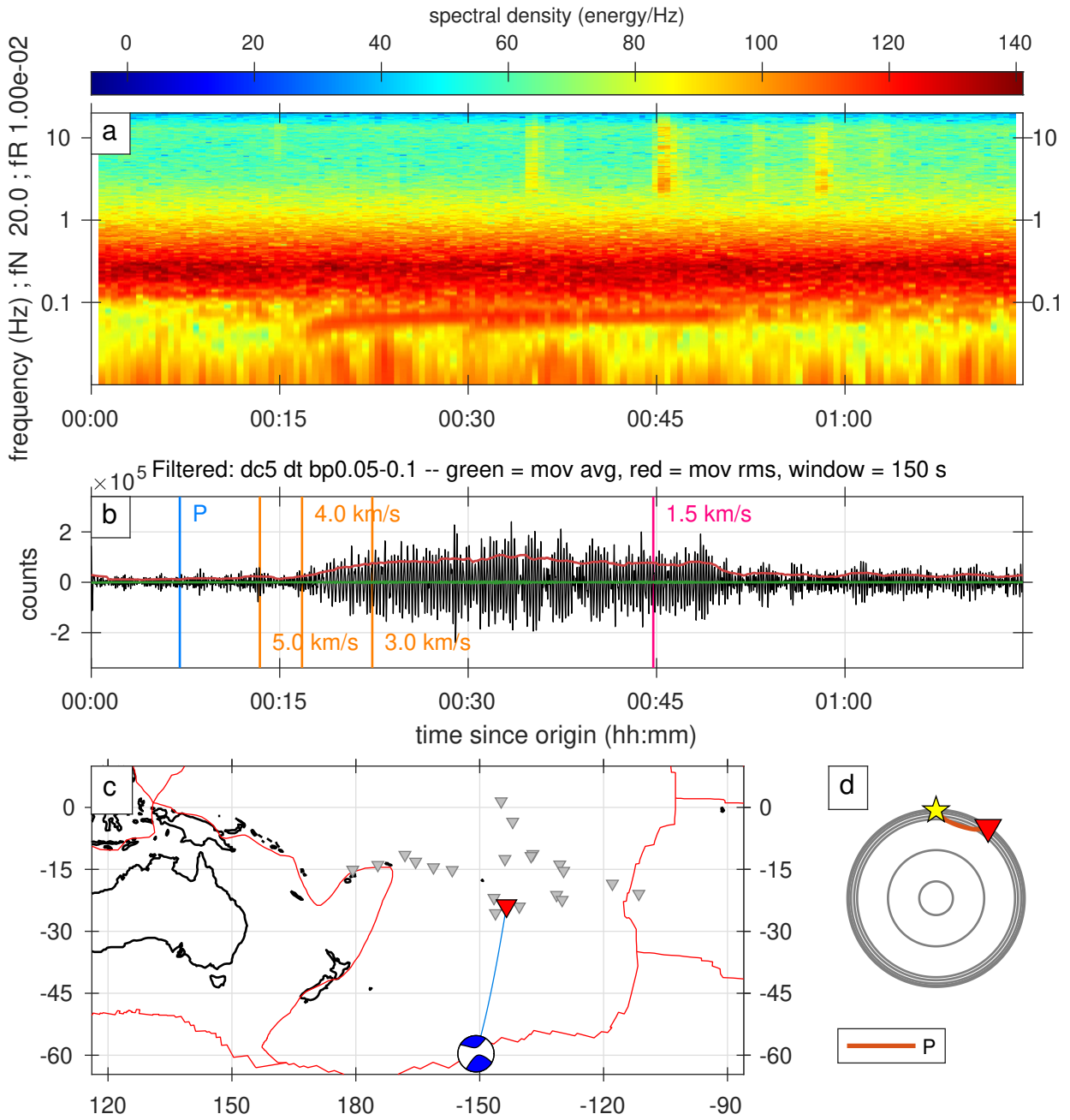


Figure S127. A full record of an earthquake classified as 2stars category.

Arrival: 2019-07-31T06:05:30.000000, ID: 11089323

Mww = 5.90, distance = 64.60 degrees, depth = 72.50 km  
84.19 - 91.77 percent

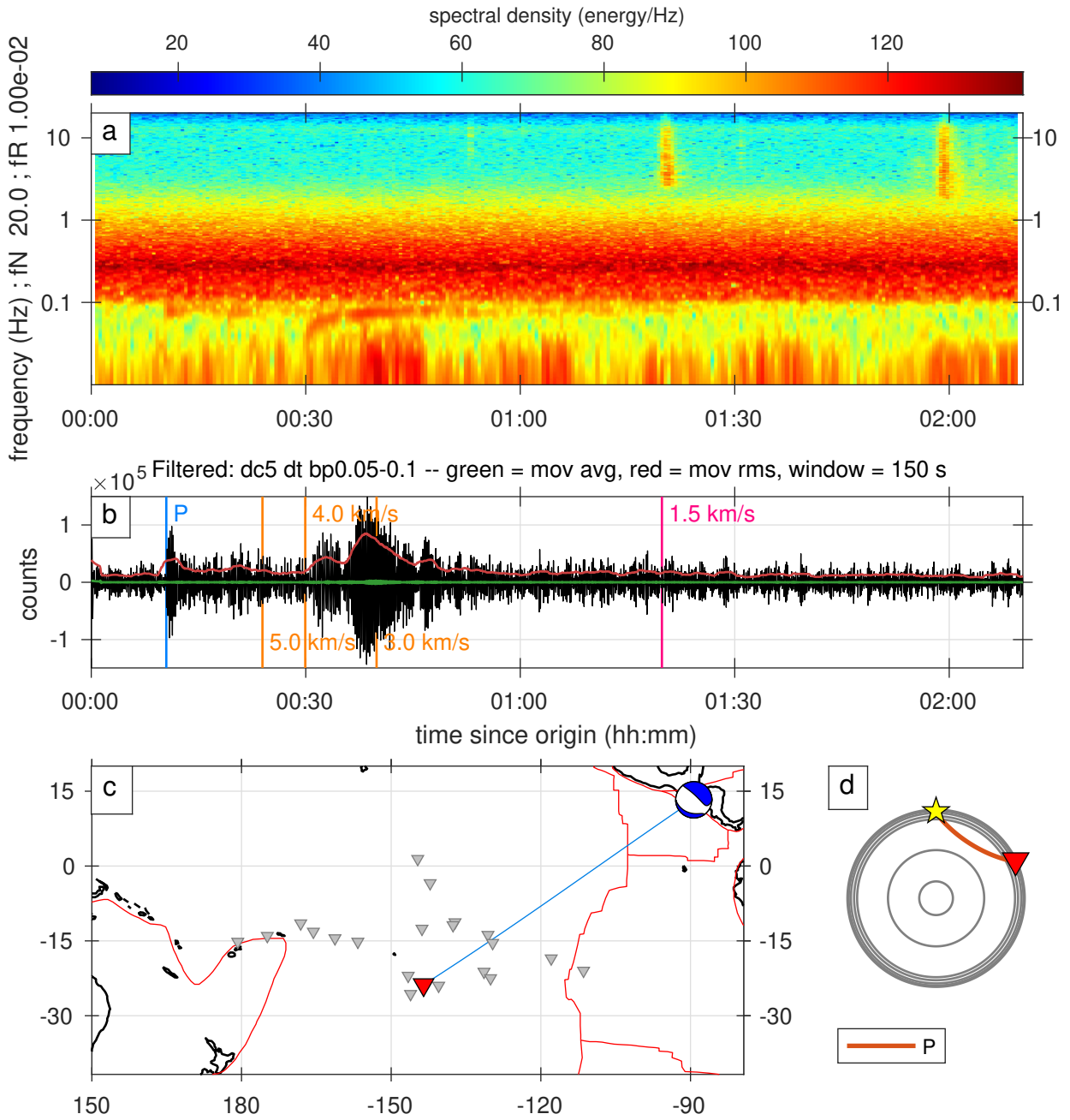


Figure S128. A full record of an earthquake classified as 2stars category.



Arrival: 2019-08-02T05:57:45.582168, ID: 11090460

Mww = 6.00, distance = 34.75 degrees, depth = 10.00 km  
33.42 - 39.21 percent

spectral density (energy/Hz)

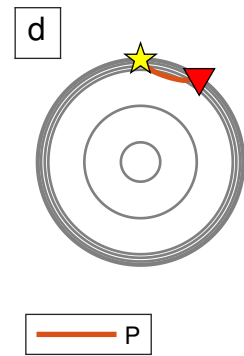
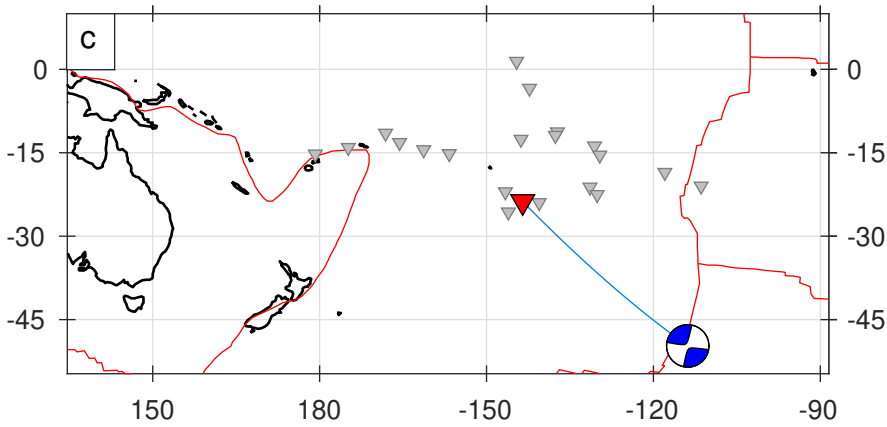
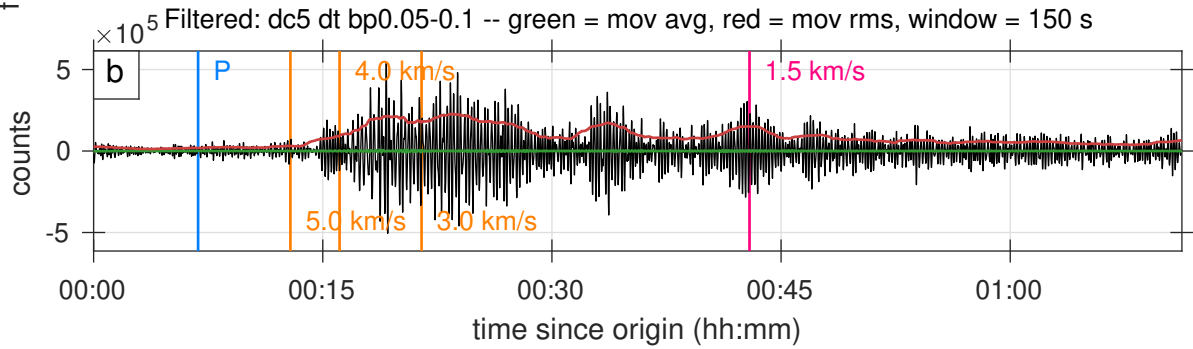
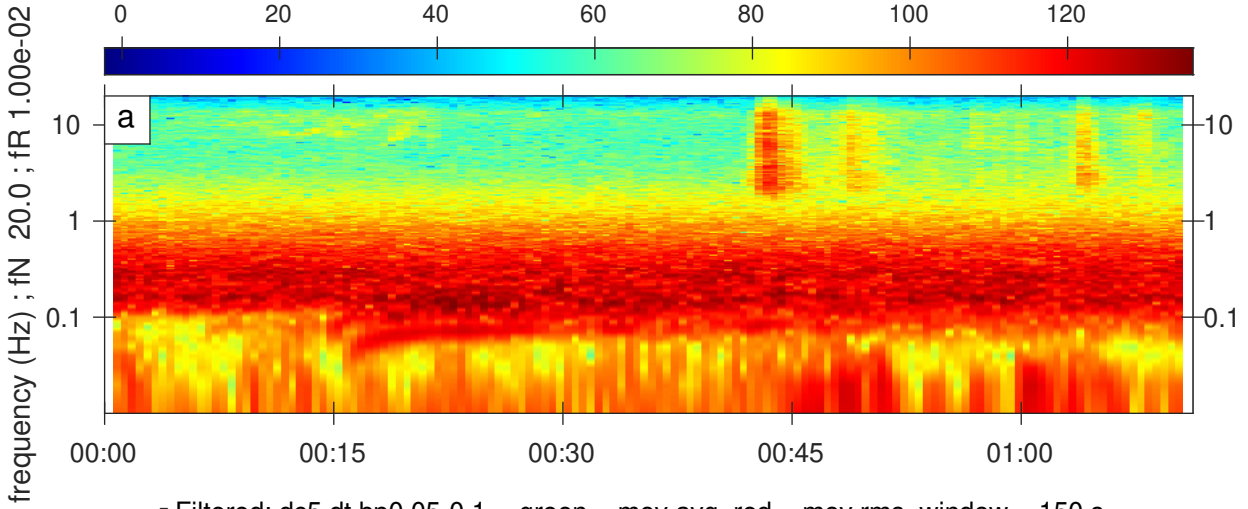


Figure S129. A full record of an earthquake classified as 2stars category.

Arrival: 2019-08-04T10:36:30.000000, ID: 11091618

Mww = 6.30, distance = 93.35 degrees, depth = 38.00 km  
35.37 - 42.06 percent

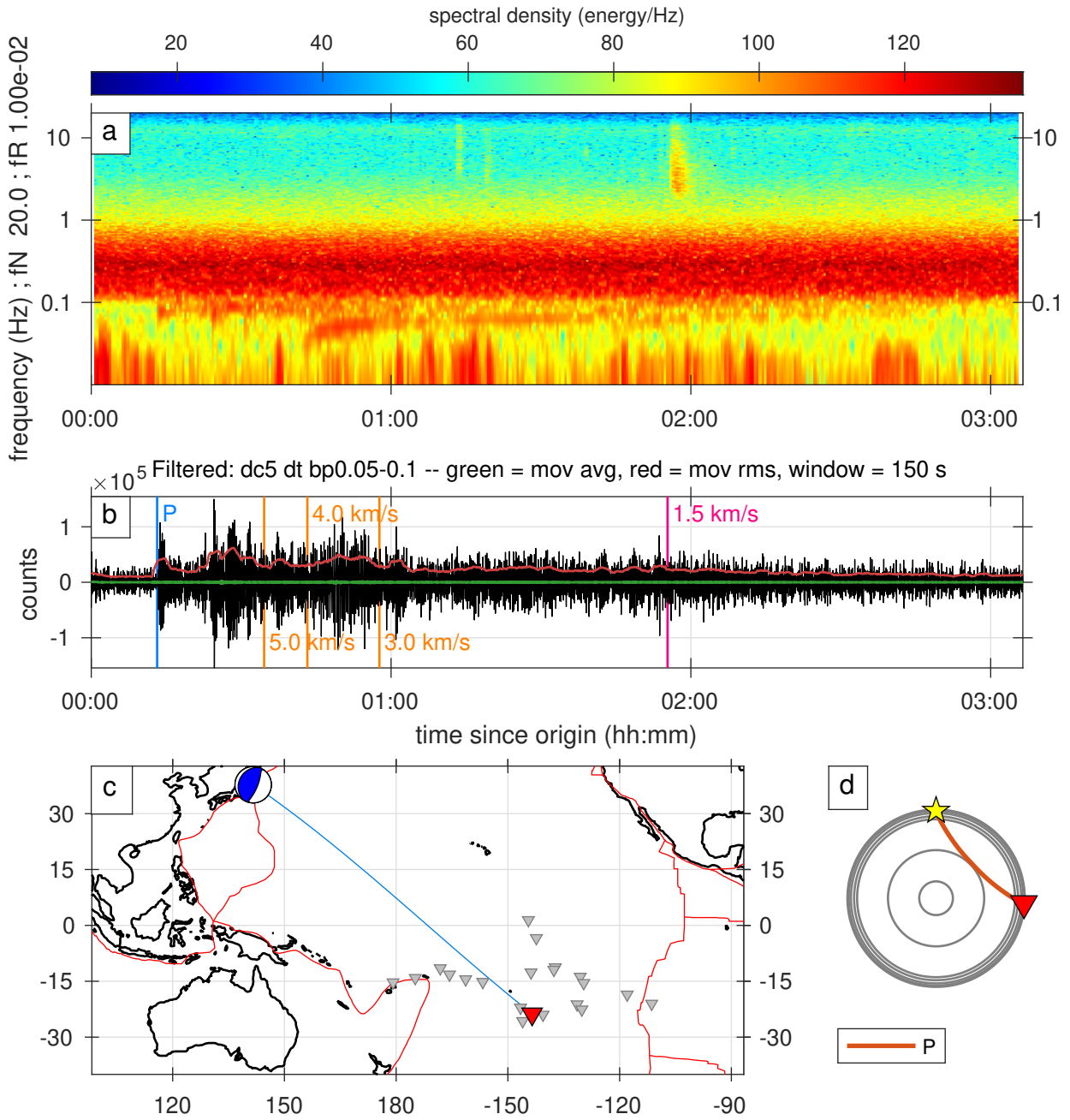


Figure S130. A full record of an earthquake classified as 2stars category.

Arrival: 2019-08-05T09:07:20.000000, ID: 11092028

mb = 5.70, distance = 29.46 degrees, depth = 10.00 km  
84.12 - 86.30 percent

spectral density (energy/Hz)

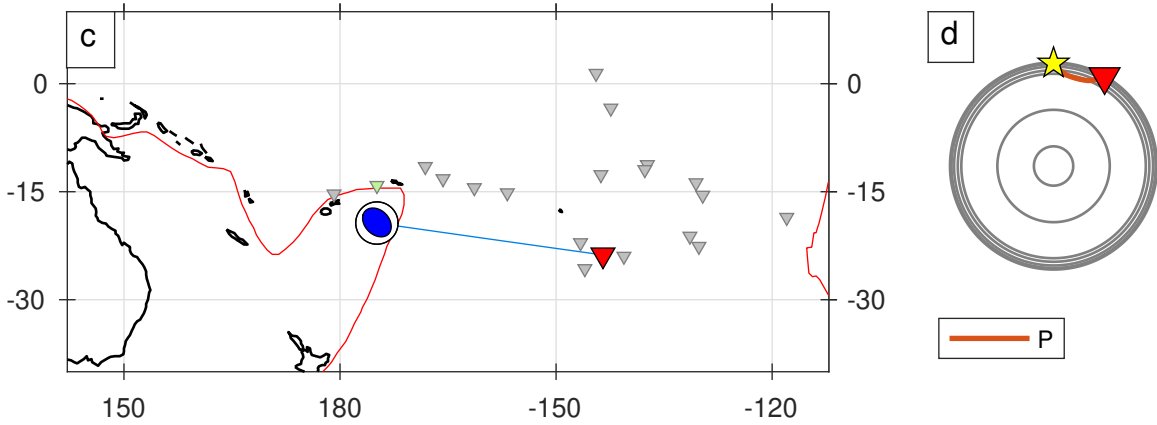
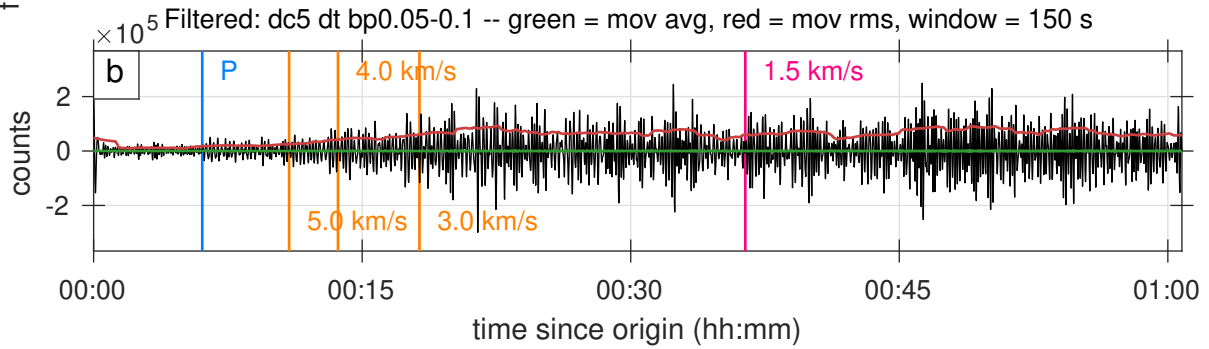
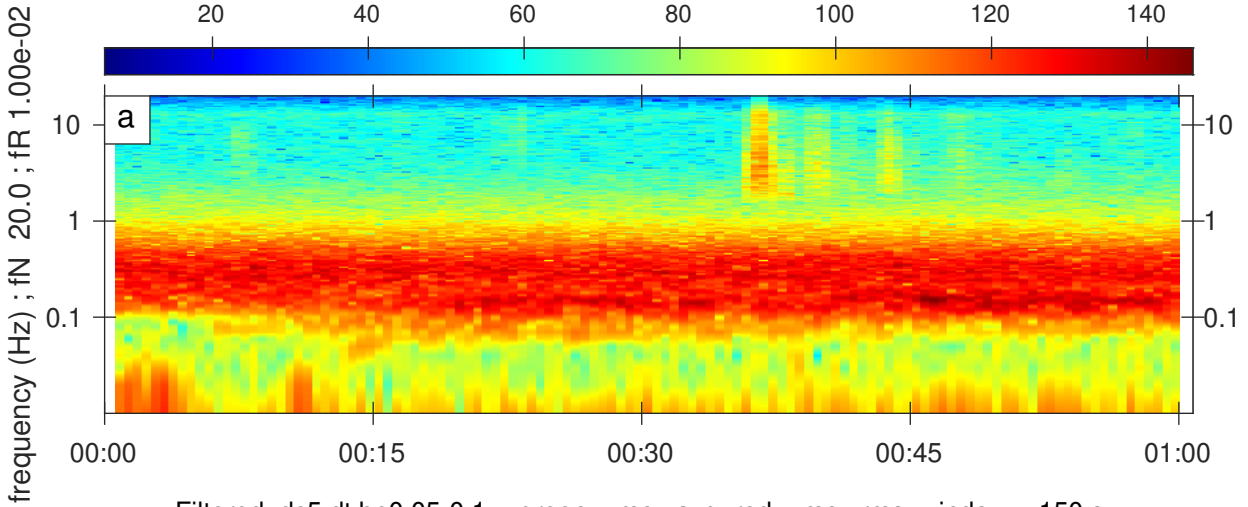


Figure S131. A full record of an earthquake classified as 2stars category.



Arrival: 2019-08-09T17:51:38.759791, ID: 11094587

Mww = 5.30, distance = 28.10 degrees, depth = 10.00 km  
82.99 - 87.41 percent

spectral density (energy/Hz)

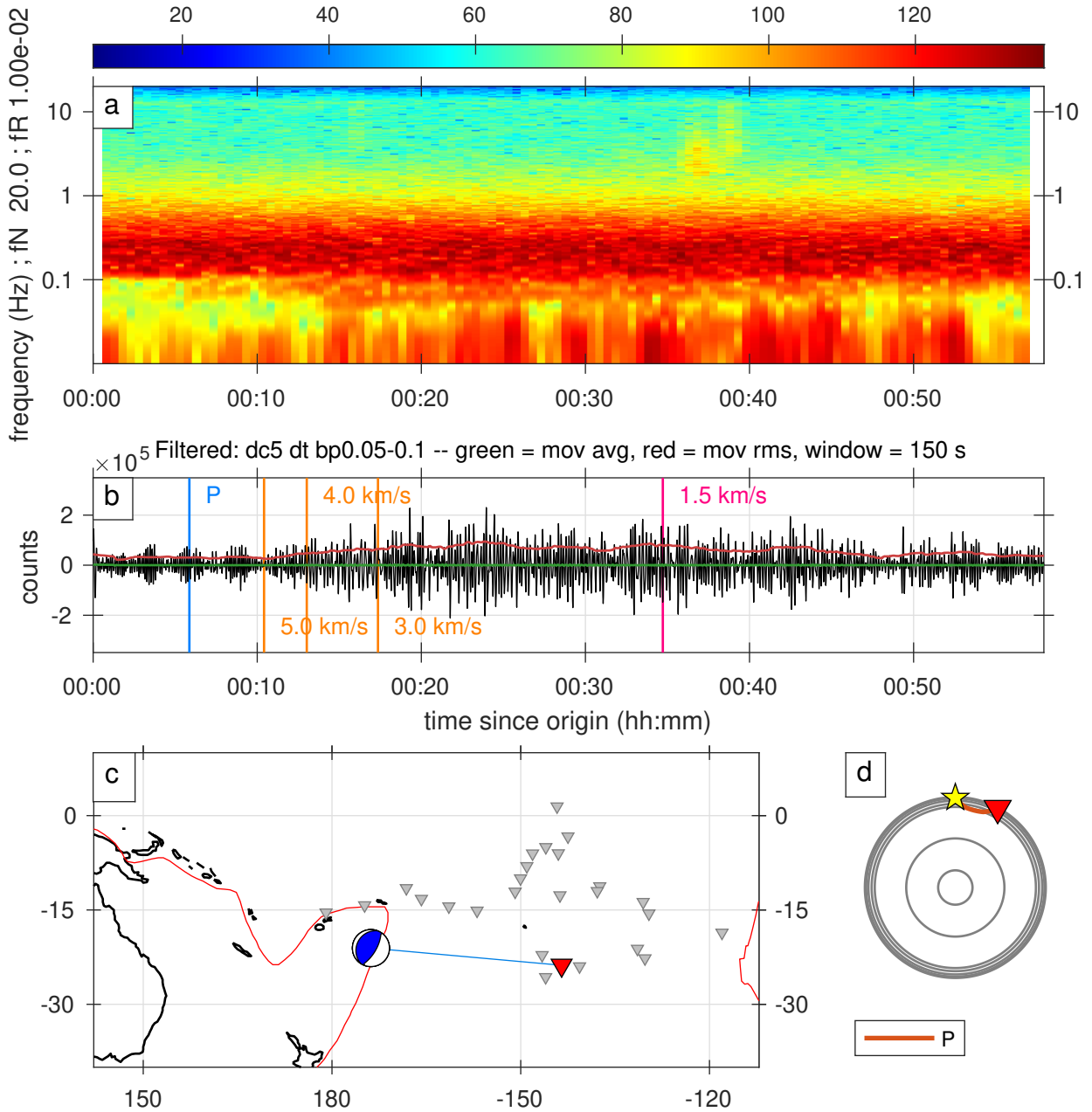


Figure S132. A full record of an earthquake classified as 2stars category.

Arrival: 2019-08-14T21:44:52.515516, ID: 11097877

Mww = 5.90, distance = 55.40 degrees, depth = 10.00 km

19.71 - 32.54 percent

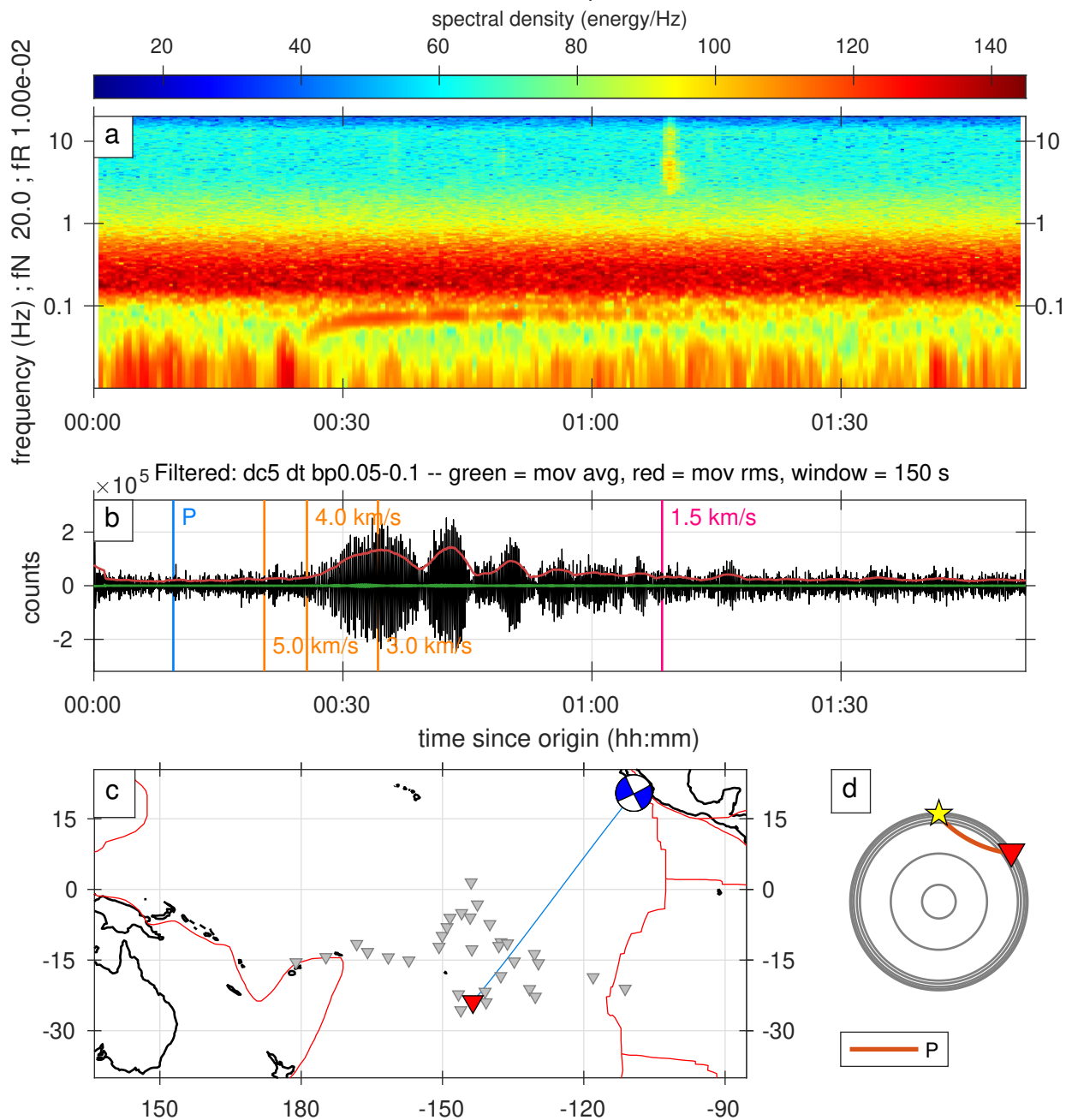


Figure S133. A full record of an earthquake classified as 2stars category.

Arrival: 2018-09-15T08:20:00.000000, ID: 10948197

Mww = 5.70, distance = 100.02 degrees, depth = 10.00 km  
70.14 - 83.83 percent

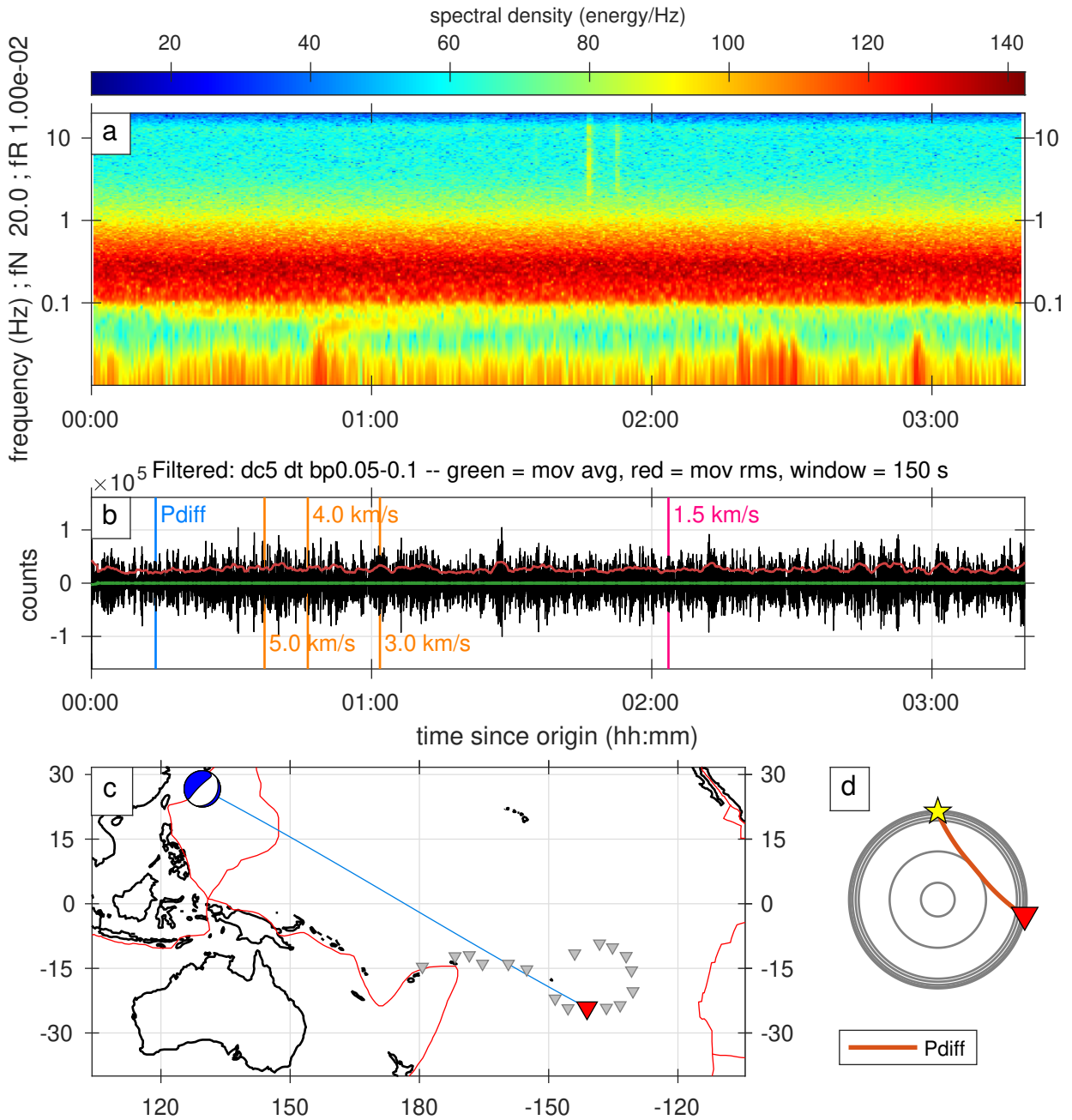


Figure S134. A full record of an earthquake classified as 1star category.

Arrival: 2018-09-15T16:38:00.000000, ID: 10948285

Mww = 5.60, distance = 100.04 degrees, depth = 10.20 km  
3.19 - 13.40 percent

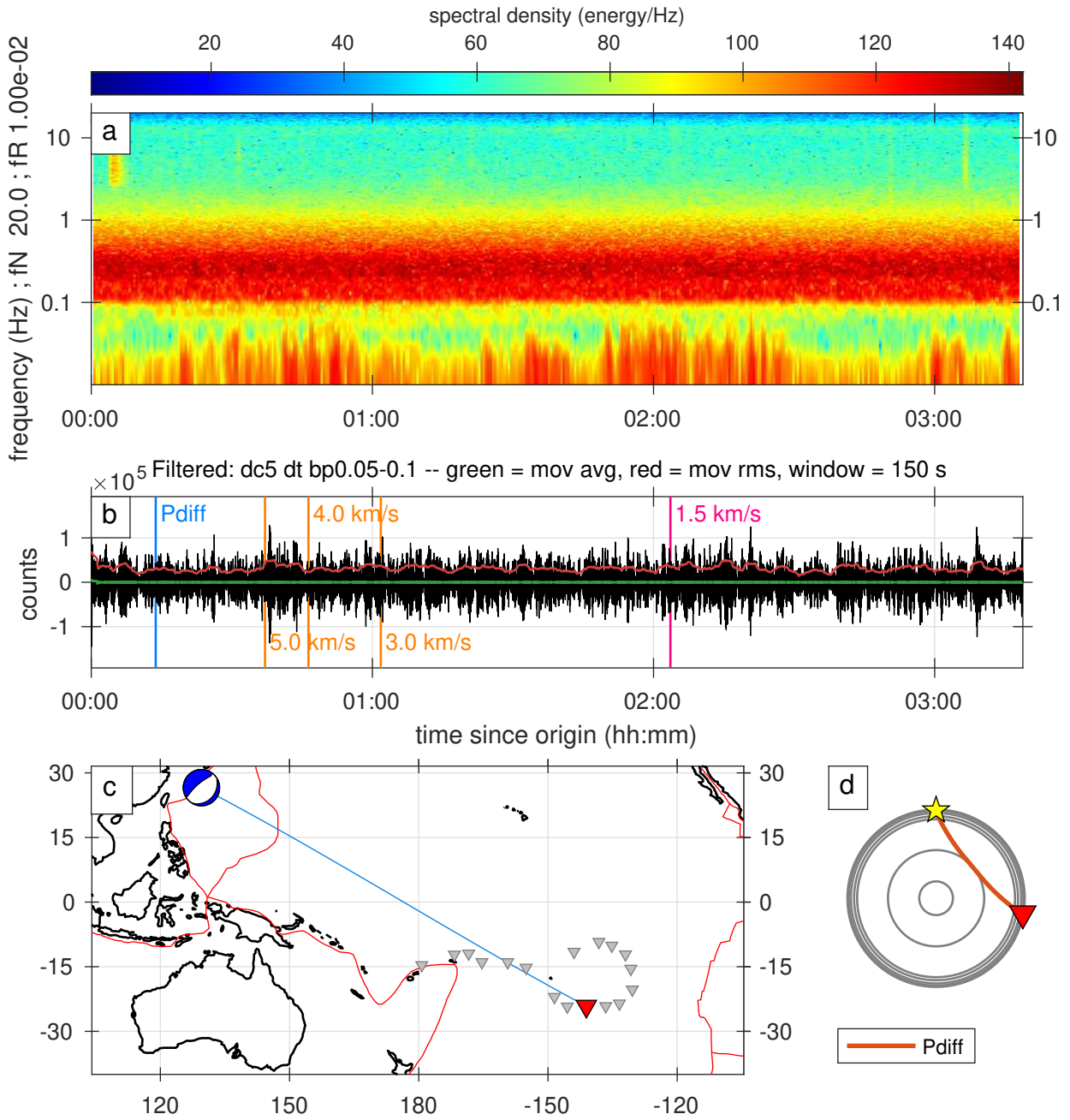


Figure S135. A full record of an earthquake classified as 1star category.

Arrival: 2018-09-18T07:50:00.000000, ID: 10953395

mb = 4.70, distance = 121.78 degrees, depth = 47.10 km  
83.98 - 100.00 percent

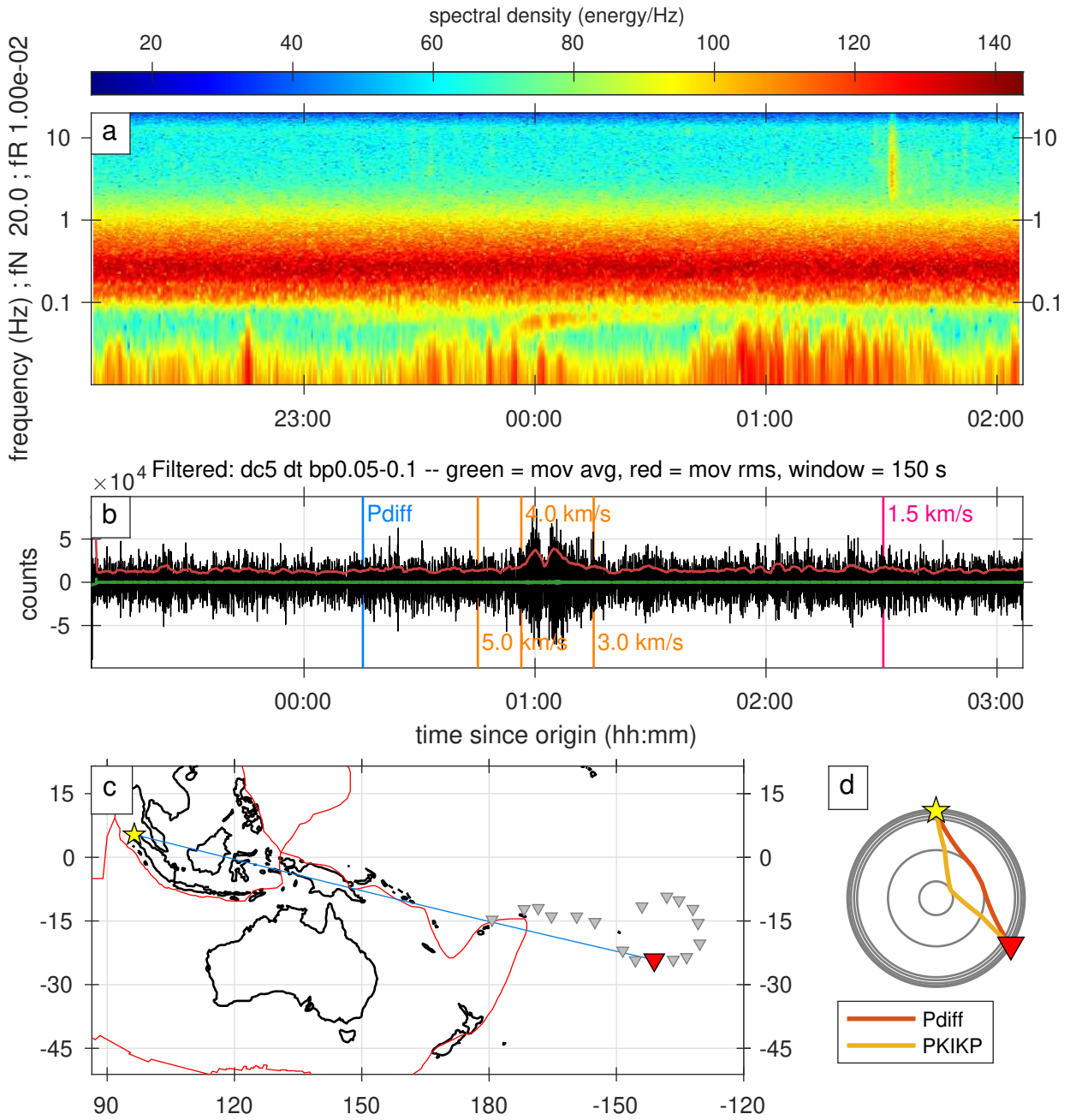


Figure S136. A full record of an earthquake classified as 1star category.



Arrival: 2018-09-18T12:07:30.000000, ID: 10949274

Mww = 5.80, distance = 60.85 degrees, depth = 10.00 km  
 11.22 - 29.23 percent

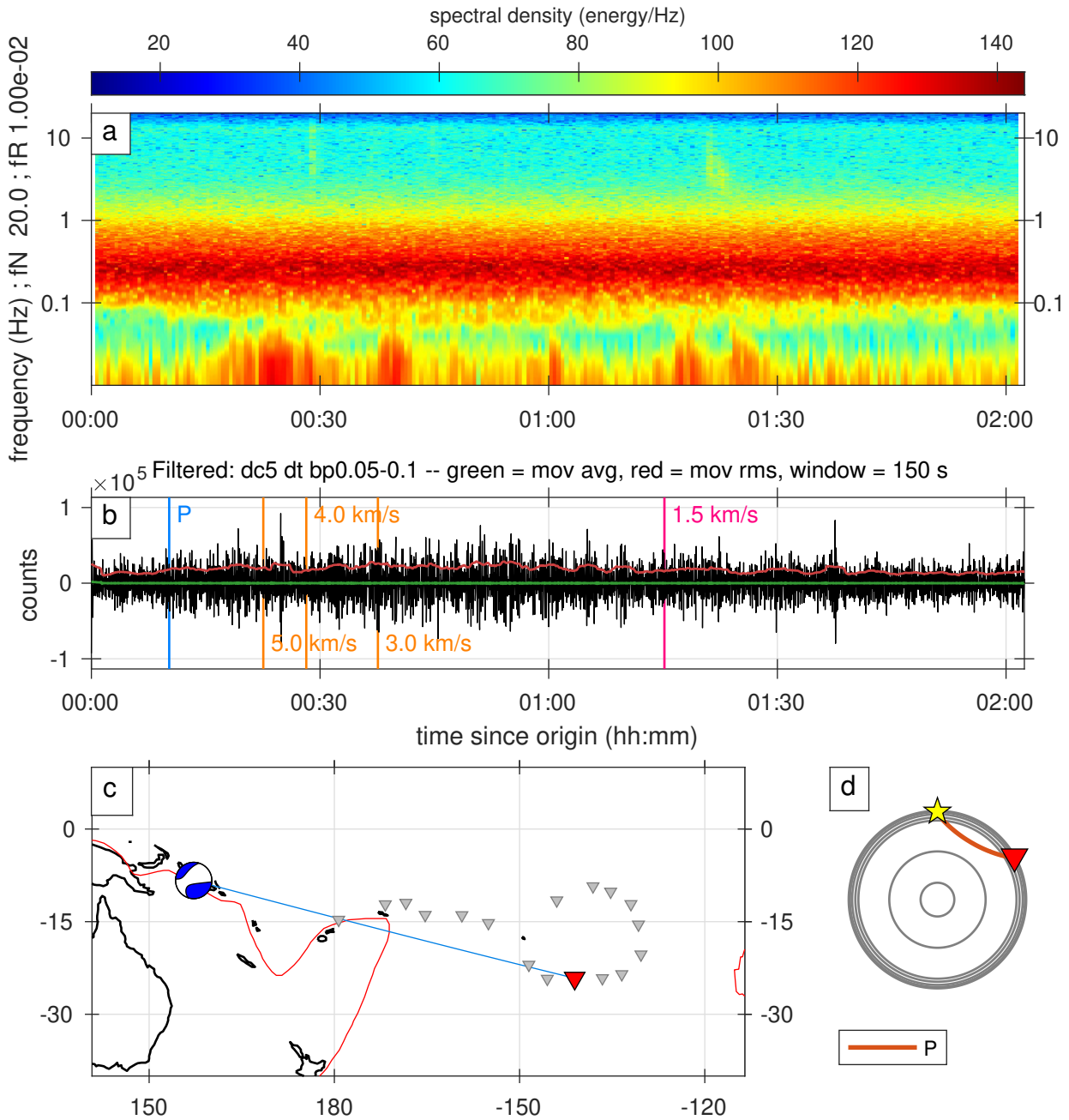


Figure S137. A full record of an earthquake classified as 1star category.

Arrival: 2018-09-21T03:49:00.000000, ID: 10950337

Mww = 5.90, distance = 36.75 degrees, depth = 652.35 km  
 93.49 - 95.74 percent

spectral density (energy/Hz)

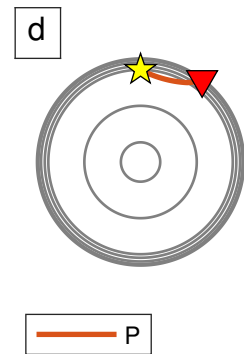
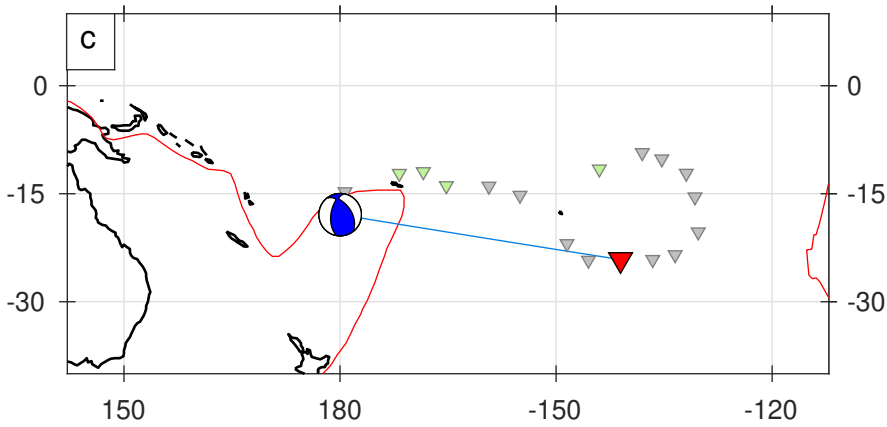
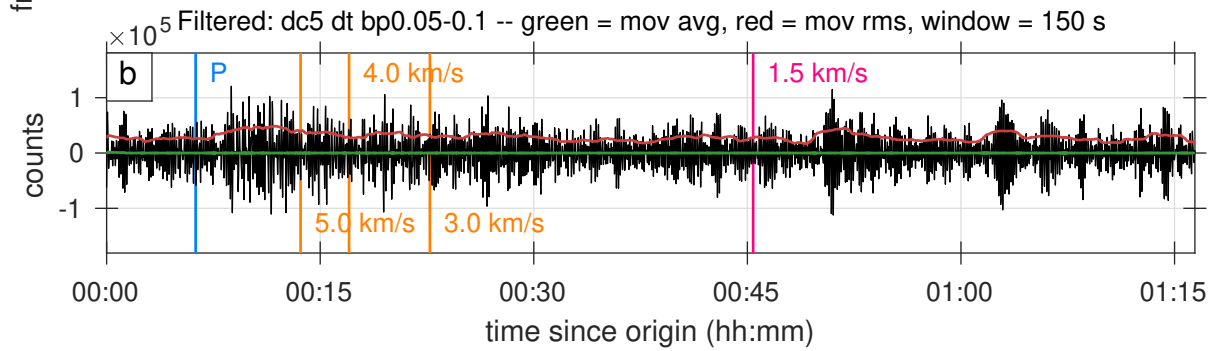
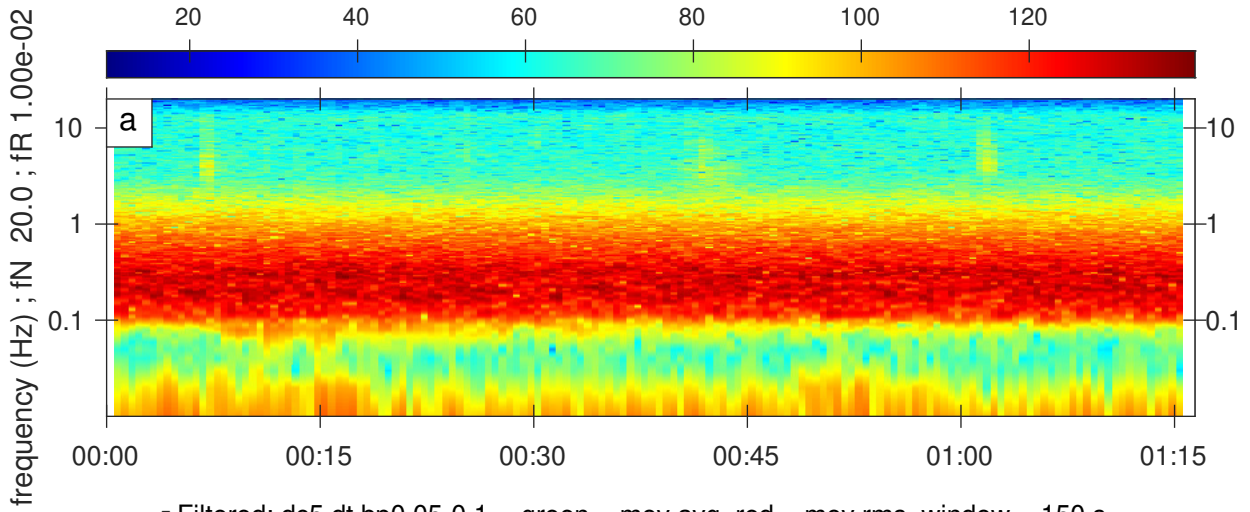


Figure S138. A full record of an earthquake classified as 1star category.

Arrival: 2018-09-28T07:17:00.000000, ID: 10953041

mb = 5.40, distance = 98.13 degrees, depth = 10.00 km

44.72 - 49.89 percent

spectral density (energy/Hz)

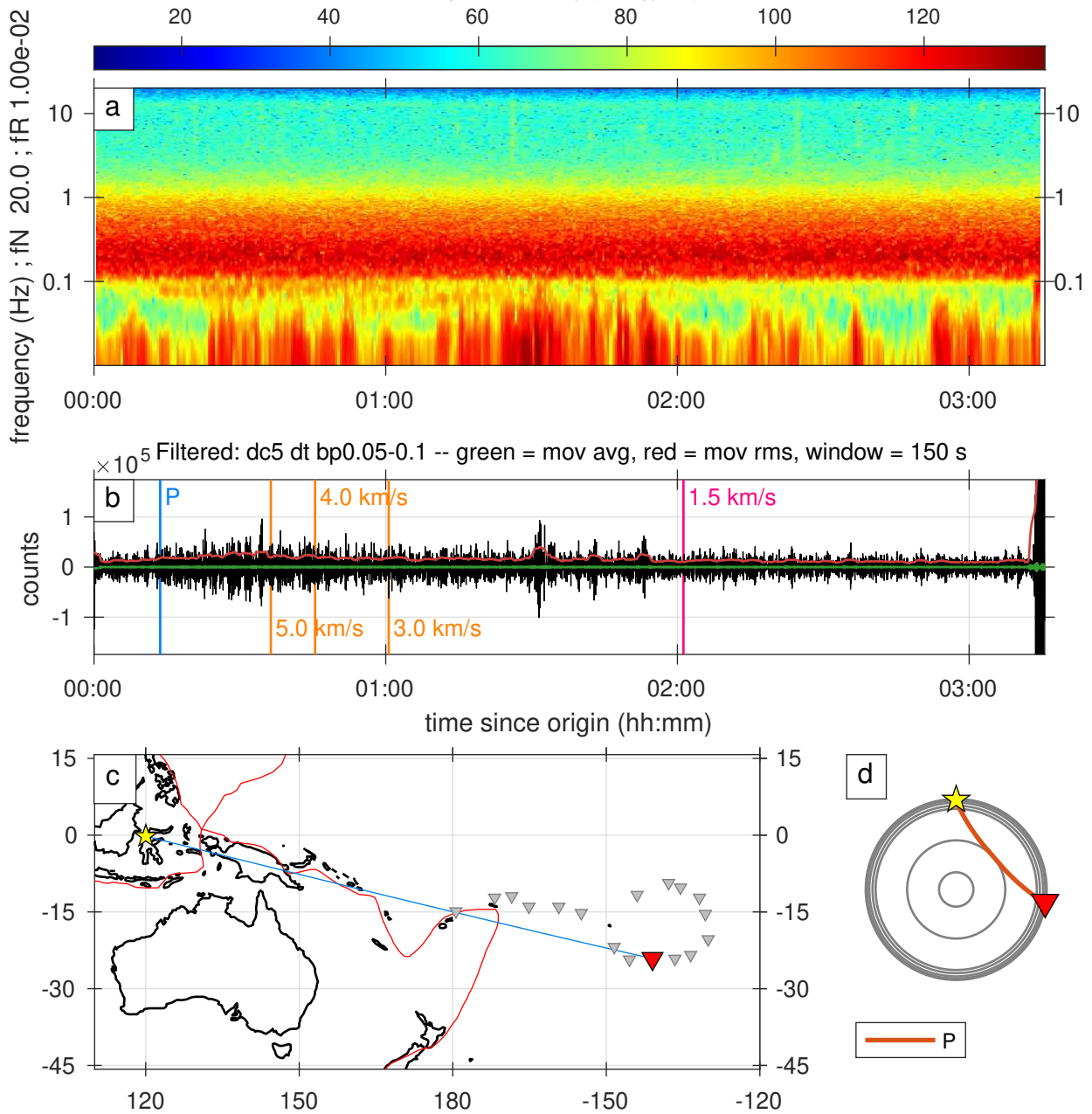


Figure S139. A full record of an earthquake classified as 1star category.



Arrival: 2018-10-02T00:13:00.000000, ID: 10954454

Mww = 6.00, distance = 93.59 degrees, depth = 29.00 km  
 31.69 - 44.44 percent

spectral density (energy/Hz)

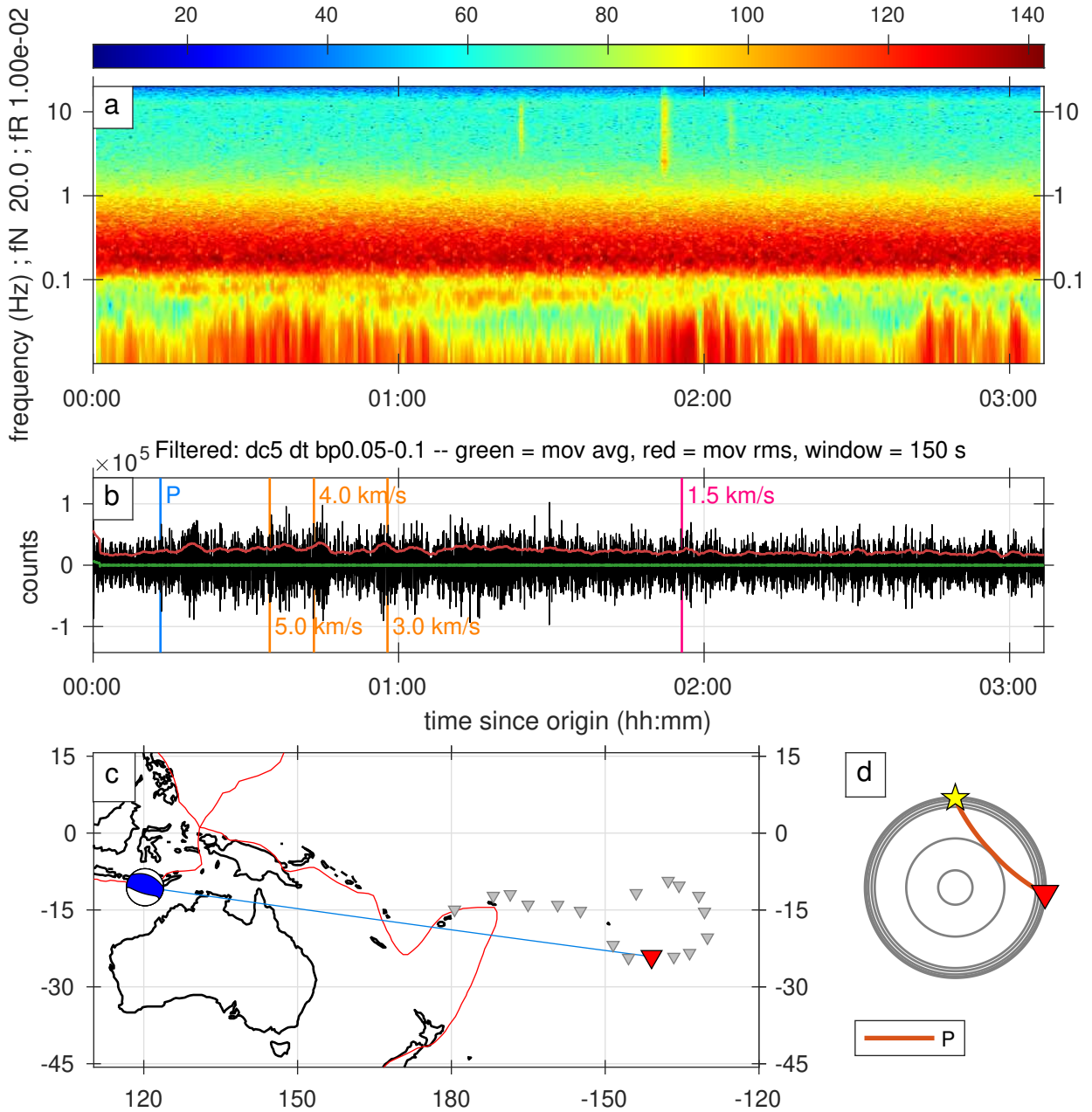


Figure S140. A full record of an earthquake classified as 1star category.

Arrival: 2018-10-02T10:17:20.000000, ID: 10954594

Mww = 5.60, distance = 47.97 degrees, depth = 10.00 km

73.25 - 79.91 percent

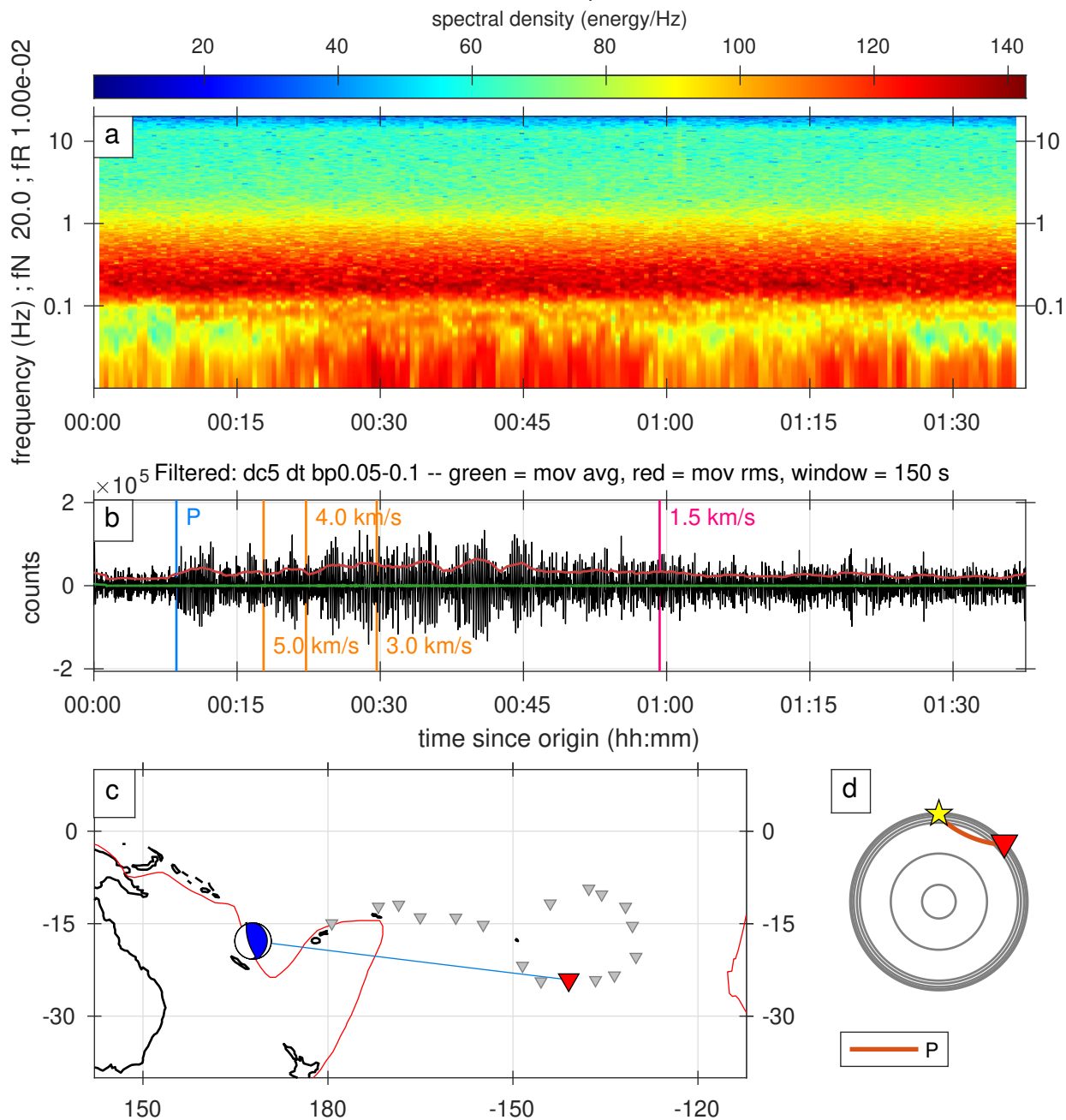


Figure S141. A full record of an earthquake classified as 1star category.

Arrival: 2018-10-05T21:18:00.000000, ID: 10956142

Mww = 5.40, distance = 45.34 degrees, depth = 5.61 km  
62.64 - 67.72 percent

spectral density (energy/Hz)

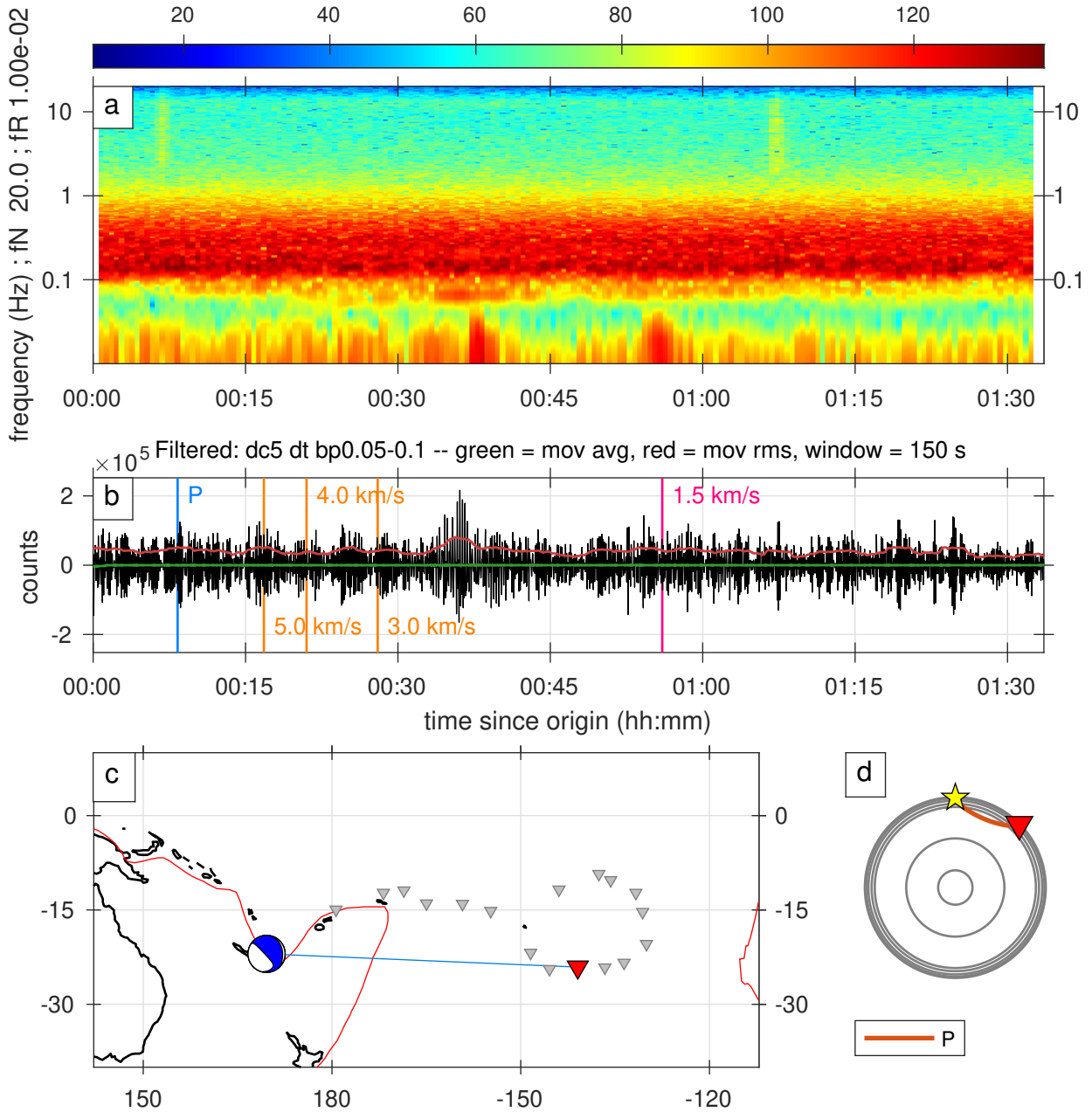


Figure S142. A full record of an earthquake classified as 1star category.

Arrival: 2018-10-07T00:40:00.000000, ID: 10956451

mb = 4.90, distance = 63.22 degrees, depth = 55.04 km

36.16 - 41.14 percent

spectral density (energy/Hz)

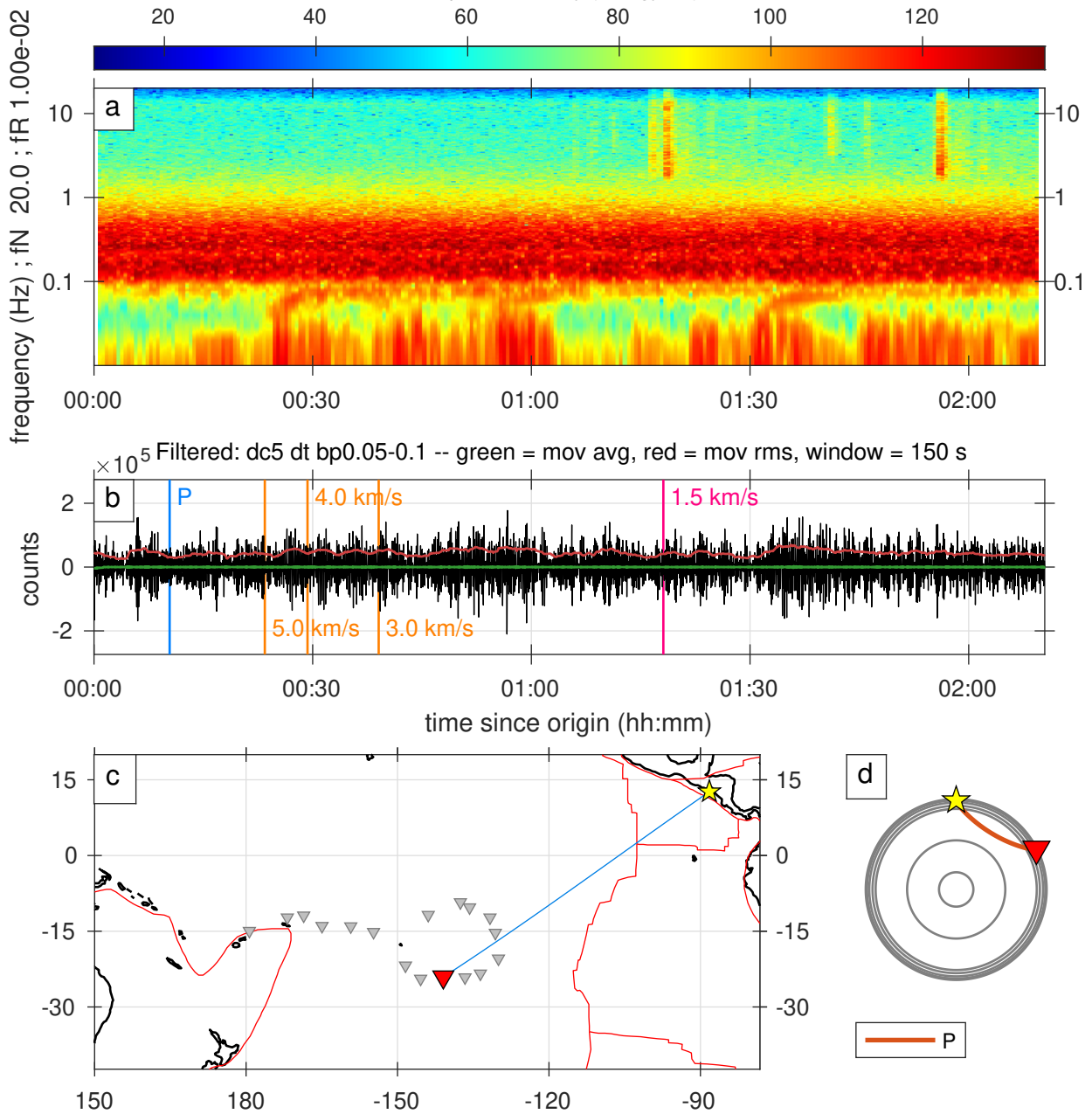


Figure S143. A full record of an earthquake classified as 1star category.

Arrival: 2018-10-10T18:59:30.000000, ID: 10957904

Mww = 6.00, distance = 100.13 degrees, depth = 9.00 km  
57.13 - 61.91 percent

spectral density (energy/Hz)

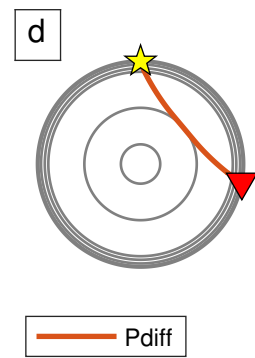
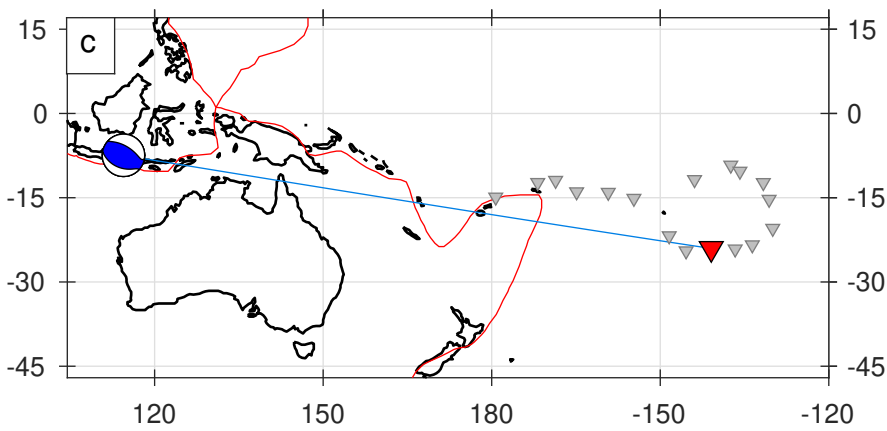
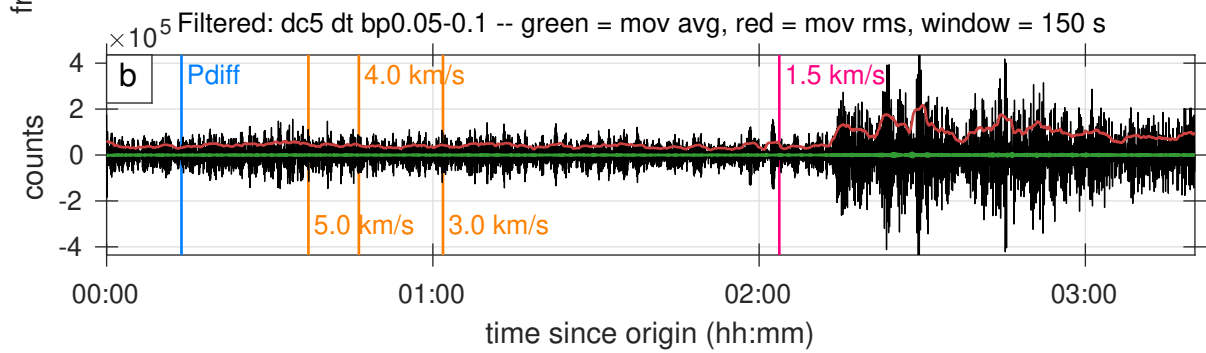
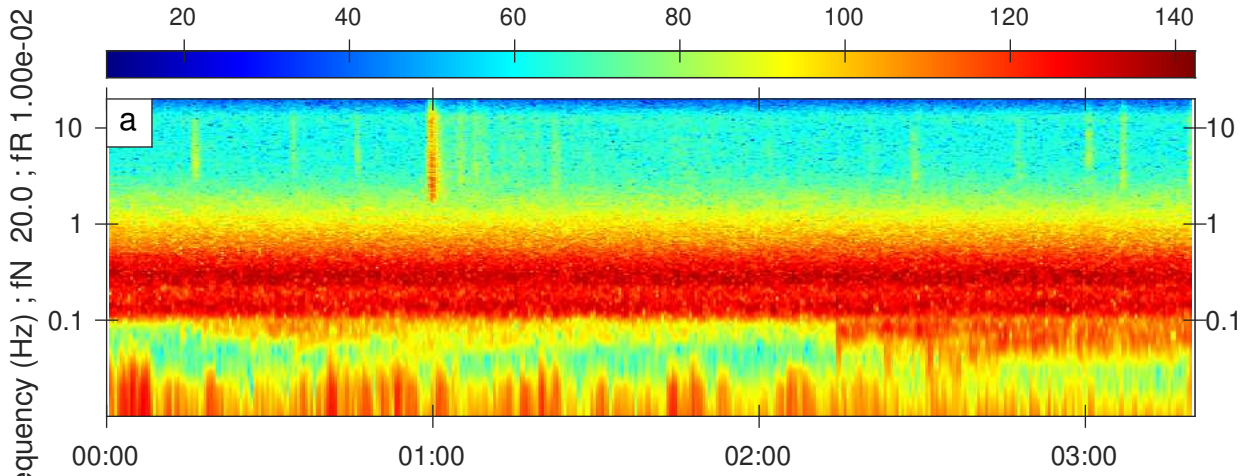


Figure S144. A full record of an earthquake classified as 1star category.



Arrival: 2018-10-12T03:03:00.000000, ID: 10958500

Mww = 5.60, distance = 67.41 degrees, depth = 10.00 km  
7.32 - 14.91 percent

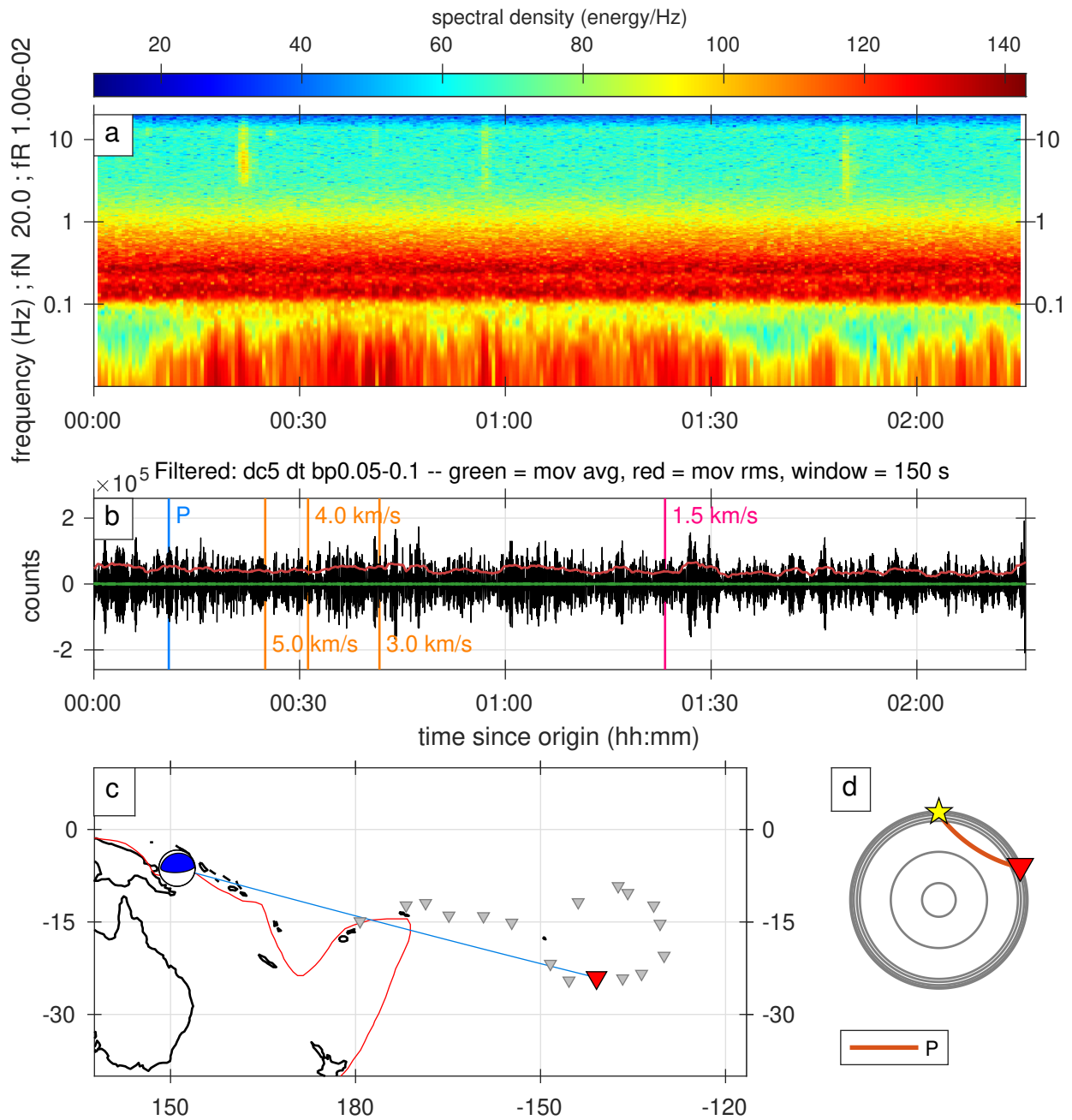


Figure S145. A full record of an earthquake classified as 1star category.

Arrival: 2018-10-12T09:48:00.000000, ID: 10958593

mb = 5.10, distance = 33.46 degrees, depth = 10.00 km  
 30.13 - 34.02 percent

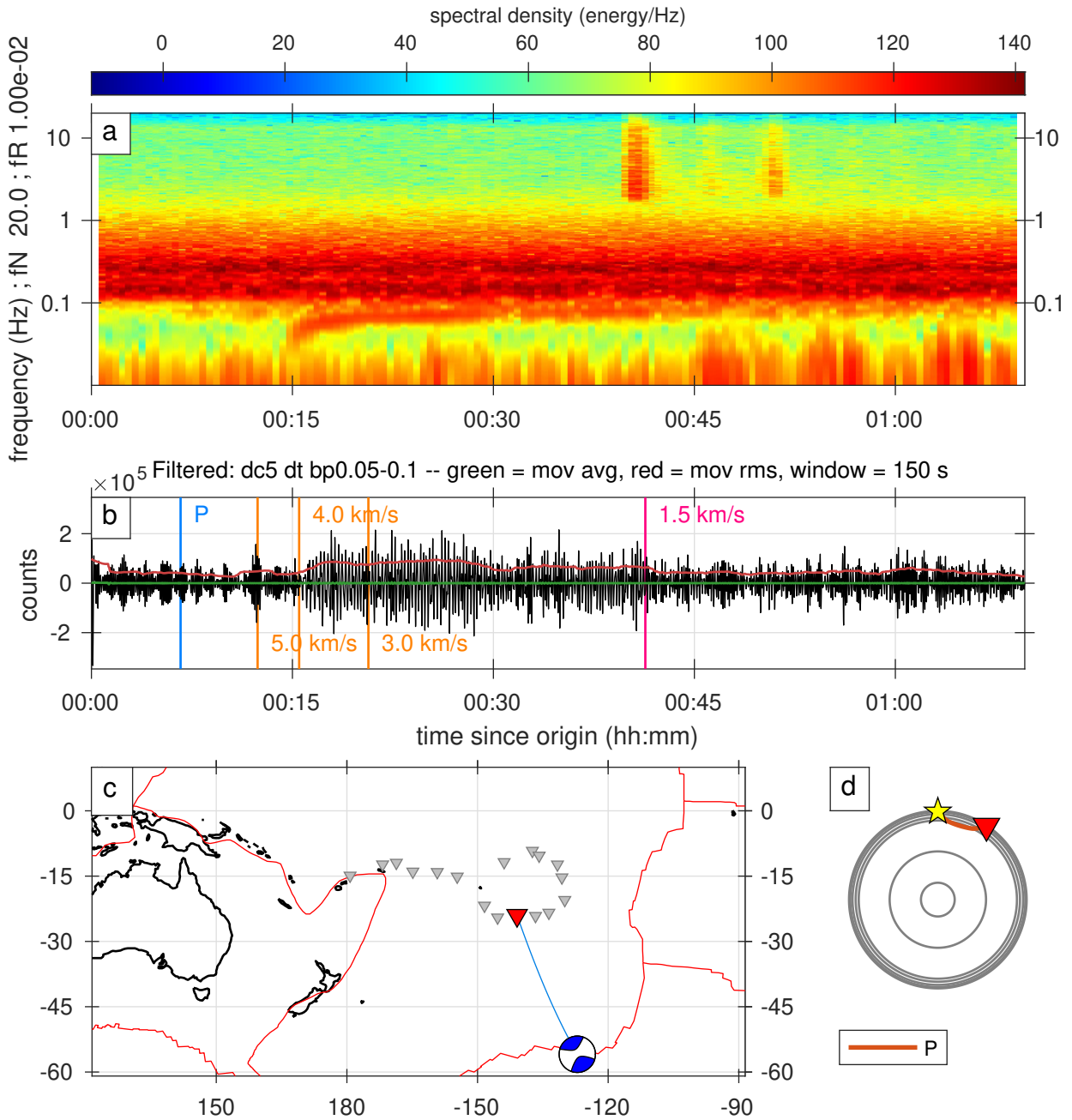


Figure S146. A full record of an earthquake classified as 1star category.

Arrival: 2018-10-12T21:20:00.000000, ID: 10958761

Mww = 5.70, distance = 61.80 degrees, depth = 64.33 km  
68.64 - 75.60 percent

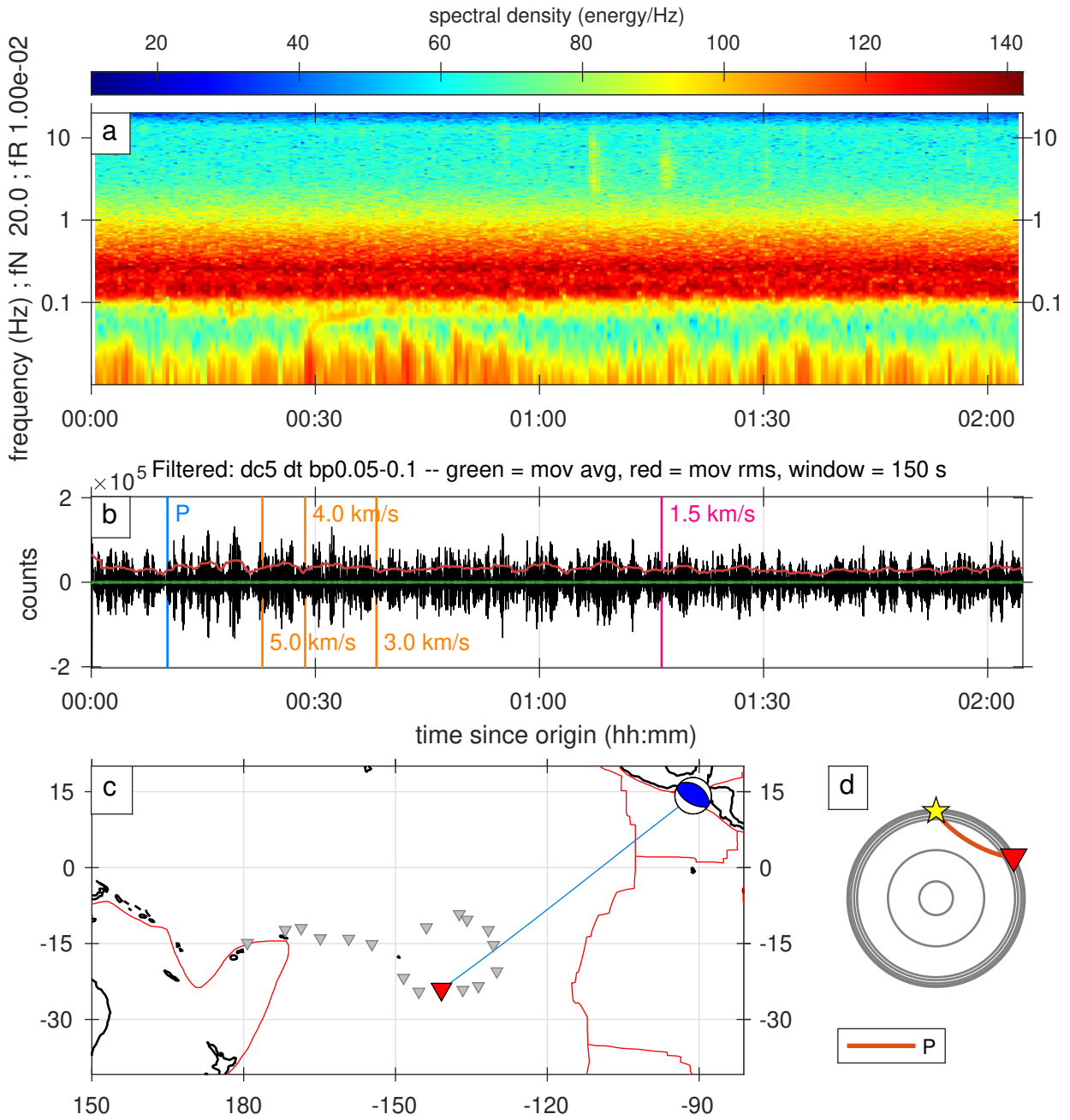


Figure S147. A full record of an earthquake classified as 1star category.



Arrival: 2018-10-26T09:18:00.000000, ID: 10964339

mww = 5.70, distance = 80.85 degrees, depth = 10.00 km  
4.96 - 6.46 percent

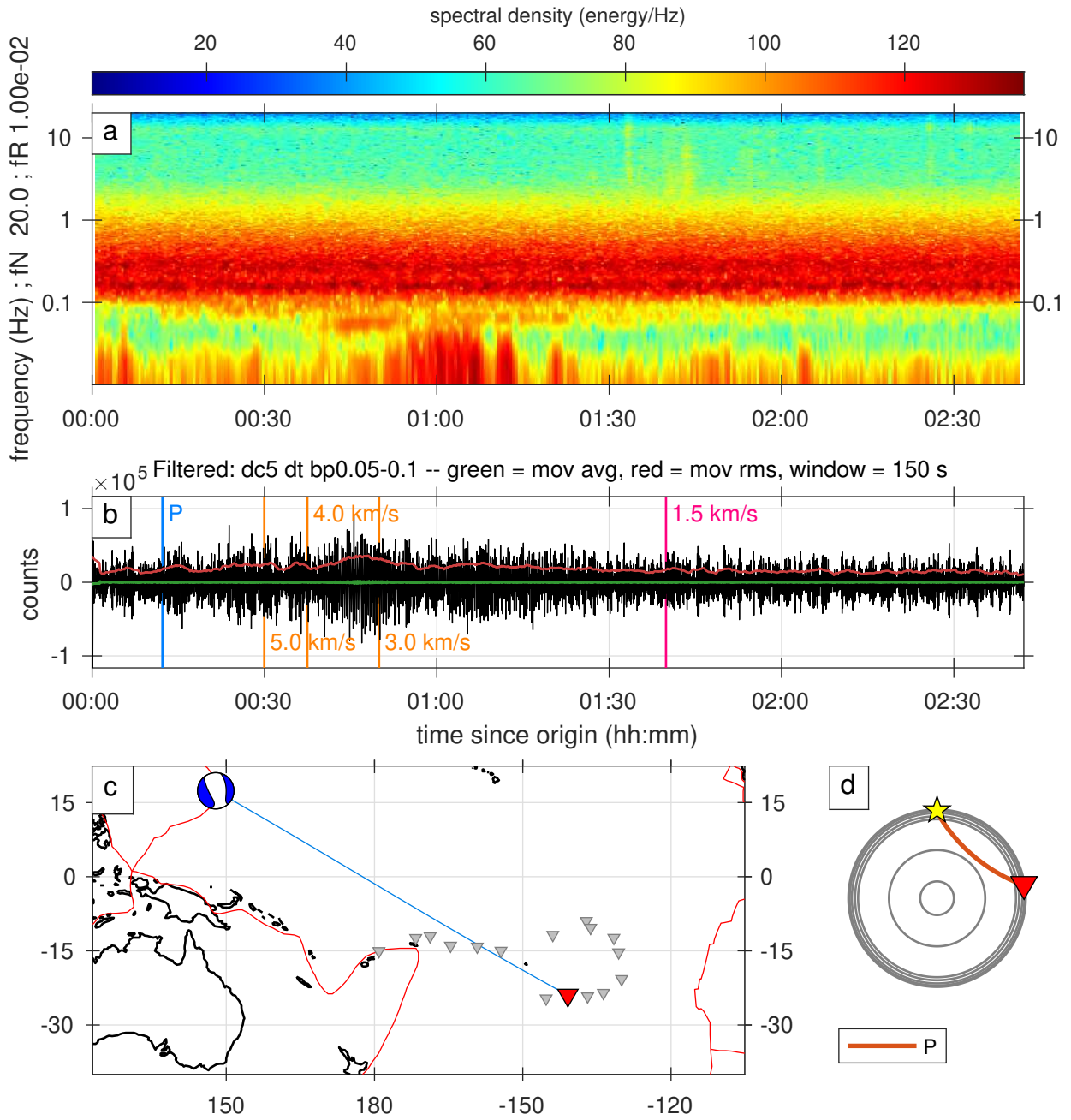


Figure S148. A full record of an earthquake classified as 1star category.



Arrival: 2018-11-04T19:40:00.000000, ID: 10967700

Mww = 5.90, distance = 95.71 degrees, depth = 9.00 km  
 9.15 - 11.11 percent

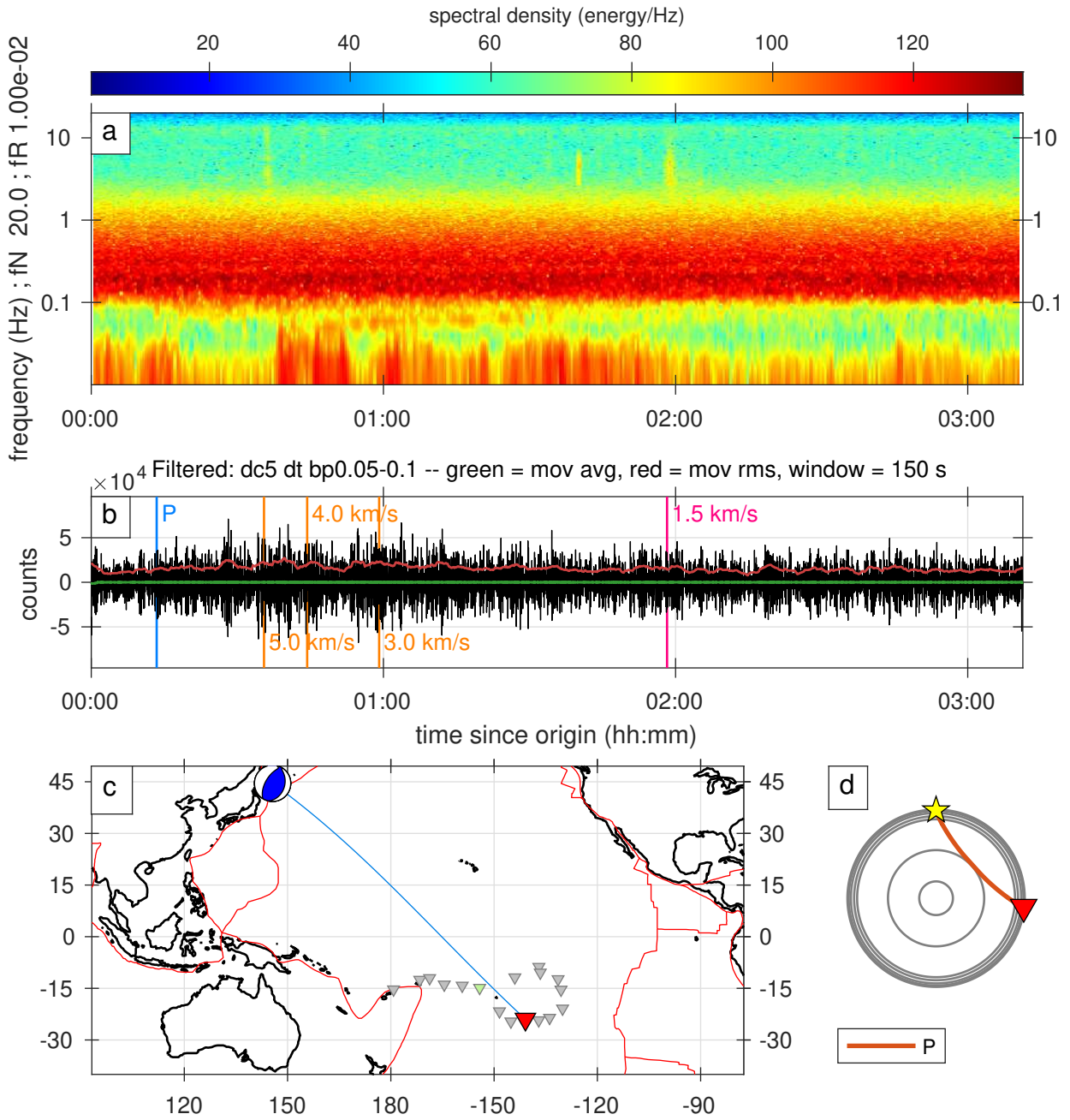


Figure S150. A full record of an earthquake classified as 1star category.

Arrival: 2018-11-25T21:10:00.000000, ID: 10974444

Mww = 5.60, distance = 69.38 degrees, depth = 10.00 km  
 59.68 - 62.48 percent

spectral density (energy/Hz)

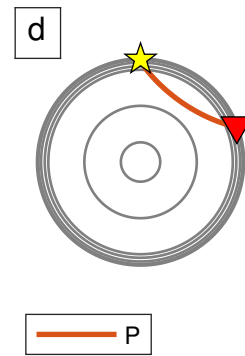
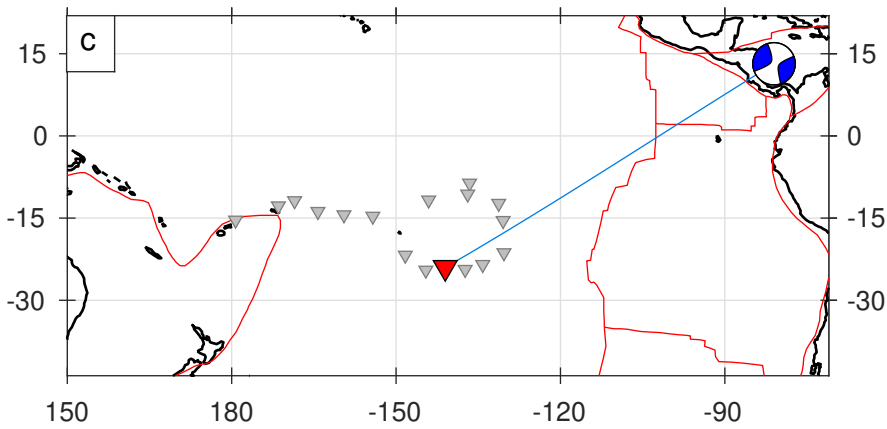
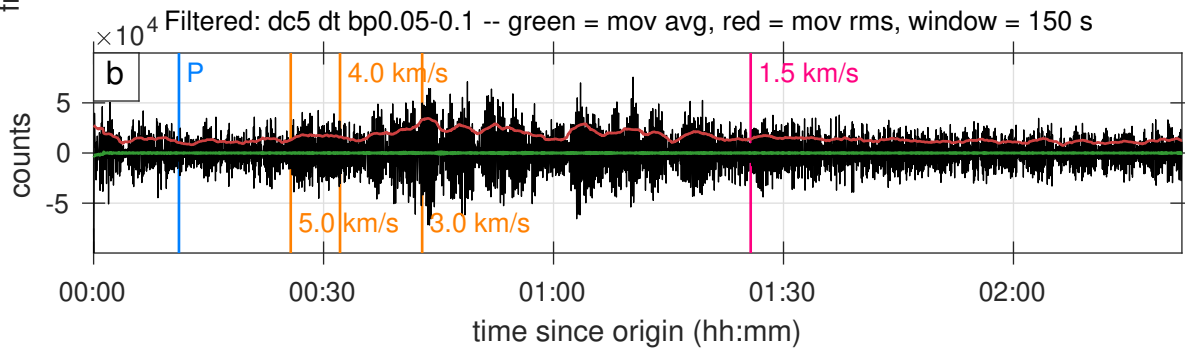
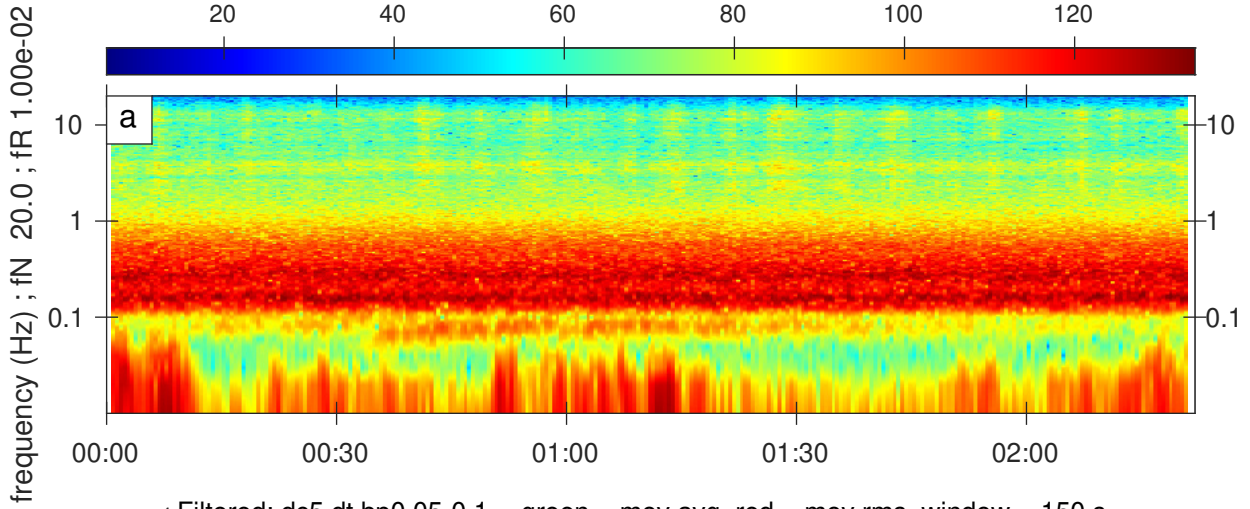


Figure S151. A full record of an earthquake classified as 1star category.

Arrival: 2018-11-29T02:44:00.000000, ID: 10975815

mb = 5.00, distance = 29.81 degrees, depth = 10.00 km  
41.94 - 44.13 percent

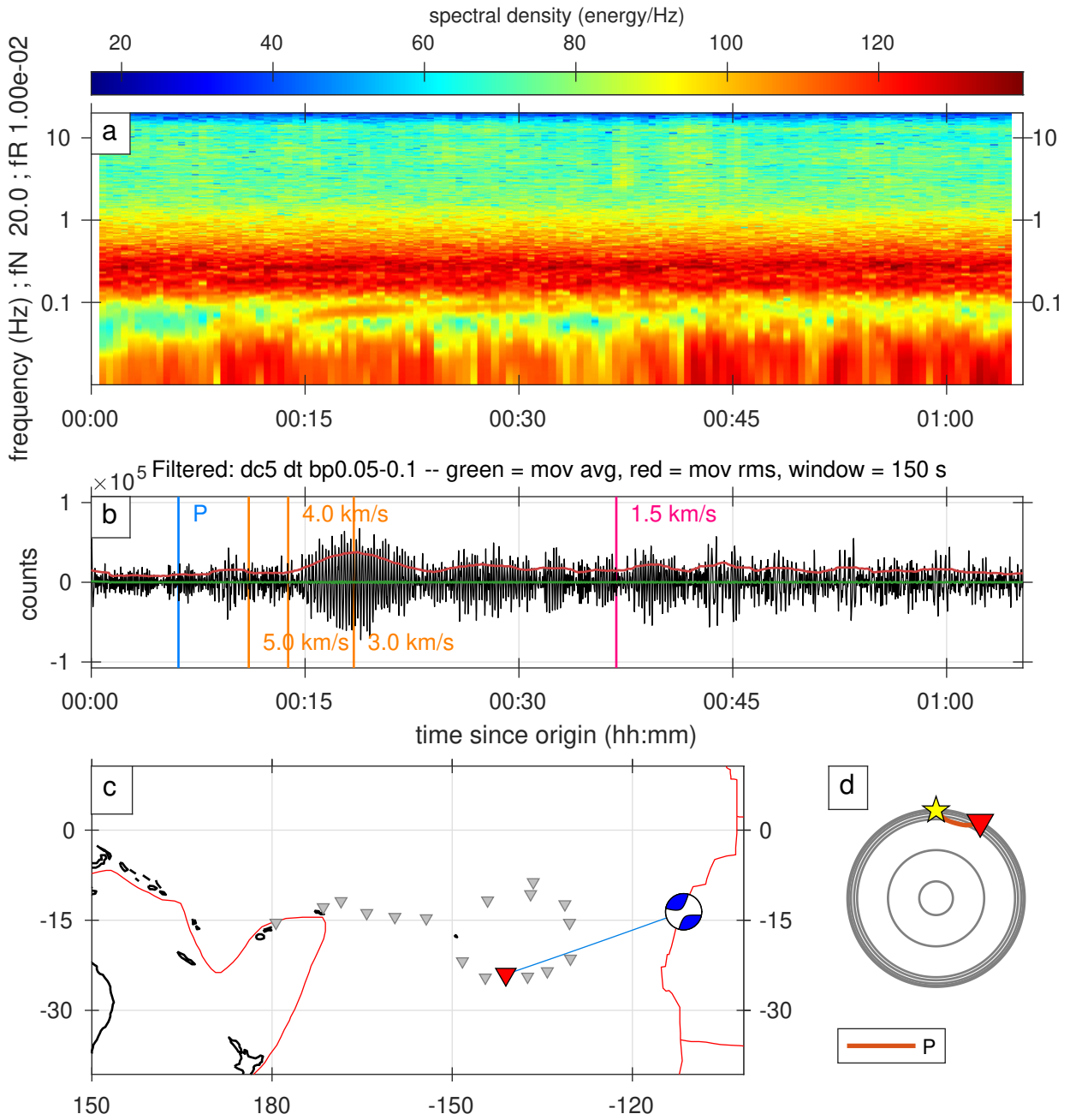


Figure S152. A full record of an earthquake classified as 1star category.



Arrival: 2018-12-03T21:30:36.595530, ID: 10979158

mb = 5.10, distance = 30.77 degrees, depth = 10.00 km

58.02 - 59.45 percent

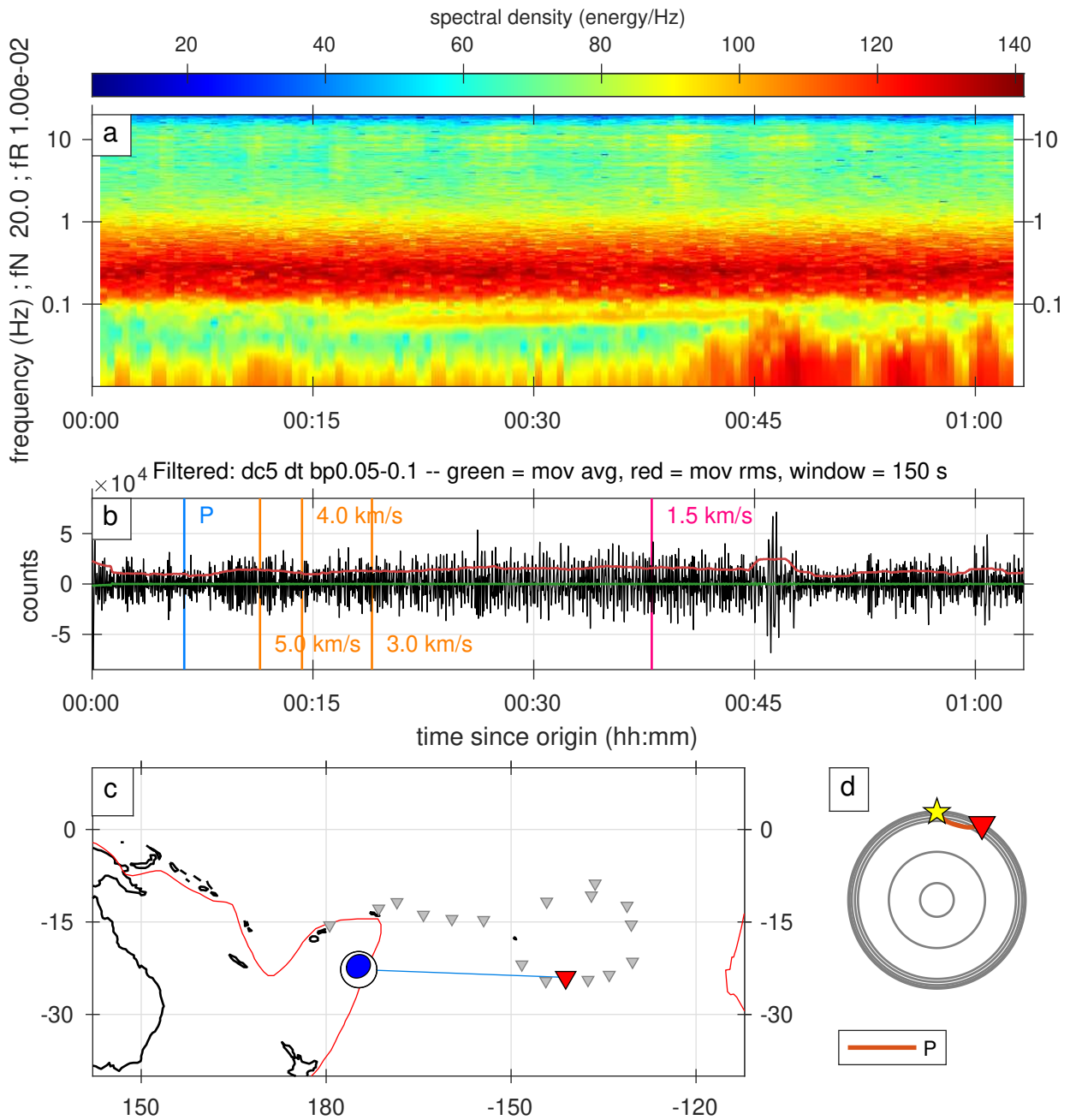


Figure S153. A full record of an earthquake classified as 1star category.

Arrival: 2018-12-15T20:33:00.000000, ID: 10985560

Mww = 5.40, distance = 47.73 degrees, depth = 11.08 km  
45.94 - 46.95 percent

spectral density (energy/Hz)

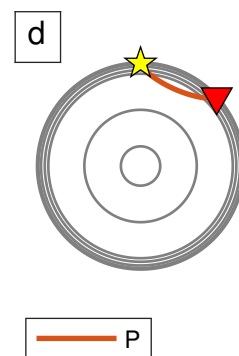
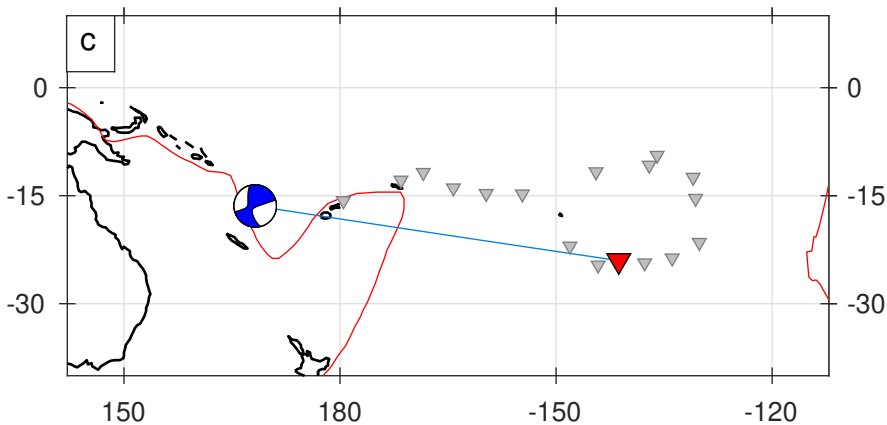
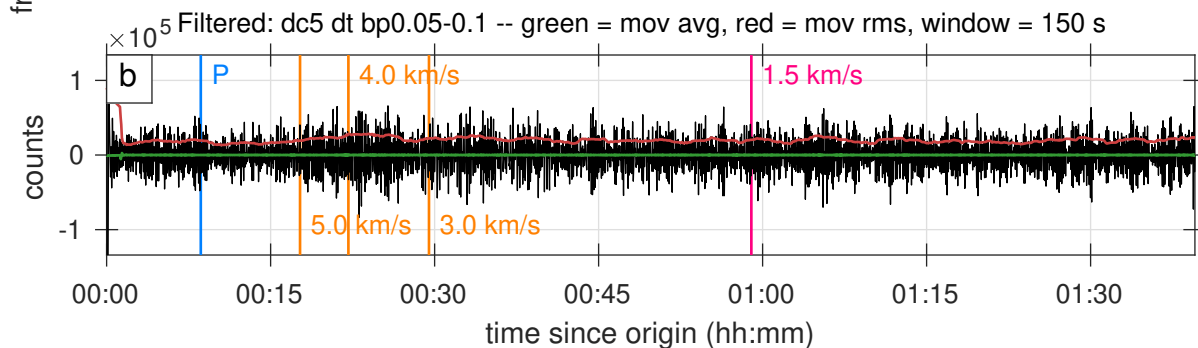
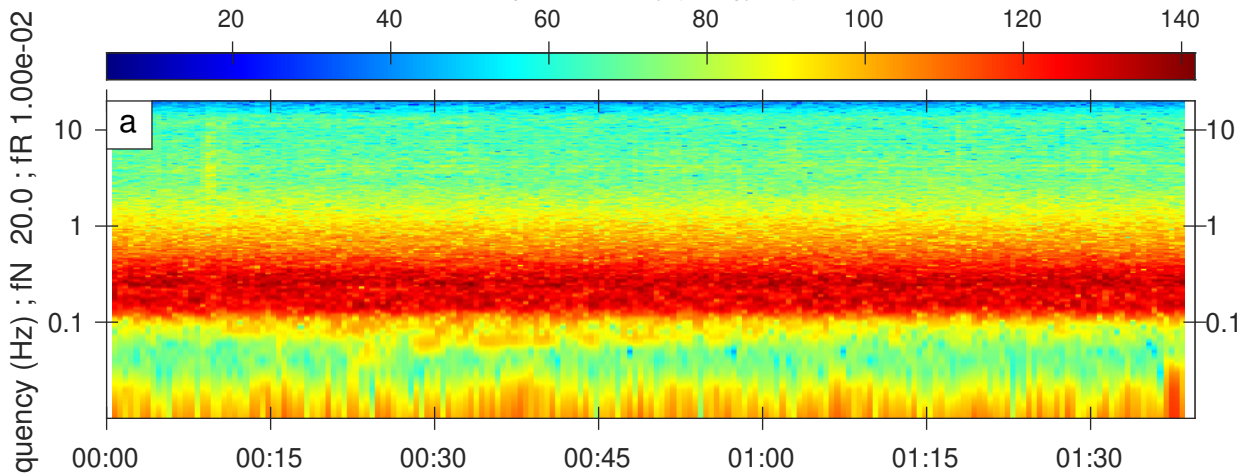


Figure S154. A full record of an earthquake classified as 1star category.

Arrival: 2018-12-16T09:52:00.000000, ID: 10985766

Mww = 6.10, distance = 77.87 degrees, depth = 61.97 km

54.03 - 55.58 percent

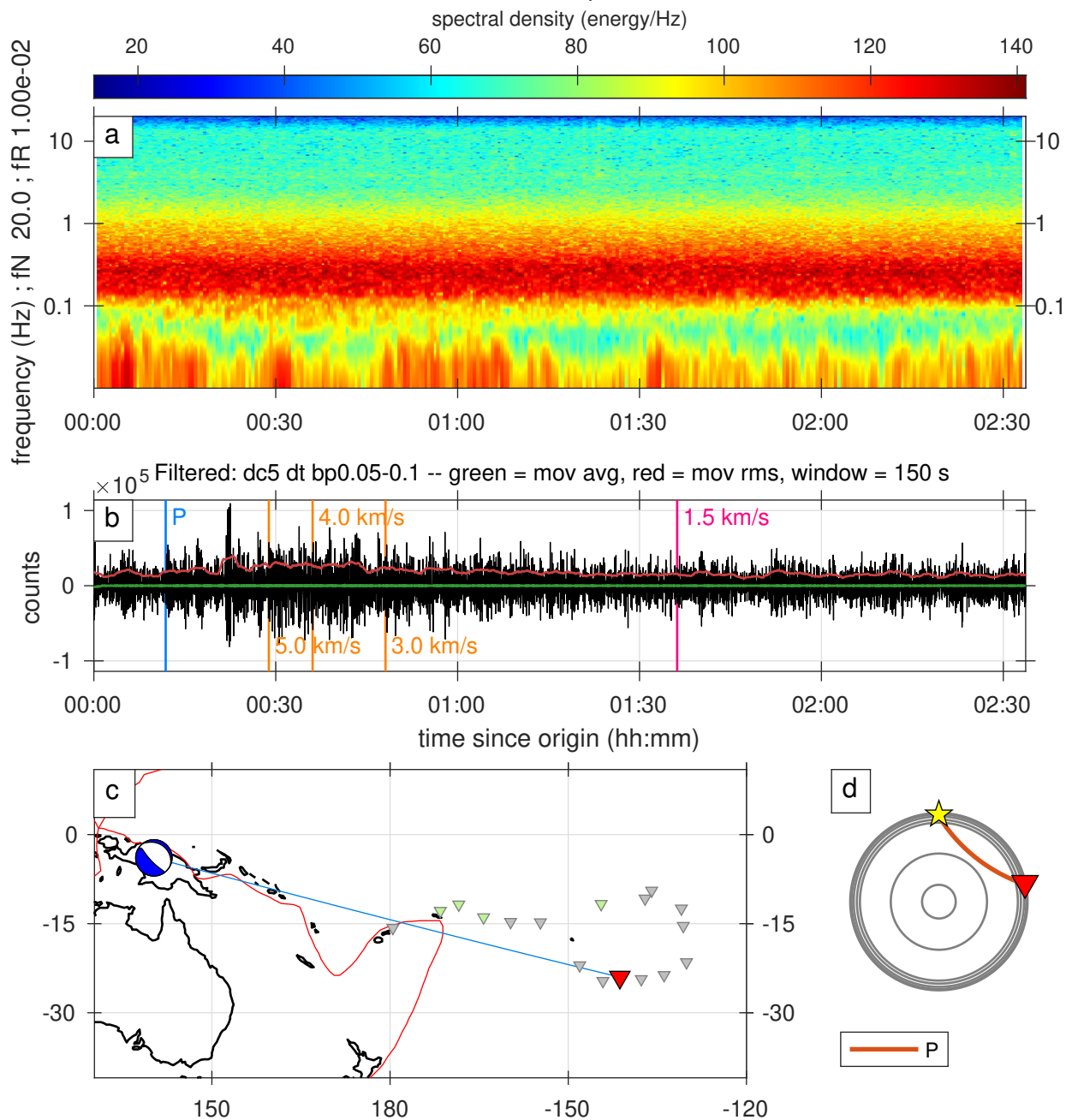


Figure S155. A full record of an earthquake classified as 1star category.



Arrival: 2018-12-16T14:40:00.000000, ID: 10985829

Mww = 5.80, distance = 94.17 degrees, depth = 10.00 km  
56.90 - 58.80 percent

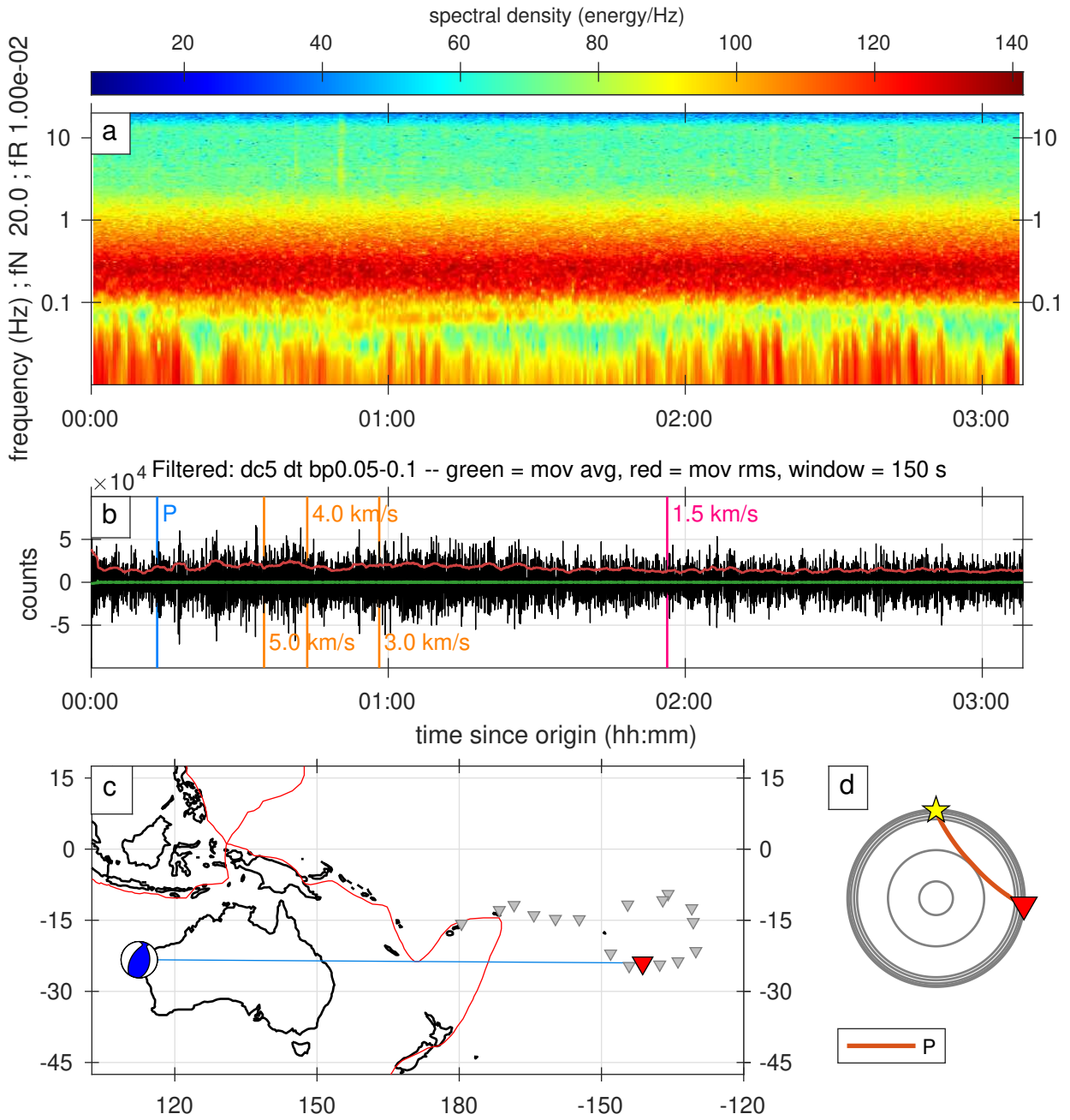


Figure S156. A full record of an earthquake classified as 1star category.

Arrival: 2018-12-22T14:33:00.000000, ID: 10988309

Mww = 6.00, distance = 49.90 degrees, depth = 42.00 km  
34.32 - 38.00 percent

spectral density (energy/Hz)

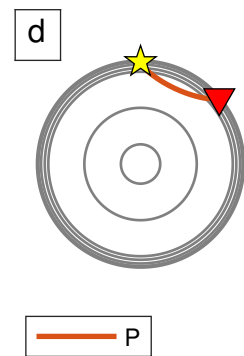
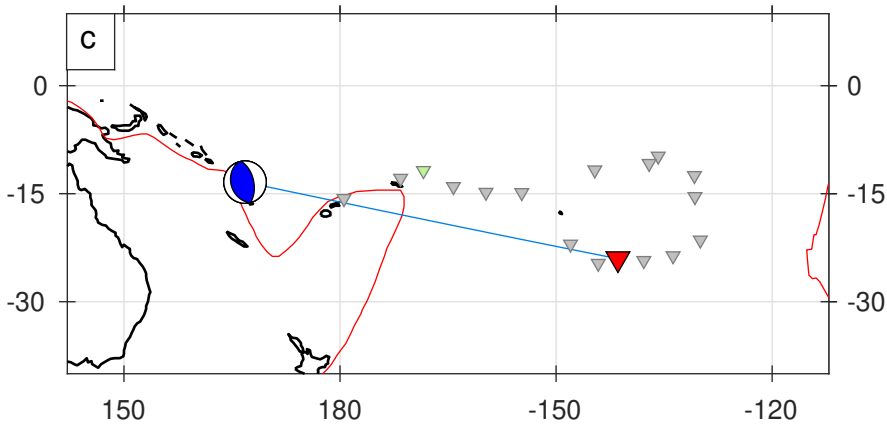
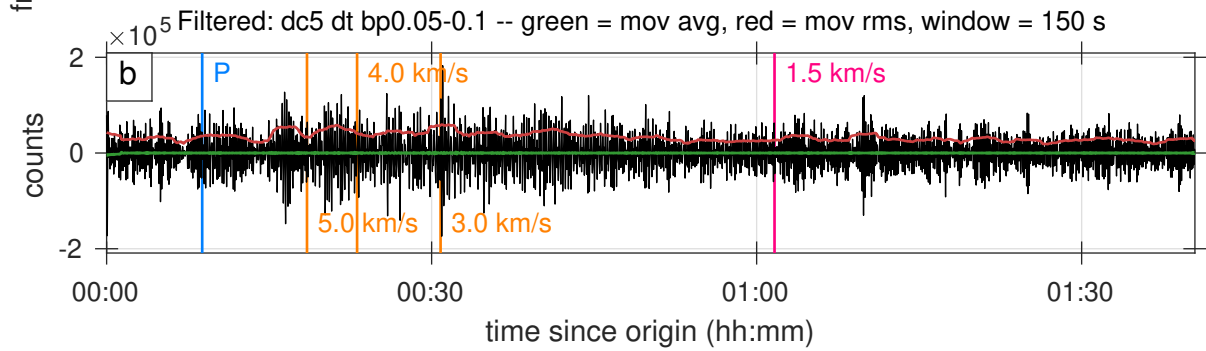
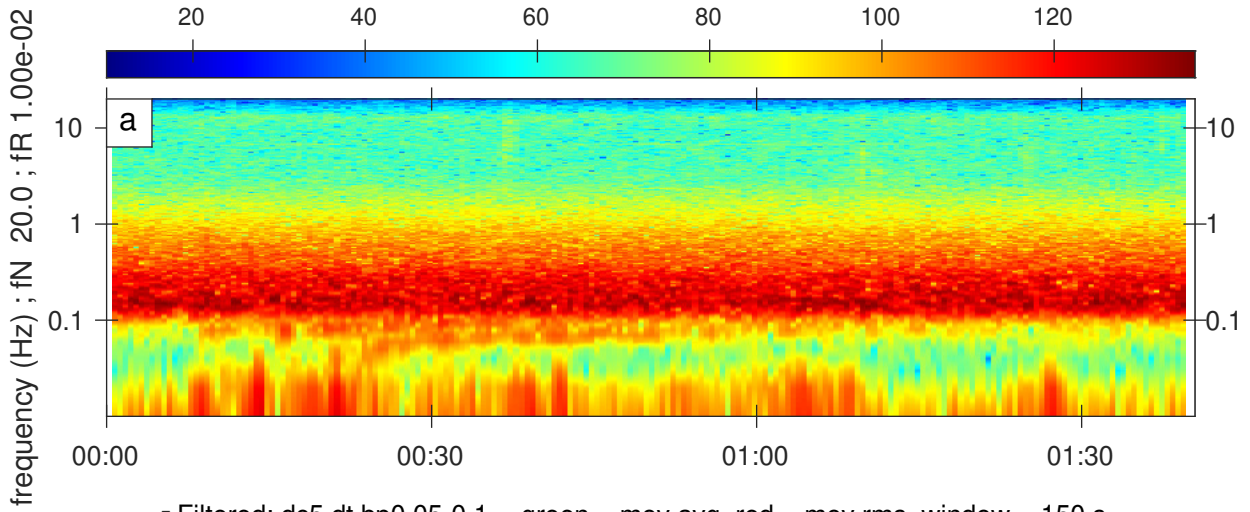


Figure S157. A full record of an earthquake classified as 1star category.

Arrival: 2018-12-25T00:25:00.000000, ID: 10989140

Mww = 5.30, distance = 93.24 degrees, depth = 10.00 km  
13.68 - 34.49 percent

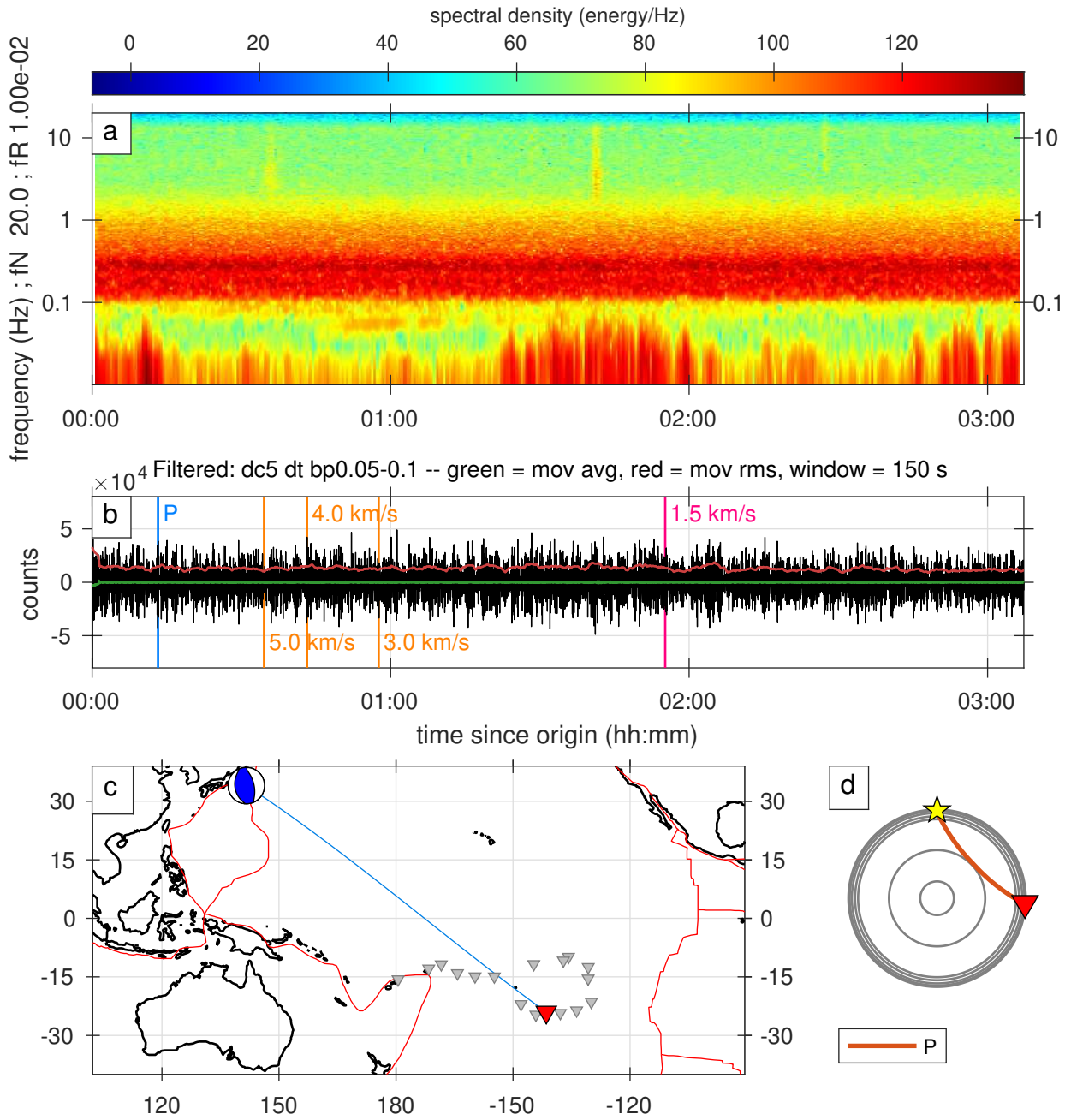


Figure S158. A full record of an earthquake classified as 1star category.

Arrival: 2018-12-26T23:42:33.082709, ID: 10989721

mb = 5.10, distance = 30.46 degrees, depth = 10.00 km

10.61 - 11.97 percent

spectral density (energy/Hz)

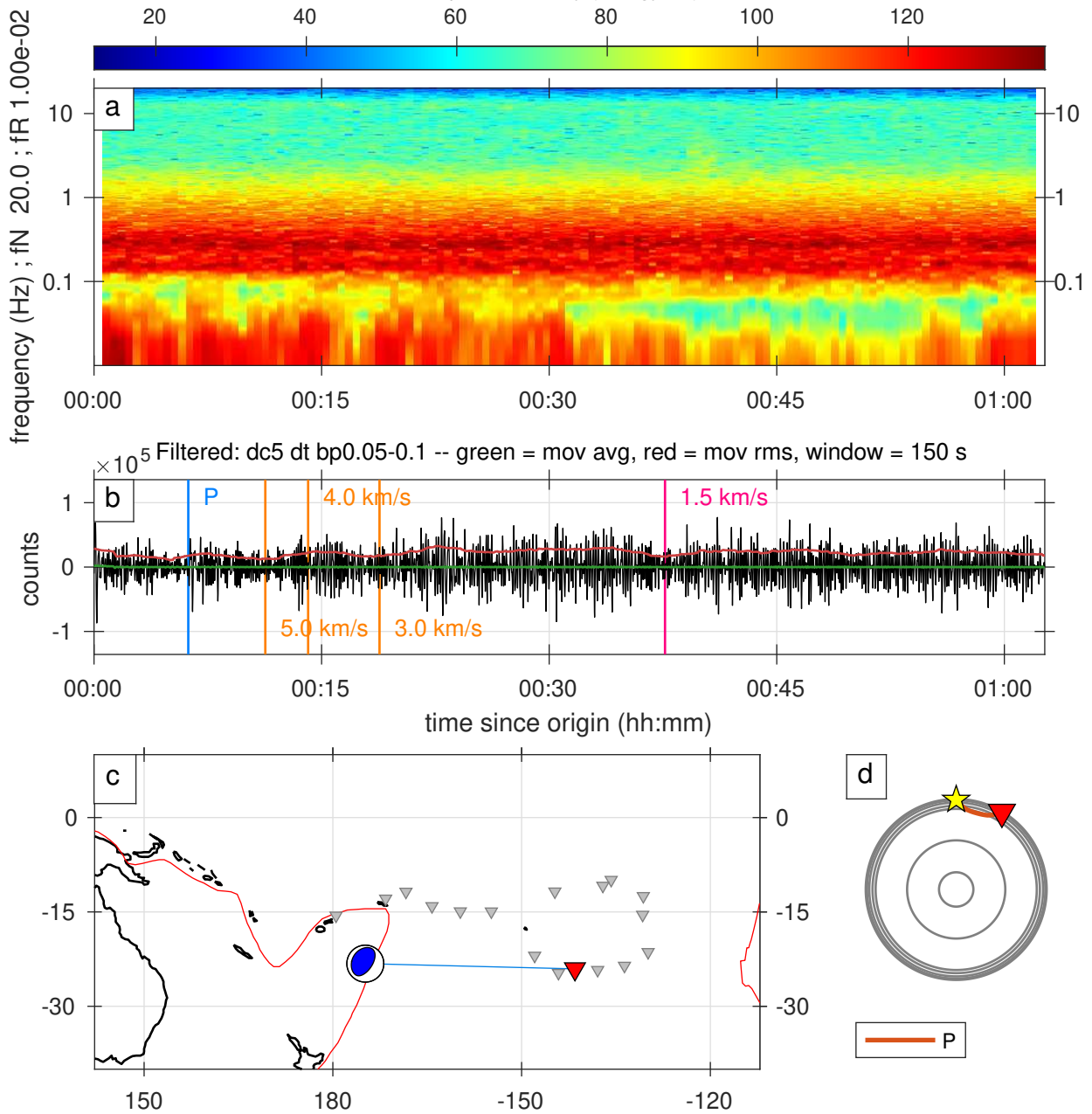


Figure S159. A full record of an earthquake classified as 1star category.

Arrival: 2018-12-27T14:52:29.434833, ID: 10989901

mb = 4.90, distance = 30.44 degrees, depth = 10.00 km  
 30.45 - 31.81 percent

spectral density (energy/Hz)

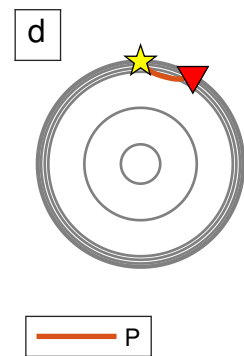
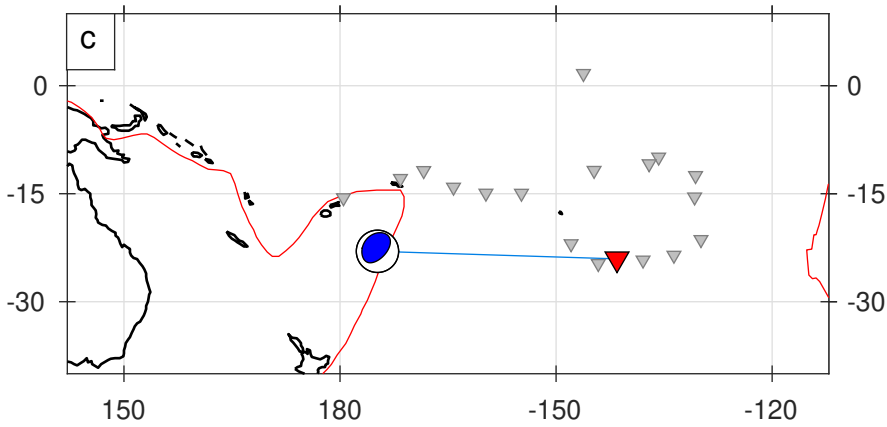
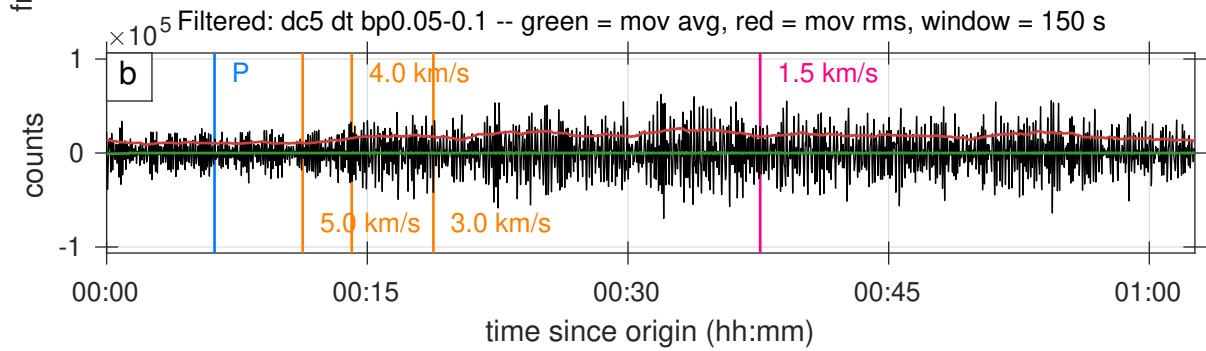
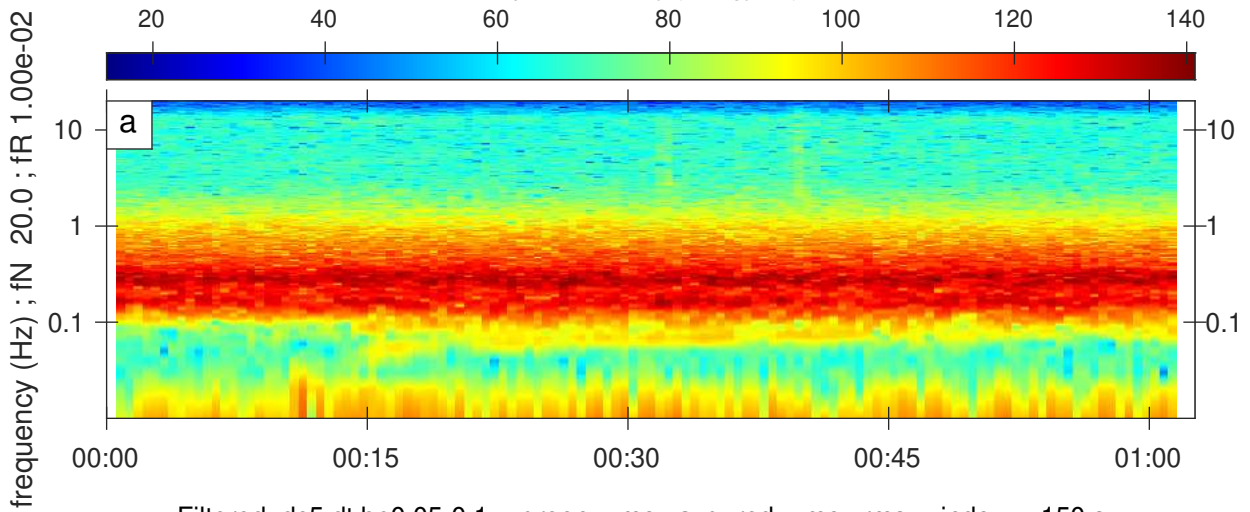


Figure S160. A full record of an earthquake classified as 1star category.



Arrival: 2018-12-28T19:59:17.362329, ID: 10996998

mb = 4.60, distance = 35.30 degrees, depth = 10.00 km

68.51 - 70.09 percent

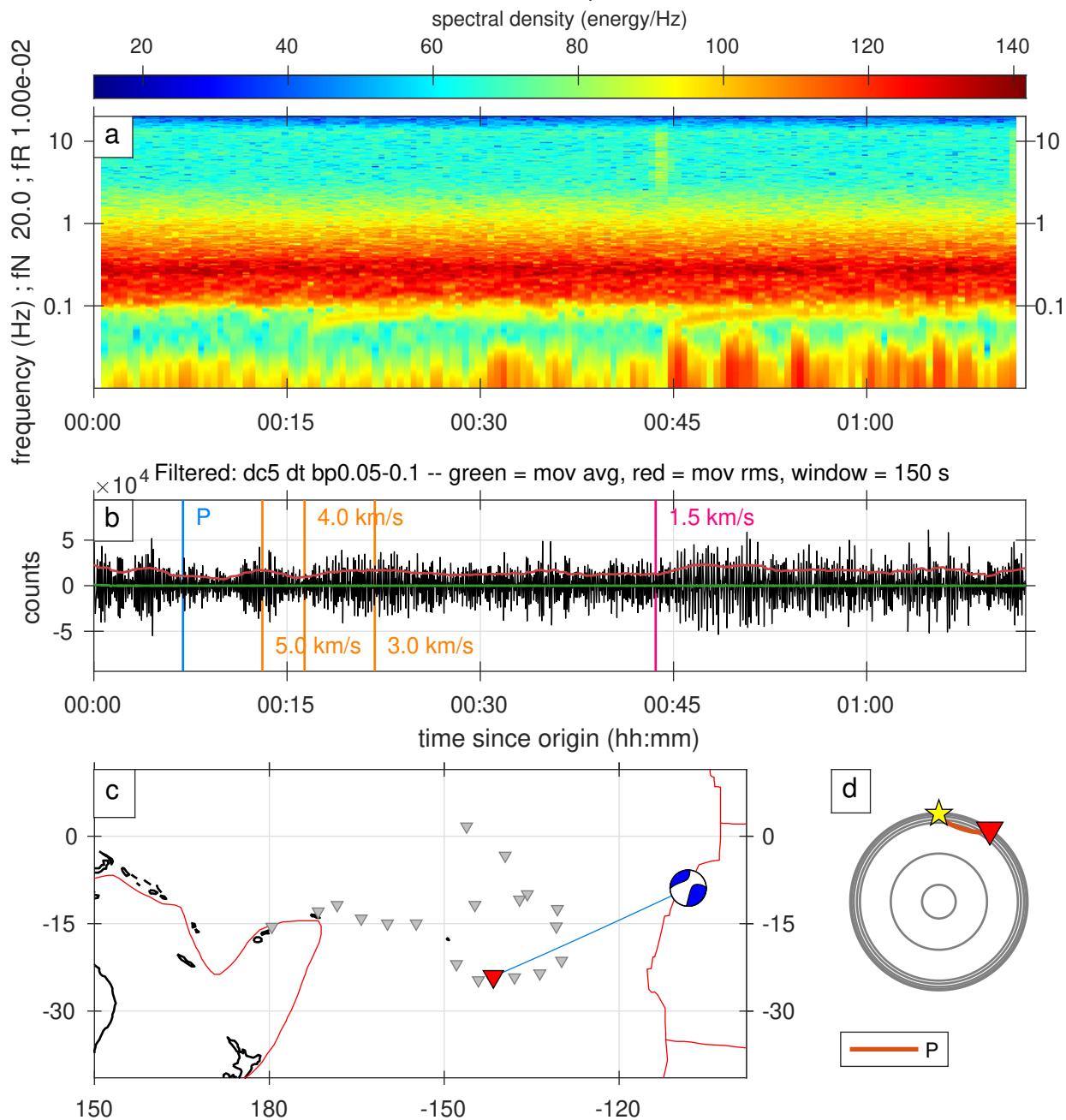


Figure S161. A full record of an earthquake classified as 1star category.

Arrival: 2018-12-28T20:27:04.655526, ID: 10990456

mb = 4.80, distance = 35.00 degrees, depth = 10.00 km  
69.12 - 70.68 percent

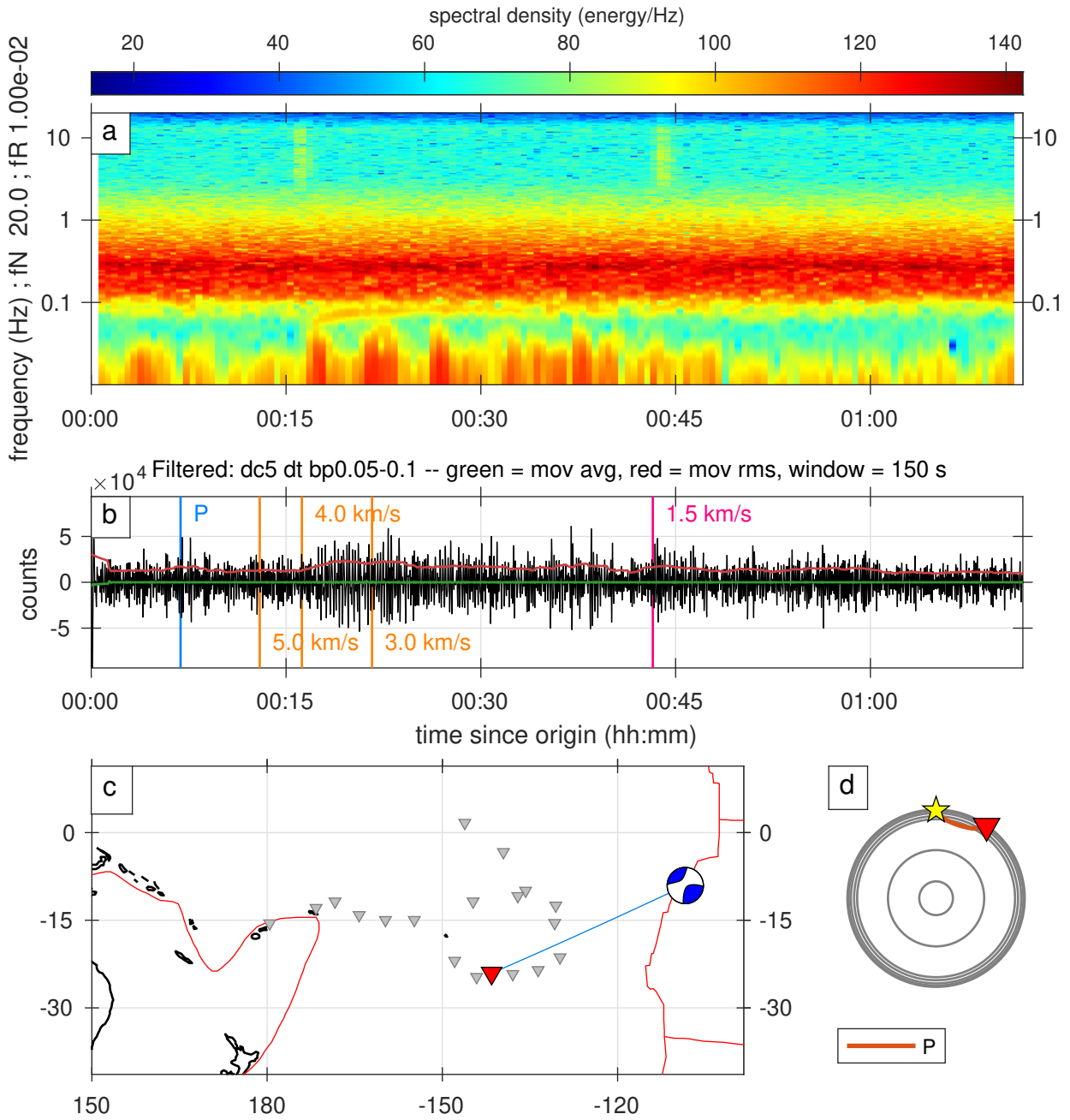


Figure S162. A full record of an earthquake classified as 1star category.

Arrival: 2019-01-05T23:07:00.000000, ID: 10992877

Mww = 5.70, distance = 86.95 degrees, depth = 14.28 km  
41.50 - 84.47 percent

spectral density (energy/Hz)

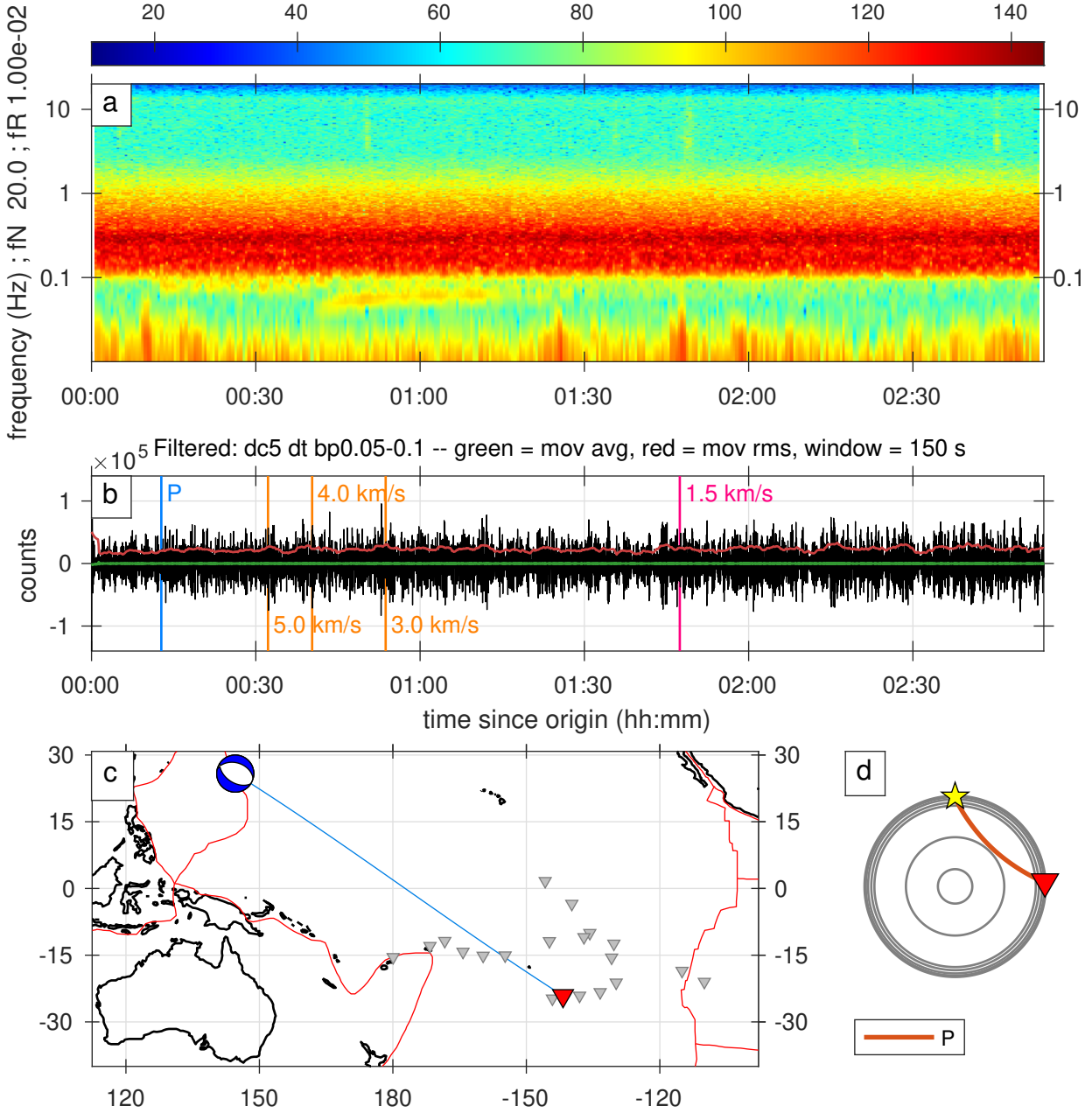


Figure S163. A full record of an earthquake classified as 1star category.



Arrival: 2019-01-17T15:18:00.000000, ID: 10996799

Mww = 6.20, distance = 71.92 degrees, depth = 10.00 km  
81.74 - 84.96 percent

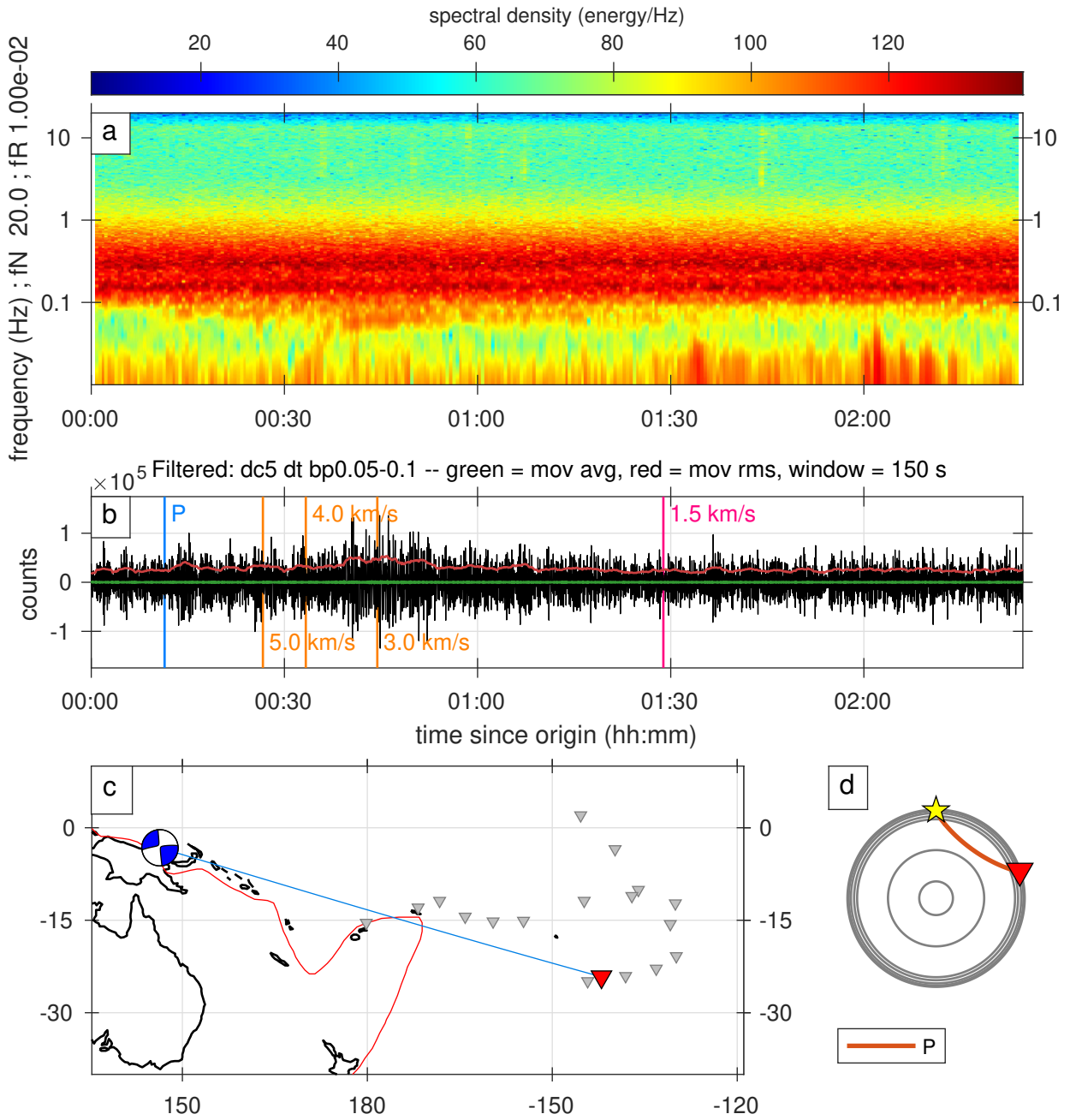


Figure S164. A full record of an earthquake classified as 1star category.

Arrival: 2019-01-25T04:55:00.000000, ID: 10999355

Mww = 5.70, distance = 63.19 degrees, depth = 60.91 km  
 42.01 - 45.30 percent

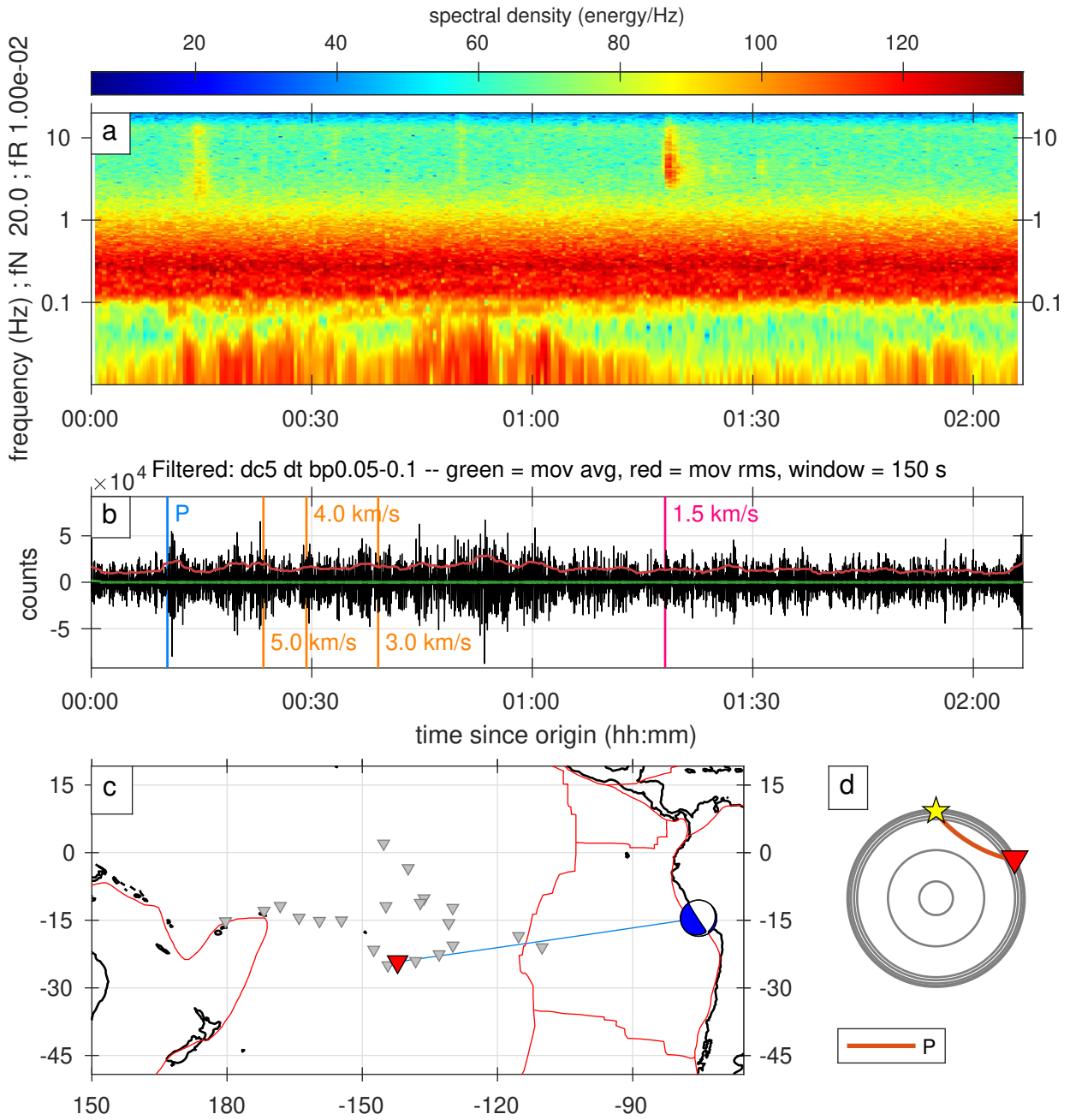


Figure S165. A full record of an earthquake classified as 1star category.

Arrival: 2019-01-26T12:43:38.600565, ID: 10999684

Mww = 5.60, distance = 70.00 degrees, depth = 10.00 km  
 91.52 - 95.18 percent

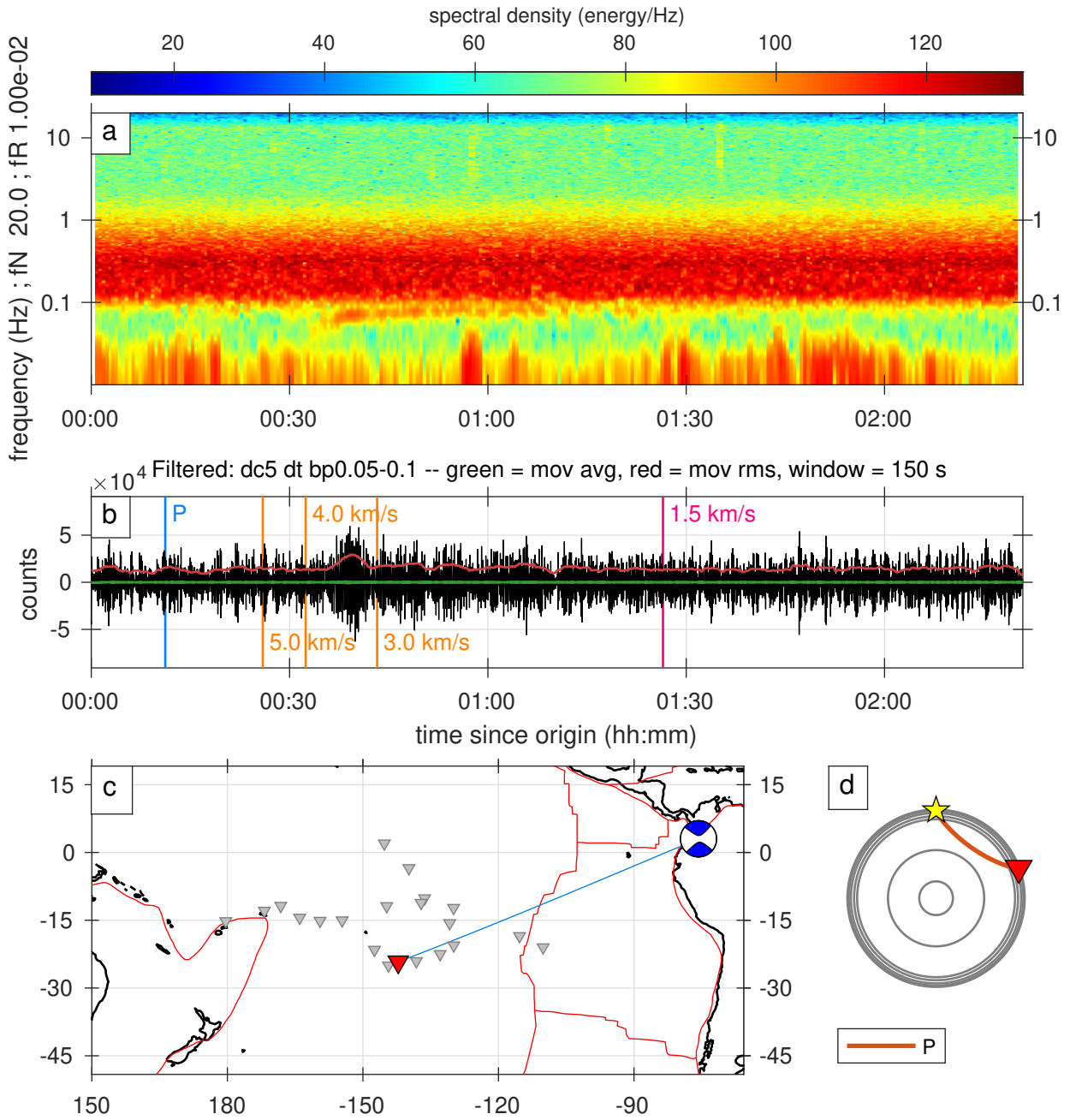


Figure S166. A full record of an earthquake classified as 1star category.

Arrival: 2019-01-30T07:55:00.000000, ID: 11000968

Mww = 5.60, distance = 63.99 degrees, depth = 51.00 km  
5.10 - 12.81 percent

spectral density (energy/Hz)

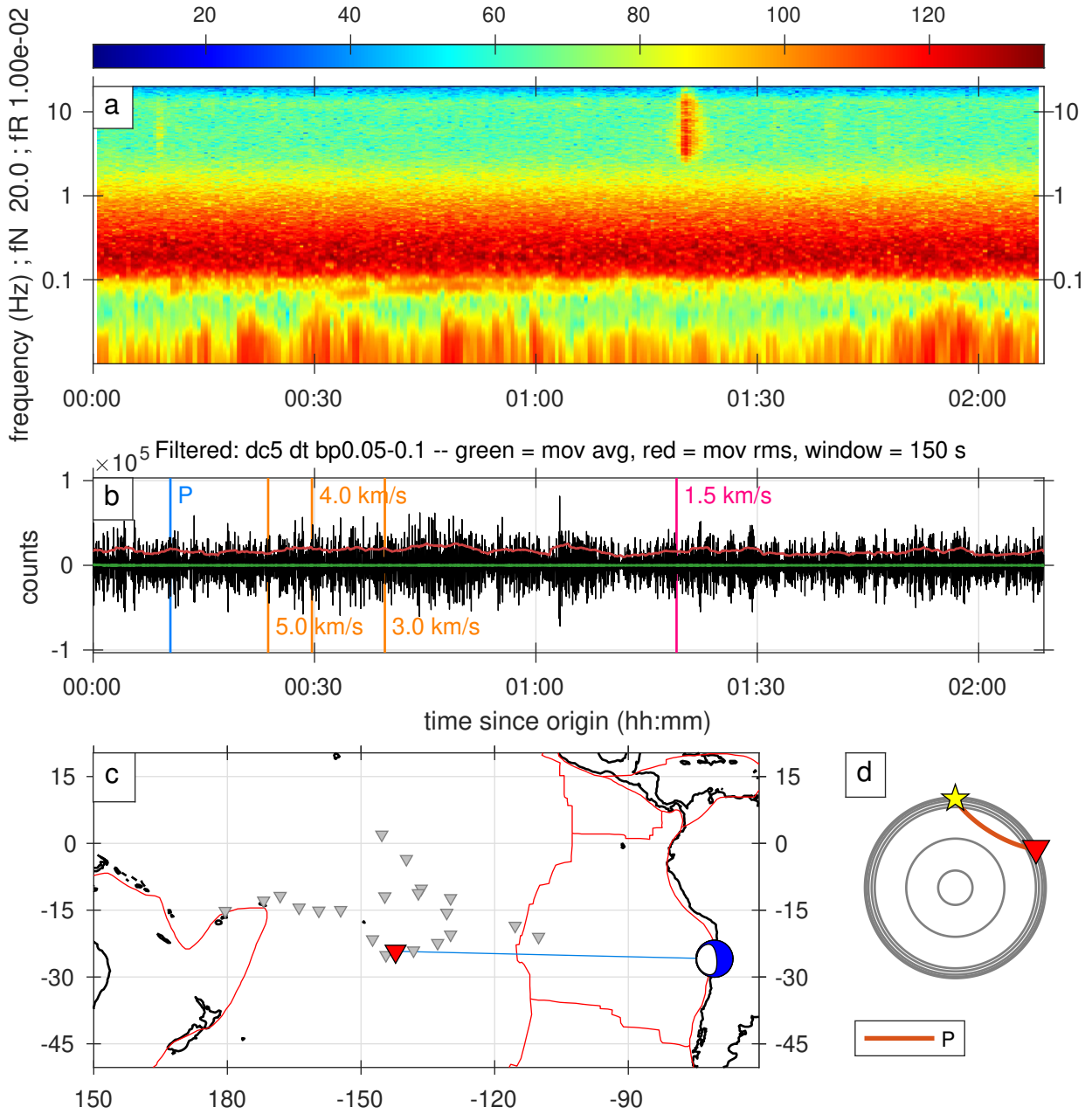


Figure S167. A full record of an earthquake classified as 1star category.

Arrival: 2019-02-08T12:08:00.000000, ID: 11003845

Mww = 5.90, distance = 95.03 degrees, depth = 24.71 km  
 20.54 - 23.06 percent

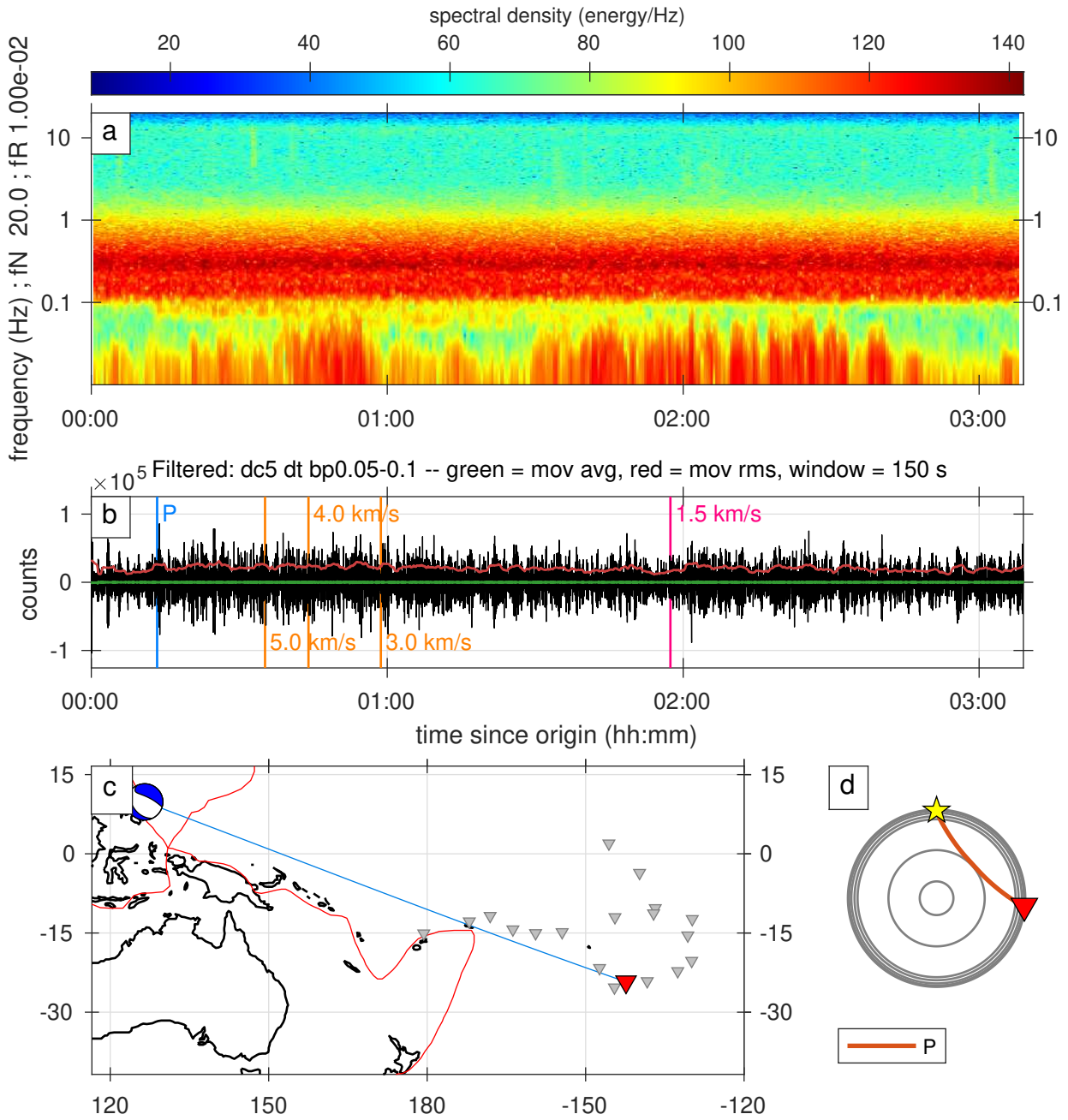


Figure S168. A full record of an earthquake classified as 1star category.



Arrival: 2019-02-15T12:53:43.791266, ID: 11005855

mb = 4.70, distance = 30.90 degrees, depth = 10.00 km

26.10 - 26.69 percent

spectral density (energy/Hz)

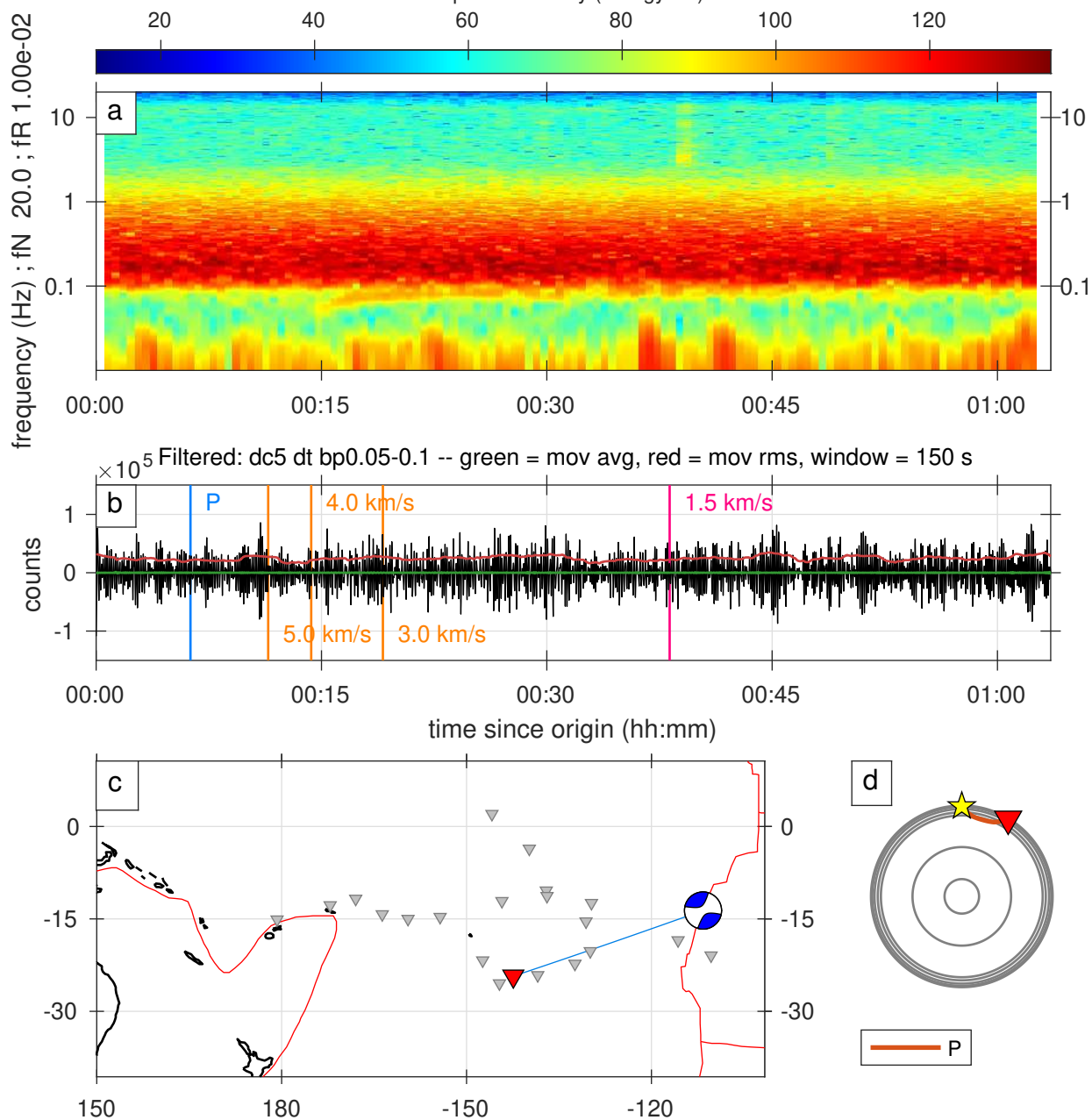


Figure S169. A full record of an earthquake classified as 1star category.

Arrival: 2019-02-16T00:00:00.000000, ID: 11006952

Mww = 5.60, distance = 33.94 degrees, depth = 10.00 km  
 32.25 - 32.91 percent

spectral density (energy/Hz)

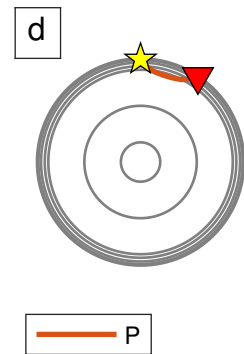
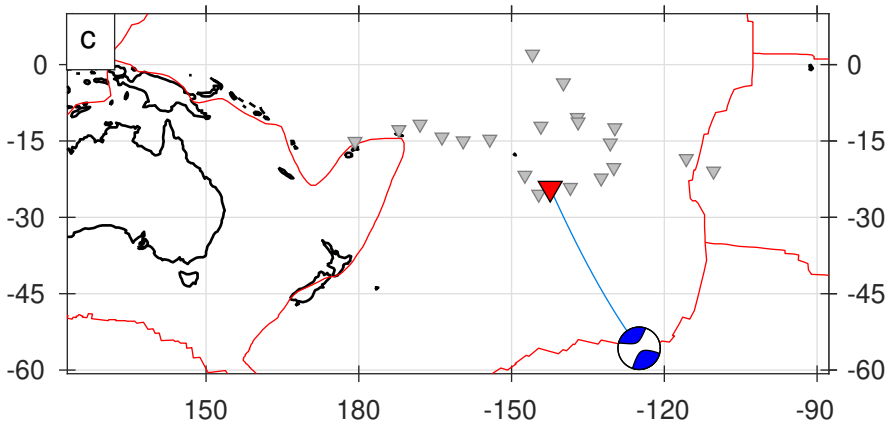
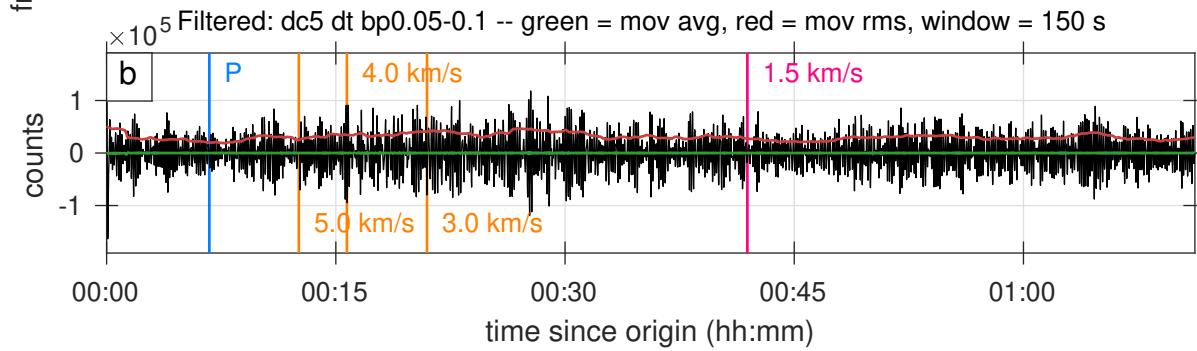
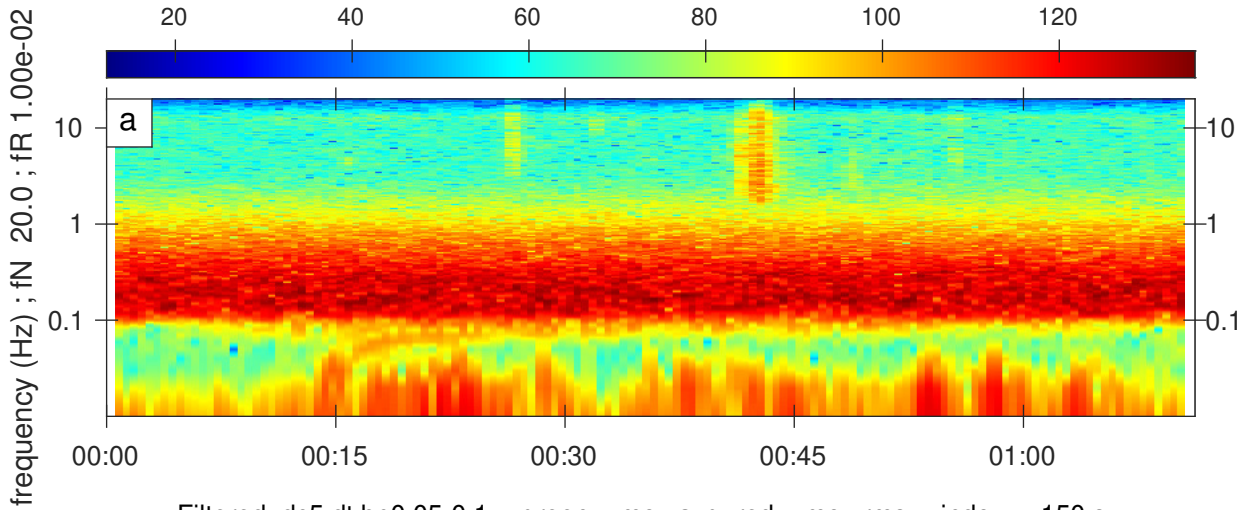


Figure S170. A full record of an earthquake classified as 1star category.

Arrival: 2019-02-17T14:45:50.000000, ID: 11006560

Mww = 6.40, distance = 66.29 degrees, depth = 368.12 km

53.77 - 55.00 percent

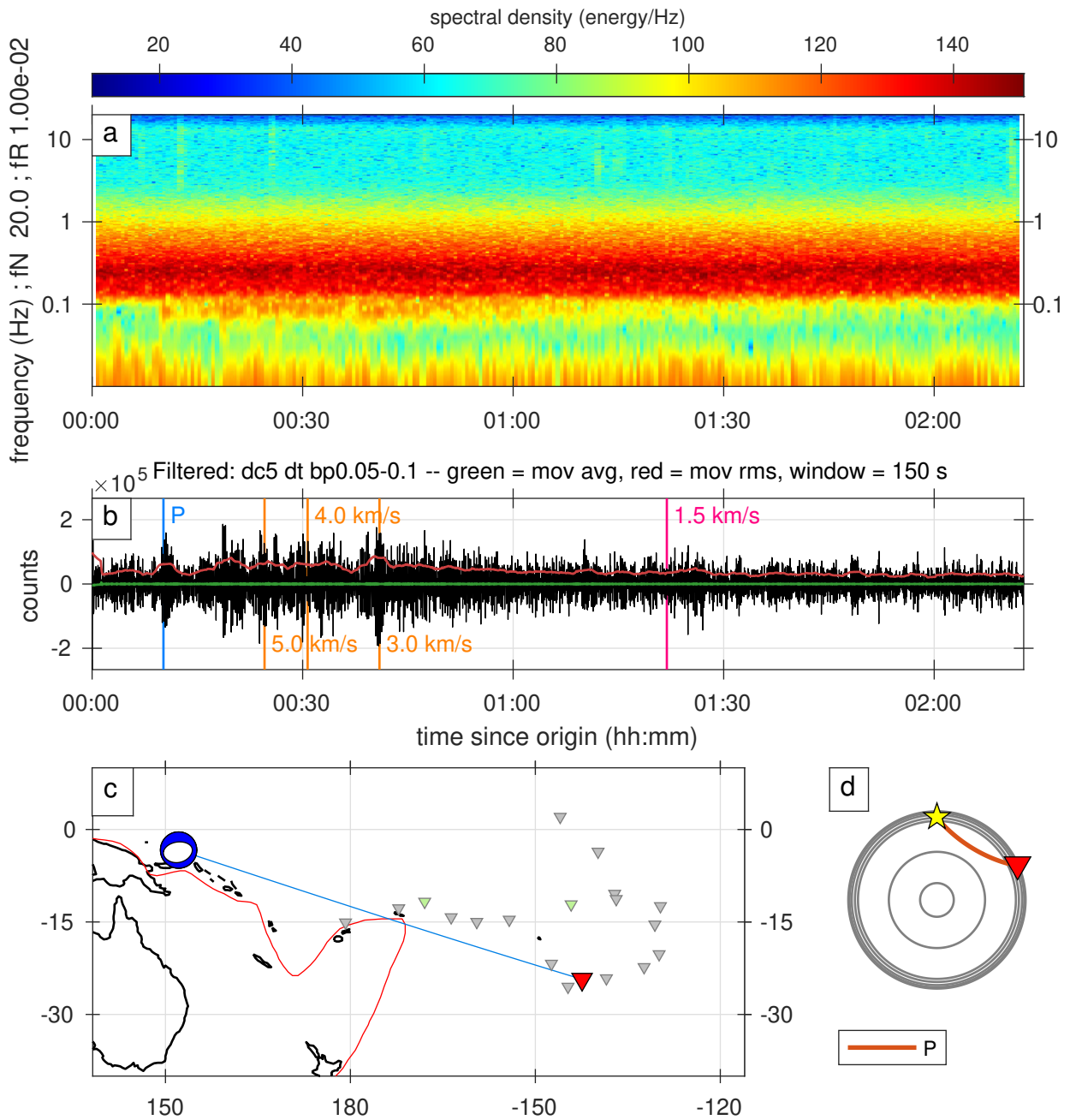


Figure S171. A full record of an earthquake classified as 1star category.



Arrival: 2019-03-06T07:28:22.218185, ID: 11011831

Mww = 5.60, distance = 40.25 degrees, depth = 10.00 km  
81.14 - 82.40 percent

spectral density (energy/Hz)

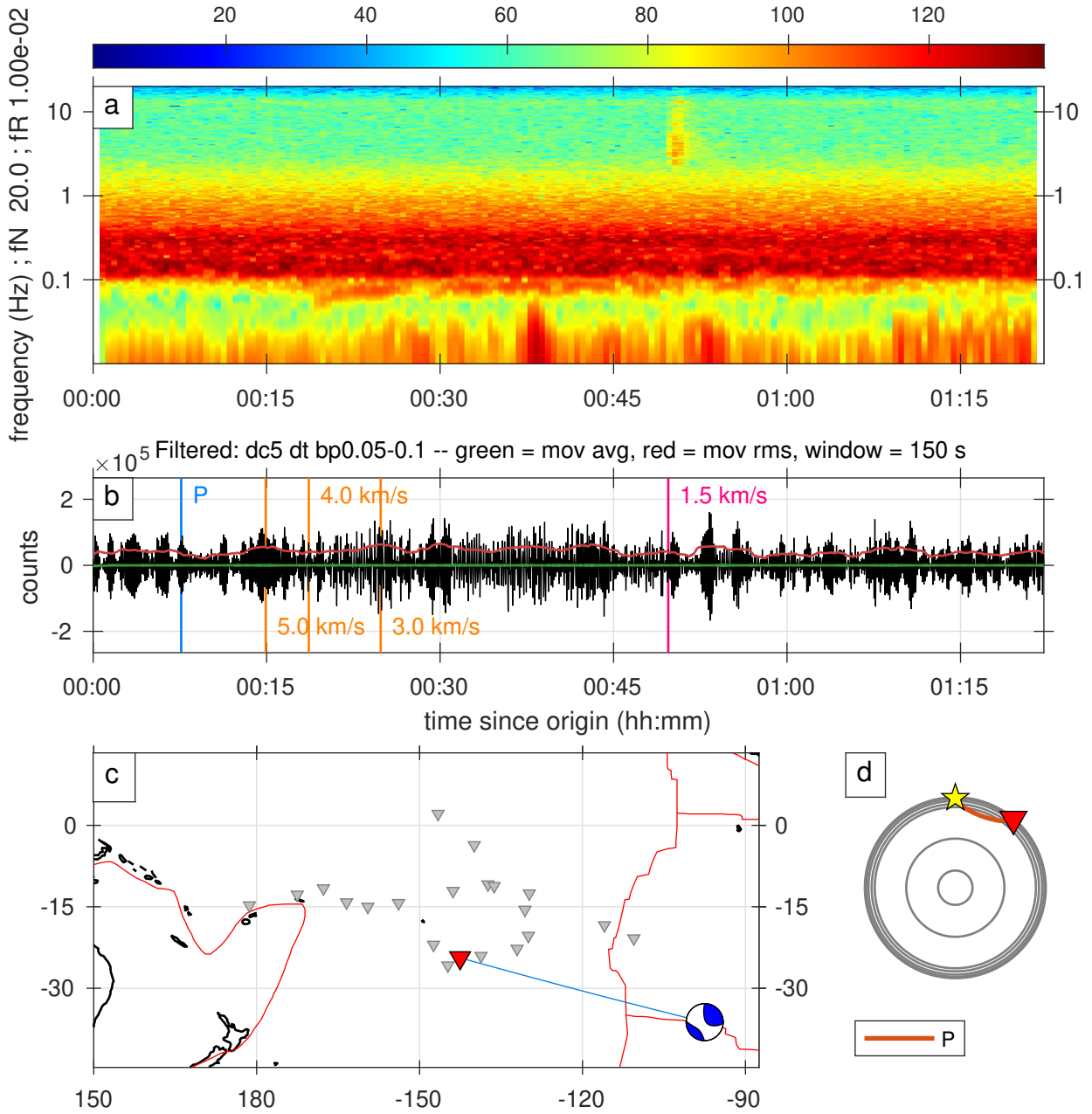


Figure S172. A full record of an earthquake classified as 1star category.

Arrival: 2019-03-11T16:36:00.000000, ID: 11013478

Mww = 5.90, distance = 67.84 degrees, depth = 34.64 km

15.17 - 16.93 percent

spectral density (energy/Hz)

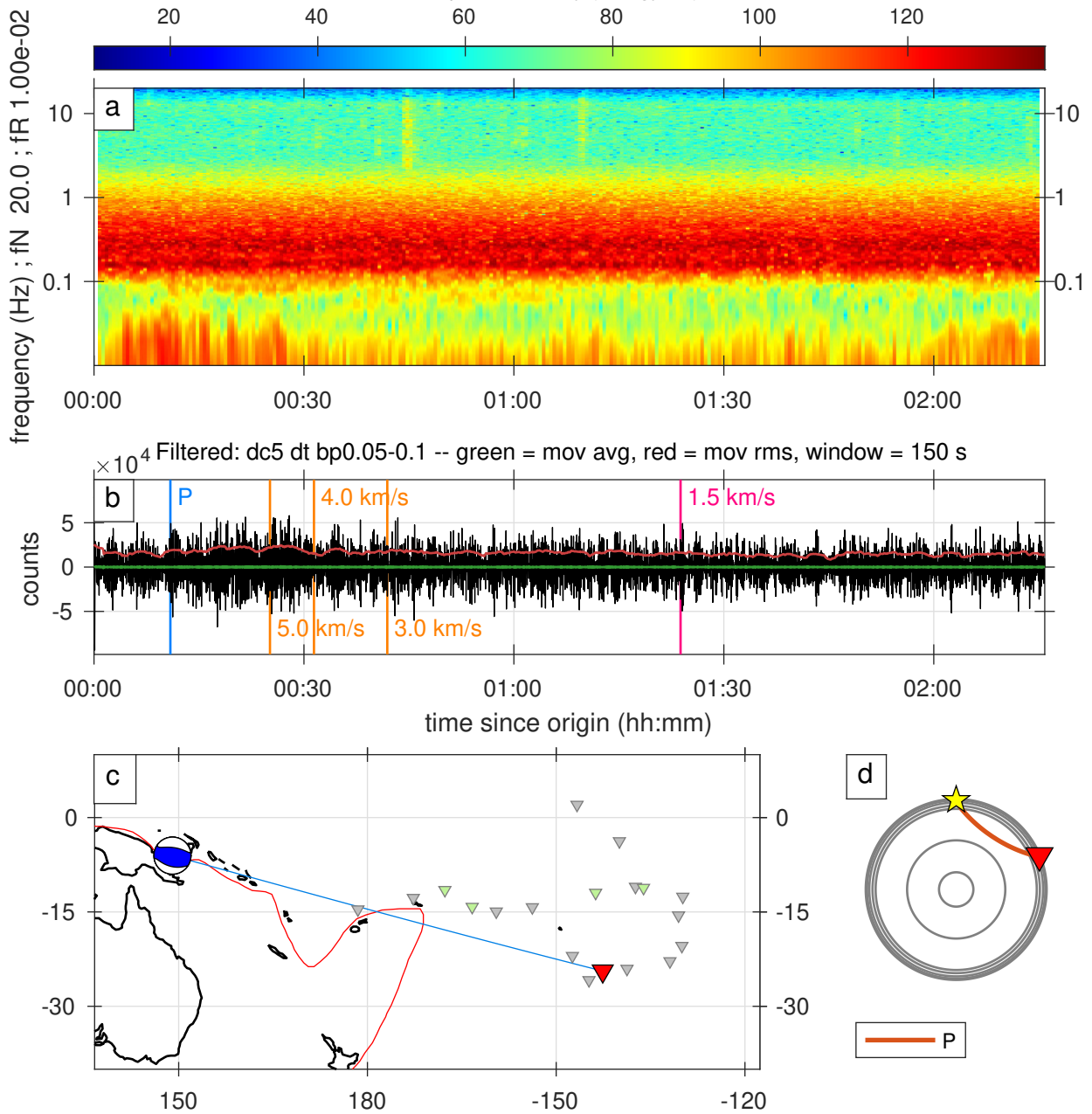


Figure S173. A full record of an earthquake classified as 1star category.

Arrival: 2019-03-15T05:15:00.000000, ID: 11014923

Mww = 6.30, distance = 71.00 degrees, depth = 359.00 km  
81.08 - 82.94 percent

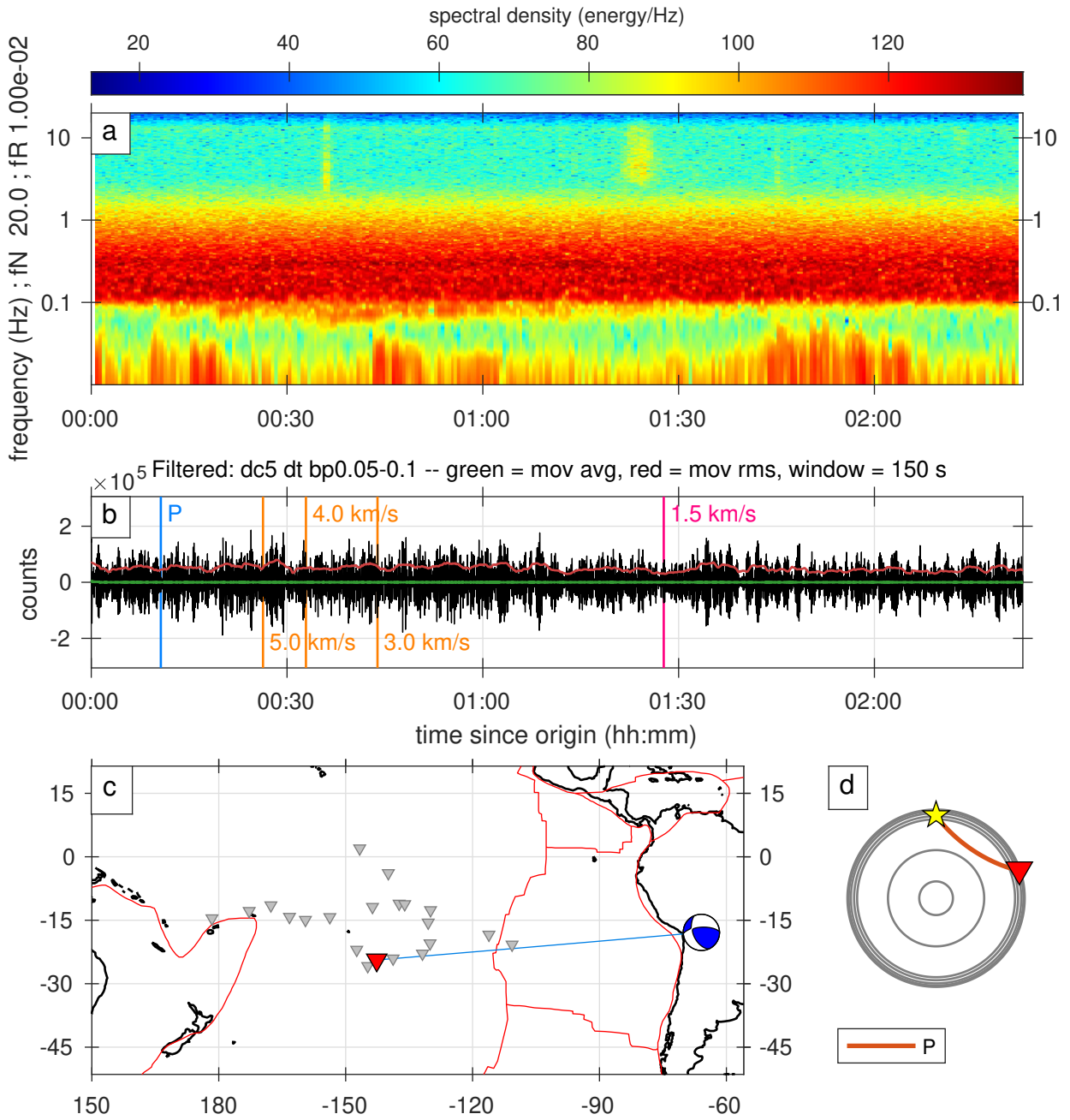


Figure S174. A full record of an earthquake classified as 1star category.

Arrival: 2019-03-15T18:00:00.000000, ID: 11015065

Mww = 5.60, distance = 30.46 degrees, depth = 10.00 km

91.08 - 91.89 percent

spectral density (energy/Hz)

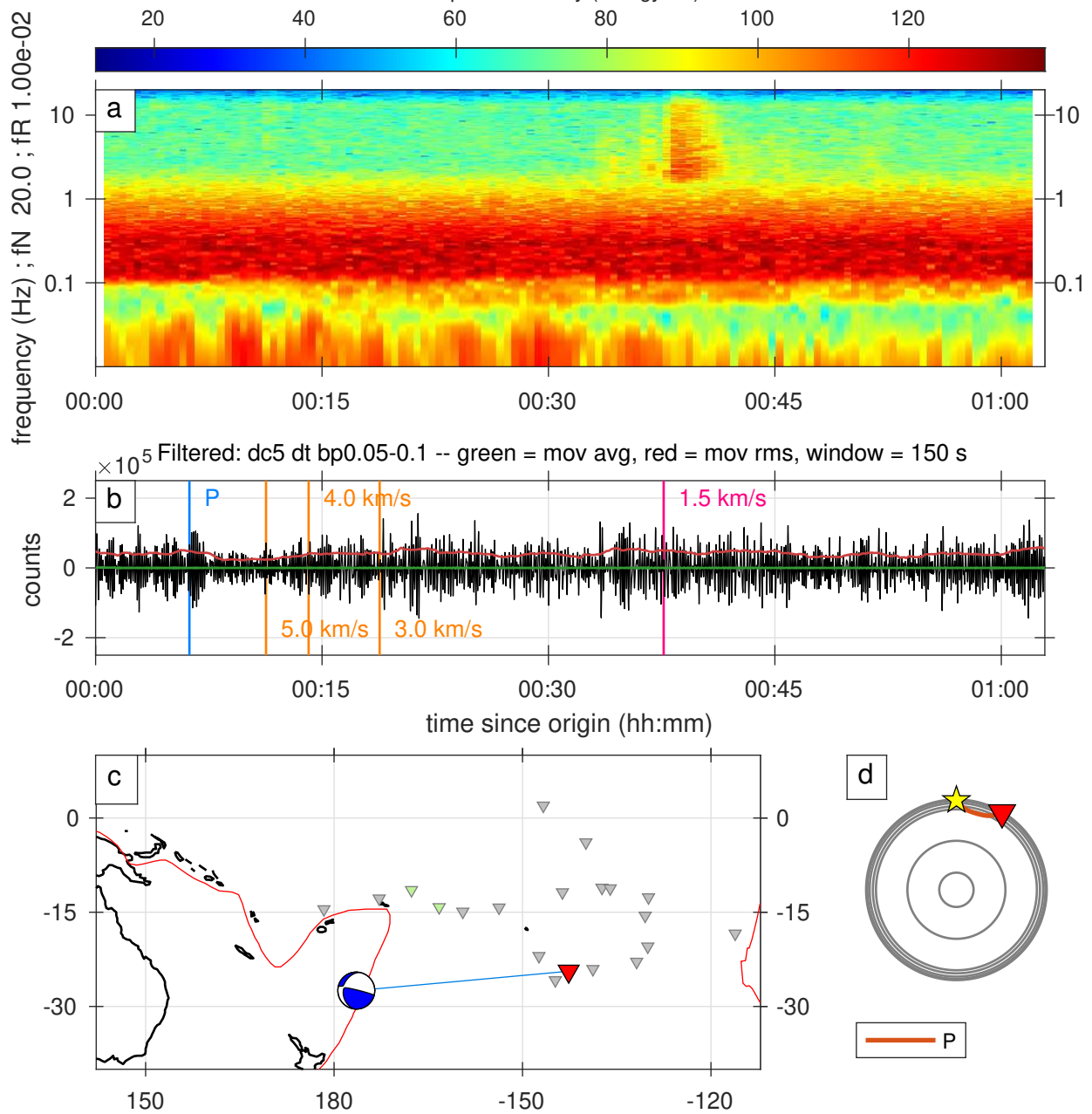


Figure S175. A full record of an earthquake classified as 1star category.

Arrival: 2019-03-20T19:09:30.000000, ID: 11016738

Mww = 5.30, distance = 28.53 degrees, depth = 10.00 km  
74.72 - 76.66 percent

spectral density (energy/Hz)

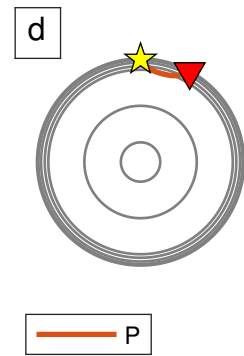
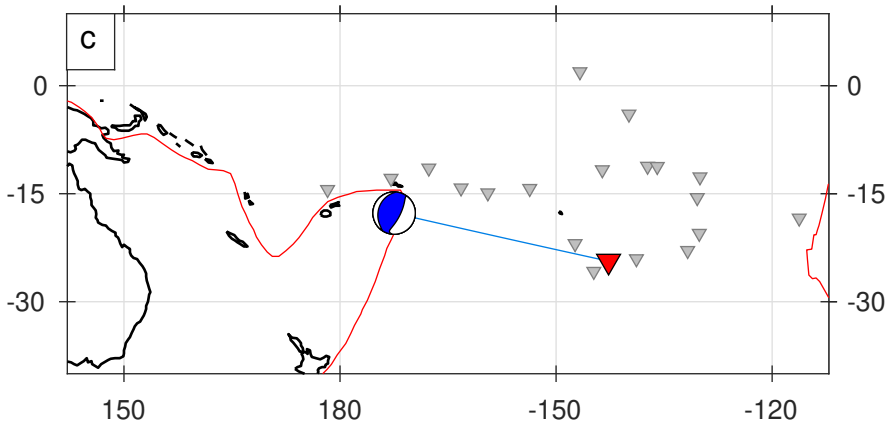
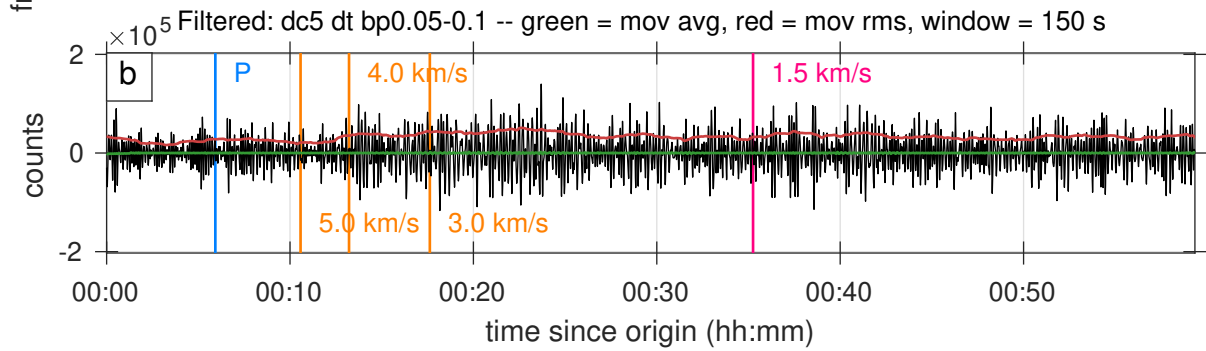
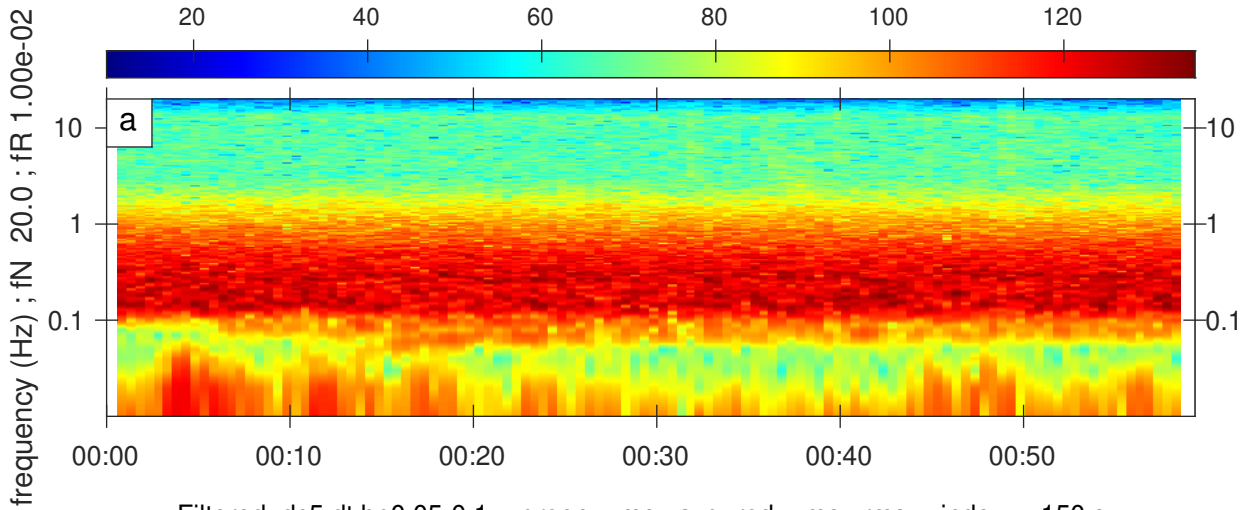


Figure S176. A full record of an earthquake classified as 1star category.



Arrival: 2019-03-23T07:55:00.000000, ID: 11017711

Mww = 5.00, distance = 31.68 degrees, depth = 10.00 km  
55.56 - 56.86 percent

spectral density (energy/Hz)

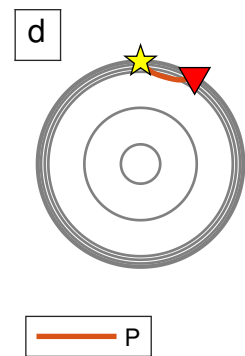
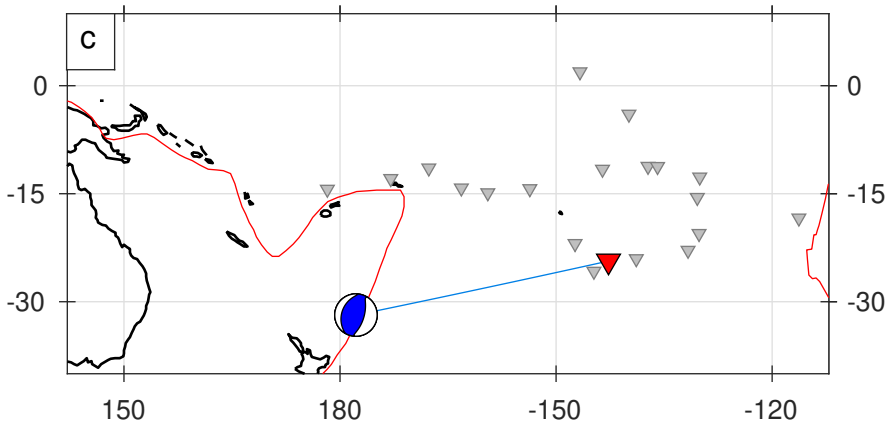
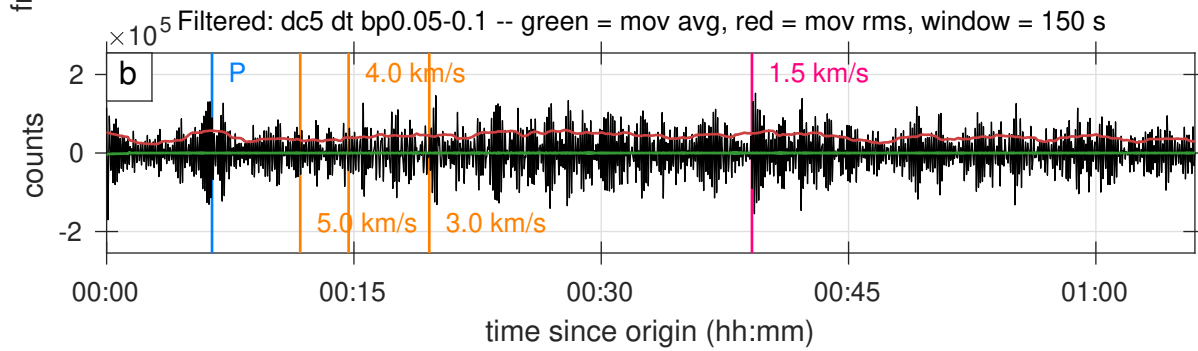
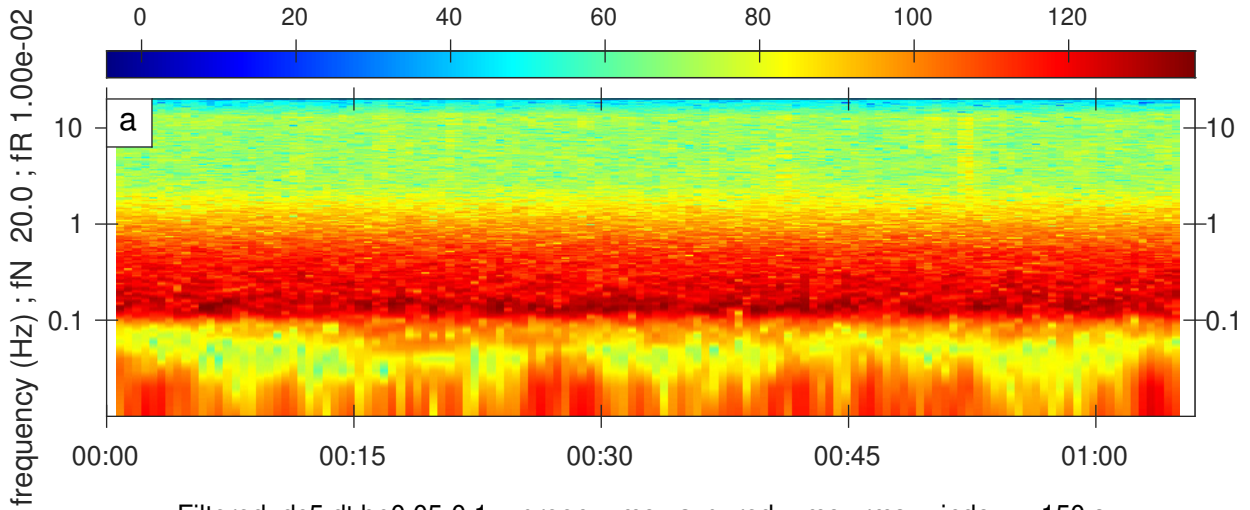


Figure S177. A full record of an earthquake classified as 1star category.

Arrival: 2019-03-23T19:32:00.000000, ID: 11017822

Mww = 6.10, distance = 70.77 degrees, depth = 122.00 km  
69.15 - 71.92 percent

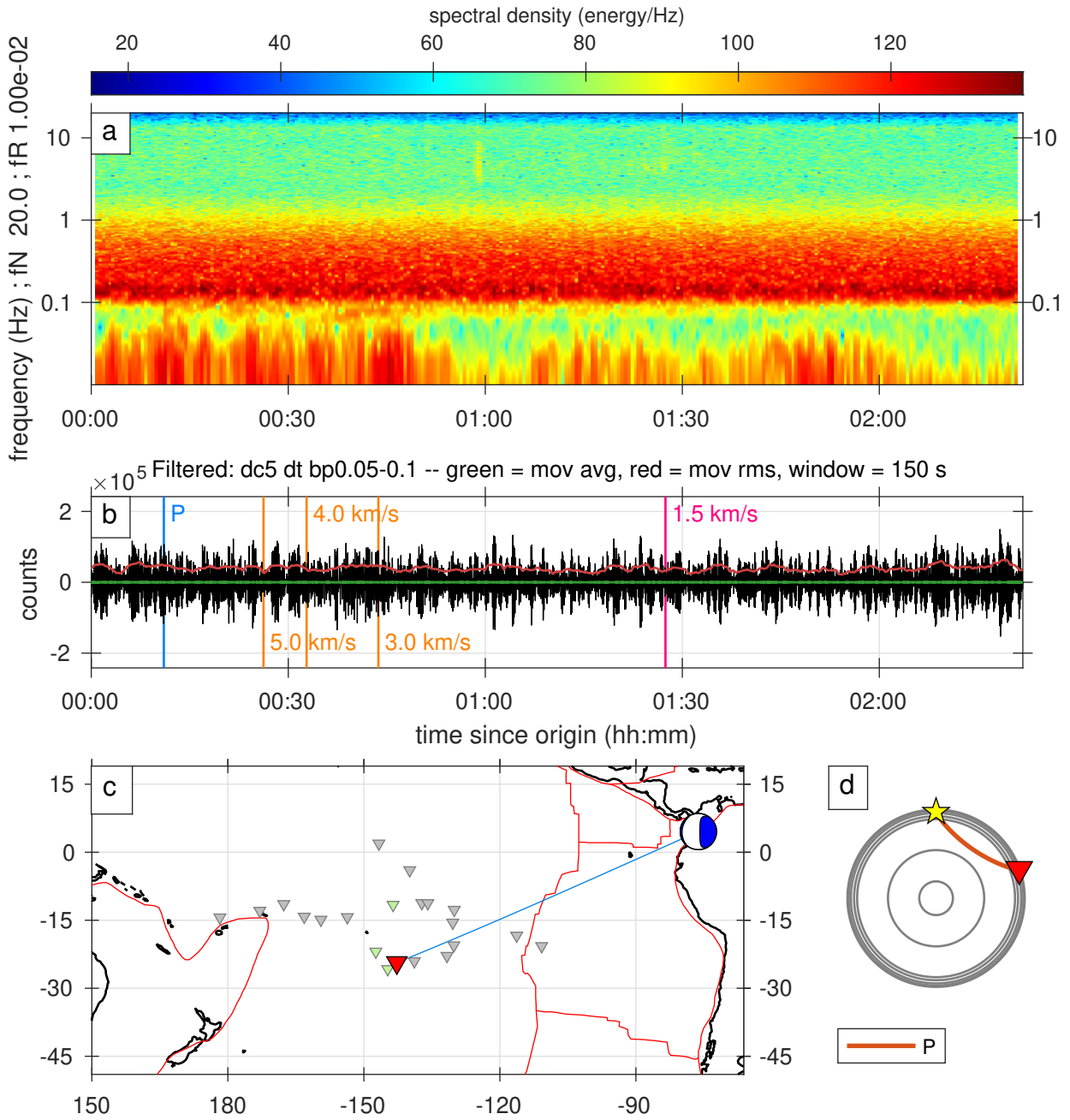


Figure S178. A full record of an earthquake classified as 1star category.

Arrival: 2019-03-24T04:50:00.000000, ID: 11017911

Mww = 6.10, distance = 91.50 degrees, depth = 45.00 km  
80.04 - 83.60 percent

spectral density (energy/Hz)

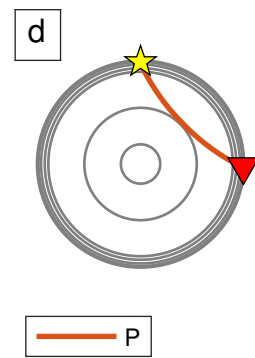
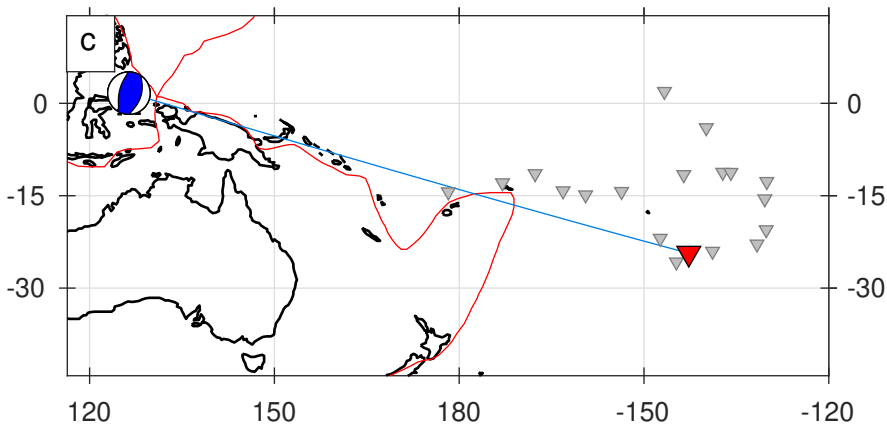
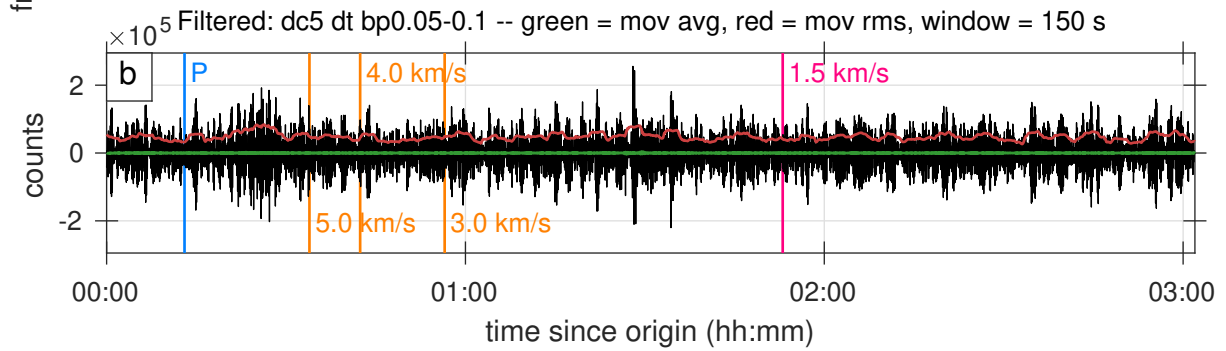
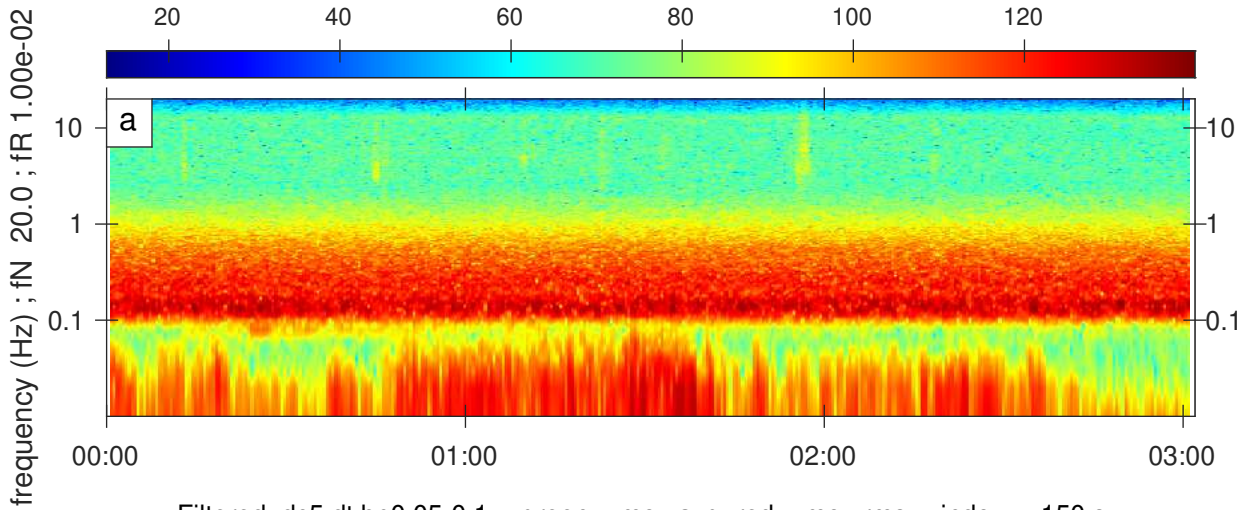


Figure S179. A full record of an earthquake classified as 1star category.



Arrival: 2019-03-31T15:38:13.945150, ID: 11020776

Mww = 5.50, distance = 61.80 degrees, depth = 29.00 km  
81.31 - 87.58 percent

spectral density (energy/Hz)

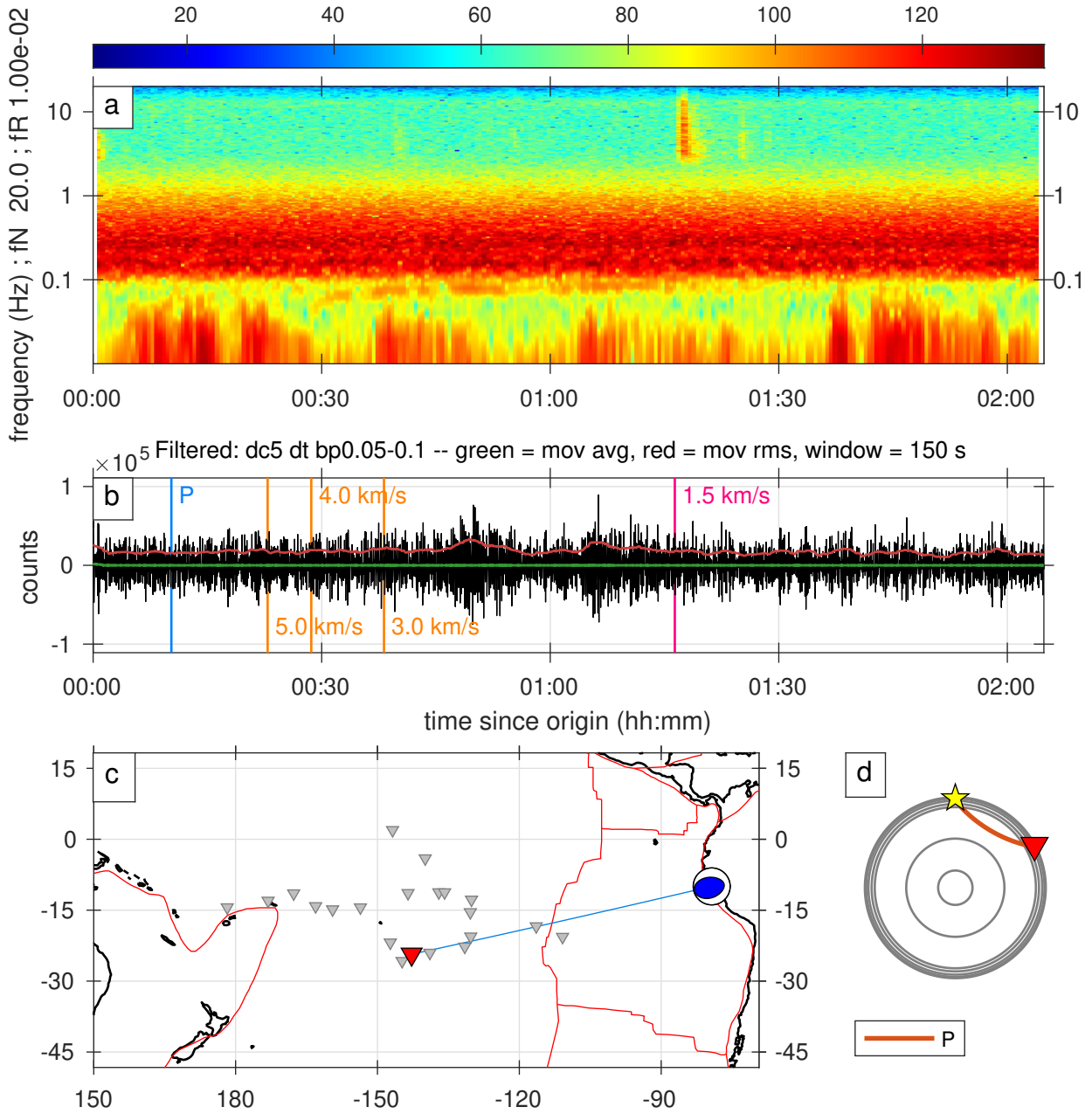


Figure S180. A full record of an earthquake classified as 1star category.

Arrival: 2019-04-05T16:27:00.000000, ID: 11022772

mww = 6.40, distance = 82.80 degrees, depth = 58.60 km

14.48 - 17.30 percent

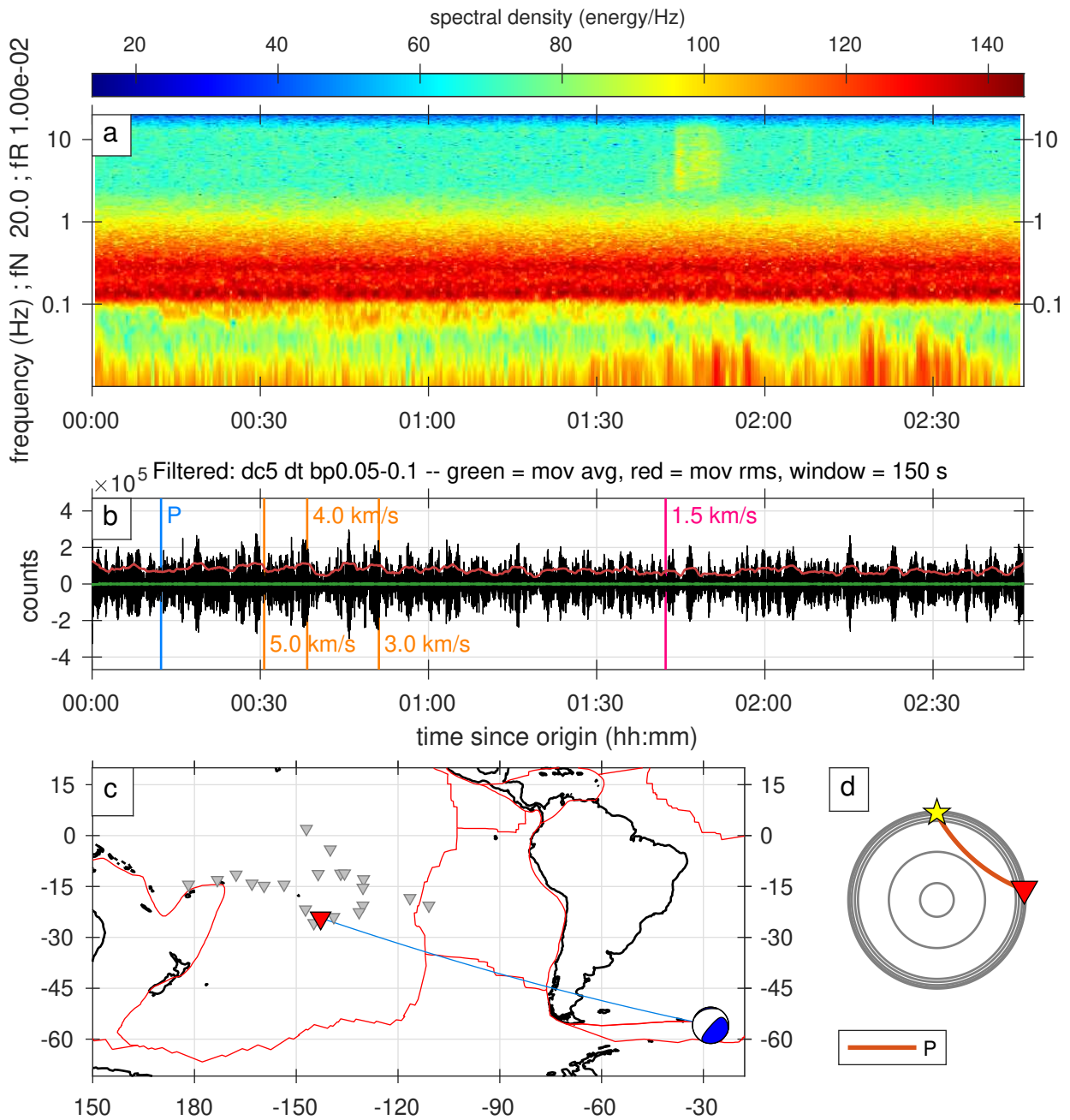


Figure S181. A full record of an earthquake classified as 1star category.

Arrival: 2019-04-08T22:36:12.501204, ID: 11023834

mb = 5.00, distance = 64.01 degrees, depth = 35.00 km  
 94.03 - 96.22 percent

spectral density (energy/Hz)

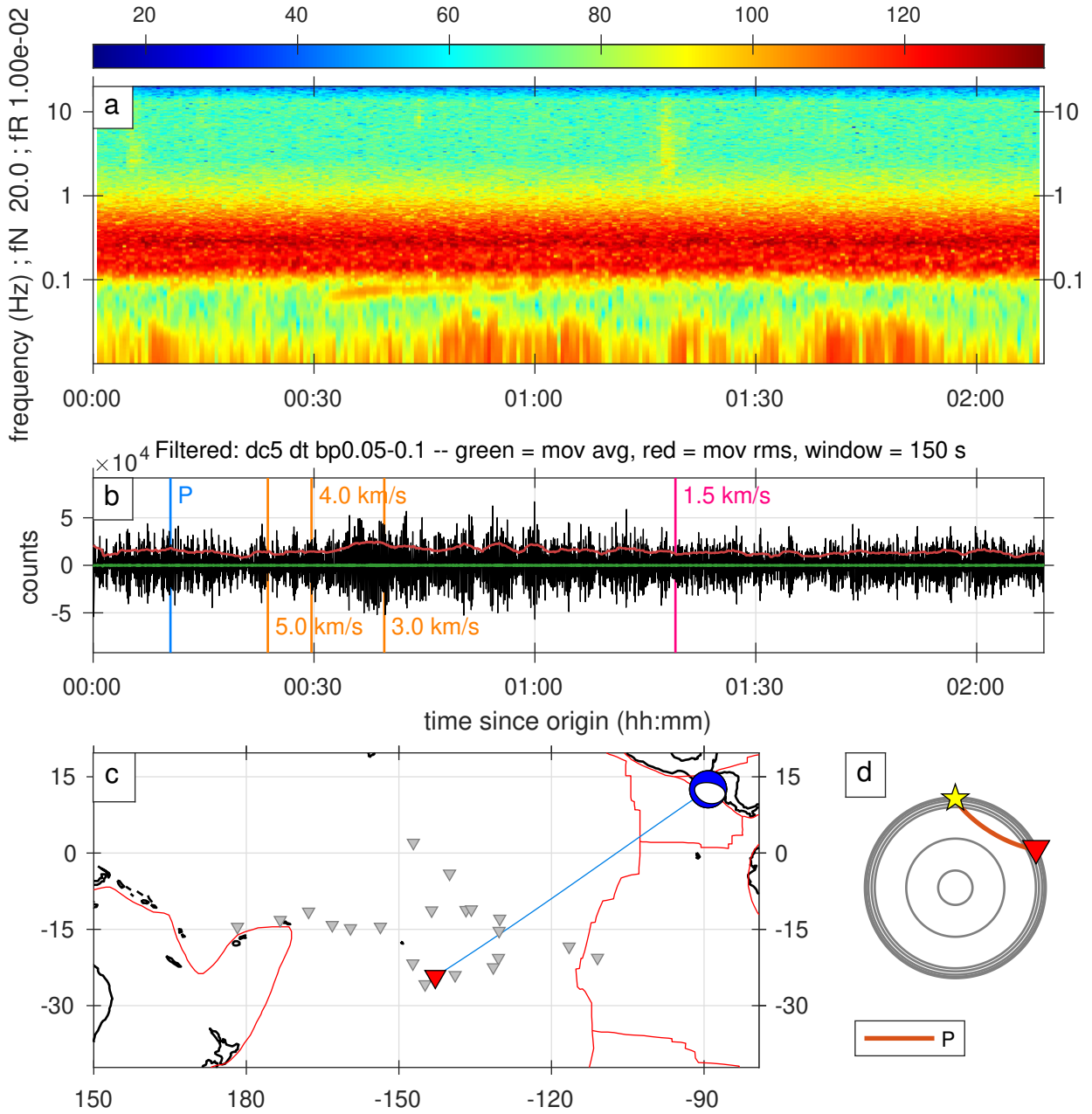


Figure S182. A full record of an earthquake classified as 1star category.

Arrival: 2019-04-22T09:28:00.000000, ID: 11028716

Mww = 6.10, distance = 101.85 degrees, depth = 20.00 km  
53.25 - 100.00 percent

spectral density (energy/Hz)

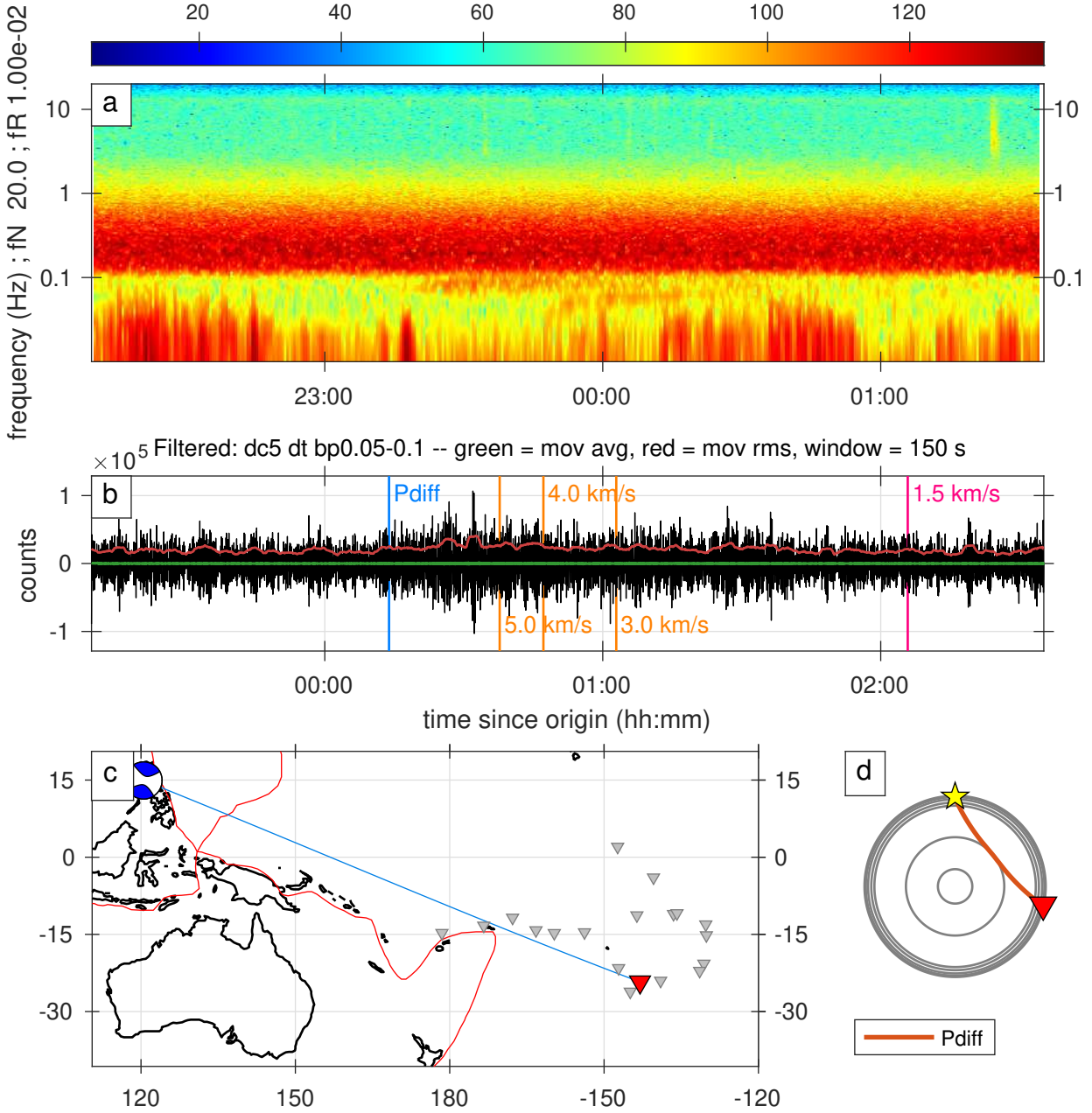


Figure S183. A full record of an earthquake classified as 1star category.

Arrival: 2019-04-23T04:57:53.726763, ID: 11028990

mb = 5.20, distance = 28.09 degrees, depth = 10.00 km  
58.34 - 61.75 percent

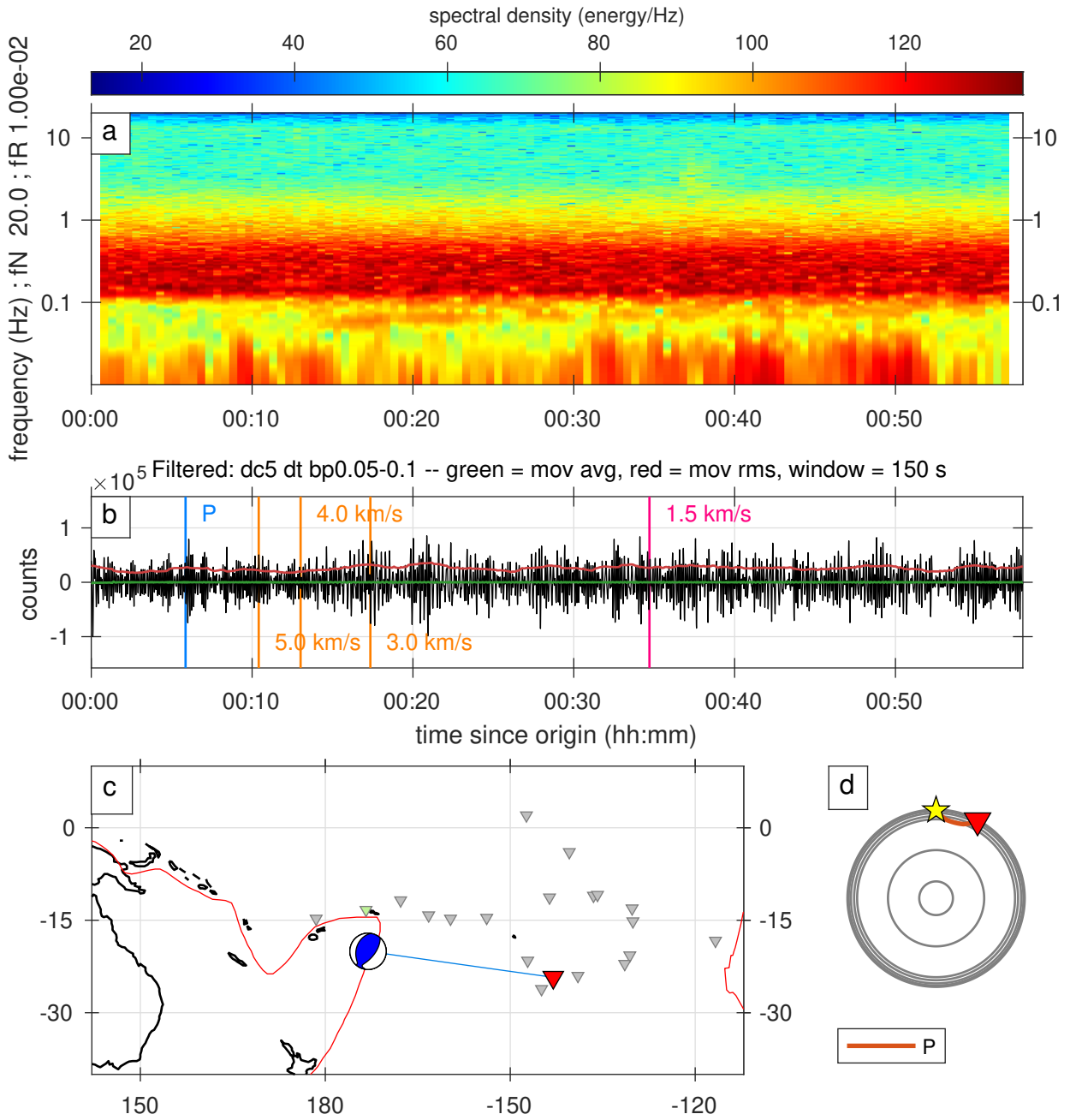


Figure S184. A full record of an earthquake classified as 1star category.



Arrival: 2019-04-26T06:17:40.510951, ID: 11030573

mb = 5.10, distance = 94.42 degrees, depth = 10.00 km  
75.05 - 100.00 percent

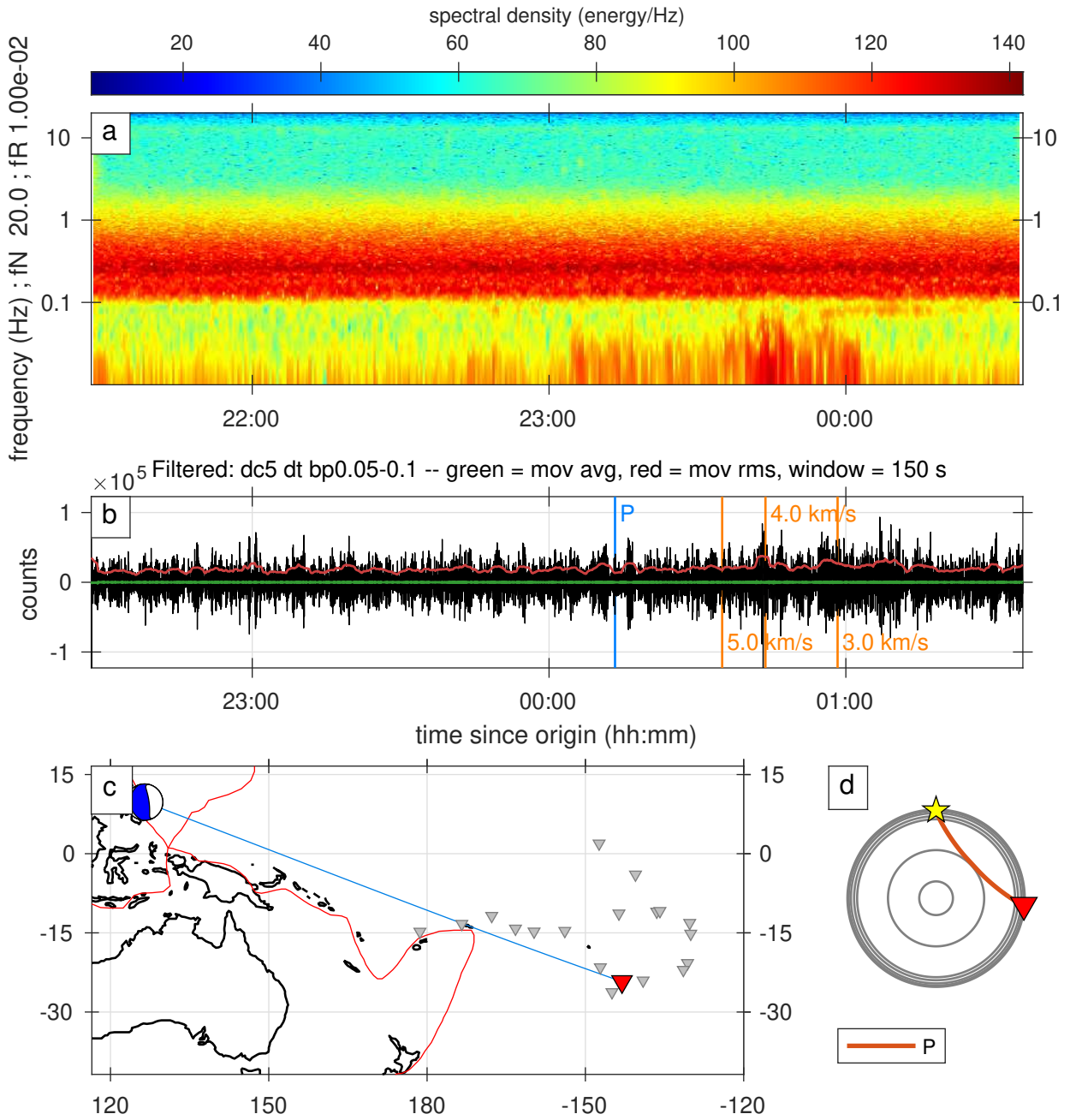


Figure S185. A full record of an earthquake classified as 1star category.

Arrival: 2019-04-26T06:33:07.628752, ID: 11030576

M<sub>w</sub> = 5.50, distance = 64.40 degrees, depth = 29.00 km

82.79 - 100.00 percent

spectral density (energy/Hz)

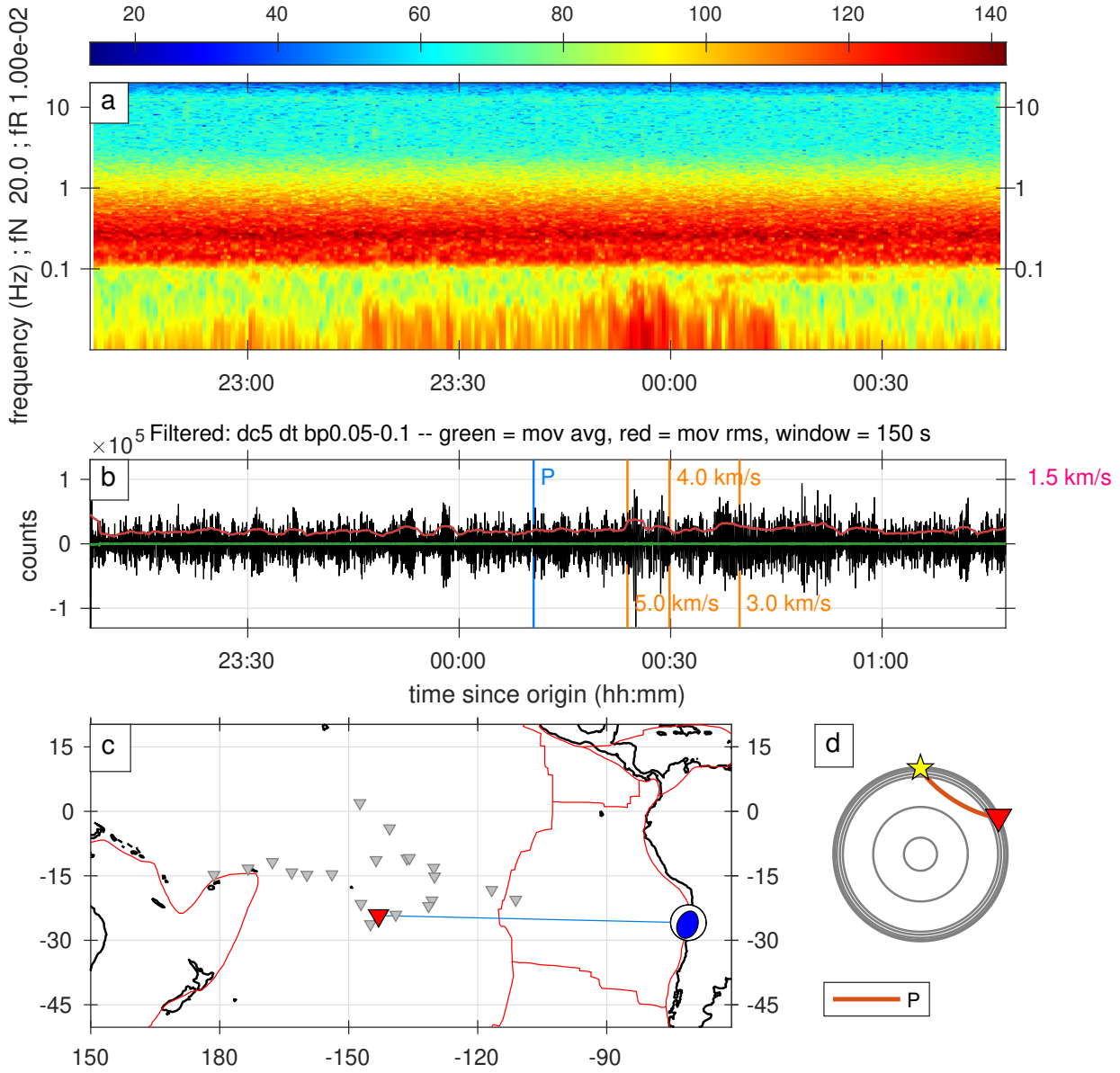


Figure S186. A full record of an earthquake classified as 1star category.

Arrival: 2019-04-27T11:06:16.175280, ID: 11031077

mb = 4.80, distance = 35.74 degrees, depth = 10.00 km  
3.51 - 5.94 percent

spectral density (energy/Hz)

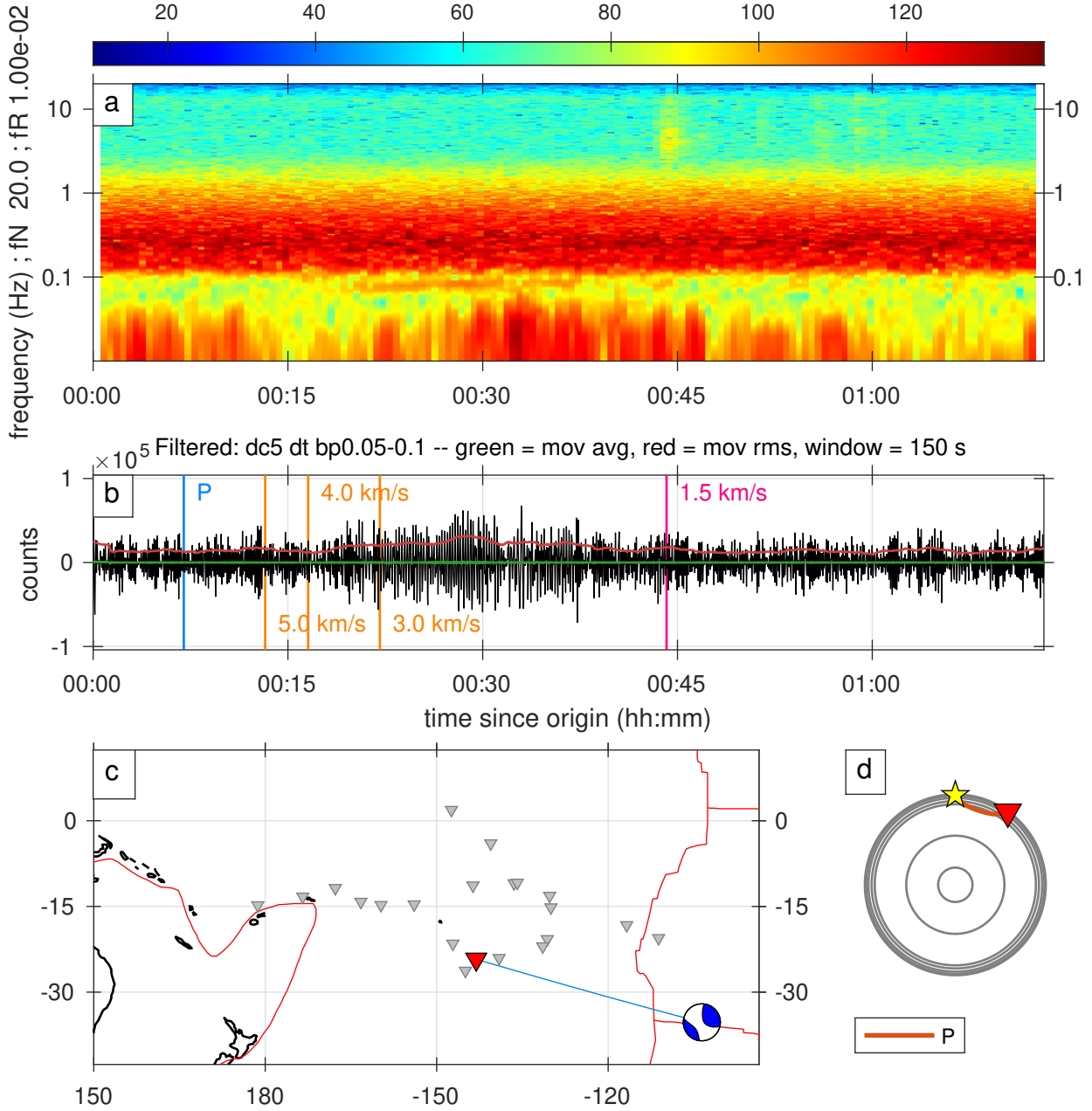


Figure S187. A full record of an earthquake classified as 1star category.



Arrival: 2019-05-04T04:39:05.524328, ID: 11033566

mb = 5.00, distance = 24.84 degrees, depth = 10.00 km  
 44.23 - 44.96 percent

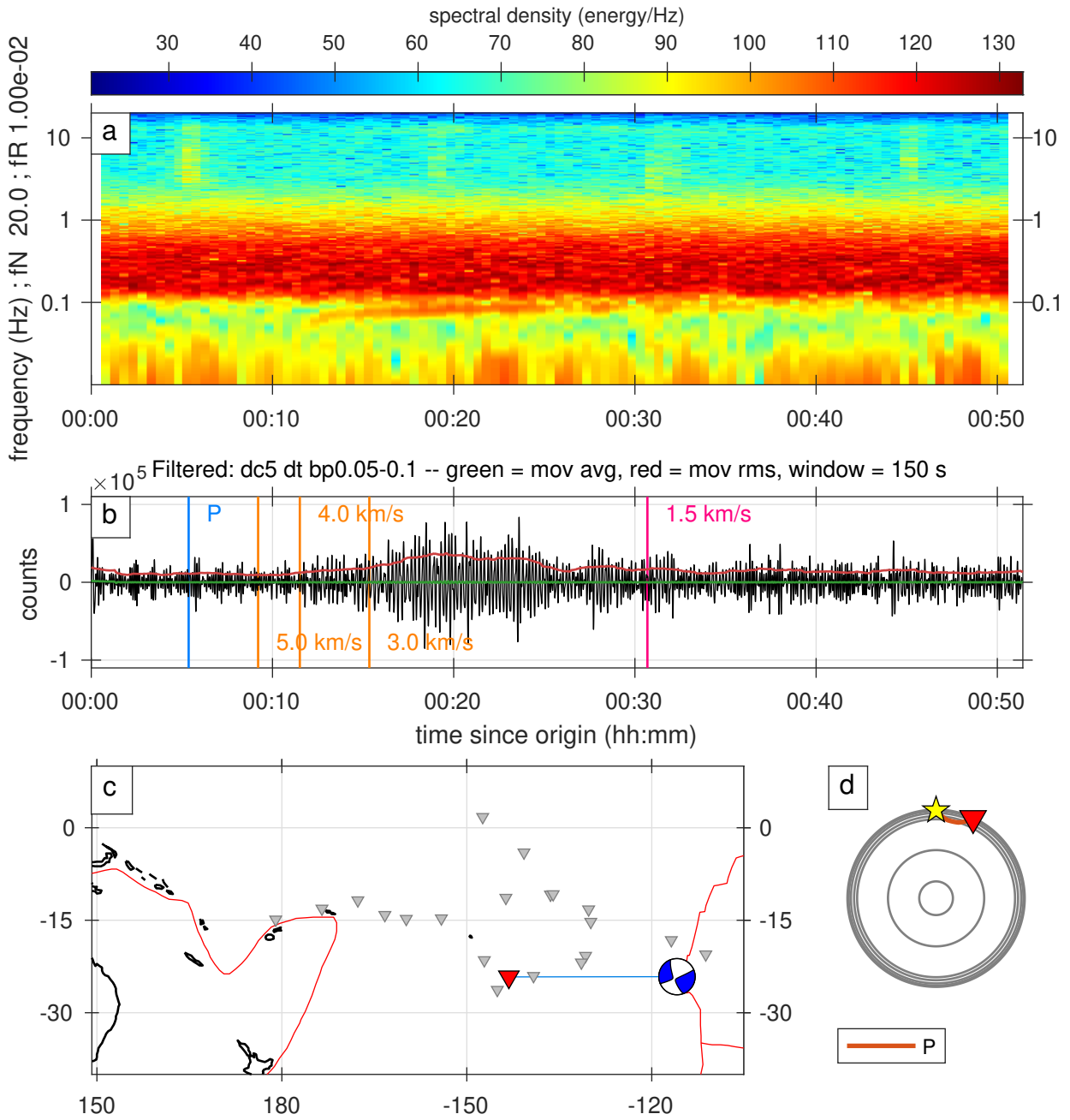


Figure S188. A full record of an earthquake classified as 1star category.

Arrival: 2019-05-10T00:02:19.151223, ID: 11035661

Mww = 6.10, distance = 98.44 degrees, depth = 22.00 km  
0.00 - 8.83 percent

spectral density (energy/Hz)

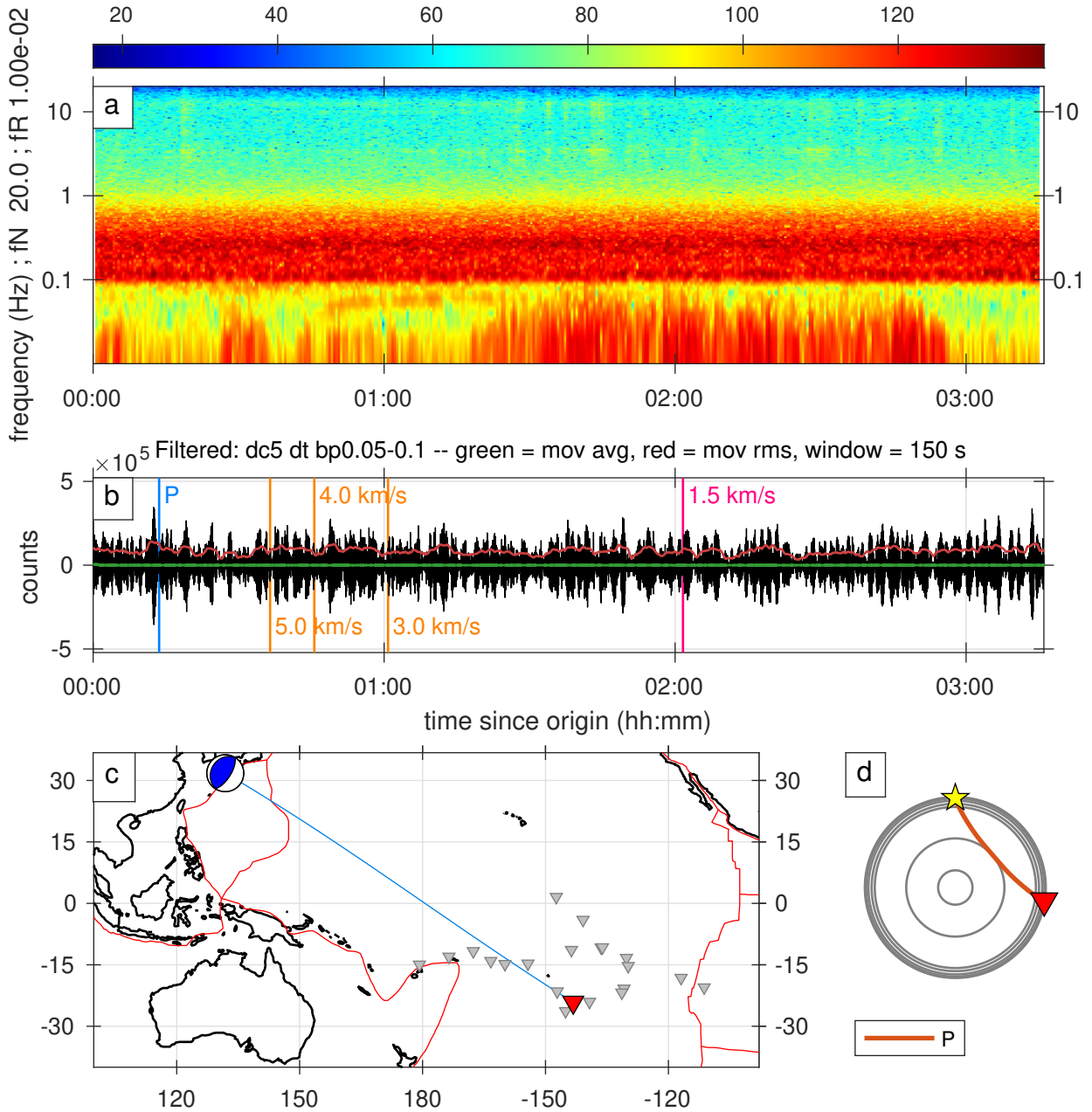


Figure S189. A full record of an earthquake classified as 1star category.

Arrival: 2019-05-17T22:48:00.000000, ID: 11038666

Mww = 5.90, distance = 64.17 degrees, depth = 21.00 km  
74.92 - 81.71 percent

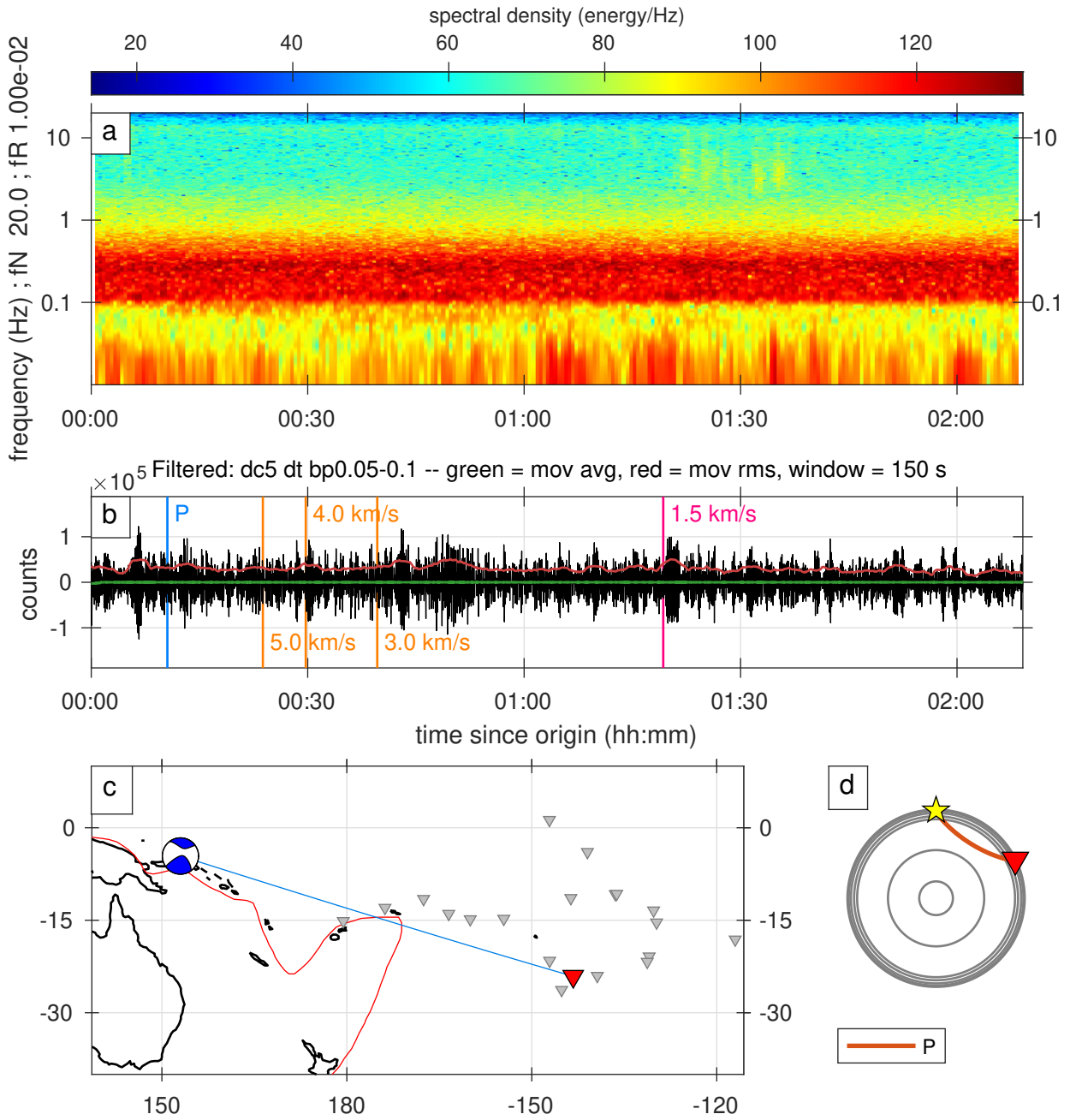


Figure S190. A full record of an earthquake classified as 1star category.

Arrival: 2019-05-23T15:10:00.000000, ID: 11040302

Mww = 5.70, distance = 43.04 degrees, depth = 19.00 km  
74.28 - 85.28 percent

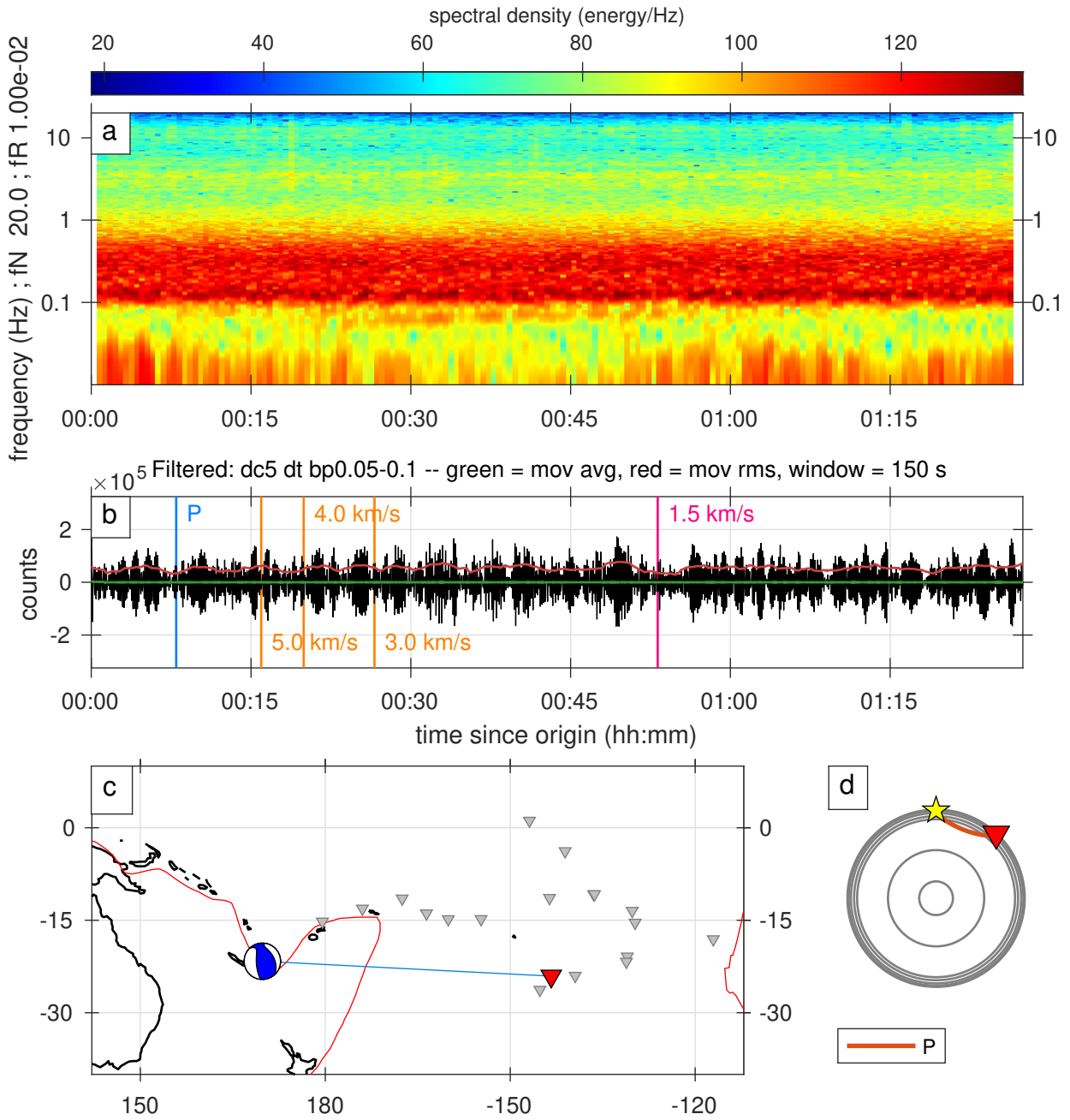


Figure S191. A full record of an earthquake classified as 1star category.

Arrival: 2019-05-31T10:26:00.000000, ID: 11042835

Mww = 6.10, distance = 92.53 degrees, depth = 90.21 km  
62.70 - 64.76 percent

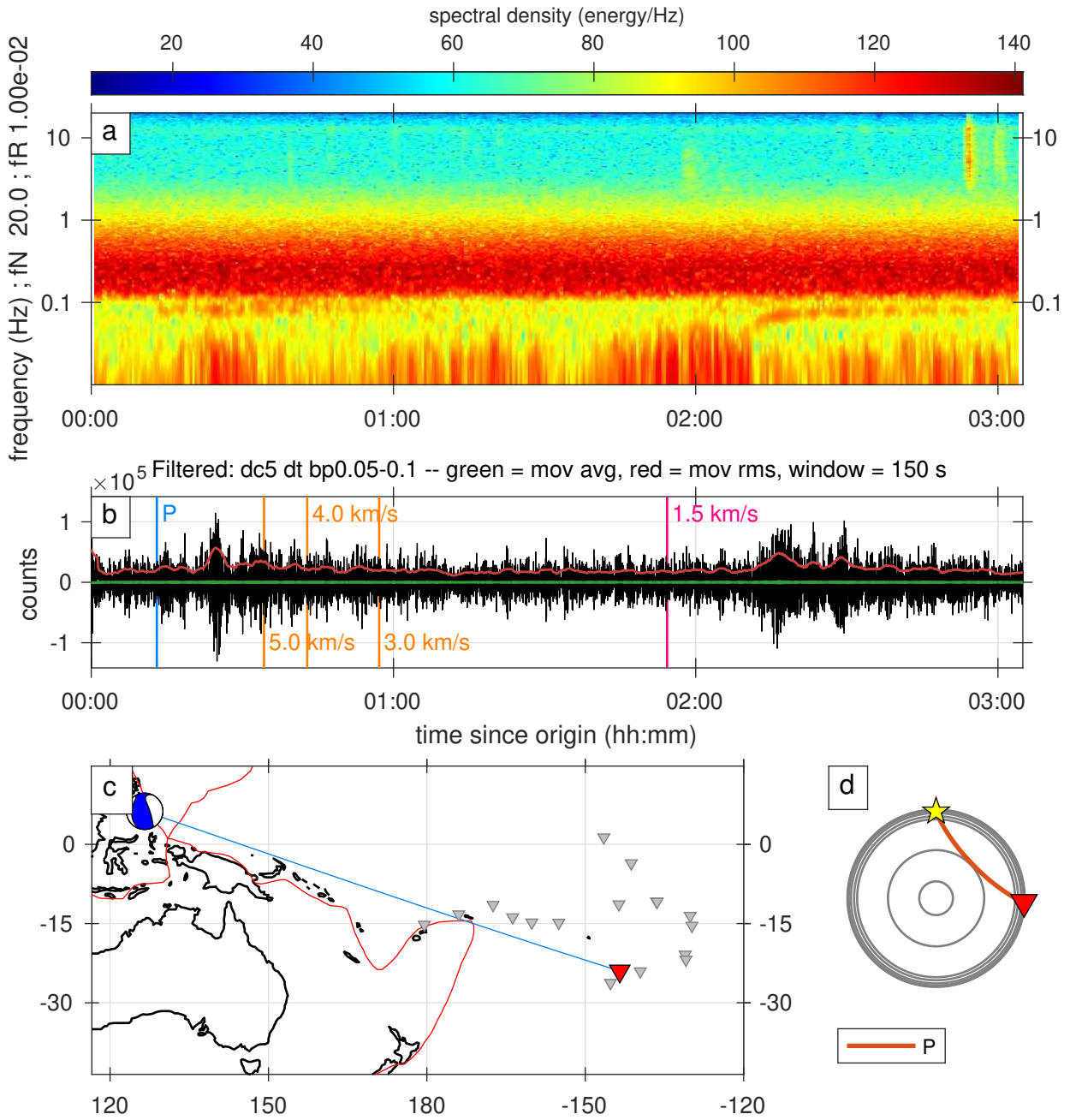


Figure S192. A full record of an earthquake classified as 1star category.



Arrival: 2019-05-31T12:06:59.436799, ID: 11042843

Mww = 5.80, distance = 55.47 degrees, depth = 10.00 km  
63.87 - 65.11 percent

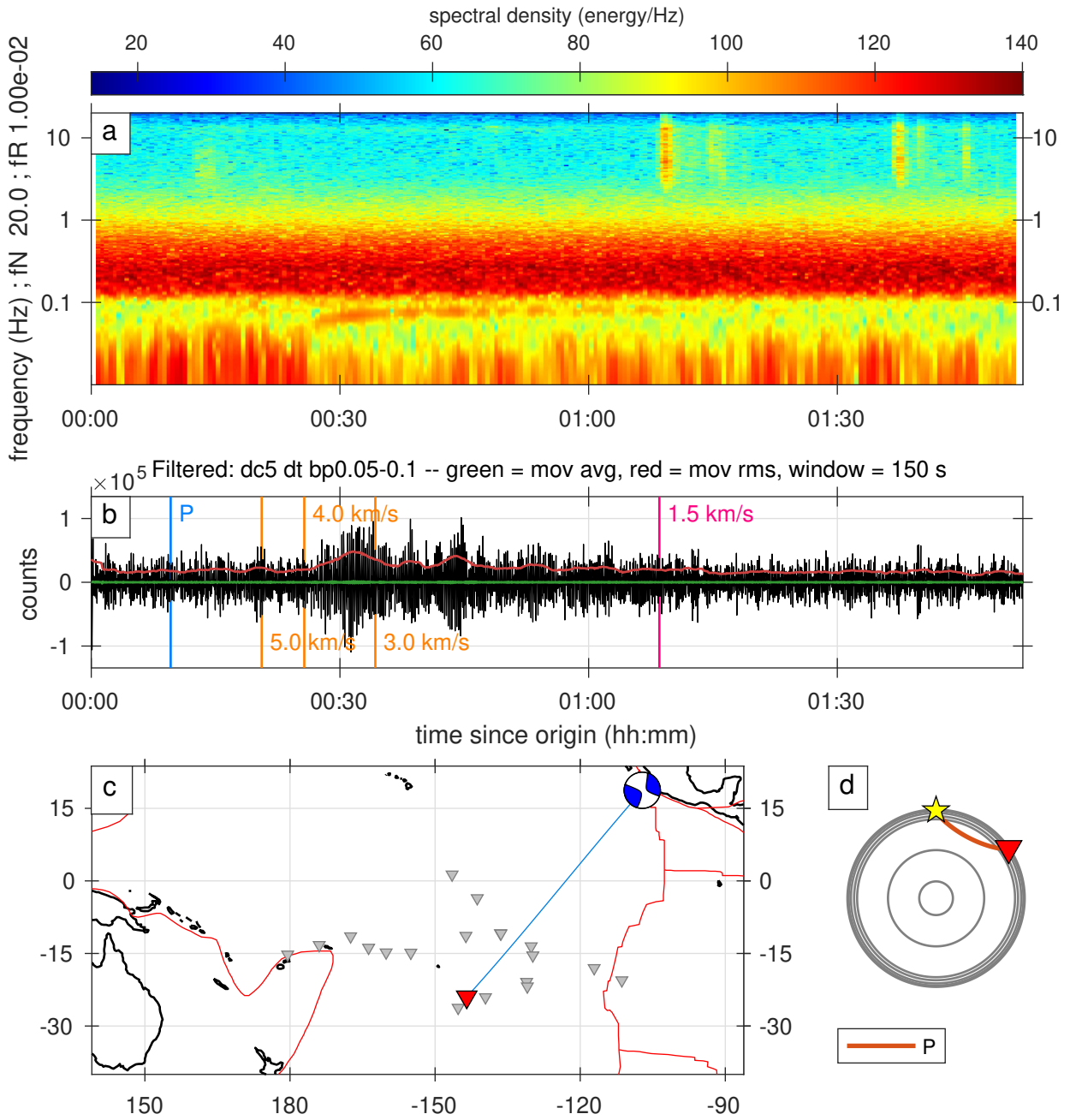


Figure S193. A full record of an earthquake classified as 1star category.

Arrival: 2019-06-11T23:30:20.523358, ID: 11047824

mb = 5.20, distance = 33.47 degrees, depth = 10.00 km  
 16.66 - 33.42 percent

spectral density (energy/Hz)

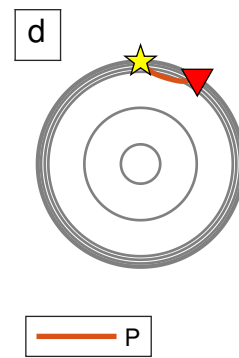
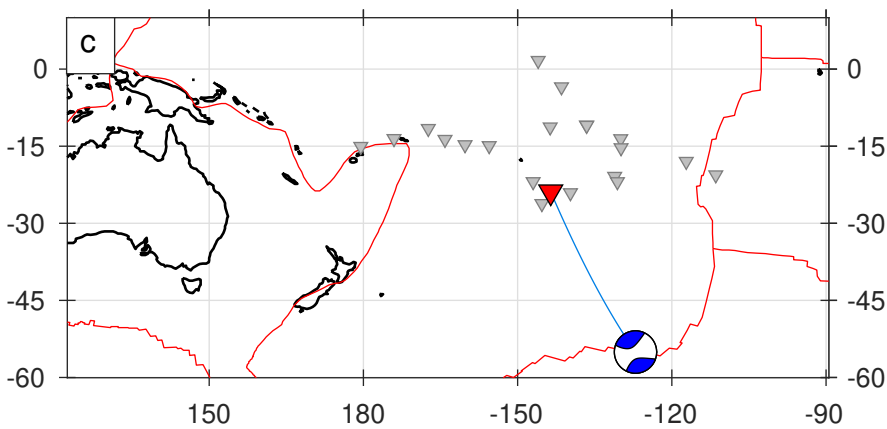
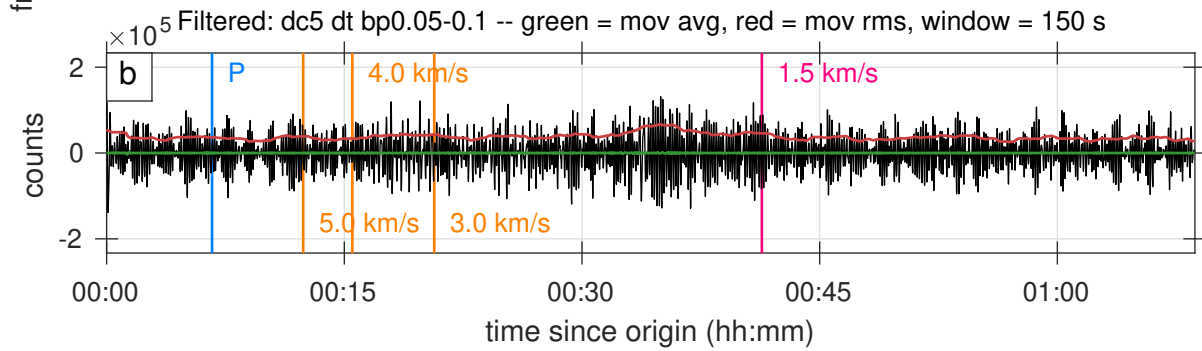
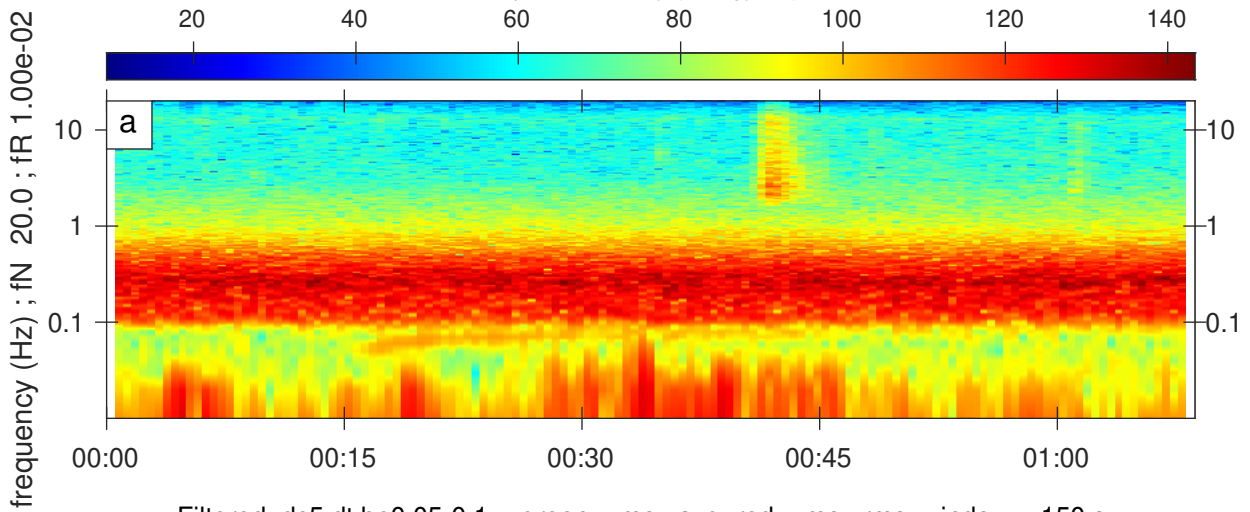


Figure S194. A full record of an earthquake classified as 1star category.

Arrival: 2019-06-13T07:39:49.179341, ID: 11048373

mb = 5.20, distance = 28.02 degrees, depth = 10.00 km

3.48 - 4.92 percent

spectral density (energy/Hz)

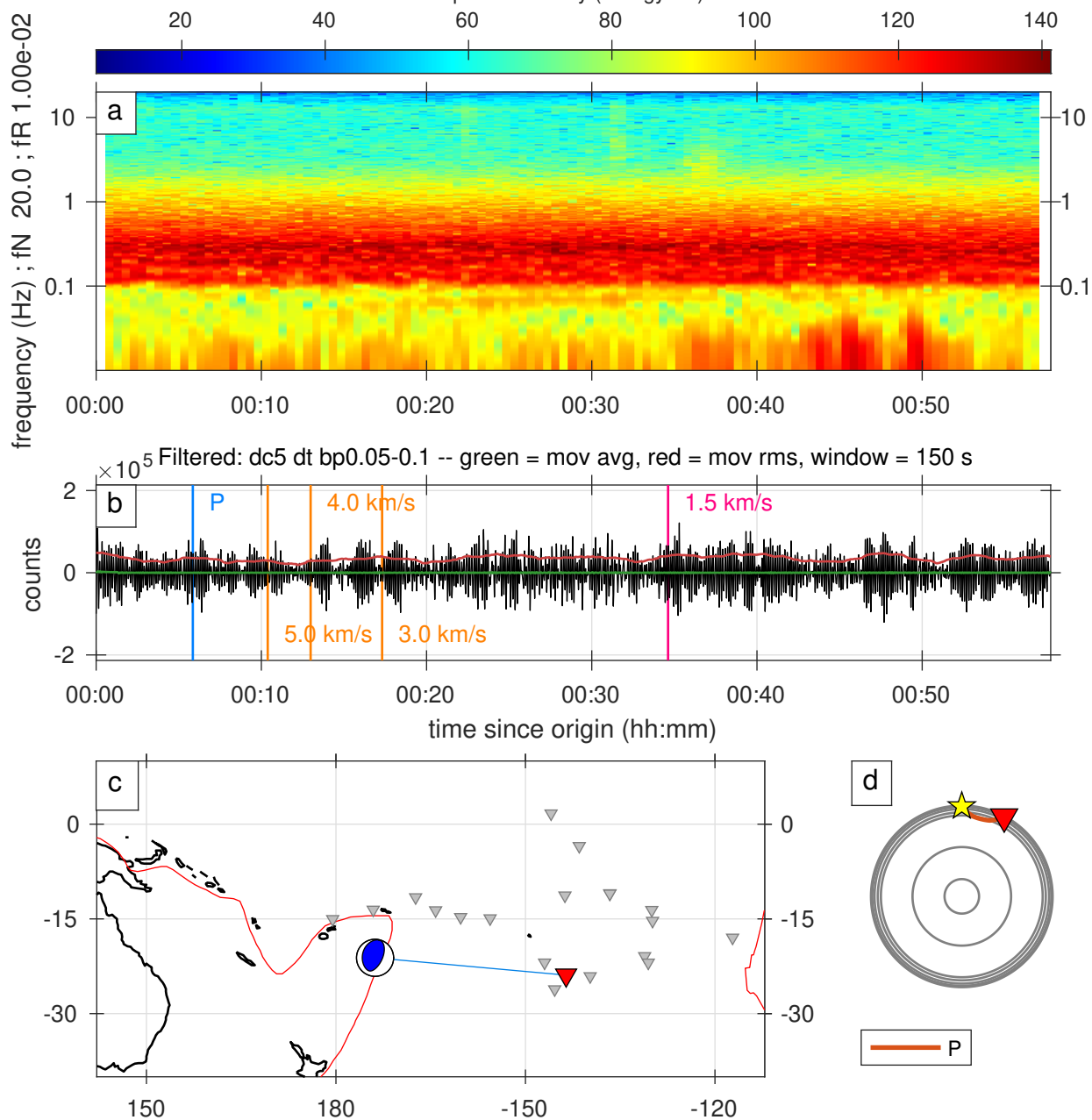


Figure S195. A full record of an earthquake classified as 1star category.



Arrival: 2019-06-14T16:36:47.494482, ID: 11048883

Mww = 5.10, distance = 62.17 degrees, depth = 10.00 km  
 52.83 - 55.97 percent

spectral density (energy/Hz)

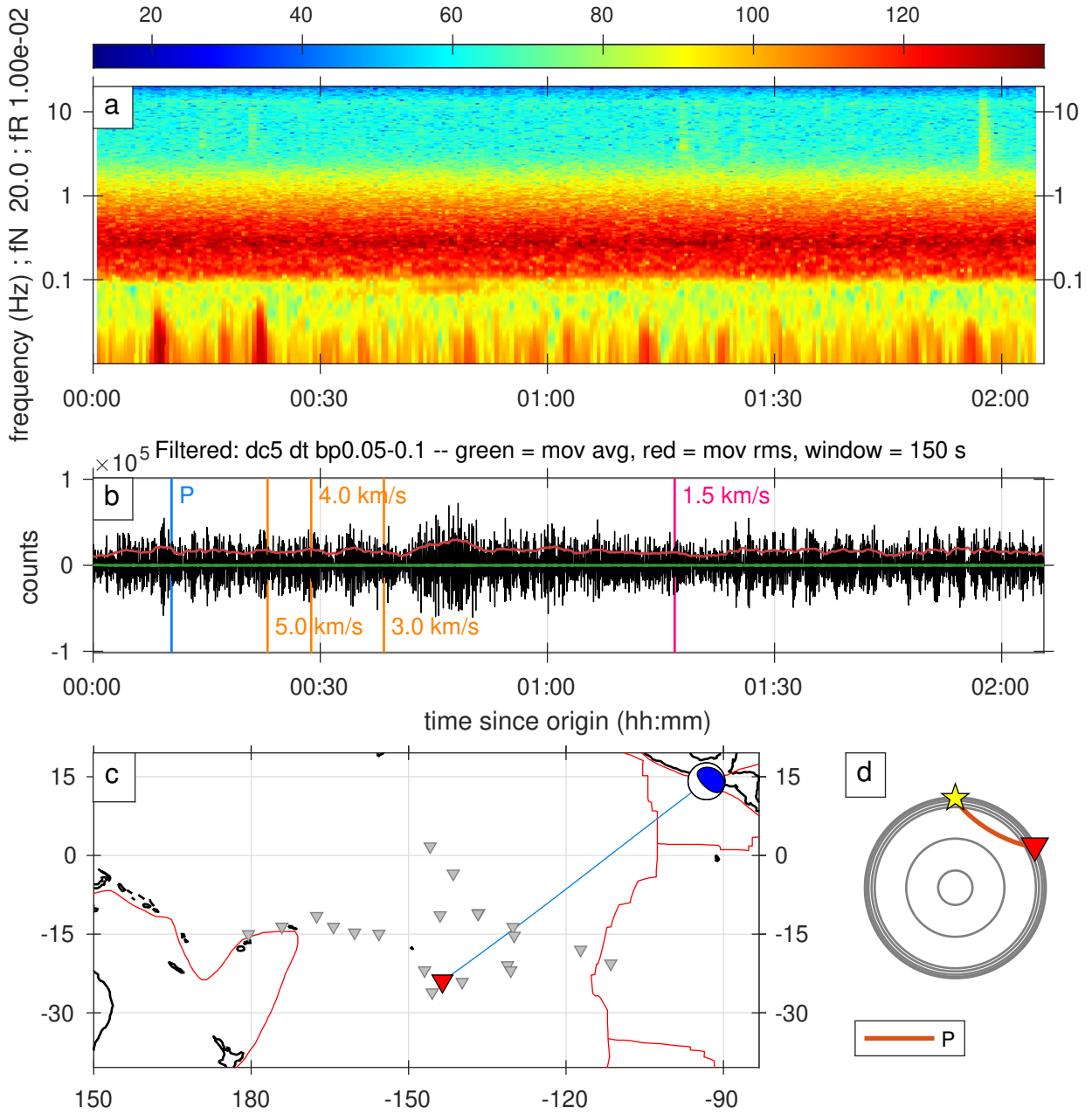


Figure S196. A full record of an earthquake classified as 1star category.

Arrival: 2019-06-24T01:17:30.000000, ID: 11052533

Mww = 6.10, distance = 77.85 degrees, depth = 28.00 km  
92.96 - 100.00 percent

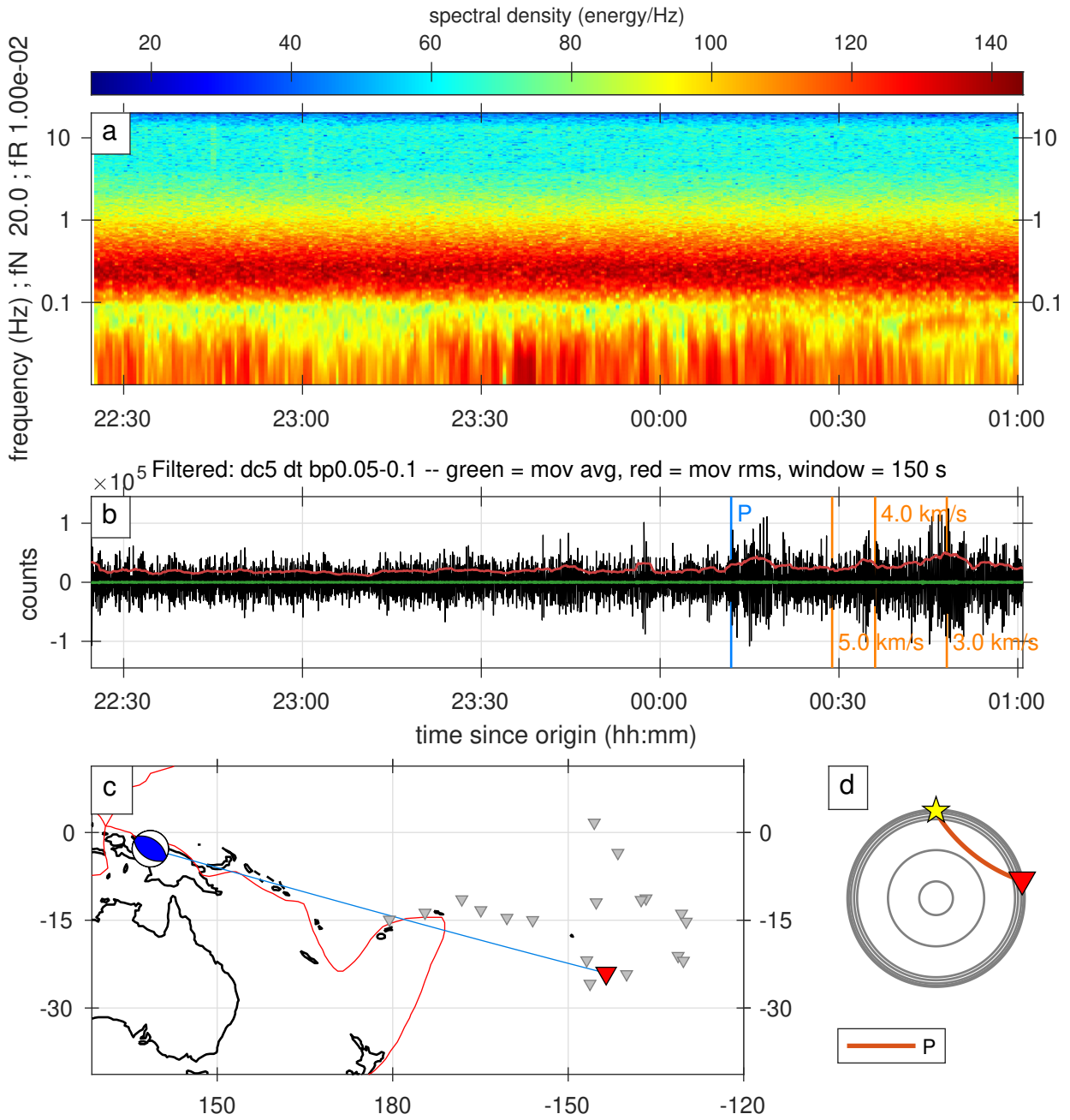


Figure S197. A full record of an earthquake classified as 1star category.

Arrival: 2019-06-25T09:18:40.000000, ID: 11052941

mww = 6.30, distance = 91.60 degrees, depth = 10.00 km  
67.94 - 74.91 percent

spectral density (energy/Hz)

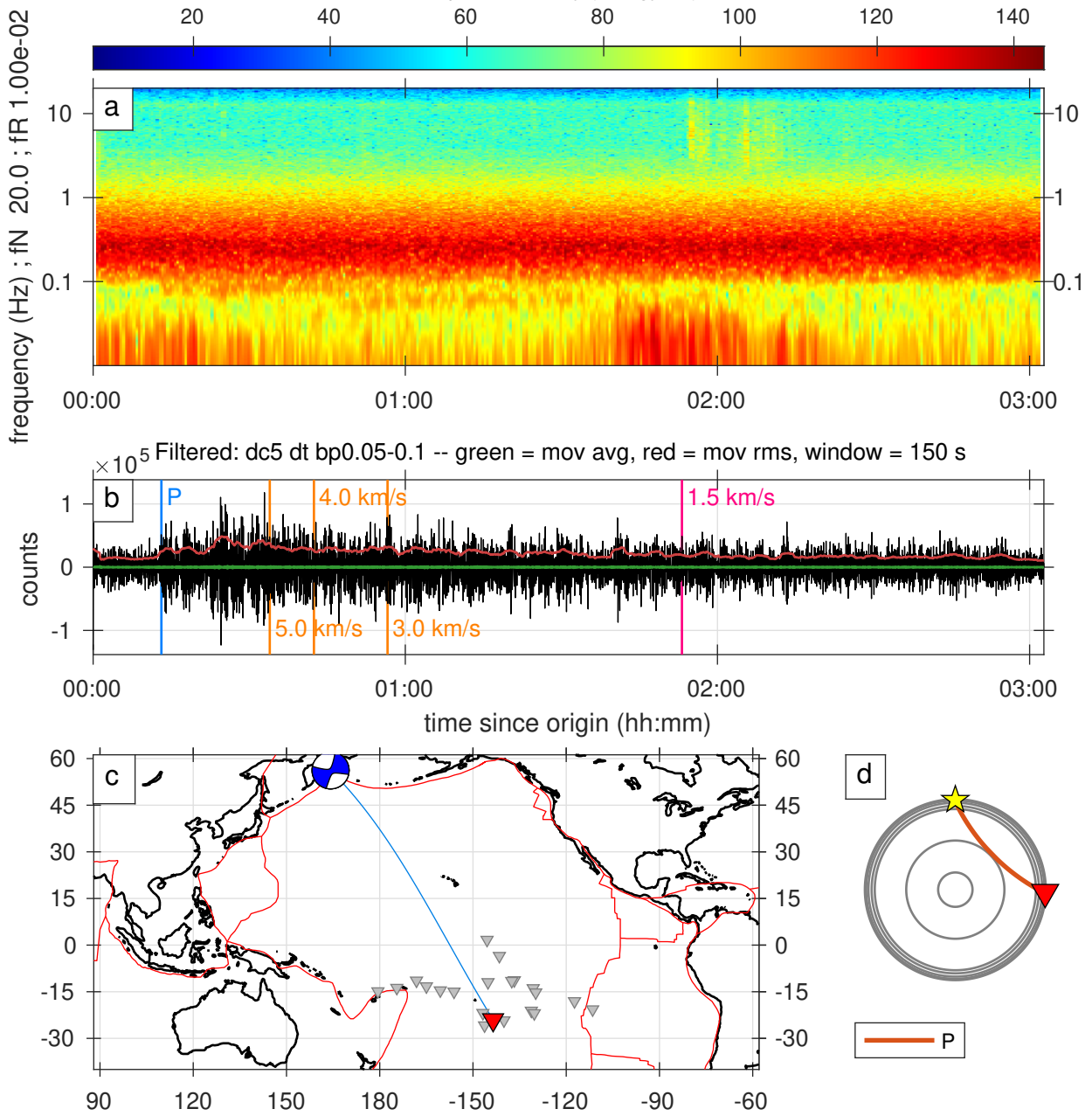


Figure S198. A full record of an earthquake classified as 1star category.

Arrival: 2019-06-28T16:05:00.000000, ID: 11054354

Mww = 6.40, distance = 82.78 degrees, depth = 410.00 km  
68.30 - 71.23 percent

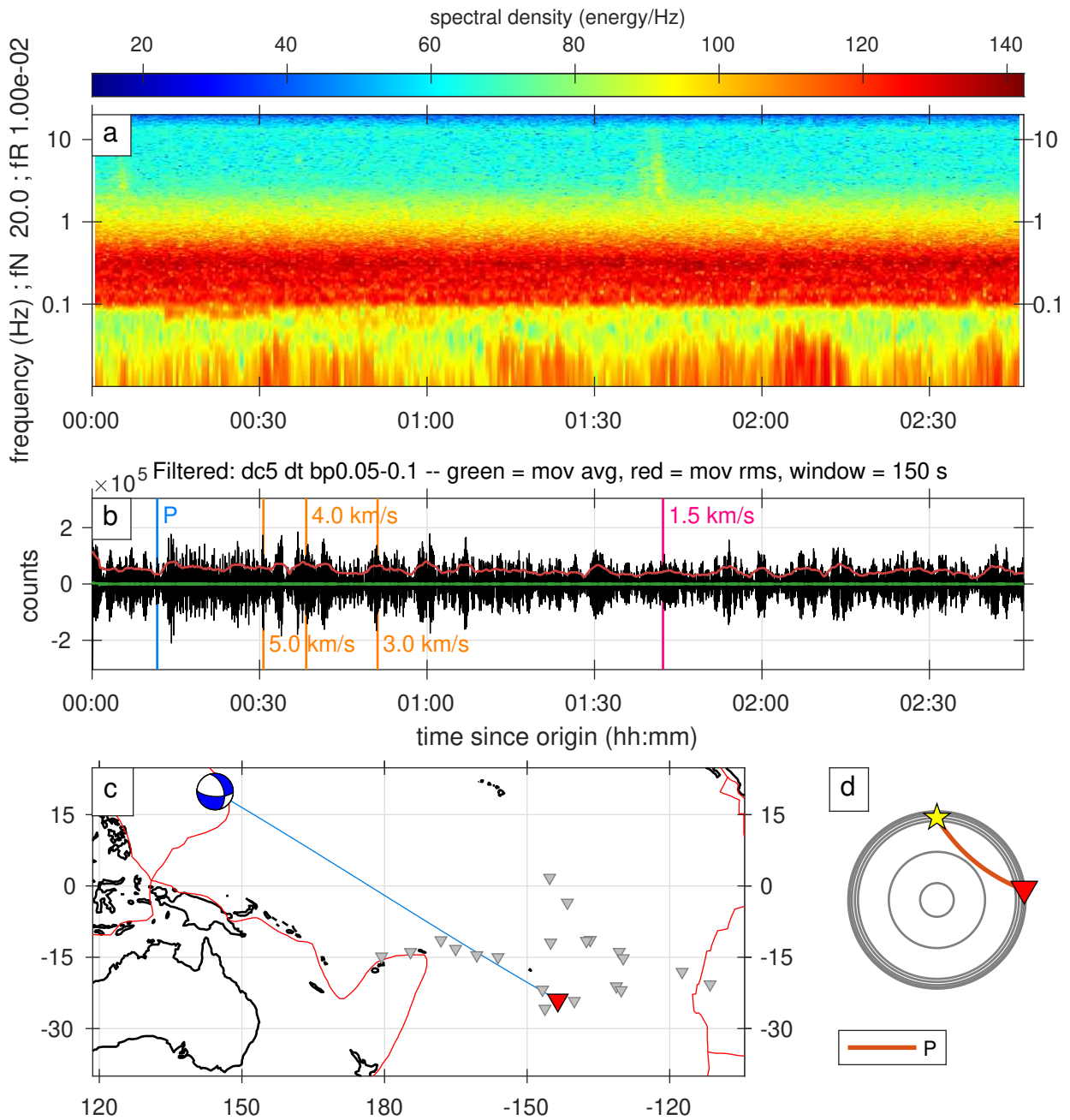


Figure S199. A full record of an earthquake classified as 1star category.

Arrival: 2019-07-05T02:14:28.097684, ID: 11057330

Mww = 5.20, distance = 29.57 degrees, depth = 10.00 km  
56.59 - 60.03 percent

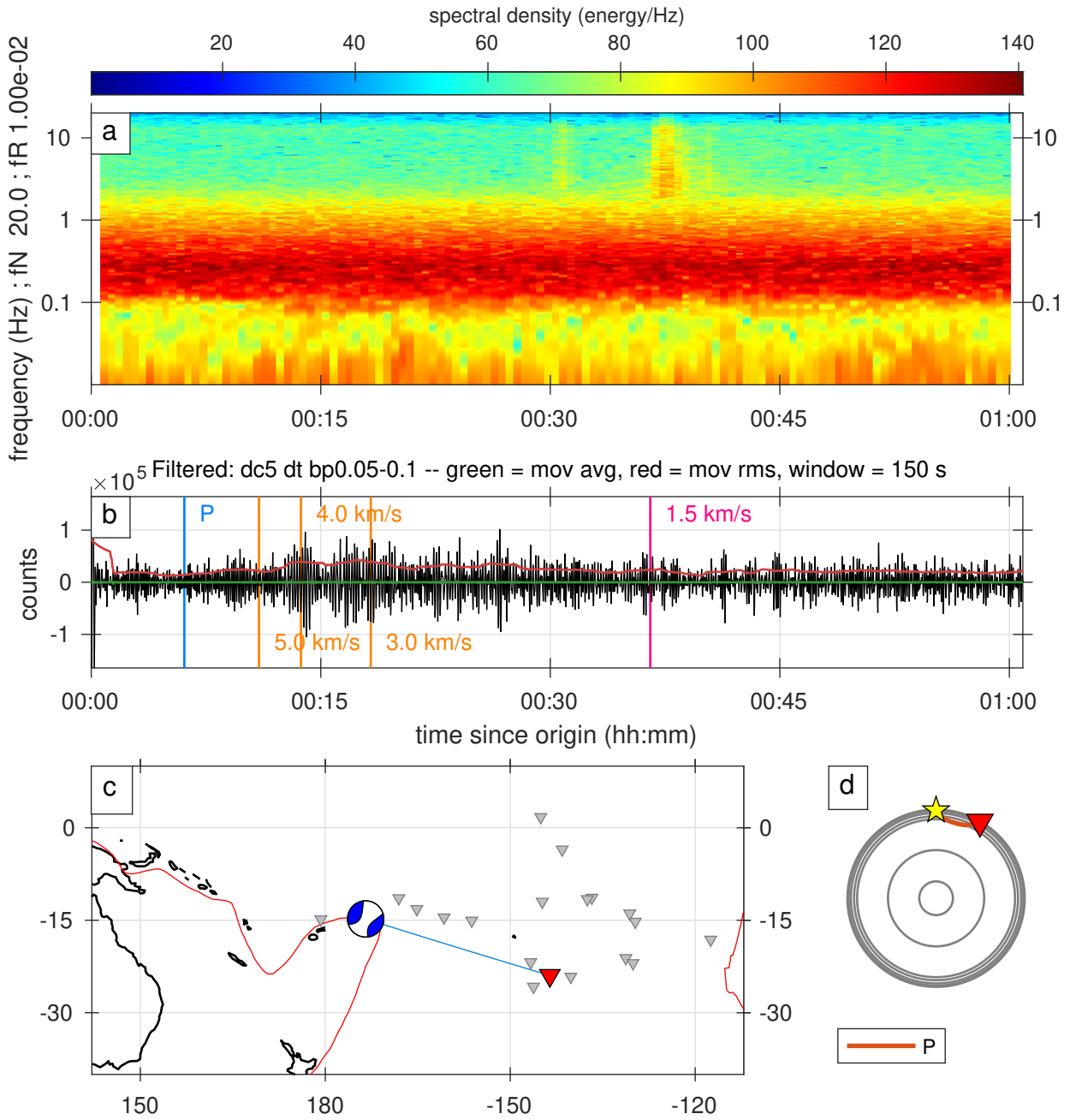


Figure S200. A full record of an earthquake classified as 1star category.



Arrival: 2019-07-05T11:18:30.952486, ID: 11057796

Mww = 5.40, distance = 64.58 degrees, depth = 6.95 km

87.15 - 94.53 percent

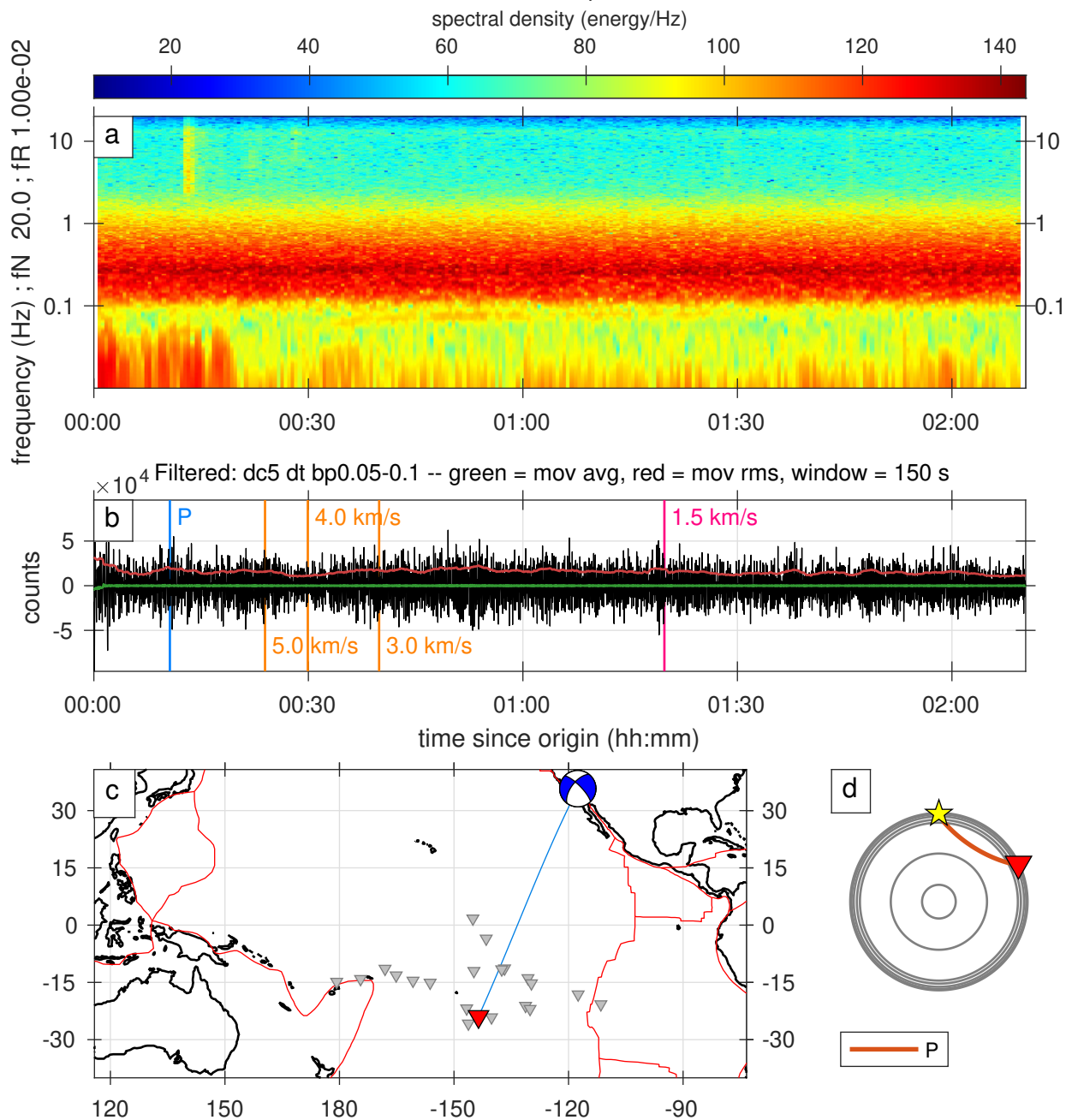


Figure S201. A full record of an earthquake classified as 1star category.

Arrival: 2019-07-05T13:10:17.341773, ID: 11057951

Mww = 5.60, distance = 76.16 degrees, depth = 5.11 km  
 91.34 - 100.00 percent

spectral density (energy/Hz)

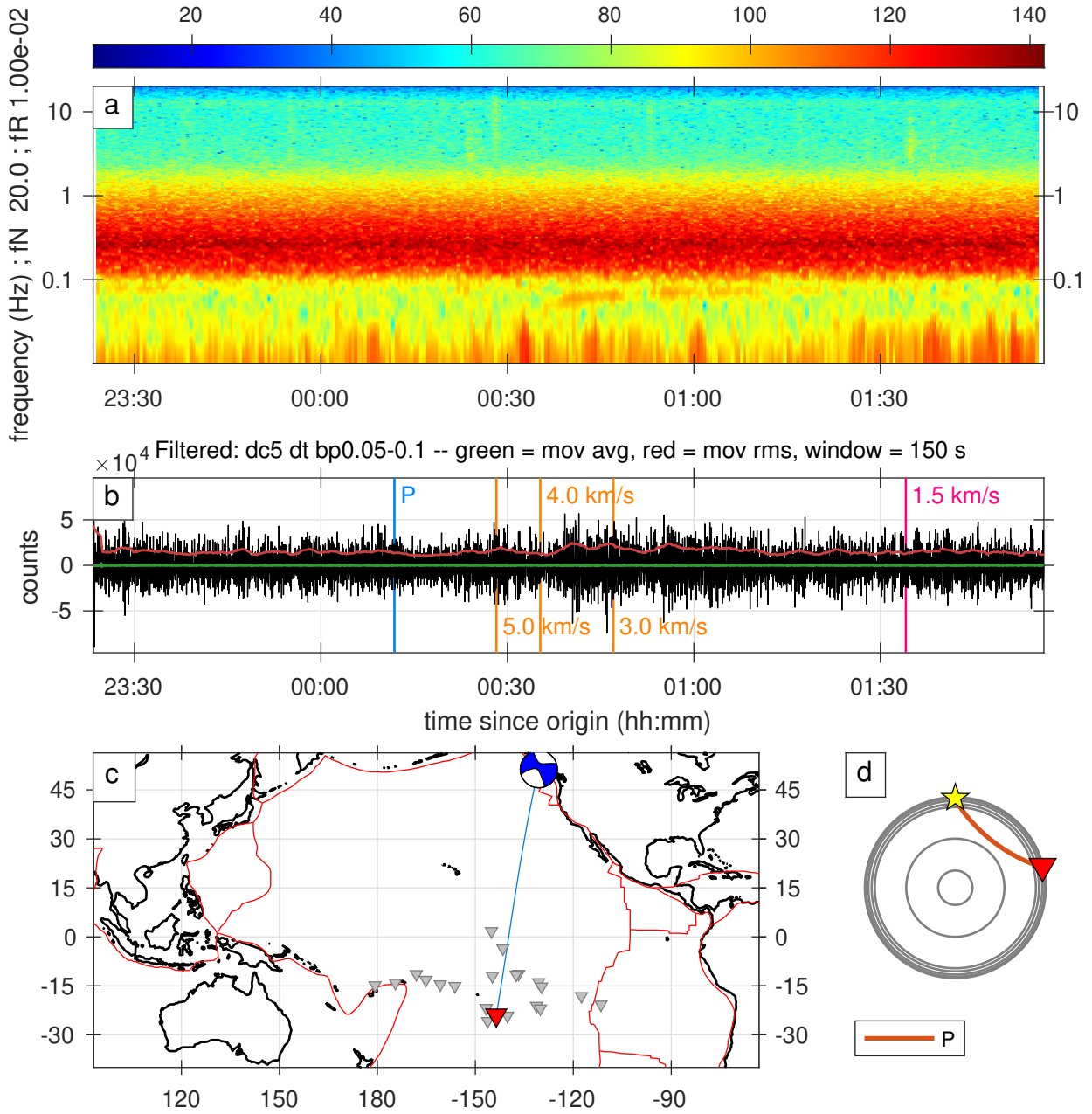
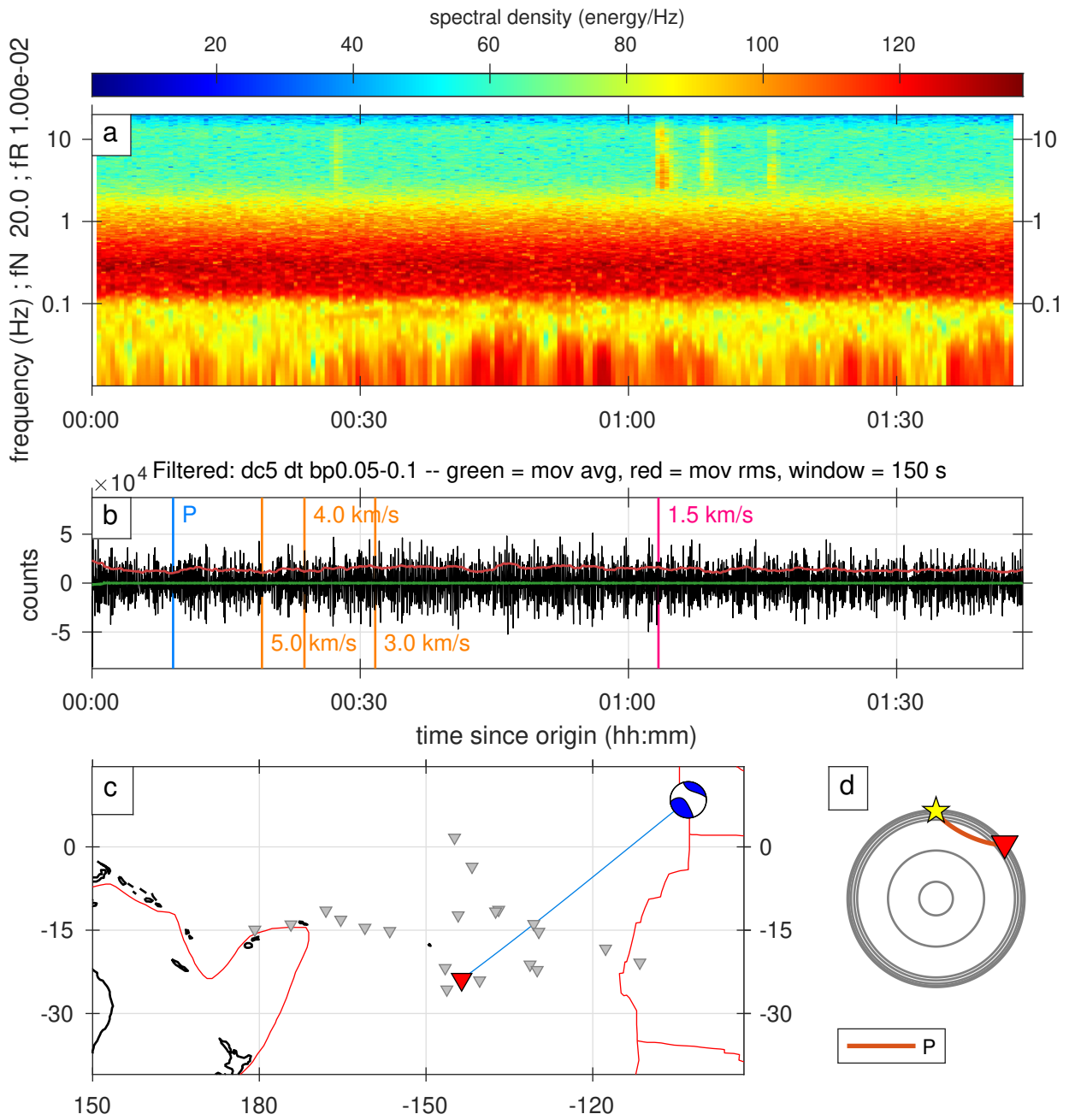


Figure S202. A full record of an earthquake classified as 1star category.

Arrival: 2019-07-17T22:25:48.308695, ID: 11077612

mb = 4.80, distance = 51.28 degrees, depth = 10.00 km  
22.41 - 54.49 percent





Arrival: 2019-07-20T14:16:54.390053, ID: 11080263

mb = 4.80, distance = 27.91 degrees, depth = 10.00 km  
60.39 - 63.01 percent

spectral density (energy/Hz)

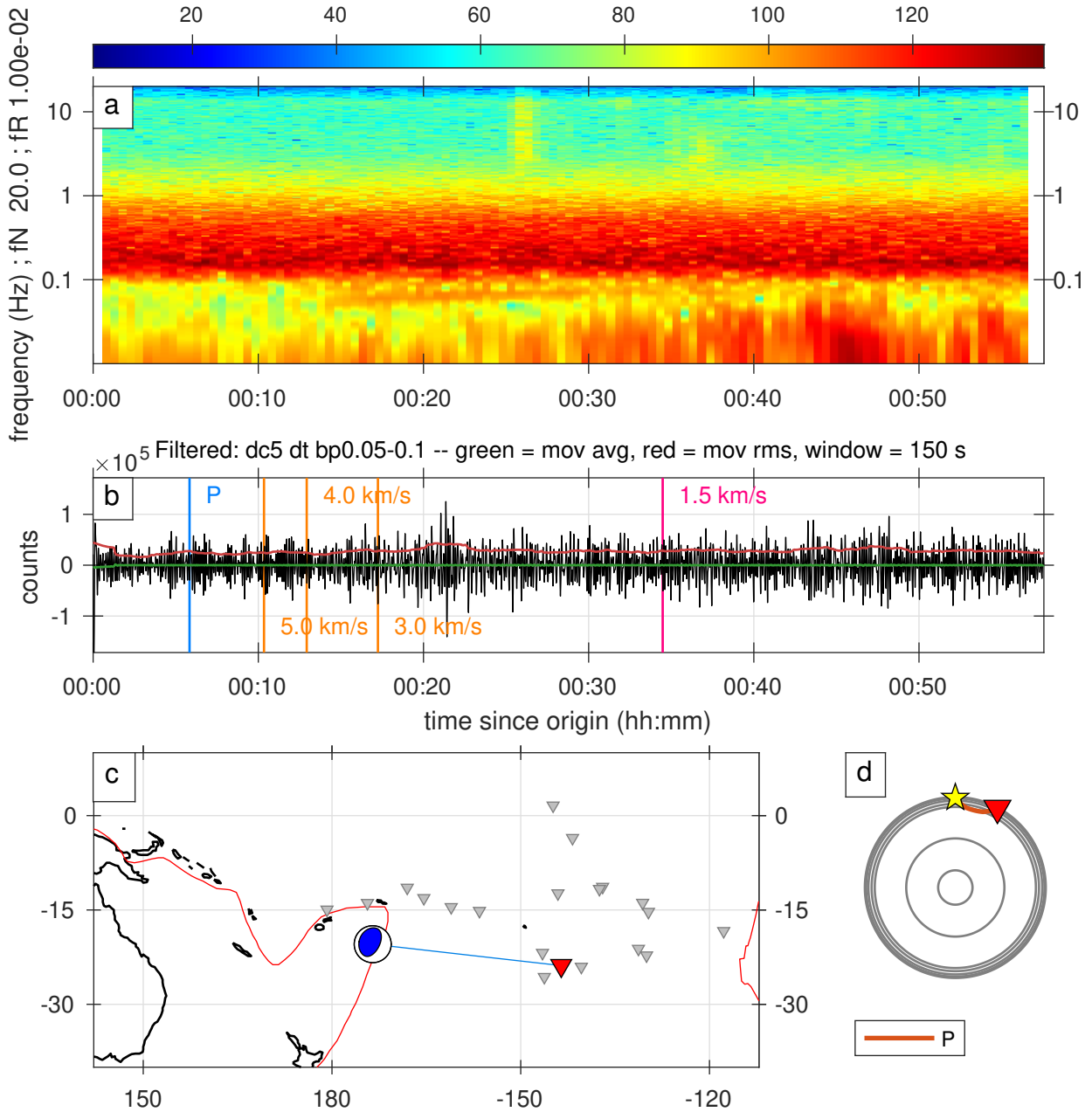


Figure S204. A full record of an earthquake classified as 1star category.

Arrival: 2019-07-20T15:22:16.823495, ID: 11080254

Mww = 5.10, distance = 27.63 degrees, depth = 10.00 km

63.37 - 65.97 percent

spectral density (energy/Hz)

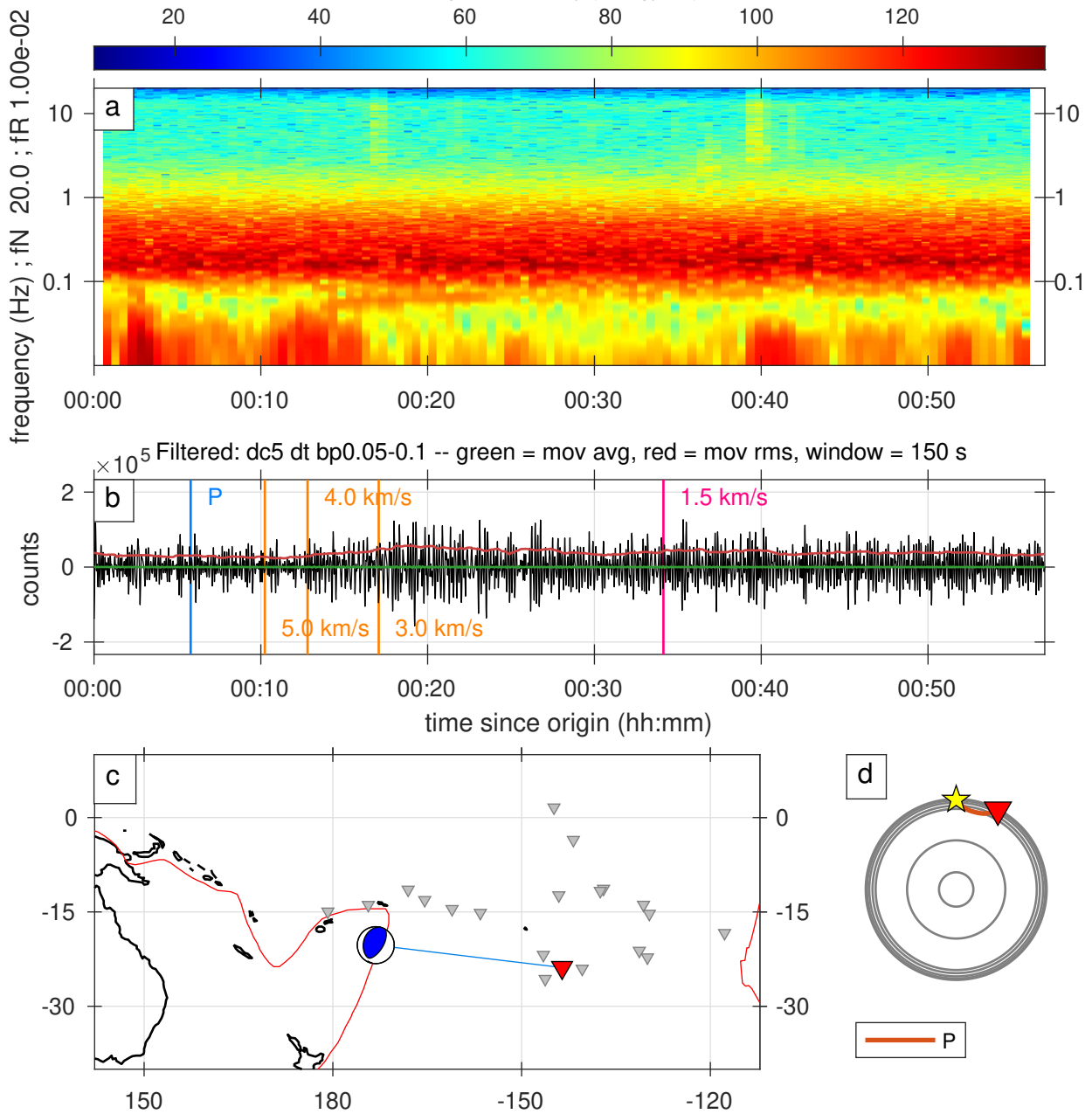


Figure S205. A full record of an earthquake classified as 1star category.

Arrival: 2019-07-21T21:05:01.099695, ID: 11081248

mb = 4.70, distance = 28.89 degrees, depth = 10.00 km  
88.20 - 93.56 percent

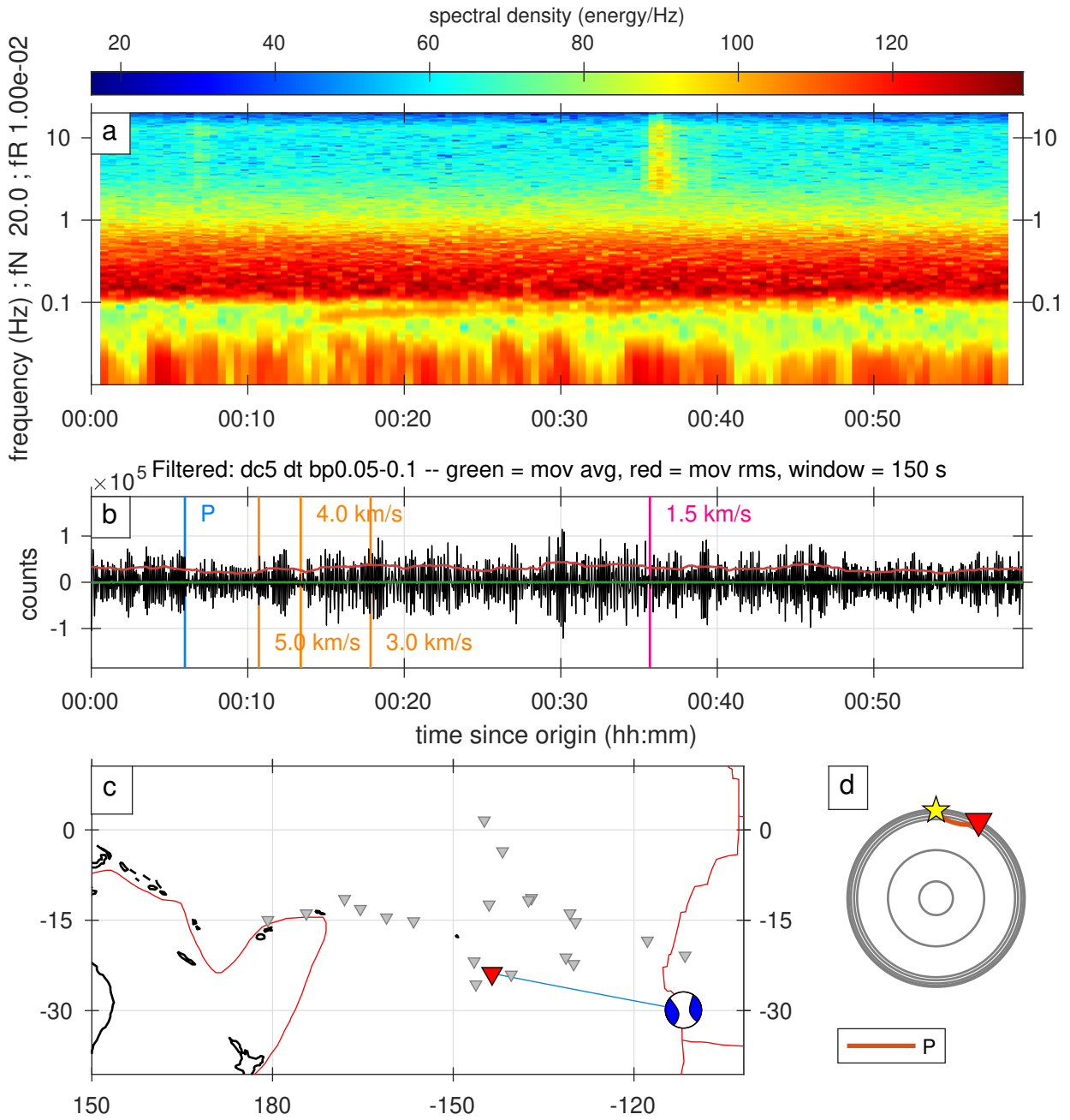


Figure S206. A full record of an earthquake classified as 1star category.

Arrival: 2019-07-23T10:43:03.328153, ID: 11082724

Mww = 6.00, distance = 56.09 degrees, depth = 10.00 km  
46.06 - 50.94 percent

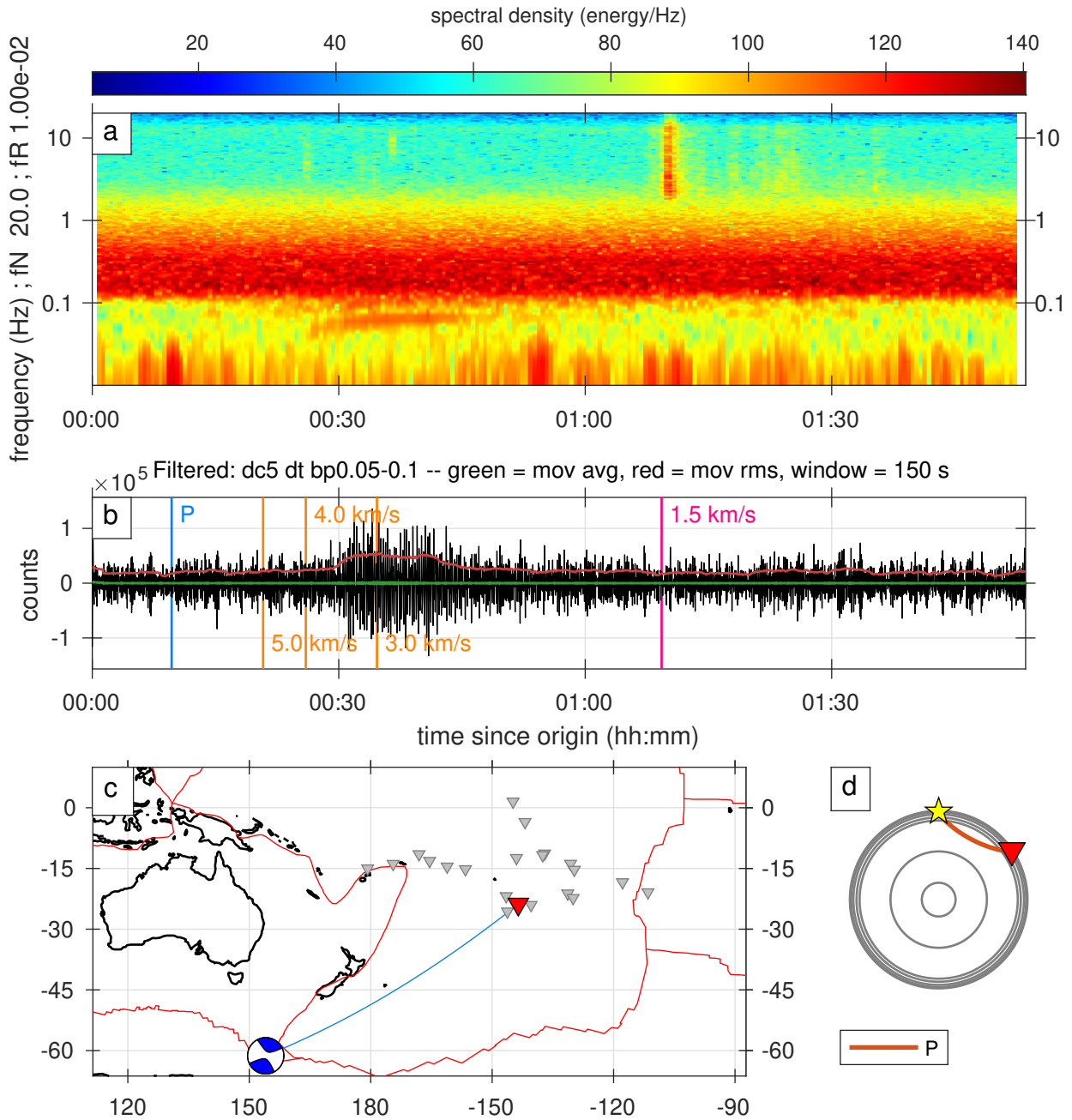


Figure S207. A full record of an earthquake classified as 1star category.

Arrival: 2019-07-27T18:45:00.000000, ID: 11086537

Mww = 6.30, distance = 94.40 degrees, depth = 367.00 km  
35.29 - 38.72 percent

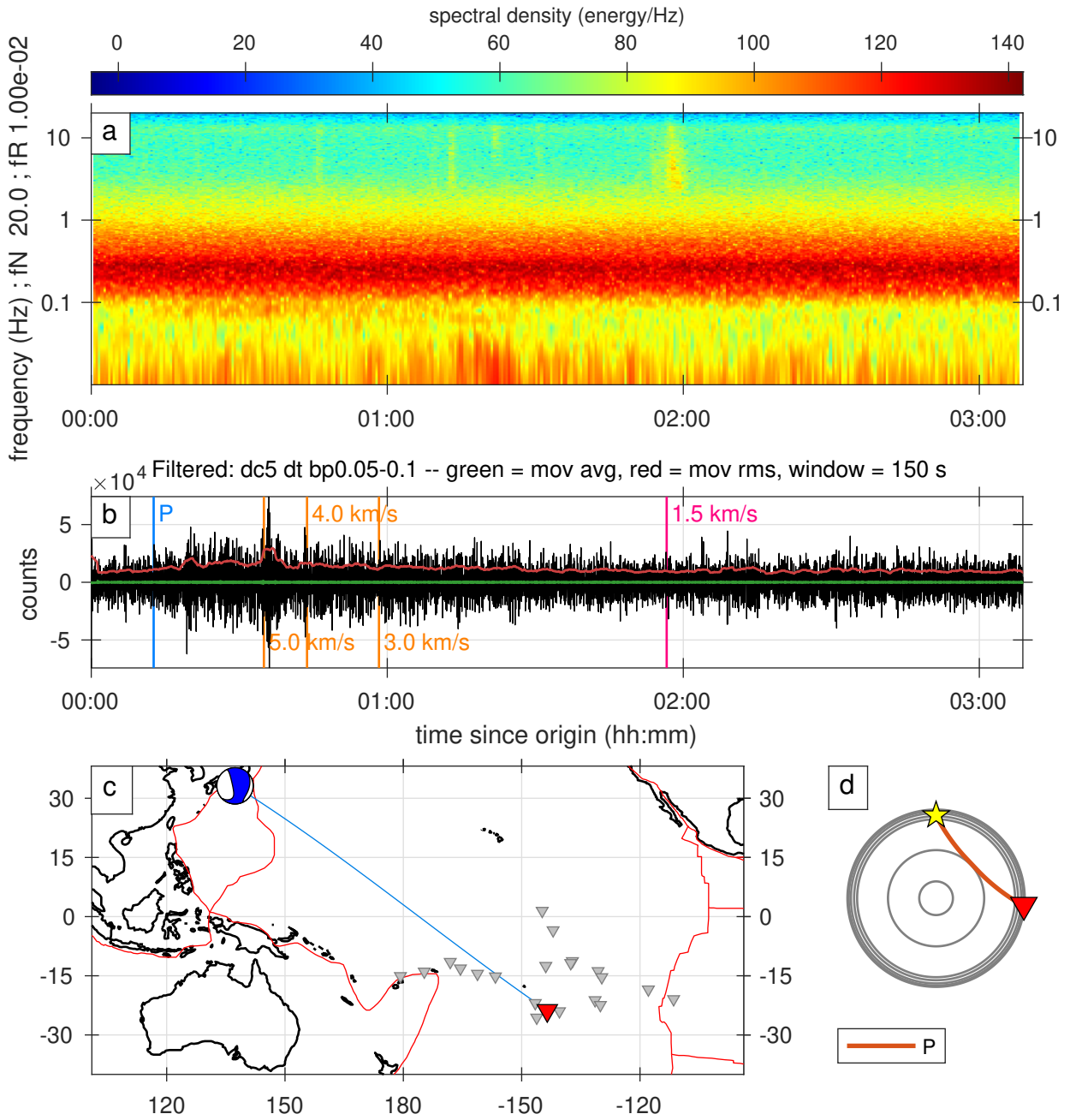


Figure S208. A full record of an earthquake classified as 1star category.

Arrival: 2019-08-02T01:05:36.604521, ID: 11090368

M<sub>w</sub> = 5.40, distance = 62.01 degrees, depth = 14.04 km  
9.39 - 19.57 percent

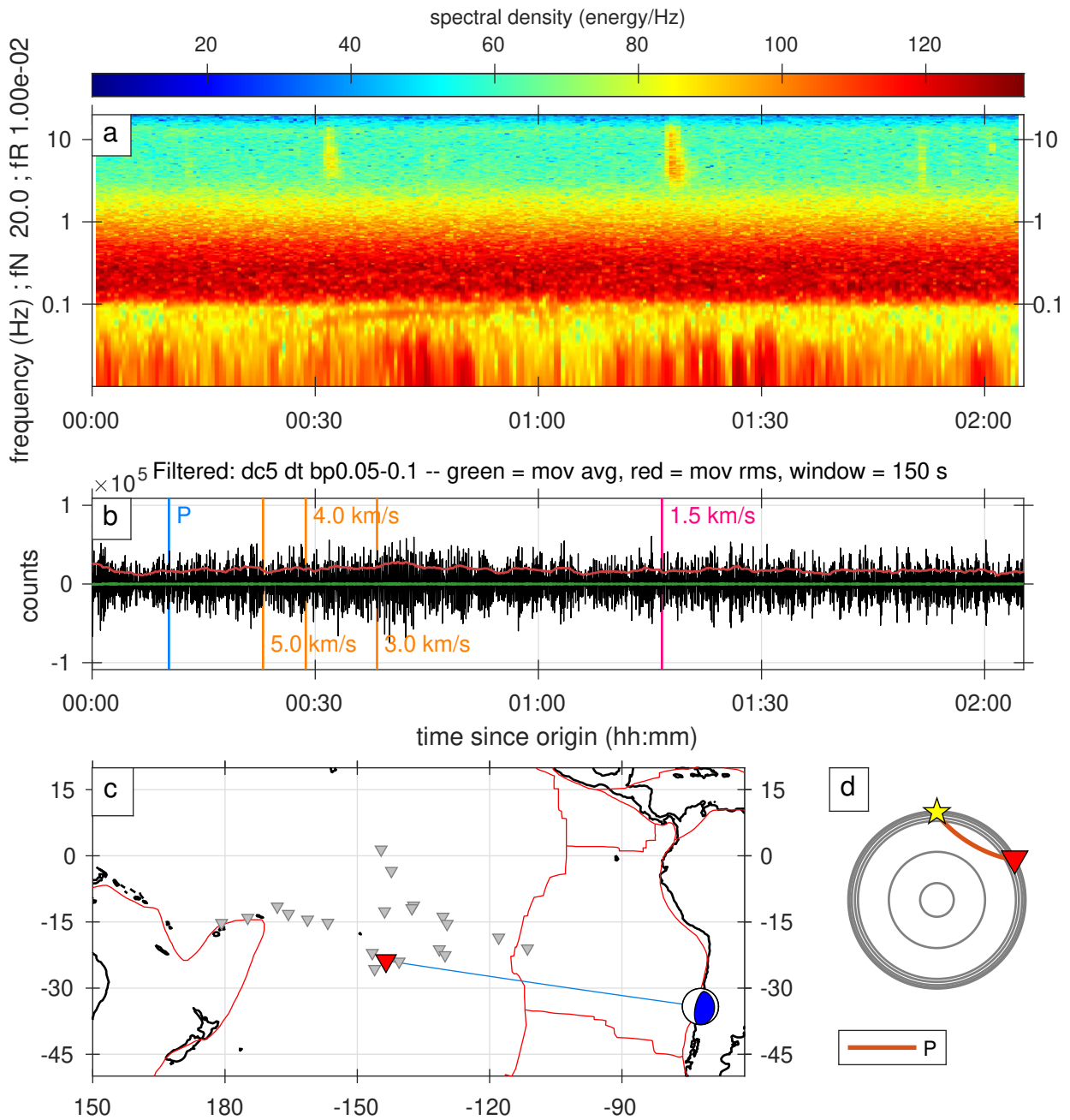


Figure S209. A full record of an earthquake classified as 1star category.



Arrival: 2019-08-06T17:28:23.573093, ID: 11092784

mb = 4.90, distance = 39.00 degrees, depth = 10.00 km  
43.97 - 46.32 percent

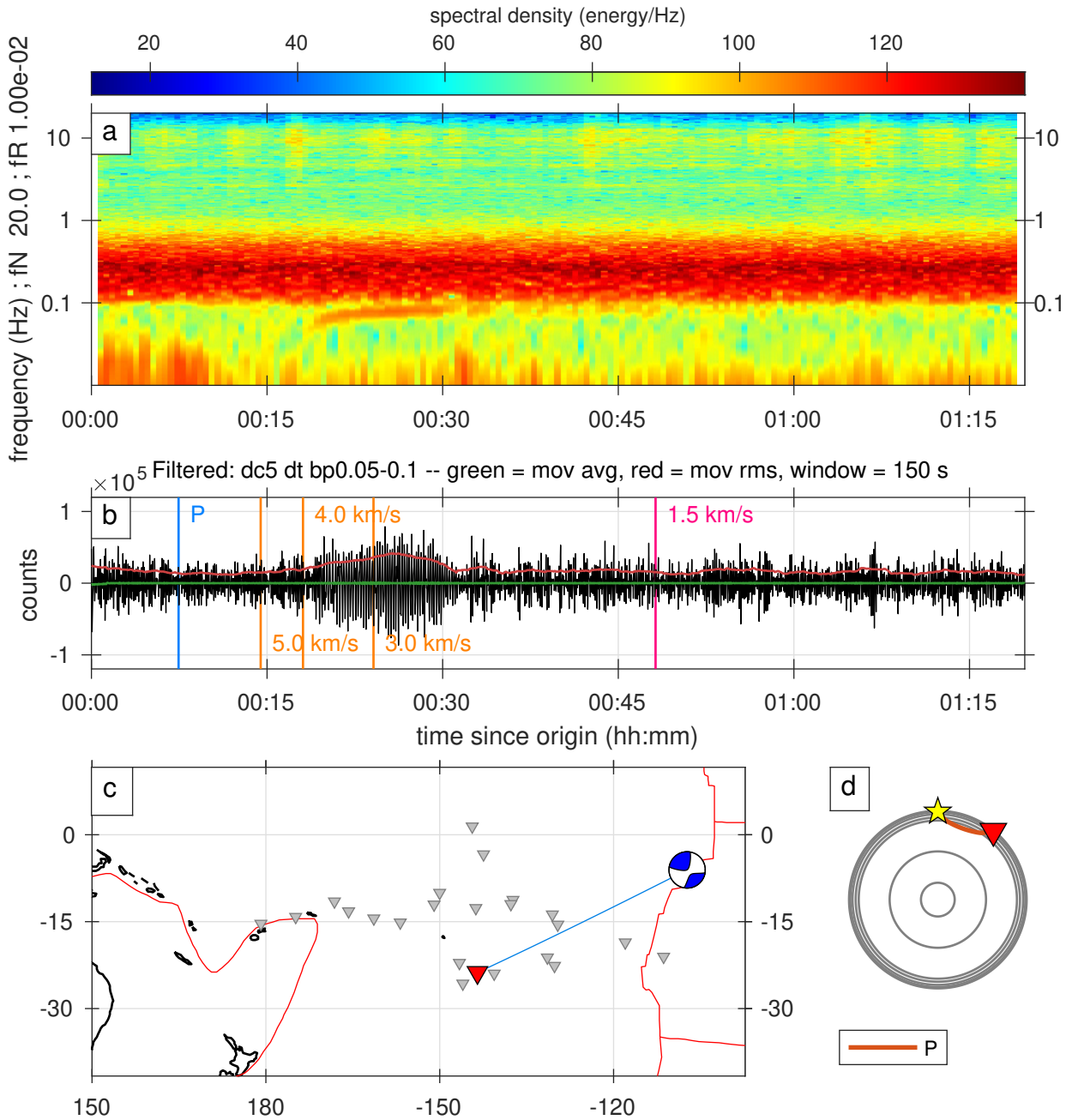


Figure S210. A full record of an earthquake classified as 1star category.

Arrival: 2019-08-06T22:22:00.000000, ID: 11092895

Mww = 5.90, distance = 44.95 degrees, depth = 150.00 km

52.59 - 55.27 percent

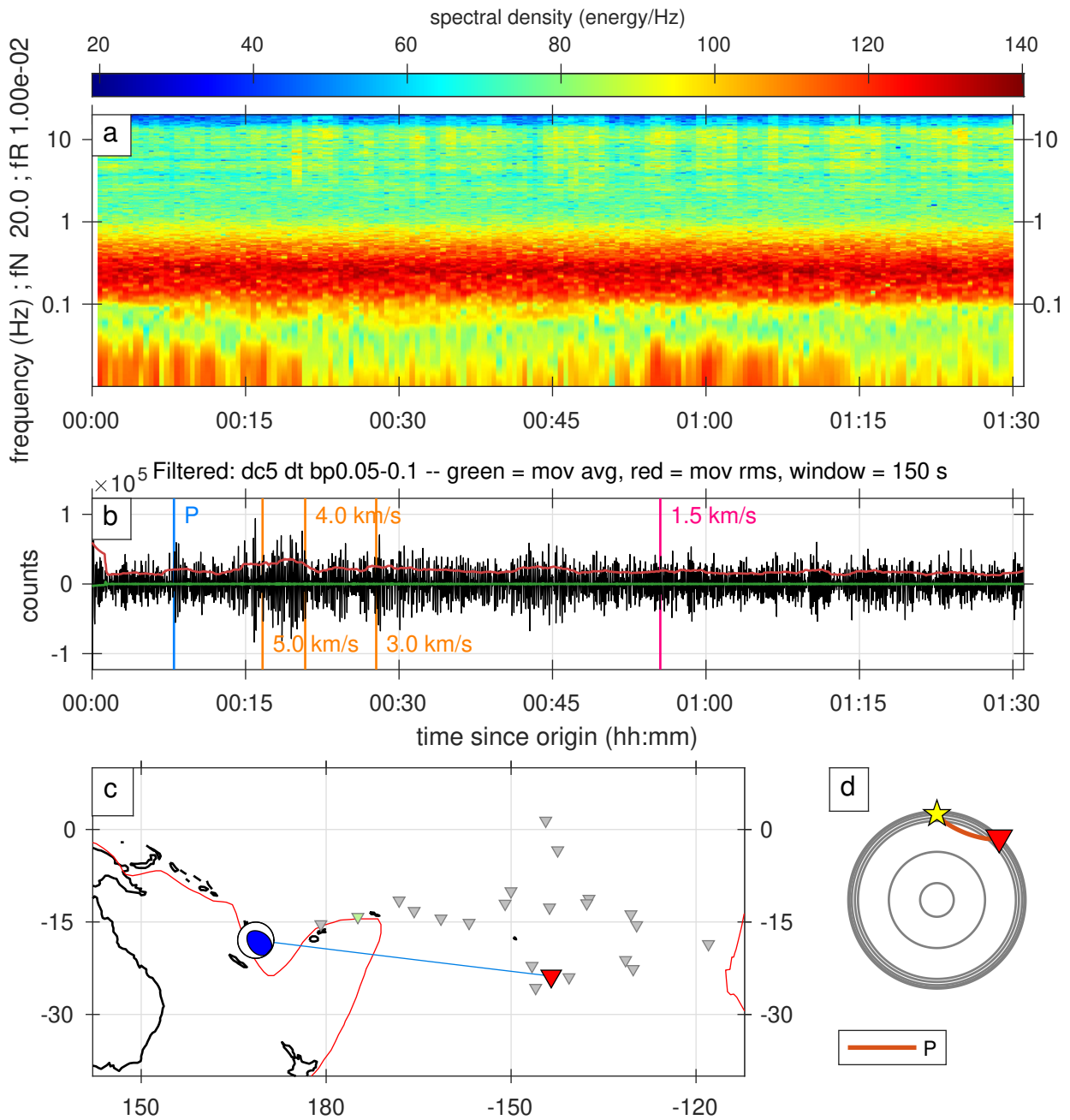


Figure S211. A full record of an earthquake classified as 1star category.



Arrival: 2019-08-07T05:41:40.000000, ID: 11093088

Mww = 5.80, distance = 46.48 degrees, depth = 123.30 km  
65.48 - 68.27 percent

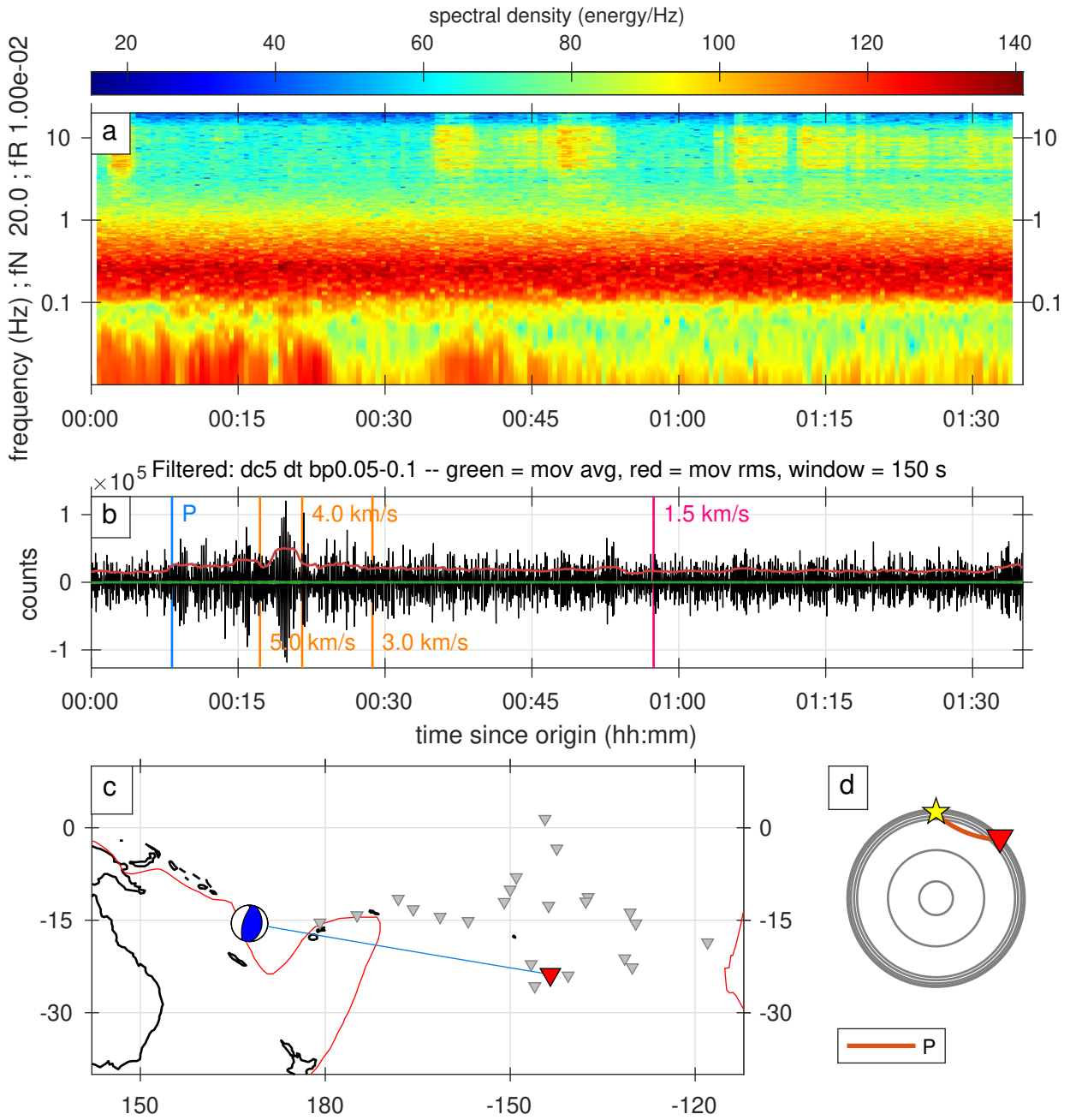


Figure S212. A full record of an earthquake classified as 1star category.

Arrival: 2019-08-12T10:45:00.000000, ID: 11096114

Mww = 5.40, distance = 44.40 degrees, depth = 10.00 km  
 25.35 - 28.54 percent

spectral density (energy/Hz)

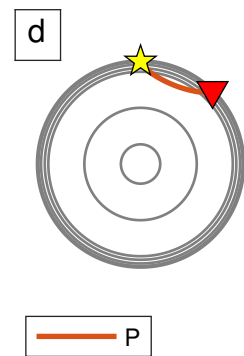
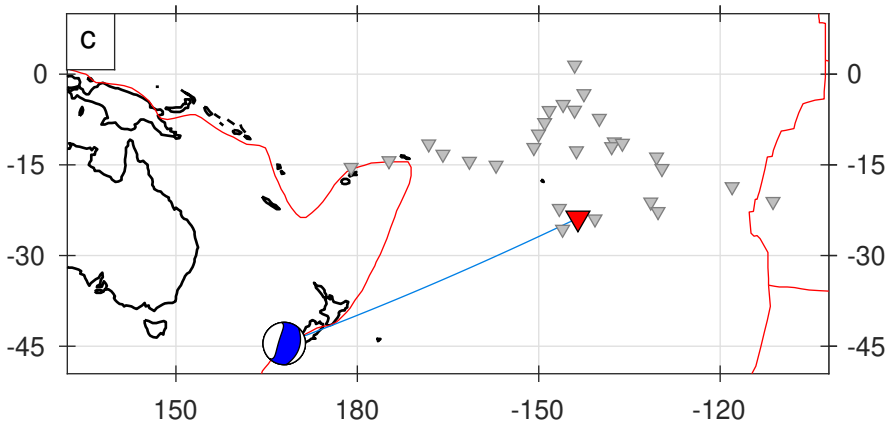
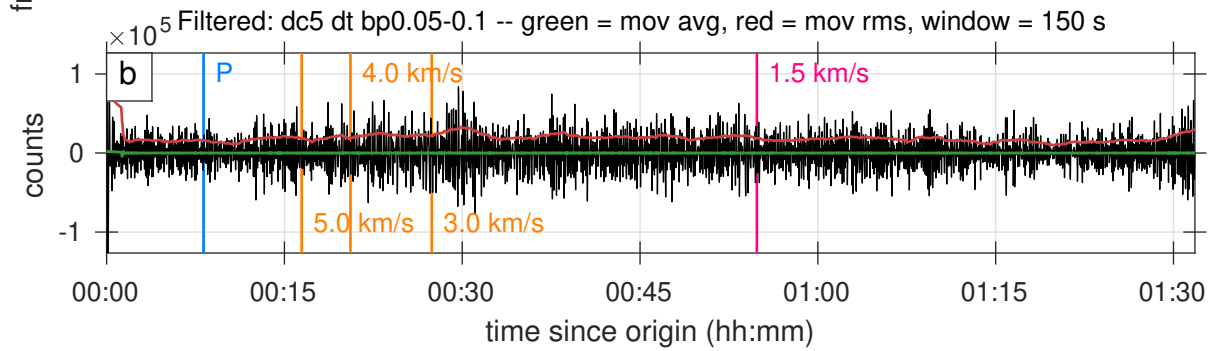
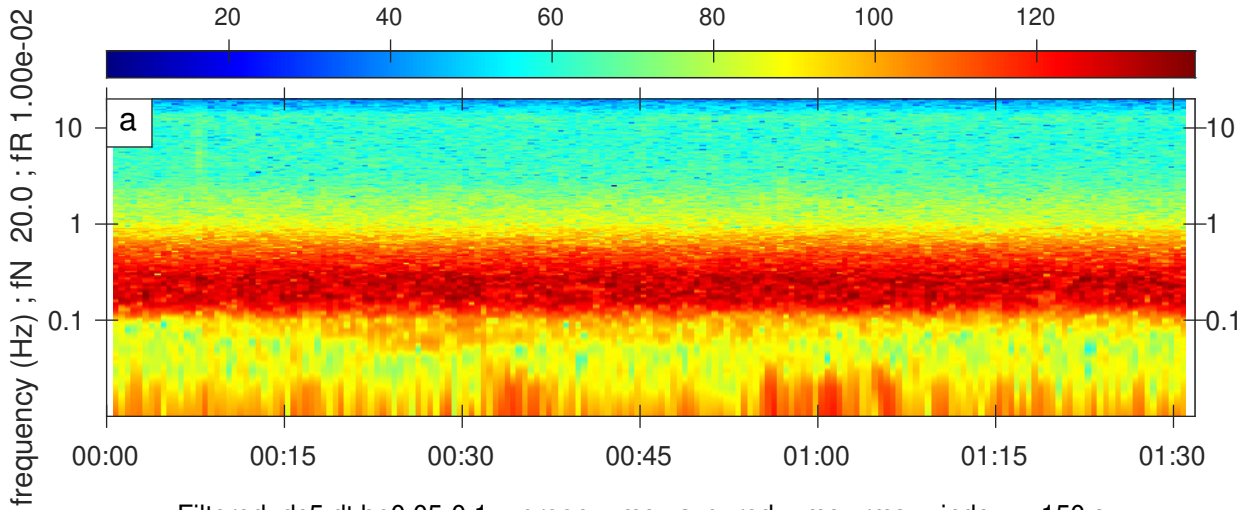


Figure S213. A full record of an earthquake classified as 1star category.