

Vertical structure of terdiurnal tides in the Antarctic MLT region: 15 years observation over Syowa

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The terdiurnal tide (TDT) in the Antarctica mesosphere and lower thermosphere (MLT) region is poorly known. In this study, we examine its characteristics using long-term neutral wind observations at Syowa (69S, 39E) between January 2004 and July 2018. The analysis reveals TDT being a significant tidal component in the Antarctica with distinct vertical structures and seasonal evolution. (1) It shows a prominent height-dependent seasonal variation, being in opposite phase above and below 94 km altitude, with peak amplitude in June –July at altitudes below 94 km, but in November –December above it. (2) The zonal wind component is 90 phase shifted from the meridional, with its amplitude of comparable or larger values than the meridional in all seasons except for November –December. (3) The vertical wavelength is shortest (50 –65 km) in local summer (Nov.–Jan.) and longest (80 –110 km) in local winter (Jun.–Aug.). Most of these features differ from those reported in the Arctic, indicating hemispheric asymmetry. Furthermore, the phase structure reveals a dominant upward propagating mode in local summer, but superposition of more than one mode in other seasons. Especially in local winter, a downward propagating mode above 95 km suggests Joule heating/ion drag as likely tidal sources from above, in addition to those from lower atmosphere. The nearly 15 years Syowa observations provide new constraints and benchmark for model simulations that seek to understand terdiurnal tidal forcing mechanisms in polar regions.

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