Meeting participants assessed that the new drilling campaign should seek to collect the most valuable and immediately useful records, which would combine the positive attributes of completeness and high-quality preservation. In addition, participants recognized that drilling should be prioritized to sedimentary basins where the fossils and artifacts have actually been found, targeting time intervals when important questions can be asked regarding human evolutionary history.

Fortunately, in the East African Rift Valley, where the largest number of fossils, hominin species, and artifacts have been recovered, fine-grained lake beds occur abundantly, not only below extant lakes but also in sequences now exposed on dry land. These lacustrine deposits, with their documented capacity to provide high-quality paleoclimate records, coupled with proximity to hominin fossil sites and excellent preservation of microfossils and biogeochemical materials compared with exposed outcrops, make for compelling drilling targets, conference participants agreed. Through such investigations, clues to the relationship between earth history and human evolution may be revealed.

—ANDREW COHEN, Department of Geosciences, University of Arizona, Tucson; E-mail: cohen@email.arizona.edu; and MOHAMMED UMER, Department of Earth Sciences, Addis Ababa University, Addis Ababa, Ethiopia

What Can Water Vapor Reveal About Past and Future Climate Change?

AGU Chapman Conference on Water Vapor and Its Role in Climate; Kailua-Kona, Hawaii, 20–24 October 2008

PAGE 122

An AGU Chapman Conference on water vapor was held in Hawaii with approximately 120 attendees from nine countries. The meeting began with a keynote presentation on the hydrological cycle and climate change and continued with sessions on issues related to the upper troposphere/lower stratosphere region (UT/LS), the interactions of convection and water vapor, and the behavior of water vapor on large scales and in future and past climates.

The conference highlighted important advances in the scientific community's understanding since the previous Chapman Conference on this subject, in 1999. Basic understanding of the future hydrological cycle changes predicted by the current generation of numerical climate models has improved significantly, owing to analyses of the Coupled Model Intercomparison Project phase 3 (CMIP3) archive of model outputs, helping to guide future research. Speakers also presented evidence of much weaker and stronger hydrological cycles at the Last Glacial Maximum (about 20,000 years ago) and hot periods in the early Eocene (55 million to 33 million years ago), respectively. While no evidence was presented to question the anticipated positive feedback of water vapor on global warming, discussions noted the expectation of local changes in relative humidity in a warmer climate.

The very low humidities observed in the subtropical troposphere are now quantifiable to first order by a simple advection-condensation theory. Observations now confirm that supersaturation of water vapor over ice up to about 50% is common near the tropical tropopause (the boundary between the troposphere and stratosphere), and that strong storms can inject significant amounts of water to as high as 21 kilometers above sea level in the tropics, directly hydrating the stratosphere. Participants highlighted the newly appreciated roles of both frontal boundaries (or other mesoscale heterogeneities) and ample water vapor throughout the troposphere in fostering storm initiation and development. These and other findings have been facilitated by new observing techniques including radar and light detection and ranging (lidar) absorption, Global Positioning System (GPS) occultation, several new satellite sensors, and newly homogenized humidity data sets.

A recurring theme was the rapid growth in the measurement and use of stable isotopes of water. There are now three satellites in orbit capable of observing deuterium ratios in atmospheric water vapor. A campaign begun just prior to the meeting, running newly developed isotopic analyzers on Mauna Loa, had within 2 weeks obtained more in situ isotopic vapor data than all collected previously. Several presenters noted the potential for isotopic measurements in vapor, rain, and clouds to constrain atmospheric process models and help interpret isotopic evidence from past climates.

Remaining challenges include poor understanding of how and why heavy rains and droughts will change in a warmer world; mysterious trends during the past 2 decades in near-surface wind, rainfall, and evaporation; the acute need for better conceptual models of how convection interacts dynamically and microphysically with its environment; and inadequate understanding of the processes determining isotopic composition. Finally, significant worries were raised concerning possible interruptions to U.S. microwave and infrared satellite monitoring due to program delays, and strategies were discussed for developing future observing systems.

For more on the discussion of future observing systems, see the online supplement to this *Eos* article (http://www.agu.org/eos_elec/).

—STEVEN C. SHERWOOD, Department of Geology and Geophysics, Yale University, New Haven, Conn.; now at Climate Change Research Centre, University of New South Wales, Sydney, Australia; E-mail: s.sherwood@unsw.edu.au; NATALIA ANDRONOVA, Department of Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor; ERIC FETZER, Jet Propulsion Laboratory, Pasadena, Calif.; and E. ROBERT KURSINSKI, University of Arizona, Tucson