

# Thermal Equilibrium of the Atmosphere with a Given Distribution Relative Humidity

ATUL KAPUR, MPO 531, ABSTRACT FOR THE PRESENTATION

A significant contribution in the development of climate models was established through the studies done by Manabe and Wetherald (1967). It was the first study to emphasize the use of fixed relative humidity in contrast to fixed absolute humidity in thermal equilibrium models. Their results showed that it takes almost twice the time to reach radiative equilibrium with a fixed distribution of relative humidity as compared to fixed absolute humidity. The sensitivity of the model atmosphere is double towards various factors such as absorber concentrations, solar constant, and cloudiness.

The PRESENTATION focused on physical processes (that a physical meteorology student might be interested in), which are responsible for the change in model sensitivity and results, while going from fixed absolute humidity to fixed relative humidity.

An interesting feature is the evolution of the atmosphere with three different cases (see Figure): (I) Fixed absolute humidity, (II) fixed relative humidity with the heat capacity of dry air, and (III) fixed relative humidity with the effective heat capacity computed with changes in moisture.

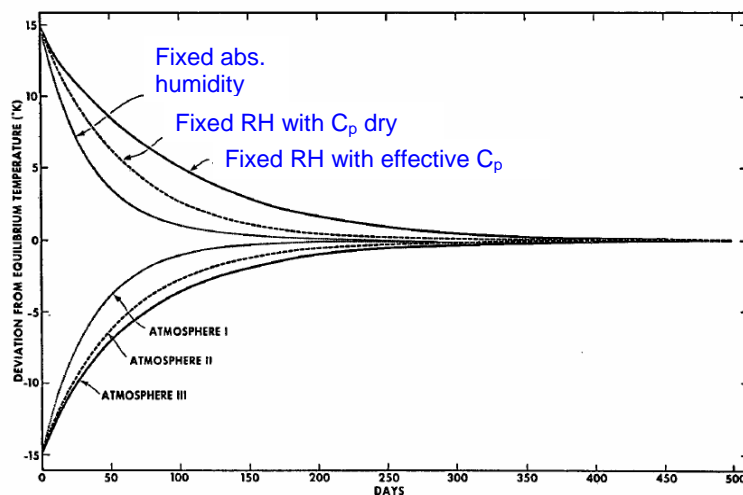


Fig: Approach of vertical mean temperature towards the state of equilibrium

REFERENCE: Manabe, S., and R. T. Wetherald (1967), Thermal equilibrium of the atmosphere with a given distribution of relative humidity, *J. Atmos. Sci.*, 24, 241– 259.