Basic theory behind parameterizing atmospheric convection

MEETINGS

Basic Theory Behind Parameterizing Atmospheric Convection

COST Action ES0905 Final Training School: Convection Parameterization From Theory to Operations;
Brac, Croatia, 29 September to 9 October 2013

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Last fall, a network of the European Cooperation in Science and Technology (COST), called "Basic Concepts for Convection Parameterization in Weather Forecast and Climate Models" (COST Action ES0905; see http://w3.cost.esf.org/index.php?id=205&action_number=ES0905), organized a 10-day training course on atmospheric convection and its parameterization. The aim of the workshop, held on the island of Brac, Croatia, was to help young scientists develop an in-depth understanding of the core theory underpinning convection parameterizations. The speakers also sought to impart an appreciation of the various approximations, compromises, and ansatz necessary to translate theory into operational practice for numerical models.

Participants first considered the interactions between convection and large-scale dynamics, from both observational and theoretical perspectives. It is these interactions that parameterizations try to represent. Most parameterizations in current operational use are based on the mass flux framework, and several speakers gave detailed attention to its theoretical foundations, the construction of practical parameterizations, and their limitations.

In analyzing the performance of convection parameterizations, interactions with other model parameterizations are critical, as are those with large-scale flow. Therefore, attention was devoted to interactions with cloud/microphysics schemes, the land surface, and boundary layer turbulence. For the land surface, even the sign of some of the relevant feedbacks is not known. The links to the boundary layer provoked some debate on the turbulence-based perspective of moist convection. Another key theme was the "gray zone" (high resolutions where convection becomes partially resolved by the model), which brings the interplay of model dynamics and parameterizations into sharp focus.

Convection parameterization remains a contentious issue, and participants debated competing approaches and differing views. The topic is cross-cutting, demanding judicious use of observations, numerical experiments, and theory. All agreed that despite the scientific and technical difficulties, some clear progress in convection parameterization is being made. Attendees pointed to recent developments in formulating both the vertical structure and the amplitude of convection, which are leading to encouraging steps forward in the representation of tropical variability and the diurnal cycle.

In all, there were nine lecturers, hailing from both academic and operational centers across Europe and the United States, and 11 student scientists in attendance. Each student was assigned to be the lead on a short project, with support from a lecturer. Lectures were followed by sessions where the student participants discussed data and mathematical analyses and some open-ended problems, all based on the student projects. Students presented their work on the final afternoon.

The school proved to be a success, producing much positive feedback from students and lecturers alike. A particular highlight was that students were encouraged to tackle complex problems from various viewpoints. As a result, they were able to develop their own fresh perspectives and strong opinions on many key issues. New ideas from talented young scientists are essential for future developments.

For details on the school and slides from the course, go to http://convection.zmaw.de/Summer-School.2625.0.html. For information on the COST Action, go to http://convection.zmaw.de/.

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