4.11

A PARAMETERIZATION OF THE SURFACE HEAT FLUX IN MIDLATITUDES

Tapio Schneider*
Courant Institute of Mathematical Sciences, New York University

Isaac M. Held
Geophysical Fluid Dynamics Laboratory/NOAA, Princeton University

ABSTRACT

We propose a parameterization of the mean heat flux near the surface in midlatitudes. The mean heat flux due to baroclinic eddies is parameterized as a diffusive flux down the mean gradient of the surface potential temperature, with a diffusivity that is a non-local function of the mean thermal structure of the atmosphere. The diffusivity for the surface heat flux at a given latitude depends on the thermal stratification of the atmosphere at the given latitude and on the thermal structure of the atmosphere polewards along the mean isentrope that intersects the surface at the given latitude. The local diffusivity at the surface is an average of atmospheric properties along the mean path (mean isentropes) of baroclinic eddies that reach the surface.

In simulations with an idealized, statistically axisymmetric GCM, in which the effects of moisture are not taken into account, the proposed parameterization of the surface heat flux due to eddies accounts for the latitude-dependent strength of the surface heat flux. Over a wide range of flow parameters, the parameterization accounts for the position of the maximum in the eddy heat flux and for the strength of that maximum. Eddy heat flux parameterizations such as those of Stone (1972) and Green (1970), which are based on quasi-geostrophic considerations and parameterize the surface heat flux at a given latitude in terms of local properties of the thermal structure of the atmosphere at the given latitude, do not account as accurately for the structure of the eddy heat flux near the surface.

* *Corresponding author address:* Tapio Schneider, Courant Institute of Mathematical Sciences, Center for Atmosphere/Ocean Science, New York University, New York, NY 10012. Email: tapio@cims.nyu.edu.

REFERENCES

Green, J. S. A., 1970. Transfer properties of the large-scale eddies and the general circulation of the atmosphere. *Quart. J. Roy. Meteor. Soc.*, **96**, 157–185.

Stone, P. H., 1972. A simplified radiative-dynamical model for the static stability of rotating atmospheres. *J. Atmos. Sci.*, **29**, 405–418.