Geophysical Research Abstracts
Vol. 18, EGU2016-3295-1, 2016
EGU General Assembly 2016

Generalized Convective Quasi-Equilibrium Closure

Jun-Ichi Yano (1) and Robert Plant (2)

(1) CNRM, Météo-France, Toulouse Cedex, France (jiy.gfder@gmail.com), (2) Department of Meteorology, University of Reading, Reading, UK

Arakawa and Schubert proposed convective quasi-equilibrium as a basic principle for closing their spectrum mass-flux convection parameterization. In deriving this principle, they show that the cloud work function is a key variable that controls the growth of convection. Thus, this closure hypothesis imposes a steadiness of the cloud work function tendency.

This presentation shows how this principle can be generalized so that it can
also encompasses both the CAPE and the moisture-convergence closures. Note that the majority of the current mass-flux convection parameterization invokes a CAPE closure, whereas the moisture-convergence closure was extremely popular historically. This generalization, in turn, includes both closures as special cases of convective quasi-equilibrium.

This generalization further suggests wide range of alternative possibilities for convective closure. In general, a vertical integral of any function depending on both large-scale and convective-scale variables can be adopted as an alternative closure variables, leading to an analogous formulation as Arakawa and Schubert's convective quasi-equilibrium formulation. Among those, probably the most fascinating possibility is to take a vertical integral of the convective-scale moisture for the closure. Use of a convective-scale variable for closure has a particular appeal by not suffering from a loss of predictability of any large-scale variables. That is a main problem with any of the current convective closures, not only for the moisture-convergence based closure as often asserted.