

Commission G Report

March 5, 2013

1. Research Report

1.1. Polar cap studies (Keisuke Hosokawa, Univ. of Electro-Communications)

A highly sensitive all-sky EMCCD airglow imager has been operative in Longyearbyen, Norway (78.2N, 15.6E; AACGM latitude 75.3) since October 2011. The imager captures 630.0 nm all-sky images with an exposure time of 4 sec, which is about 10 times shorter than that achieved by conventional cooled CCD imagers. This allows us to visualize the structure of polar cap patches without blurring effects and better estimate their periodicities. Hosokawa et al. (2013) presented, as one of the first results from the imager, an event of successive appearance of patches on the night of December 21, 2011. A time-series of the optical intensity at zenith showed modulations having two distinguished periods, one at 40 min and the other at 5--12 min. One possible explanation is that such a coexistence of two different periodicities is a manifestation of simultaneous occurrence of patch generation processes on the dayside. Namely, the 40 min periodicity was created by large-scale reconfiguration of the dayside convection pattern while the 5-12 min modulations were closely associated with mechanisms driven by pulsed reconnection on the dayside magnetopause. Such a combined effect of multiple patch generation processes may play a role in structuring patches; thus, it would be of particular importance for evaluating the space weather effects in the trans-ionospheric communications environment in the polar cap.

1.2 EISCAT-radar related studies (Satonori Nozawa, Nagoya Univ.)

A physical process for the latitudinal motion of an auroral arc based on the four-side bound Cowling channel model is proposed. Assuming that an upward field-aligned current (FAC) is associated with the auroral arc that forms a Cowling channel with finite lengths not only latitudinally but also longitudinally and that the upward FAC region is primarily embedded in a purely northward electric field, the primary Hall current driven by the northward electric field accumulates positive excess charges at the eastern edge of the channel and negative charges at the western edge. The charges produce a westward secondary electric field. This secondary electric field moves the arc with its magnetospheric source drifting together with the magnetospheric plasmas equatorward and simultaneously produces the electric field outside the channel that moves the downward FAC equatorward of the upward FAC region equatorward together with the upward FAC. Thus, the whole 3-D current system is expected to move equatorward as often observed in the afternoon auroral zone.

Poleward-moving auroral forms (PMAF), the ionospheric signatures of flux transfer events (FTEs), are intermittent phenomena observed in the cusp during negative interplanetary magnetic field intervals. We present initial results from a new high-sensitivity all-sky imager installed at Longyearbyen, Norway in October 2011. The 630.0-nm all-sky images taken with a time resolution of 4 s reveal that one of the PMAFs that occurred with such typical separation times on 29 December 2011 comprises two consecutive auroral bursts. This observation provides evidence that one PMAF could reflect double FTEs—there is not always a one-to-one correspondence between FTEs and PMAFs.

New instrument: In order to investigate drift velocities of the ionospheric irregularities at high-latitudes, three dual-frequency GNSS receivers with mutual distances of 172-242 m have been operated at EISCAT Tromso radar site since September 2012. The receivers sample GNSS signals at a rate of 50 Hz. We observed the ionospheric scintillation associated with aurora activities.

1.3. Airglow imaging experiment (Kazuo Shiokawa, Nagoya Univ.)

The Solar-Terrestrial Environment Laboratory (STEL), Nagoya University, started routine observation of VLF waves at Athabasca (54.72N, 246.69E, MLAT=61.3), Canada, using a loop antenna since February 16, 2012. The loop antennas measure east-west and north-south magnetic field variations with a sampling rate of 100 kHz. Quick-look spectra are available at <http://stdb2.stelab.nagoya-u.ac.jp/vlf/index.html>

2. Meetings (future meetings)

Following big meetings scheduled in relation to URSI Commission-G. Both meetings recently opened the web page for paper submission.

IAGA the XIIth Scientific General Assembly, Merida Yucatan, Mexico, August 26-31, 2013

Symposium web-page: <http://www.iaga2013.org.mx/>
Abstract deadline: April 13, 2013

International CAWSES-II Symposium, Nagoya, Japan, November 18-22, 2013

Symposium web-page: <http://www.stelab.nagoya-u.ac.jp/cawses2013/>
Abstract deadline: June 30, 2013

3. Publication list

Polar cap studies (Related to 1.1)

Hosokawa, K., J. I. Moen, K. Shiokawa, and Y. Otsuka, Decay of polar cap patch, *Journal of Geophysical Research*, 117, doi:10.1029/2012JA018165, 2013.

EISCAT radar related studies (Related to 1.2)

Fujii, R., O. Amm, H. Vanhamäki, A. Yoshikawa, and A. Ieda (2012), An application of the finite length Cowling channel model to auroral arcs with longitudinal variations, *J. Geophys. Res.*, 117, A11217, doi:[10.1029/2012JA017953](https://doi.org/10.1029/2012JA017953). (Article first published online: 22 NOV 2012)

Taguchi, S., K. Hosokawa, Y. Ogawa, T. Aoki, and M. Taguchi (2012), Double bursts inside a poleward-moving auroral form in the cusp, *J. Geophys. Res.*, 117, A12301, doi:[10.1029/2012JA018150](https://doi.org/10.1029/2012JA018150). (Article first published online: 5 DEC 2012)