北極圏流星レーダーで観測された大気潮汐波の長期的振舞い

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Long-term behaviors of atmospheric tide observed by NSTMR Arctic meteor radars

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Nippon/Norway meteor radars have been in operation in the Arctic region since early 2000s in close collaboration between NIPR and UiT, and wind fields at meteor heights from 80 to 100km are observed over 16 years, longer than one solar cycle. Atmospheric tides are salient feature of neutral wind and temperature at these heights excited mainly by thermal forcing due to insolation absorption by water vapor and ozone in the lower atmosphere and are propagated upwards to the thermosphere. Hence, observed tidal field and its variability basically reflect the climatology of seasonal to longer timescale and unsteadiness of the middle atmosphere in between , e.g. temperature structure and associated background mean wind along with equinoctial and anti-symmetric solstitial forcings and others. Various dissipative processes in the broad height range are also in effect, including infrared cooling , diffusion, gravity wave interaction above 80km and ion drag on neutral motions as hydro-magnetic tide in the lower thermosphere. Atmospheric tide is also excited by in-situ UV and EUV solar heating at these heights and propagates downward to the mesosphere. Specific solar radiation and ion drag tend to involve solar cycle variation but in-situ excited diurnal tide might be somewhat small to contribute to local variation of diurnal component in the meteor region. Tidal theory for idealized neutral atmosphere predicts dominant evanescent (trapped) and short-vertical wavelength propagating mode, and our observation confirmed diurnal wind component at polar latitude is almost evanescent in spring to summer season, while semidiurnal component is predominant and likewise varies appreciably. Figure 1 shows a long record of diurnal components of meridional wind from March to September months at 94 km over 16years at Svalbard with monthly mean sunspot numbers. Tidal analysis is for 30days window shifted by 6 days. Tidal field at meteor heights are thus subject to various complications as stated above and also to unknown electromagnetic disturbances. Remarks on the averaged figure of polar atmospheric tide and its variable nature will be given by further analyses as year-to-year deviations from long-term averaged monthly mean, and also comparisons with our viscid ATM2 modelling and others.

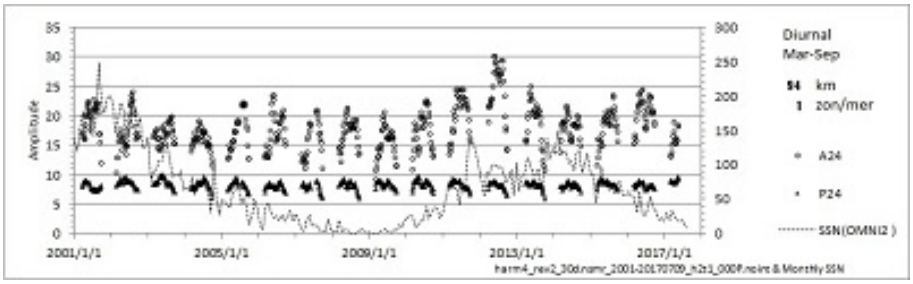

Fig.1 A long record of diurnal amplitude and phase of meridional wind from March to September period at 94 km over 16 years at Svalbard with monthly mean sunspot numbers.

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