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Characteristics of airglow and auroral emissions in the lower- and upper-thermosphere obtained with IMAP/VISI on ISS

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We report the recent highlights of results on airglow and auroral distribution in the lower- and upper-thermosphere based on IMAP/VISI measurement data, and also report the current status of the operation VISI. IMAP/VISI is a visible imaging spectrometer which aims to measures nightglow emissions from ISS (~400 km altitude) covering the wide range from +51 deg. to ? 50 deg. in geographical latitude. VISI adopts two field-of-views (+/-45 deg. to nadir) to make a stereoscopic measurement of the airglow and aurora emission to subtract background contaminations from clouds and ground structures. Each field-of-view has 90 deg width faced perpendicular to the orbital plane, which is mapped to ~600 km width at 100 km altitude and ~300 km width at 250 km altitude. A continuous line-scanning for all emissions lines in the nightside hemisphere in the latitudinal range from +51 deg. to -51 deg. is carried out by VISI with the successive exposure cycle with a time interval of 1 - several sec, which corresponds to a spatial resolution of 10 km ? a few tens km. From VISI data, we obtain the global distribution of airglow emissions (O 630 nm at 250 km alt., OH Meinel band 730 nm at 87km alt., and O2 (0-0) atmospheric band 762 nm at 95 km alt.) and auroral emissions (O 630 nm at 250 km alt., N2 1P 730 nm at ~110 km alt. and O2 762 nm at ~120 km alt.).

Since the successful launch of IMAP on August 2012, we found that meso-scale (~10 - 50 km) wave pattern is always seen in the airglow emission at O2 762 nm mainly at mid-latitudes. The typical O2 airglow intensity is several hundreds R to several kR. Most of O2 airglow shows straight-shaped pattern, which indicates plane atmospheric gravity waves. In addition, we found more than 30 events on the concentric gravity wave (CGW) pattern in O2 airglow emission, which suggests that the local generation source in the lower-atmosphere. 26 CGW events out of total 30 events happened in March and April in 2013, which suggests its seasonal effect.

VISI sometimes measured auroral emissions at high-latitudes during geomagnetically disturbed period. One of major purposes of auroral measurement with VISI is to understand the generation process of gravity wave by auroral activity. However, we could not obtain the gravity wave event caused by aurora so far. Another target of VISI high-latitude measurement is SAR arc in the sub-auroral region. Even though the solar activity is expected to be maximum in 2012 ? 2013, we could not obtain the SAR arc data so far. However, we still expect to measure the SAR arc event caused with a major storm during a solar declining phase.

In addition, in the low-latitude region around the magnetic equator, we frequently obtained the enhanced O630 nm emission associated with equatorial ionization anomaly (EIA) overlapped with small-scale dark filament pattern, i.e., plasma bubble. We found the seasonal dependence of O630 nm intensity in the EIA which is consistent with the vertical motion of ionospheirc plasma due to the dragged by thermospheric day-to night tidal winds. The O630 nm intensity associated with EIA significantly decreased during the main phase of magnetic storm when the Dst index is larger than 90 nT. This fact suggests that the westward electric field associated with Region-2 current system penetrates to the ionosphere in the lower latitude that reduce the upwelling of EIA. We also obtained the MSTID pattern in O 630 nm emission in the eastside of North America on August 1 2013 by comparing the O 630 nm emission and TEC map. We carried the special operation for the measurement of MSTID last winter, and will summarize the result.

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