the Global Water System Project, UNESCO International Hydrology Programme (IHP), and WCRP's Global Energy and Water Cycle Experiment. The ubiquitous nature of water ensures that the benefits of the broad application of these principles will accrue not only to the water sector, but to all sectors considered in the GEOSS plan. During the International Decade on Water for Life (2005–2015) it is hoped that members of the water community will commit to partnering with GEOSS as it implements its plan.

The workshop was attended by representatives from the National Aeronautics and Space Administration (NASA), European Space Agency (ESA), National Oceanic and Atmospheric Administration (NOAA), World Climate Research Programme (WCRP), UNESCO International Hydrological Programme (IHP), Global Energy and Water Cycle Experiment (GEWEX), Coordinated Enhanced Observing Period (CEOP), International Association of Hydrological Sciences (IAHS), IAHS Decade on Predictions in Ungaged Basins (PUB), Global Water System Project (GWSP), International Geosphere-Biosphere Programme (IGBP), Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI), Japan's Marine Science and Technology Center (JAMSTEC), and the Integrated Global Observing Strategy Partnership (IGOS-P). There were also representatives from a number of U.S., Japanese, and European universities and national laboratories.

The International Water Cycle Workshop was held in Seattle, Washington, 27–29 July 2004.

Acknowledgments

The workshop hosts wish to thank Japanese and European colleagues for providing the opportunity to participate in the GEO process. Without their assistance, U.S. researchers would not have participated in this important review and road map process.

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MYRES: A Program to Unite Young Solid Earth Researchers

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The first Meeting of Young Researchers in the Earth Sciences (MYRES-I), held in August of 2004, focused on "Heat, helium, hotspots, and whole mantle convection." Biennial meetings, with MYRES-I as the first, are one of the ways the MYRES initiative is building an "international, interdisciplinary, open and unbiased community of colleagues who interact regularly to informally exchange ideas, data, and tools, and formulate new collaborative research projects" (see *Young Solid Earth Researchers of the World Unite*! published in *Eos, 85*(16), 160, 2004). This article reports on our first workshop, discusses what is happening in the community, and calls for proposals to keep MYRES funded.

A New Meeting Concept

The MYRES meetings are organized by, and for, junior members of the solid Earth research community. In 2004, funding from the U.S. National Science Foundation (NSF), the European Science Foundation (ESF) and the Scripps Institution of Oceanography enabled the initiative to nearly fully fund this meeting with a diverse and international crowd of nearly 100 participants selected from an oversubscribed pool.

MYRES was founded on the idea that through thorough and critical exposure to each other's thinking, young researchers can avoid becoming overspecialized and perpetuating entrenched views. Thus, the eight keynote presentations were conceived primarily as tutorials aimed at familiarizing practitioners of one research area with the results and cross-disciplinary implications of another. Presentations were reviewed in advance by all lecturers to maintain a coordinated focus. Fully referenced and annotated slides, some with a glossary of jargon, were made available before the meeting on the MYRES Web page, where they remain accessible today.

In line with the promise of being "open and unbiased," special attention was paid to exposing the pitfalls, misconceptions, and presumptions that all too often reinforce existing boundaries between research domains and impede a sound interpretation of the progress made in the field as a whole.

The integrative approach of the first MYRES workshop allowed the participants to formulate scientific questions that require a multifaceted, collaborative approach and long-term vision.

Answering Questions on the Structure and Evolution of Earth's Mantle

What is the convective style of the Earth's mantle? Does the mantle convect as a whole, or is it layered? How is heat transport organized in the Earth? Do mantle plumes exist? What is their contribution in delivering Earth's heat to the surface? What are the origins and correlation length scales of mantle heterogeneity? What is the nature and role of geochemical reservoirs? Is there an undifferentiated reservoir in the lowermost mantle?

These questions do not stand alone; they require interdisciplinary solutions involving geochemical, seismological, and geodynamical observations and models. Thus, in addition to mastering one's own disciplines, it is necessary to know more than "just enough to be convinced" by evidence from other areas arguing one way or another on such important questions.

Researchers must know enough to be able to challenge each other's views and interpretations and to incorporate the progress made in another discipline into one's own research. This requires, at the very least, understanding the uncertainties of the data collected and of the models derived by one's colleagues.

Communicating Uncertainty Across Disciplines

Calculating, representing, and then conveying the uncertainty in a seismic mantle model, for example, such that it can be meaningfully interpreted by others, is a daunting task. Uncertainties in the observations can at best only be estimated, as the distribution of the errors is usually unknown.

However, the uncertainty in the models based on these data is almost always out of reach, owing to the sheer size of the model space of the unknowns. Moreover, large models with many parameters derived from limited observations are invariably non-unique.

Geophysical inverse theory, statistics, and advanced visualization techniques make the uncertainty problem tractable to some extent, but the "best model," fundamentally, is subjective. As a consequence, model users (e.g., the geodynamicist wanting to predict dynamic topography or calculate the driving forces for mantle convection from seismic wave speeds, or the mineral physicist wishing to interpret wave speed heterogeneity in terms of mantle temperature) almost inevitably need access to the scientist constructing the model.

Small meetings provide this opportunity, and small meetings focused on the junior members of the academic hierarchy (students, postdocs, and untenured faculty), such as MYRES, are able to do this extremely well.

Mantle Structure: Inference and Interpretation

The MYRES-I workshop opened with a discourse on "Seismic tomography: Art or science?," mixing answers to questions regarding mantle structure with further questions on how to represent and interpret model uncertainties. Art and science, the subjective and the objective, are linked in the construction of mantle models from seismic observations. The attendees were taught to evaluate the robustness and uniqueness of such models by critically evaluating data coverage, inversion damping, and issues regarding the measurements themselves.

Such problems are not unique to seismology. The second tutorial lecture, "How to interpret geophysical data for mantle dynamics," discussed the sources of error in measuring mineral physics constants and their conversion to other geophysical observables. "Constraints on mantle structure from surface observables" discussed satellite gravity data and post-glacial rebound. Observational constraints were introduced with their non-uniqueness and trade-offs, and the influence of a priori assumptions was highlighted.

Understanding mantle mixing is not the sole subject of either geochemistry or geodynamics, but rather benefits from the fruitful interaction between both.

"Geochemical observables on the composition of the Earth and its reservoirs" introduced participants to the bulk silicate Earth and to the size and distribution of reservoirs. Petrological and geochemical databases are increasingly available online, and thus hypotheses can be easily tested. Caveats abound: Mass balance is ignorant about the topology of the reservoirs. This, perhaps, has historically been the most important misunderstanding regarding mantle structure, and it takes both geochemists and geophysicists to clear up the confusion.

"Noble gas constraints on mantle structure and convection" identified problems and paradoxes highlighted by primordial isotopes sampled by plumes and ridges. "Dynamics of thermal boundary layers and convective upwellings" answered, among others, the question of how many plumes can theoretically be expected in a convective mantle like Earth's.

The tutorial portion of the conference ended by highlighting "The role of the core: Heat and mass flux," and with a thorough treatment of "Seismic constraints of boundary layers." This presentation revealed how physical properties at the core-mantle boundary can be measured, and how well, and advocated the use of seismic arrays. The development of large arrays is an area of funding growth in seismology, and the necessity of providing rapid and open access to such new data in order to fully utilize it was discussed.

MYRES-I was as much about explaining and understanding science as it was about sharing data, identifying common goals, and looking forward together to the future. Informal group discussions focused on concerns not usually discussed at scientific meetings. These included candid discussions on model uncertainties, wish lists, caveats, and explaining jargon. It became clear that seemingly neutral scientific words such as "heterogeneity," "small-scale," "red spectrum," or "well-mixed" lead their own lives in the various subdisciplines of our science.

In cutting across traditional research boundaries and through its informal, tutorial format, MYRES-I "served a unique purpose not met by other available meetings," an attendee indicated in the meeting's exit questionnaire. In other quotes from the questionnaire, attendees noted that they "felt more comfortable speaking out than at other meetings," which, in turn, led them to "understand constraints from other disciplines for [their] own research better."

A Wide Community of Junior Scientists

In between meetings, the MYRES community is moving online (see http://www.myres.org). A Web site is maintained with all lecture notes, exit survey results, and the compiled commentary from the breakout and forum sessions. An online glossary of terms that all should know about each other's research fields is in the planning stage.

Also present and growing online are perhaps the most tangible results of the MYRES effort: nascent "proposals" by spontaneous groupings of young scientists. These run from "testing the mantle's plum pudding model," to "improving scaling between seismic velocities and thermal/compositional anomalies," and from "what is the source, style, and magnitude of heat transfer through the lower mantle?" to "constraining the geotherm."

Materials are being added to the Web site on a semi-continual basis.

A Call for Proposals

The steering committee wishes to initiate MYRES-II, and hereby calls for short proposals for a second meeting. These proposals have been (at the AGU 2004 Fall Meeting, in San Francisco) and will continue to be (at the European Geosciences Union Vienna spring meeting, on 27 April 2005) presented to the MYRES community in town hall meetings, as well as online, to anyone who signs up for the mailing list. The next meeting theme and venue will then be decided by community vote, and the meeting chairs must then obtain funding, whether from NSF and ESF (as was the case for MYRES-I) or any other sources.

MYRES-I was a success. With your help it is hoped that the momentum is maintained.

MYRES-I was held in La Jolla, California, 12–15 August 2004.

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BOOK REVIEW

Living With Earthquakes in the Pacific Northwest: A Survivor's Guide, 2nd edition

Robert S. Yeats

Oregon State University Press, Corvallis; 390 pp.; ISBN 0-87071-024-9; 2004.

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In 1995, Robert S. Yeats found himself teaching a core curriculum class at Oregon State University for undergraduate nonscience majors, linking recent discoveries on the earthquake hazard in the Pacific Northwest to societal response to those hazards. The notes for that course evolved into the first edition of this book, published in 1998. In 2001, he published a similar book, *Living With Earthquakes in California: A Survivor's Guide* (Oregon State University Press).

Recent earthquakes, such as the 2001 Nisqually M_w6.8, discoveries, and new techniques in paleoseismology, plus changes in public policy decisions, quickly outdated the first Pacific Northwest edition. This is especially true with the Cascadia Subduction Zone and crustal faults, where our knowledge expands with every scientific meeting.

This book begins with a lucid, but thorough, exposition of plate tectonics, geology, seismology, paleoseismology, and geodesy, as they apply to the Pacific Northwest and the West Coast in general. Particular attention is paid to the Cascadia Subduction Zone and its potential for earthquakes in the M_w9 magnitude range. Slab earthquakes, such as the 2001 Nisqually quake, and crustal earthquakes also receive their share, however. Known active faults with potentially serious impact, such as the Seattle fault, are thoroughly covered. Details are given on how we know what we know, from submerged forests to lidar ground imaging to the Japanese tsunami records that have pinned down the date and time of the last great subduction event (about 9:00 p.m. on 26 January 1700).

From geology and seismology, Yeats then proceeds to the subject of earthquake prediction and forecasting (with a clear distinction between the two), both scientific and nonscientific, and probabilistic earthquake hazard analysis. Site effects are covered, with graphic examples from Mexico City and Nisqually. The tsunami hazard is well-expounded, with many eyewitness accounts of the waves from the 1964 M_w9.2 Alaska earthquake. The last few chapters expound on earthquake insurance, earthquake engineering and retrofit, home earthquake safety, and public policy.

One of the things that impresses me about Yeats' writing is his ability to expound in relatively great detail on technical topics without triggering any math or science anxiety on the part of the reader. Every scientific exposition is clearly related to its human relevance, often with engaging tales of disaster or potential disaster. The same goes for the many figures and photographs, which contain details for geologists, et al. while also being easy to read and to the point.

Yeats' sections on the earthquake insurance industry and governmental response to seismic hazard go significantly beyond most other books on seismology, especially those intended