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Ground-based imaging observations of the upper atmosphere

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It is now well known that gravity waves contribute significantly to the form of the large-scale atmospheric circulation, especially in the mesosphere and lower thermosphere (MLT), because of wave dissipation and the accompanying momentum flux divergence. Gravity waves are typically generated by meteorological disturbances and orographic structures in the lower atmosphere and propagate into the upper atmosphere while growing in amplitude. In addition, some of these waves directly, or as secondary waves, penetrate into the ionosphere/thermosphere through the MLT region, where they can seed plasma instabilities. It has also 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 behaviour of the waves. Solar-Terrestrial Environment Laboratory, Nagoya University has made long-term airglow imaging observations of the gravity waves in the mesopause region using the Optical Mesosphere and Thermosphere Imager (OMTI) system in the world. Characteristics of the gravity waves in the MLT region seem to reflect the conditions in the lower atmosphere.

In the presentation, I will share several results of the ground-based measurements of the MLT gravity waves and discuss future collaborative works with the ISS-IMAP mission.