How should hydrology education adapt to deal with major environmental and other issues and to take advantage of advances in computational capabilities? What should students be learning about hydrology? And, with hydrologists having a diversity of backgrounds, interest, and training, is there such a thing as a cohesive hydrology community? These and other topics generated a provocative discussion during a 5 May town hall meeting at the European Geosciences Union (EGU) General Assembly, in Vienna, Austria.

The historical separation of hydrology education into engineering and science programs “does not allow us to prepare students for the 21st-century challenges in hydrology,” asserted Markus Weiler, director of the Institute of Hydrology at the Albert Ludwig University of Freiburg, in Germany. He wondered whether there are ways to bring the two communities together, particularly related to education, “and move hydrology out of that niche of being a by-product of a bigger program” and instead be its own program. Weiler was one of three speakers invited to make brief presentations.

Another presenter, James Kirchner, director of the Swiss Federal Institute for Forest, Snow, and Landscape Research and professor in the Department of Earth and Planetary Science at the University of California, Berkeley, focused his comments on three themes: the need to teach portable skills, to teach across interdisciplinary boundaries, and to teach members of the public who need to know about water resources and students who may have no aspiration to become hydrologists.

Kirchner told meeting attendees, many of whom teach, that they should consider that most of their students will not pursue hydrology as a career; even if they do, the tools they will use likely will be different than those currently used, and they may not even have been thought of yet. “Although it is useful for professional certification purposes for people to have a specific tool kit of some kind, we should not miss the opportunity to use water resources and hydrology as a vehicle for teaching portable skills,” such as understanding models and theory or using data to query the natural world, that they can use no matter what they do in the future, he said.

Noting that “the big divide” in hydrology is between people trained in engineering and those trained in other fields such as geology or forestry, Kirchner encouraged students from both areas to understand and learn from each other’s perspectives. “We need to think broadly about what hydrology is. It’s not just predicting the hydrograph. It’s not even just a physics problem,” he said, adding that if the discipline is drawn more broadly to also include chemistry, biology, economics, and even geopolitics, “then we can have an interesting and inspiring time, and our students can too.”

Another speaker also questioned whether it is more important to teach students hydrology techniques, tools, and “recipes” of the trade or to provide them with broader skills and teach them to think, so they can continue learning. Murugesu Sivapalan, professor of geography and civil and environmental engineering at the University of Illinois at Urbana-Champaign, contended that it is better to be problem oriented than method oriented. He said hydrology education should move away from teaching recipes, whether in class or through books, and instead encourage in students a curiosity about the world.

Günter Blöschl, head of the Department of Hydrology and Water Resources Management at the Institute for Hydraulic and Water Resources Engineering of the Vienna University of Technology, Austria, commented that the focus should be on teaching “mind patterns” rather than specific tools. “This is what you should teach, and this is what will carry on to the next century and to a changing world,” he said.

Blöschl added that diversity within the hydrology community should be viewed as a benefit rather than a burden. “We should be more creative to make use of the diversity rather than to streamline everything and have one mainstream model of hydrology education,” he said.

Town hall moderator Jan Seibert, professor of hydrology and climate in the Department of Geography at the University of Zurich, in Switzerland, told Eos that diversity is a strength of hydrology. With diversity, he said, “we are covering a lot of different ground, and we can adapt much better to new issues and new problems. On the downside, this is problematic because it is harder to define what we are.”

—RANDY SHOWSTACK, Staff Writer

Mesospheric Ice Clouds as Indicators of Upper Atmosphere Climate Change

Workshop on Modeling Polar Mesospheric Cloud Trends; Boulder, Colorado, 10–11 December 2009

The 20-year-old speculation that high-altitude summertime ice clouds (polar mesospheric, or noctilucent, clouds, here denoted MC) are affected by anthropogenic activities has recently received support from a 30-year time series of solar backscatter ultraviolet (SBUV) satellite measurements. SBUV data reveal a significant trend in bright MC properties. However, the robustness of the trend, extracted from interannual, local time, and solar cycle variability, and its underlying causes remains debatable.

General circulation models that simulate MC have finally reached the sophistication to address this question. Two modeling groups have reported simulating trends in MC optical properties, which closely match the SBUV data. The models are (1) Leibniz Institute Middle Atmosphere/Ice (LIMA/Ice) and (2) Whole Atmosphere Community Climate Model–Polar Mesospheric Clouds (WACCM-PMC). Both simulations agree well with satellite data in the Northern Hemisphere (NH). Trends of Southern Hemisphere MC are apparently masked by large interannual variability.

To understand how two different simulations could produce such remarkable agreement, MC scientists recently attended an informal workshop at the Laboratory for Atmospheric and Space Physics, in Colorado.

Changes in the mesosphere result from a host of long-term forcings, including changes in greenhouse gases (GHG). The WACCM group reported that simulations covering the period from 1953 to 2003 and altitude range 0–140 kilometers indicate a negligibly small (<0.4 K per decade) cooling in the MC domain (the high-latitude summertime mesopause region, 80–90 kilometers). A simulated 10–15% per decade increase of water vapor results in part from oxidation of rising concentrations of methane. This study (with no ice modeling) points toward water vapor as the possible...
driving force for MC trends. Use of the same long-term forcing in WACCM-PMC (with an ice parameterization) showed excellent agreement with SBUV trends in the NH polar region.

To investigate the stratospheric influences on the NH clouds, LIMA/Ice simulates millions of ice particle trajectories governed by winds that are forced at the lower boundary (~40 kilometers) by a meteorological database, updated every 6 hours over the period from 1961 to 2008. GHG concentrations were held constant. The LIMA/Ice group reported that a small mesospheric cooling rate (~1 K per decade) was found to be due partly to stratospheric contraction owing to stratospheric cooling. Yet even this model simulated the observed trend in MC, despite the lack of any explicit methane or carbon dioxide trends in the mesosphere.

Subsequent discussion considered unmodeled influences (e.g., space shuttle injections of water and detailed nucleation schemes). None was considered to be of major importance for MC trends. Interhemispheric coupling is implicit in both models, but its influence has not been separately isolated.

The WACCM group noted that although their model predicts realistic upper stratospheric cooling (~1 K per decade), it is difficult to segregate the various influences in a free-running model. Future work will include sensitivity calculations in which the various forcings are held constant. The LIMA/Ice modeling group plans realistic optical calculations, coupling between chemistry and dynamics, and the addition of GHG increases. Progress should be forthcoming before the next meeting of the International Association of Geomagnetism and Aeronomy (IAGA)/International Commission on the Middle Atmosphere (ICMA)/Climate and Weather of the Sun-Earth System (CAWSES) Workshop on Long-Term Changes and Trends in the Atmosphere, to be held in Boulder, Colo., 15–18 June 2010.

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### ABOUT AGU

**Nine AGU Journals Rated Highly by Australian Evaluation System**

PAGE 183

Nine AGU journals recently received high ratings from the Australian Research Council’s Excellence in Research for Australia (ERA) initiative evaluation system. ERA evaluates and rates peer-reviewed journals in a wide range of research fields on the basis of expert review and public consultation. For the 2010 ratings, released in February, ERA evaluated more than 20,000 peer-reviewed journals.

The system rates journals as (from highest to lowest) A*, A, B, or C. According to ERA criteria, “Typically an A* journal would be one of the best in its field or subfield in which to publish and would typically cover the entire field/subfield. Virtually all papers they publish will be of a very high quality.” The criteria also state that A* journals are those that publish important work that will shape the field. In addition, A* journals typically have low acceptance rates and an editorial board dominated by field leaders.

AGU journals were rated very highly in several Fields of Research (FOR) codes as part of the Australian and New Zealand Standard Research Classification. Seven AGU journals (with FORs in parentheses) achieved the A* rating: *Journal of Geophysical Research* (Geophysics, Astronomical and Space Sciences, Geomatic Engineering), *Geophysical Research Letters* (Astronomical and Space Sciences, Geophysics), *Reviews of Geophysics* (Geophysics, Geomatic Engineering), *Paleoceanography* (Ecology, Geochemistry, Oceanography), *Water Resources Research* (Environmental Engineering, Civil Engineering), *Global Biogeochemical Cycles* (Atmospheric Sciences, Geophysics), and *Tectonics* (Geology, Geophysics).

In addition, two AGU journals—*Geochemistry, Geophysics, Geosystems* (Earth Sciences) and *Earth Interactions* (Physical Geography and Environmental Geoscience, Geophysics)—received the A rating, the second-highest rating. The ERA criteria state that “the majority of papers in a Tier A journal will be of very high quality.”

More information about the ERA ratings can be found at http://www.arc.gov.au/era/journal_list_dev.htm.

—BILL COOK, Director of Publications, AGU