Study of latitudinal and longitudinal differences of mesospheric and ionospheric waves based on 3-dimentional FFT analysis of long-term multi-point airglow images

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In this presentation, we review recent results obtained by the 3-dimentional Fast Fourier Transform (FFT) analysis of multi-point airglow images reported by Takeo et al. (2017) and Tsuchiya et al. (2018; 2019; 2020). We used the airglow images taken by the Optical Mesosphere Thermosphere Imagers (OMTIs) at Shigaraki (SGK) (35°N, 136°E, 1999-2017) and Rikubetsu (RIK) (44°N, 144°E, 1999-2017), Japan, Athabasca (ATH), Canada, (55°N, 247°E, 2005-2017), and Magadan (MGD), Russia (60°N, 151°E, 2008-2017). First we estimated phase-velocity spectra of mesospheric gravity waves in 557.7-nm airglow images and medium-scale traveling ionospheric disturbances (MSTIDs) in 630.0-nm airglow images. For all the stations, mesospheric gravity waves in 557.7-nm airglow images tend to propagate poleward in summer and equatorward in winter (except for MGD). The summer-time poleward waves may be caused by duct propagation of gravity waves from tropospheric convection source. Wind filtering effect by mesospheric jet is clearly seen over Japan (SGK and RIK), while it becomes less evident at high latitudes in ATH and MGD. For MSTIDs in 630.0-nm airglow images, southwestward-propagating waves are dominant at SGK, RIK, and ATH (except for summer), while they are not evident at MGD. Clear anti-correlation of MSTID power (amplitudes) and 11-year solar activity can be found at SGK, RIK, and ATH. We also show wavenumber spectra of gravity waves and MSTIDs at these stations. Weak positive correlations were obtained between the daily wave power of gravity waves in 557.7-nm images and MSTIDs in 630.0-nm images, suggesting that the MSTIDs in the thermosphere may be partially generated by the gravity waves from the mesopause region.

References:

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