

Stratosphere-troposphere coupling over Asian summer monsoon

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Stratospheric circulation may provide useful information in the increase in medium-range forecasting skill for tropospheric weather. The dynamical processes that might give a tropospheric response to a change in the stratosphere are still uncertain. Aim of the study is to understand the association between the features of stratospheric QBO and the tropospheric circulation over the monsoon region. In the study, zonal wind and temperature data for 23 vertical levels from 1000 hPa to 1 hPa for the period 1960-2009 obtained from ECMWF has been considered. Indian summer monsoon rainfall (ISMR) data, which is the area averaged June to September rainfall of 306 stations well distributed over India is taken. Equatorial lower stratospheric wind shows a significant association with the biennial periodicity of the Indian summer monsoon. The presence of Low Level westerly Jetstream (LLJ) at 1.5 km and strong Tropical Easterly Jetstream (TEJ) around 14 km produces a strong vertical shear in the troposphere. During the period of the westerly phases of the QBO in the lower stratosphere produces opposite shear zone in the upper troposphere/lower stratosphere region. On the other hand, in the easterly phase of the QBO, the shear zone in the upper troposphere lower stratosphere (UT/LS) region is generally weak. It has been noted that during the westerly phases of the QBO, the Indian summer monsoon is quite active and during the easterly phase the monsoon found to be generally weak or moderate. In the TBO cycle, strong monsoon years are associated with westerly anomalies in the lower stratosphere and easterly anomalies in the upper troposphere. Reverse is noted during the year of weak monsoon. The zonal wind anomalies exhibit a dipole structure in the troposphere, which changes alternately with the strength of the monsoon. Middle troposphere over the monsoon region seems to be modulating the QBO-TBO interaction. Lower stratospheric westerly anomalies in the winter indicate an active monsoon in the next summer, and easterlies indicate a weak monsoon in biennial scale.