COST Action ES0905 Final Training School : Convection parameterization from theory to operations

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COST Action ES0905 organized a 10-day training course on Atmospheric Convection and its Parameterization. The school was held on the island of Brac, Croatia from 29 September to 9 October. It aimed to develop in-depth understanding of the core theory underpinning convection parameterizations, and an appreciation of the various approximations, compromises and ansatze necessary to translate theory into operational practice for numerical models. There were 9 lecturers, crucially from both academic and operational centres across Europe and the US, alongside 11 talented young scientists who were keen to develop expertise in this area. Each student was assigned to lead on a short project, with support from a particular lecturer.

The format encouraged very close interactions and intermingling of perspectives throughout. Lectures were followed by sessions for active discussion, data analysis or mathematical analysis based on the student projects. The afternoon sessions were led by students with input from the lecturers being available but only if requested. Each student presented their work on the final afternoon.

Participants first considered the interactions between convection and large-scale dynamics, taking 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 detailed attention was given by several lecturers to its theoretical foundations, the construction of practical parameterizations, and their limitations. In analysing the performance of convection parameterizations, interactions with other model parameterizations are critical, as well as those with the 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 debates on the turbulence-based perspective of moist convection. Another key theme was the so-called “grey 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 competing approaches and differing views were freely aired and debated. The topic might appear very specialized but was revealed to be strongly cross-cutting, demanding judicious use of observations, numerical experiments, and theory. The school proved to be a great success, producing much positive feedback from students and lecturers alike. A particular highlight was that students were able to get to grips with complex problems from various perspectives. As a result, they were able to develop fresh perspectives and strong opinions of their own on many key issues. Such fresh perspectives from talented young scientists are essential for future developments. One thing agreed by all is that despite the scientific and technical difficulties, some clear progress in convection parameterization *is* being made. Recent developments in the formulations of detrainment and of closure were discussed, which are leading to encouraging benefits in the representation of tropical variability and the diurnal cycle.

The Action website at http://convection.zmaw.de/ contains much information about the group, including details of and slides from the training school at http://convection.zmaw.de/Summer-School.2625.0.html The lecturers were: Bechtold (ECMWF); Derbyshire (Met Office, UK);Fuchs (University of Split); Gerard (Royal Meteorological Institute of Belgium); Hohenegger (MPI, Hamburg); Mironov (DWD,

Offenbach); Plant (University of Reading); Raymond (New Mexico Tech); Yano (CNRM, Toulouse).