

Long-term Variabilities in the Mesosphere and Lower Thermosphere (MLT) Winds

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The horizontal wind data acquired by MF radar at Tirunelveli (8.7N, 77.8E) for the years 1993-2006 are used to study the long-term variabilities in the mesosphere and lower thermosphere (MLT) winds. The zonal wind shows dominant semi-annual oscillation with westward winds during equinox months and eastward winds during solstice months. The firstward westward phase, which occurs during spring equinox undergoes interannual variability with larger westward winds during the years 1993, 1995 and 1997. This interannual variability has been interpreted as biennial oscillation (BO) in the MLT winds. However, this BO is absent in the year 1999, as the large westward winds, which is expected to occur during the year 1999, instead appear during the year 2000. Hence the period of BO is extended from nearly two years to three years. A comparison with stratospheric QBO suggests that the large westward MLT winds occur during when eastward winds occur at all levels in the lower stratosphere. It is observed that the period of stratospheric QBO winds is also extended to three years during when mesospheric BO period is extended to three years. Besides SAO and QBO, the zonal winds undergo intraseasonal oscillation (ISO), however with smaller amplitudes. It is well known that tropospheric parameters undergo intraseasonal variability with a period range 30-70-days, which has been termed as Madden-Julian oscillation. As the power spectrum of MLT zonal winds show similar periodicities in the range 30-70 days, it suggests that there could be a possible relation between the two oscillations observed at two different height regions. However, the direct upward propagation of ISO to MLT heights is not possible, as they have very slow phase speeds. It is generally believed that the intraseasonal cycles in the tropical tropospheric convection produce intraseasonal variations in the intensity of gravity waves and non-migrating tides impinging upon the mesosphere. These IS modulated wave activity induces similar periodicities in the wave induced driving of the zonal MLT flow. The present study aims to test this hypothesis using long-term outgoing longwave radiation (OLR) data, which have been used as a proxy for tropical convection. The long-term observations of meridional winds show that they undergo annual oscillation, which also shows enhancements in some years, when large westward winds are observed in zonal winds. Besides, there is a decreasing tendency in annual mean meridional winds.