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Multipoint airglow imaging measurements of mesospheric gravity waves over Japan

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Atmospheric gravity waves significantly contribute to the wind/thermal balances in the mesosphere and lower thermosphere (MLT) through their vertical transport of horizontal momentum. It has been reported that the gravity wave momentum flux preferentially associated with the scale of the waves; the momentum fluxes of the waves with a horizontal scale of 10-100 km are particularly significant. Airglow imaging is a useful technique to observe two-dimensional structure of small-scale (<100 km) gravity waves in the MLT region and has been used to investigate global behavior of the waves. The Solar-Terrestrial Environment Laboratory, Nagoya University, has made long-term airglow imaging observations with ground-based all-sky airglow imagers using the Optical Mesosphere and Thermosphere Imager (OMTI) system. Each airglow imager of OMTI has interference filters on rotating wheels to observe airglow emissions in the vicinity of the mesopause (OI 557.7-nm, emission height ∼96 km; OH Meinel-bands, ∼86 km) and the ionosphere (OI 630.0-nm, ∼250 km). Four airglow imagers, which each has the field-of-view with a size of 5 deg x 5 deg in longitude and latitude at the mesopause height, has been in operation in Japan and, as a whole system, they nearly cover all part of Japan. This multipoint network enables us to detect propagation signatures and the spatial extent of MLT waves over a much wide range than ever.

In the presentation, we will report recent results of the MLT gravity waves having a very large spatial extent based on the OMTI multipoint measurements, such as a coherent gravity wave ducting and large concentric gravity wave rings possibly induced by a typhoon; these results offer new insight into dynamical coupling process between the lower and upper atmosphere.