

FORMOSAT-2/ISUAL observations of 630-nm airglow vertical structure in the F-region ionosphere

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In order to clarify the physical and chemical processes occurring in the F-region ionosphere, optical observation of 630-nm airglow is a useful method. Since observations have primarily been carried out by imagers on the ground, three-dimensional structures of airglow are not yet fully understood. In order to understand its vertical structure, we carried out 630-nm airglow observation with the ISUAL instrument on board the FORMOSAT-2 satellite. The FORMOSAT-2 flies on a sun-synchronous (09:30 to 21:30 LT) polar-orbit at an altitude of 891 km. The ISUAL looks at the Earth's limb in the midnight direction while the satellite proceeds northward. It consists of an imager, a spectrophotometer, and an array photometer. We used the imager with 630-nm wavelength filter for our experiment.

In December 2006 and from May to June in 2007, airglow observations were carried out on 125 E-155 E orbit (Australia to Japan). Owing to the satellite motion, airglow images were obtained in the geomagnetic latitude range between 30 S and 50 N over 30 minutes in December 2006, and between 50 S and 20 N over 25 minutes in May and June 2007. On each night, 2-5 bright airglow regions were found in the obtained images. The maximum brightness was located at an altitude of around 200 km, which is lower than the typical altitude of 280 km. Airglow drastically changed their latitudinal locations day by day.

We will show these results from our experiments, and consider validity of the obtained vertical structure. We will discuss comparison between the observed vertical airglow distribution and the model expectation derived from IRI-model and MSIS-model. In addition, we will compare the results with the vertical electron density profile obtained from GPS occultation measurements by FORMOSAT-3/COSMIC. We will further discuss daily variation of the airglow behavior and its relevance to geomagnetic activity.