Geophysical Research Abstracts
Vol. 15, EGU2013-5173, 2013
EGU General Assembly 2013

A proposal for representing large-scale processes in cloud simulations

Tapio Schneider (1,2), Zhihong Tan (2), Joao Teixeira (3), and Kyle Pressel (2)

(1) ETH Zürich, Geological Institute, Dept. of Geosciences, Zürich, Switzerland (tapio@ethz.ch), (2) California Institute of Technology, Pasadena, California, USA, (3) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, USA

Large-eddy simulations and other cloud-resolving simulations can only be expected to deliver climatically relevant answers to the question of how clouds change with climate to the extent that the large-scale processes driving such simulations are represented in a physically realistic manner. In particular, this means that for simulations of clouds in statistically steady states, it is desirable that the large-scale processes satisfy steady-state energy and moisture balances. The surface energy balance, for example, is crucial for how the near-surface relative humidity responds to climate changes; it is generally not satisfied in simulations that, as is commonly done, prescribe surface temperatures and/or surface fluxes. Here we present a framework for forcing simulations of low-latitude clouds with large-scale processes that respect such large-scale balances. Radiative energy fluxes are modeled explicitly, albeit in an idealized manner, surface and top-of-atmosphere energy balances are satisfied in climatically relevant ways, and large-scale eddy fluxes of sensible heat and moisture are represented parametrically. We argue that such a representation of large-scale processes is necessary to obtain realistic responses of clouds to climate changes and show preliminary results of large-eddy simulations of subtropical low clouds.