MEETING

Understanding Atmospheric Water and Climate

Water and Climate, The First Lorenz Center Workshop
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Understanding climate and climate change is, and always will be, rooted in an understanding of water. In the atmosphere, water mediates the main modes of energy transfer, through both radiative and convective processes, often in uncanny ways. For instance, the slow and large-scale coupling of clouds to radiation has a strong, but still poorly understood, influence on the amplitude and pattern of atmospheric circulation—and hence regional climate. But untangling these influences often depends on understanding convective processes that happen more quickly and on much finer scales. From the point of view of better understanding the atmospheric general circulation and climate change more broadly, no barrier to progress looms as large as an inadequate understanding of the coupling between water and circulation.

To help focus attention on these crucial issues, a workshop on water and climate, sponsored by the Lorenz Center at the Massachusetts Institute of Technology (MIT), was held at the MIT Endicott Center, near Boston. This was the first Lorenz Center workshop and a fitting debut given the center's devotion to advancing understanding of how climate works by nurturing creative approaches to fundamental problems. Toward that end, the organizers structured the workshop with 26 short (20-minute) invited presentations as well as extended discussions. An emphasis was placed on articulating fundamental issues so they would be accessible to scholars in the physical (not only climate) sciences. Presentations were focused on the troposphere but included contributions related to geomorphology, statistical physics, oceanography, and the stratosphere. In addition to the invited speakers, Ph.D. candidates and postdoctoral scholars from the area were invited to attend. There was a strong turnout from MIT and Harvard, bringing the number of participants to about 50.

The workshop emphasized the importance of encapsulating key aspects of the behavior of the Earth system in idealized frameworks as a means of advancing science more efficiently. Radiative-convective equilibrium emerged as an exciting example of such an approach. Workshop talks illustrated how understanding this simple system can advance understanding of the tropical atmosphere and climate. New approaches were also highlighted, including the use of Earth system models configured in idealized ways so as to better link to the development of ideas and their dialogue with data.

Given the importance of idealization, several workshop participants noted that a troubling trend is the development of Earth system models that are too singularly focused on the most complex representation of the climate system imaginable, at the expense of the ability to configure such models to solve more idealized problems. More emphasis on using such models to solve idealized problems would be helpful in advancing understanding in a way that is directly traceable to the more comprehensive models yet amenable to critical observations, which in the long term is crucial for improved prediction. These needs should influence how the models are designed and hence their broader utility and relevance for scientific work.

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