

**Study of three-dimensional structure of ionosphere
based on 630-nm airglow observation
with FORMOSAT-2/ISUAL**

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There is 630-nm airglow by atomic oxygen in the ionospheric F-region. The emission occurs when oxygen molecules ionized by the daytime ultraviolet rays recombine with electrons in the nighttime. It is known that the airglow and the total electron content of the ionosphere well correlated by comparison of observations of all-sky cameras and GPS-receiver network in Japan. The observation of the 630-nm airglow is useful to clarify spatial structures of the ionosphere. Since observations have primarily been carried out by imagers on the ground, the three-dimensional structures are not fully understood. In order to investigate the three-dimensional structures, we carried out 630-nm airglow observation with the ISUAL instrument on board of the FORMOSAT-2 satellite. ISUAL observations of 630-nm airglow were conducted for a total 14 days in December 2006, May—June 2007, and April—May 2008 in the region from Australia to Japan. We estimated altitude profile of the airglow layer. The estimated peak altitude was 220 km—280 km. There were bright emissions near the equator and around 30° S. Simultaneous observations between ISUAL and a ground-based imager were successful over Darwin at 15 UT on May 16, 2007. Figure 1 shows an example of the limb-scan image from ISUAL (top panel), and the horizontal image of airglow over Darwin, Australia (bottom panel). We studied structures of the MSTID (Medium-Scale Traveling Ionospheric Disturbance). By using height information from ISUAL and horizontal distribution of airglow from the imager, we modeled three-dimensional structure of the airglow. Reconstructed ISUAL image from the model agreed well with the real data. We further tried to estimate three-dimensional structures of the ionosphere based on the ISUAL data only. From much clearer images of airglow on December 21, 2006 and May 16, 2007, we successfully estimated reasonable structures of the MSTID and equatorial anomaly, respectively. From these studies we showed that the limb imaging of 630-nm airglow from space is a useful tool to study the ionosphere structures.

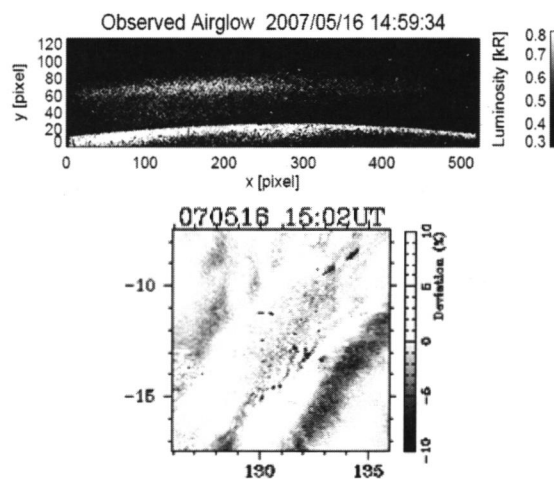


Figure 1. (top) Limb image of 630 nm airglow from ISUAL, and (bottom) corresponding horizontal image from the OMTI of Nagoya University at Darwin, Australia. Observations were conducted at around 15 UT on May 16, 2007.

References

We thank NSPO (National Space Organization), Taiwan for giving us chances of FORMOSAT-2/ISUAL experiment of 630-nm airglow. We are grateful to Solar-Terrestrial Environmental Laboratory, Nagoya University for providing us with airglow imager data from Darwin, Australia.