陸別・信楽・アサバスカ・マガダンの大気光画像を用いた中間圏大気重力波・中規模伝搬性電離圏擾乱の水平波数分布の長期統計解析

土屋 智 [1]; 塩川 和夫 [1]; 大塚 雄一 [1]; 中村 卓司 [2]; 山本 衛 [3]; Connors Martin[4]; Schofield Ian[5]; Shevtsov Boris[6]; Poddelsky Igor[6]
[1] 名大宇地研; [2] 極地研; [3] 京大・生存圏研; [4] Centre for Science, Athabasca Univ.; [5] Athabasca University, Canada; [6] IKIR

Statistical analysis of wavenumber distribution of mesospheric and ionospheric waves in airglow images in Japan, Canada and Russia

Satoshi Tsuchiya[1]; Kazuo Shiokawa[1]; Yuichi Otsuka[1]; Takuji Nakamura[2]; Mamoru Yamamoto[3]; Martin Connors[4]; Ian Schofield[5]; Boris Shevtsov[6]; Igor Poddelsky[6]
[1] ISEE, Nagoya Univ.; [2] NIPR; [3] RISH, Kyoto Univ.; [4] Centre for Science, Athabasca Univ.; [5] Athabasca University, Canada; [6] IKIR

Airglow imagers are a powerful tool to obtain two-dimensional images of waves in the upper atmosphere. Atmospheric gravity waves (AGWs) in the mesosphere and medium-scale traveling ionospheric disturbances (MSTIDs) in the ionosphere are typical wave structures seen in the 557.7-nm (emission altitude: 90-100 km) and 630.0-nm (200-300 km) airglow images, respectively. Investigation of the horizontal characteristics of AGWs and MSTIDs is essential for understanding the dynamical variation of middle and upper atmosphere.

Takeo et al. [JGR, 2017] studied horizontal parameters of AGWs and MSTIDs over 16 years by using airglow images obtained at Shigaraki, Japan (34 N, 136 E). Tsuchiya et al. [JGR, 2018; JpGU, 2018] have applied the same spectral analysis technique to the airglow images obtained at Rikubetsu, Japan (43 N, 143 E), Athabasca, Canada (54 N, 246 E), and Magadan, Russia (60 N, 150 E). However, comparison of characteristics of horizontal wavenumber at different locations over 10 years has not yet been conducted.

In this study, we have applied the 3-dimentional FFT spectral analysis technique to the 557.7 nm and 630.0 nm airglow images at Rikubetsu and Shigaraki, Japan, Magadan, Russia, and Athabasca, Canada, focusing on their wavenumber distributions over ten years. For MSTIDs seen in the 630-nm airglow images in the thermosphere, the power spectrum density is strongest in summer compared to other seasons at all stations. We confirmed that this is not because of the 630-nm airglow layer thickness, since the difference of the thickness between summer and winter calculated based on IRI and MSIS models is not significant. When the solar activity is low, the power of longer wavelength waves is higher at Rikubetsu, but lower at Shigaraki. This solar activity dependence at Rikubetsu is consistent with the consideration of faster AGW dissipation for smaller scale waves by molecular viscosity in the upper atmosphere (e.g., Vadas and Fritts, JGR, 2006; Yigit and Medvedev, JGR, 2010), while that at Shigaraki may be due to latitudinal gradient of F-layer plasma density and associated 630-nm airglow intensity through spectral contamination to the lower wavenumber region. In the presentation we will also show characteristics of AGWs in the mesopause region observed in the 557.7-nm airglow images.