Geophysical Research Abstracts,
Vol. 10, EGU2008-A-12443, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-12443
EGU General Assembly 2008

A spectral convection parameterisation with a dynamical Arakawa-Schubert quasi-equilibrium closure

Till M. Wagner, Hans-F. Graf

Centre of Atmospheric Science, University of Cambridge

A key element in every convection parameterisation is the closure assumption, because it is defining where, when and how strong convective processes are acting within the general circulation model. One of the most commonly used closure assumptions is the convective quasi-equilibrium (QE) hypothesis first proposed by Arakawa and Schubert (1974). This assumption states that the cumulus convection is in balance with the large scale forcing, which means that convection is almost instantly reacting to large scale processes leading to instability.

An advantage of the Arakawa and Schubert (1974) scheme is that it accounts for the mutual interaction of different convective cloud types via the influence of the environment. Here the QE hypothesis assumes instantaneous adoption of an equilibrium state.

We transformed the QE formulation in order to allow for the dynamical interaction of the cumulus clouds, so we do not assume that the cumulus clouds are in equilibrium with each other and balance the large scale forcing immediately.

First results show, that the resulting system of equations is a feasible closure leading to a realistic spectrum of cumulus clouds. Nonetheless, the system of equations does not necessarily lead to a stable equilibrium solution, i.e. a cloud spectrum which is in an equilibrium state and balancing the large scale forcing. It even might be an exceptional case, which poses the question if the QE hypothesis is a sensible closure, in the sense that it is possible to derive a well defined solution of the subgrid-scale convection processes.