# Impact of stratospheric planetary wave and ozone variabilities on the austral polar middle atmospheric circulation and tidal variabilities

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Long term (2005-2020) analysis of the Skiymet Rothera meteor radar wind observation (67.5°S, 68.1°W) reveals large year-to-year variability in monthly mean zonal winds in the lower thermosphere (UMLT) region (82-98 km), during November-December with strong westward winds in the background flow. The stratospheric winds from ERA-5 reanalysis datasets over 67.5°S also show interannual variability, with large variability in eastward winds at stratospheric heights during November. The large variability in westward wind at UMLT heights coincide with the large variability in the eastward wind at stratospheric heights, during the years 2006–2011, 2015, 2018 and 2020, when the amount of ozone loss is more in the austral high-latitude stratosphere. It is seen that in the month of September, the years having the reduced meridional heat flux at stratospheric heights, due primarily to the planetary wave of zonal wavenumber 1, decreases the polar stratospheric temperature. This in turn enhances the formation of polar stratospheric clouds (PSCs), which activates chlorine radicals and results in the significant loss of ozone in the austral polar stratosphere. The large temperature gradient generated due to the ozone loss may generate strong eastward wind with height at the stratosphere and are connected to the strong westward winds in the UMLT heights via the upward propagating gravity waves [1]. Further, it is found that the ozone loss also influences the migrating semi-diurnal (SW2) tidal variabilities at the UMLT heights, with low activity during the years of more ozone loss. These results provide the observational evidence of the impact of planetary waves on the catalytic destruction of Antarctic ozone leading to the circulation and tidal amplitude changes, extending up to the UMLT region.

1. N. V. Rao, N., P. J. Espy, R. E. Hibbins, D. C. Fritts, A. J. Kavanagh, "Observational evidence of the influence of Antarctic stratospheric ozone variability on middle atmosphere dynamics," *Geophys. Res. Lett.*, **42**, 3, October 2015, pp. 7853–7859, doi:10.1002/2015GL065432.