

## The elements of the thermodynamic structure of the tropical atmosphere

*Wednesday 27 May 2020 14:10 (20 minutes)*

This study uses the global storm-resolving model simulations from ICON at 2.5km to investigate how robust weak temperature gradient (WTG) holds in the tropics and which moist-adiabatic process tropical atmosphere indeed experiences.

The virtual effect of water vapor arises from that the molecular weight of water vapor is much smaller than that of dry air. With the same pressure and temperature, this virtual effect makes moist air lighter than dry air. The model results show that the virtual temperature is relatively homogeneous at mid- and lower troposphere. To achieve this, the horizontal temperature structure has to change to accommodate the horizontal moisture difference and is not homogeneous. However, in the upper troposphere, both the absolute temperature and the virtual temperature are not homogeneous, and vary as a function of moisture, indicating a weakening influence of convection gravity waves there. Such a temperature structure is different from that in radiative-convective equilibrium (RCE) configuration where virtual temperature is homogeneous throughout the entire free troposphere.

For the vertical structure, the model results suggest that the actual moist-adiabatic process that tropical atmosphere experiences is between the pseudo-adiabat and the reversible-adiabat with the effect of condensate loading assuming air parcels originating from 972 hPa.

**Authors:** BAO, Jiawei (Max Planck Institute for Meteorology); STEVENS, Bjorn (Max Planck Institute for Meteorology)

**Presenter:** BAO, Jiawei (Max Planck Institute for Meteorology)

**Session Classification:** Simulating Convective Organisation