

Response of tropical tropopause temperature to changes in tropical sea surface temperatures

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The tropical tropopause temperature is controlled both by midlatitude 'stratospheric pump' and equatorial waves caused by tropical convection (Holton et al., 1995; Kerr-Muslow and Norton, 2006). To understand how the TT temperature is influenced by tropical convection, variations of TT temperature with change in tropical sea surface temperature (SST) distribution are examined by using an atmospheric general circulation model (CCSR/NIES AGCM). We performed 2 types of experiments. In one type of runs, zonal anomalies of tropical SST are changed (S' runs). In the other type, tropical SSTs are uniformly changed (S runs).

For all experiments, adiabatic cooling/heating induced by changing Brewer-Dobson circulation was dominant in the tropical lower stratosphere (50 hPa), which is consistent with 'stratospheric pump'. However, at the TT level (90 hPa), the adiabatic effect is not a main factor. In S' runs, the increase in zonal asymmetry of the tropical SST caused the cooling of zonal mean TT temperature by vertical eddy heat transport associated with a Gill-type equatorial wave pattern. When the tropical SSTs are raised uniformly (S+1 run), the TT temperature was warmed by diabatic heating. When the tropical SSTs are decreased uniformly (S-1 run), the TT temperature was not changed. In addition, radiative heating by change in cloud top height also affects the TT temperature locally.