

Long-term variability of mean winds and its oscillations in the mesosphere and lower thermosphere within $\pm 22^\circ$

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Long-term variability of mean zonal and meridional winds in the Mesosphere and Lower Thermosphere (MLT) are studied at seven locations using MF radar observations from Kauai (22° N, 154° W), Tirunelveli (8.7° N, 77.8° E), Christmas Island (2° N, 157° W), and Pameungpeuk (7.4° S, 107.4° E) and meteor radar observations from Koto Tabang (0.2° S, 100.3° E), Jakarta (6° S, 107° E), and Rarotonga (21.2° S, 159.7° W). Locations with nearly similar latitudes such as Christmas Island and Koto Tabang, and Jakarta and Pameungpeuk are treated as single location (Ignoring longitudinal difference) and the data are appended at each latitude to get long-term data. Thus, we have five distinct latitudes. The length of the data is different at different latitudes and spans a maximum of two decades between 1990 and 2010.

The zonal wind shows a distinct semiannual oscillation (Mesospheric SAO) at all locations. The annual mean zonal winds within $\pm 9^\circ$ are westward biased and are eastward biased outside. The quasi-biennial variability of MLT winds (called MQBO) is observed at all locations. The amplitude of MQBO is maximum over the equator (6-8 m/s) and decreases with increasing latitude. Long-term variability of MQBO is studied which shows that the MQBO strength is more during 1991-1997 than during 2004-2010 period. The MSAO basically shows a biannual modulation. The mean meridional winds show a distinct annual oscillation at all locations. But, the time at which winds change direction (from north to south or south to north) is different at different latitudes. Furthermore, the meridional winds show similar long-term variability at conjugate locations of Tirunelveli and Jakarta-Pameungpeuk.

Keywords: Mesosphere, MLT dynamics, Long-term studies, MF radar, Meteor radar, MQBO