*d. Interaction between moist physics and dynamics*

To aid the discussion, we write the zonally averaged temperature equation as

 (12)

in which, *φ* is the latitude; *v* is the meridional wind; *ω* the vertical velocity;  the potential temperature; *Q* the diabatic heating; overbar denotes zonal average. Upon vertical integration from the surface (*ps*) to the tropopause (*pt*), the vertical transport term on the right hand side drops out, and using the quasi-geostrophic approximation (Andrew et al. 1987), we have

 (13)

For the dry model, *Q* is specified as a relaxation to the radiative equilibrium temperature , which can be schematically written as

 (14)

where *α* is a relaxation coefficient. Substituting (13) and (14) into (12) and integrating over the tropics from the equator to latitude  (say 30N), we get the following steady-state relationship between low-latitude temperature and eddy transport after some rearrangements:

 (15)

In the IAP dry model, the last term on the right hand side is smaller than that in the CAM3.1 because of weaker eddy activities. This explains why IAP-core simulated a warmer troposphere in low latitudes relative to CAM-core.

**References**

Andrews, D. G., J. R. Holton, and C. B. Leovy, 1987: Middle Atmosphere Dynamics, pp. 123-133.