MEETINGS

Improving Hydrology in Land Ice Models

Community Earth System Model Land Ice Working Group Meeting; Boulder, Colorado, 13 January 2011

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Recent observations indicate that mass loss from glaciers and ice sheets ("land ice") is increasing. The drivers of these changes are not well understood, and modeling the land ice response to them remains challenging. As a result, the Intergovernmental Panel on Climate Change explicitly avoided speculating on 21st-century sea level rise from ice dynamical processes in its fourth assessment report. The mismatch between observations of land ice change and model skill at mimicking those changes is behind recent efforts to develop next-generation land ice models. Necessary improvements to existing models include improved dynamics, coupling to climate models, and better representations of important boundary conditions and physical processes. Basal sliding, the primary control on the rate of land ice delivery to the oceans, is one such boundary condition that is largely controlled by land ice hydrology.

While the past decade has seen significant progress in the understanding and modeling of land ice hydrology, these advances have not been incorporated into next-generation land ice models. To this end, a workshop was held at the National Center for Atmospheric Research as part of the annual winter meeting of the Land Ice Working Group (part of the Community Earth System Model effort). The meeting was attended by approximately 40 participants from the United States, United Kingdom, Canada, and China. Following a series of scientific presentations highlighting the current state of research, participants discussed three themes: (1) identifying and prioritizing long- and short-term goals for land ice hydrology modeling, (2) identifying impediments to implementing current process-scale hydrology models into large-scale models, and (3) identifying key observations needed to constrain and improve land ice hydrology models.

The primary short-term goal is the implementation of a mass-conserving model of water flow beneath glaciers and ice sheets with explicit calculation of water pressures. This model should couple to a glacier sliding "law" consistent with theory and observations and allow for water inputs from supraglacial and englacial sources. Other short-term goals include adopting a common platform for building models and developing standardized test cases for comparison of different hydrology models. Participants noted that impediments to the wider implementation of existing process-scale models include a disparity of spatial and temporal scales between process- and continental-scale models, poorly constrained parameters, the lack of an accepted and unified land ice hydrological model, and sparse or absent observations of key variables. Observations necessary for further progress include ice geometry at high resolution (~1 kilometer), maps of bed character (hard versus soft), bed thermal state and geothermal flux, locations and rates of surface water input, basal water pressures at relevant spatial and temporal scales, statistical descriptions of important subgrid-scale properties such as surface and basal roughness and channel morphology, and the distribution of crevasses, moulins, and lakes.

Colleagues from Los Alamos National Laboratory, Simon Fraser University, the University of British Columbia, and Lamont-Doherty Earth Observatory are currently taking initial steps toward implementing improved hydrology models in the Community Ice Sheet Model. A more detailed workshop report, including an outline for achieving the short-term goals discussed above, can be found at http://www.cesm.ucar.edu/working_groups/Land+Ice/reports/011311.report.pdf.

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Dynamos, Domains, and Paleomagnetic Poles

Earth's and Planetary Interiors: Observation and Numerical Models of Paleomagnetic and Planetary Magnetism; Beijing, China, 7–11 July 2010

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The second international Beijing Earth and Planetary Interior Symposium (BEPIS; http://www.paleomag.net/meeting) was held at the Institute of Geology and Geophysics, Chinese Academy of Sciences (CAS), just down the road from the Bird's Nest and other iconic structures of the 2008 Beijing Olympics. The symposium was organized by Rixiang Zhu (CAS, Beijing, China) and Keke Zhang (Exeter University, Exeter, UK) and brought together more than 100 scientists, including 30 graduate students from 10 countries. Thirty-nine invited talks were organized along three major themes: planetary dynamos, paleomagnetism, and mineral magnetism. The talks were held in alternating and sometimes closely interleaved sessions and were supported by 40 poster presentations.

The wide range of topics included solar magnetic fields, paleomagnetic records of early planetary differentiation, the composition and physical state of Earth's inner core, mantle control of geomagnetic polarity reversals, mean field dynamo theory, paleointensity records, and biogeomagnetism. It is unusual for scientists from such different disciplines to attend one another's sessions, but this is a notable feature of the drawing power of BEPIS; such cross-disciplinary meetings are essential to seeing how theory, experiment, and data might converge to increase insight and make progress on significant problems.

Social highlights included a banquet with entertainment by traditional folk singers joined by conference attendees and, on the Sunday immediately following the conference, a group wedding party for seven couples associated with and hosted by the Paleomagnetism and Geochronology Laboratory, Beijing.

Following the success of the first meeting, in 2007, and the second, in 2010, BEPIS will become a regular occurrence every 3 years; the next BEPIS meeting will be held in Beijing in 2013. The long-term aim is to probe progress on the physics of Earth and planetary interiors via magnetism through meetings of optimal size for interactions, involving about 100 active researchers in an open format.

A group photo from the meeting can be seen in the online supplement to this *Eos* issue (http://www.agu.org/eos_elec).

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