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A multiscale model for the interaction of bulk microscale hot towers with convective scale motions

D. Ruprecht (1), A. Majda (2), R. Klein (3)

(1) Freie Universität Berlin (ruprecht@zib.de) (2) Courant Institute of Mathematical Sciences, New York University (jonjon@cims.nyu.edu), (3) Potsdam Institute for Climate Impact Research, Germany (rupert.klein@zib.de)

We are interested in the interaction of gravity waves with deep moist convection. In particular, we hope to gain new insight into how gravity waves can trigger moist convection and how the resulting “convective towers” can in turn create gravity waves. By applying multiscale asymptotic techniques, Majda and Klein, [1], derived a set of model equations, that describes interactions of convective scale (10 km) environments with moist processes in narrow,1 km–wide, deep convective columns. The model couples the linearized, anelastic equations describing convective scale motions with equations for the evolution of the bulk microscale columnar flow, and with equations for the evolution of the moist variables. By averaging, we obtain a closed system in which the bulk microscale flow interacts with the convective flow via source terms that describe the net moist physics effects. An implementation of this model will, for example, allow us to simulate a gravity wave passing over a bubble of strongly moistened air, thereby triggering small-scale condensation and convection. Also, we expect to see how moist processes trigger internal waves on the 10 km–scale, which then in turn initiate condensation in the neighborhood leading to a coupled wave phenomenon.

The presentation will summarize the key ideas of the model derivation and move on to present first results from numerical explorations of the relevant flow regime.

[1] R. Klein and A.J. Majda, *Systematic multiscale models for deep convection on mesoscales*, Theor. & Comput. Fluid Dyn. **20** (2006), 525–551.