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Role of the vertical eddy heat flux in the tropical tropopause temperature response to tropical sea surface temperature changes

K. Yoshida (1) and K. Yamazaki (2)

(1) Hokkaido University, Graduate school of environmental science, Sapporo, Japan (kohei@ees.hokudai.ac.jp), (2) Hokkaido University, Faculty of environmental earth science, Sapporo, Japan, (yamazaki@ees.hokudai.ac.jp)

Impact of changing convection on the tropical tropopause (TT) temperature associated with tropical sea-surface temperature (SST) variations like ENSO is investigated by numerical experiments using an atmospheric general circulation model (CCSR/NIES AGCM) and observed data analysis (ERA-40). In the GCM experiment, we modify zonal mean component (S runs) and zonally asymmetric component (S' runs) of the tropical SSTs as idealized experiments. In other experiment, we use observed SST (Sobs run) in the period of prominent ENSO event as a realistic experiment, and this result is compared to ERA-40 data. For control run (CTR), cooling effects of vertical advection are dominant in climatological seasonal variation of the zonal-mean TT temperature. However, for the enhanced (weakened) tropical SSTs' zonal asymmetry, the vertical eddy heat flux ($\overline{w'\theta'}$) convergence associated with a Matsuno-Gill type equatorial wave pattern predominantly exerts cooling (heating) anomaly from CTR on the zonal-mean TT temperature. In Sobs run, the vertical eddy heat flux convergence is the primary factor for the controlling interannual zonal-mean TT temperature variation, especially in the peak of El Nino event. Additionally, ERA-40 data is consistent with Sobs run about influence of vertical eddy heat flux on the TT temperature. It is found that the vertical eddy heat flux convergence at the TT Layer reacts sensitive to the 'strength' of the Matsuno-Gill type tropical stationary wave response, and this term seems to explain much of the observed TT temperature variation associated with ENSO.