

Longitudinal dependence in the interannual variation of the temperature anomalies

Presenter : Sanjay Kumar MEHTA (Mission Researcher, RISH, Kyoto University)

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Abstract

The interannual variation in the temperature anomalies is known to be due to El Nino Southern Oscillation (ENSO), quasi biennial oscillation (QBO), volcanic eruption etc. However, the difference in the interannual variation between different longitude sectors is not well understood. In the present study, the longitudinal dependence of the interannual variation of the temperature in the tropical troposphere, tropopause region and lower stratosphere is carried out using GPS RO data for the period 2001-2011 and using ERA Interim data for the period 1980-2011. The interannual variations of the deseasonalized temperature anomalies show clear longitudinal difference between tropical east Pacific (180W-90W) and rest of the tropics. This longitudinal difference is observed in troposphere and tropopause region. The longitudinal difference is more pronounced in the mid troposphere between altitude 5-12 km (500-200 hPa) when compared to lower troposphere. The longitudinal difference minimizes to nearly zero at altitude 14-15 km (~ 150 hPa) and again appears at the tropopause region (~ 100-70 hPa). The longitudinal difference at the tropopause region is, however, more or less opposite in phase as observed in the troposphere. There is no longitudinal difference in the temperature anomalies appear above tropopause region. The anomalies of the tropopause altitude and pressure do not show longitudinal difference as observed in its temperature. The temperature anomalies at tropopause region over eastern Pacific show similar structure as the anomalies in the lower stratosphere. Therefore it appears that the QBO influence over the eastern Pacific is more compared to other longitudes. However, when we examine the tropopause altitude, there was not much difference observed over different longitudes. Thus the large difference in tropopause temperature anomalies over the eastern Pacific from rest of the longitudes is not due to the QBO but because of the ENSO. The sea surface temperature (SST) anomalies also show consistent difference between east Pacific and rest of the longitudes as observed in the troposphere. This study reports that the interannual variation in the zonal mean temperature is largely contributed by the eastern Pacific oscillation.