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Evaluation of a stochastic deep convection parameterization in HarmonEPS.

Lisa Bengtsson
SMHI, Norrköping, Sweden(Lisa.Bengtsson@smhi.se)

Cumulus parameterizations used in most operational weather and climate models today are based on the mass-flux concept which took form in the early 1970's. In such schemes it is assumed that a unique relationship exists between the ensemble-average of the sub-grid convection, and the instantaneous state of the atmosphere in a vertical grid box column. However, the relationship between the convective sub-grid variability and the large-scale state of the atmosphere is unlikely to be a simple deterministic function (Palmer, 2011).
Because of the statistical nature of the parameterization challenge, it has been recognized by the community stochastic parameterizations can be used to improve the description of statistical fluctuations of cloud number and intensities within a NWP model gridbox. In Bengtsson (2013) we use a two-way interacting cellular automata (CA), coupled to the deep convection parameterization as a way of introducing a stochastic behavior. The cellular automata possesses many qualities interesting for deep convection parameterization. In the one-dimensional entraining plume approach, there is no parameterization of horizontal transport of heat, moisture or momentum due to cumulus convection. In reality, mass transport due to gravity waves that propagate in the horizontal can trigger new convection, important for the organization of deep convection (Huang 1988). The self-organizational characteristics of the CA allows for lateral communication between adjacent NWP model grid-boxes, and temporal memory. Thus the CA scheme used in this study contain three interesting components for representation of cumulus convection, which are not present in the traditional one-dimensional bulk entraining plume method; horizontal communication, memory and stochastisity. The scheme is implemented in the high resolution regional NWP model ALARO, and simulations show enhanced organization of convective activity along squall-lines. In this study we evaluate the behaviour of the scheme in the meso-scale Ensemble Prediction System, HarmonEPS. We want to understand if a stochastic convection parameterization can describe the uncertainty associated with cumulus convection in NWP.