Dynamics of ionospheric convection associated with low latitude aurora in Hokkaido during the March 2015 storm

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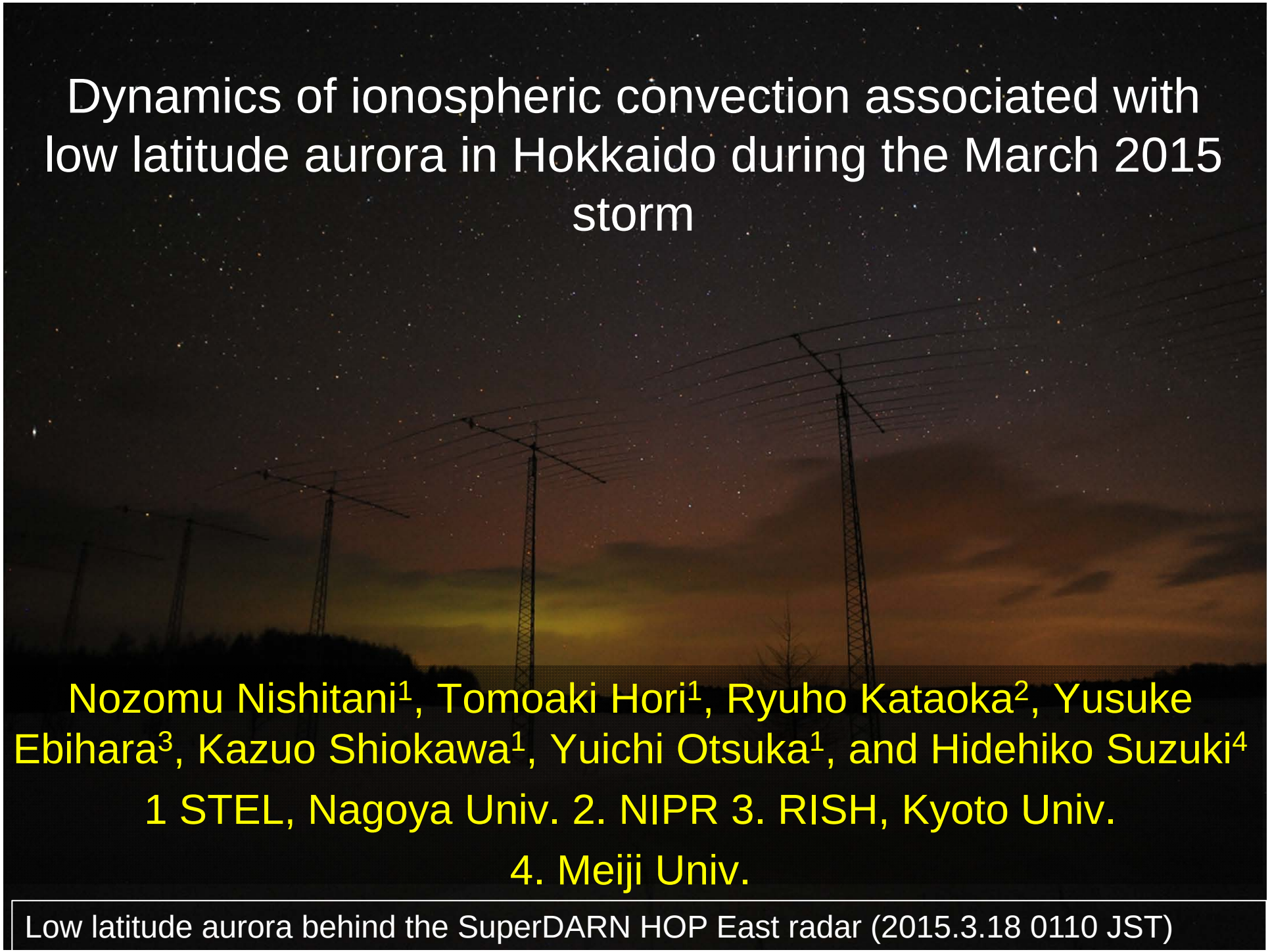
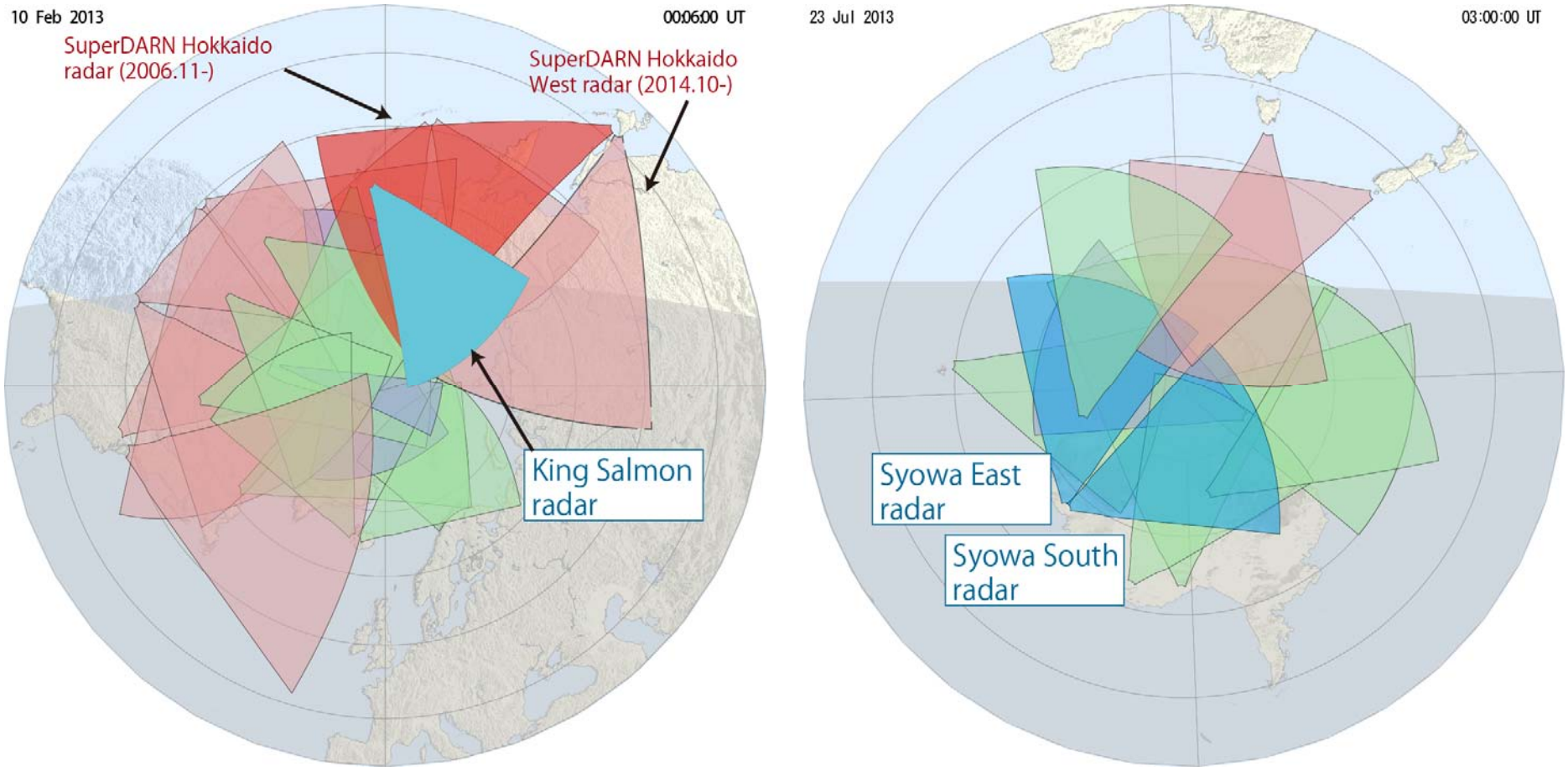


Low latitude aurora behind the SuperDARN HOP East radar (2015.3.18 0110 JST)

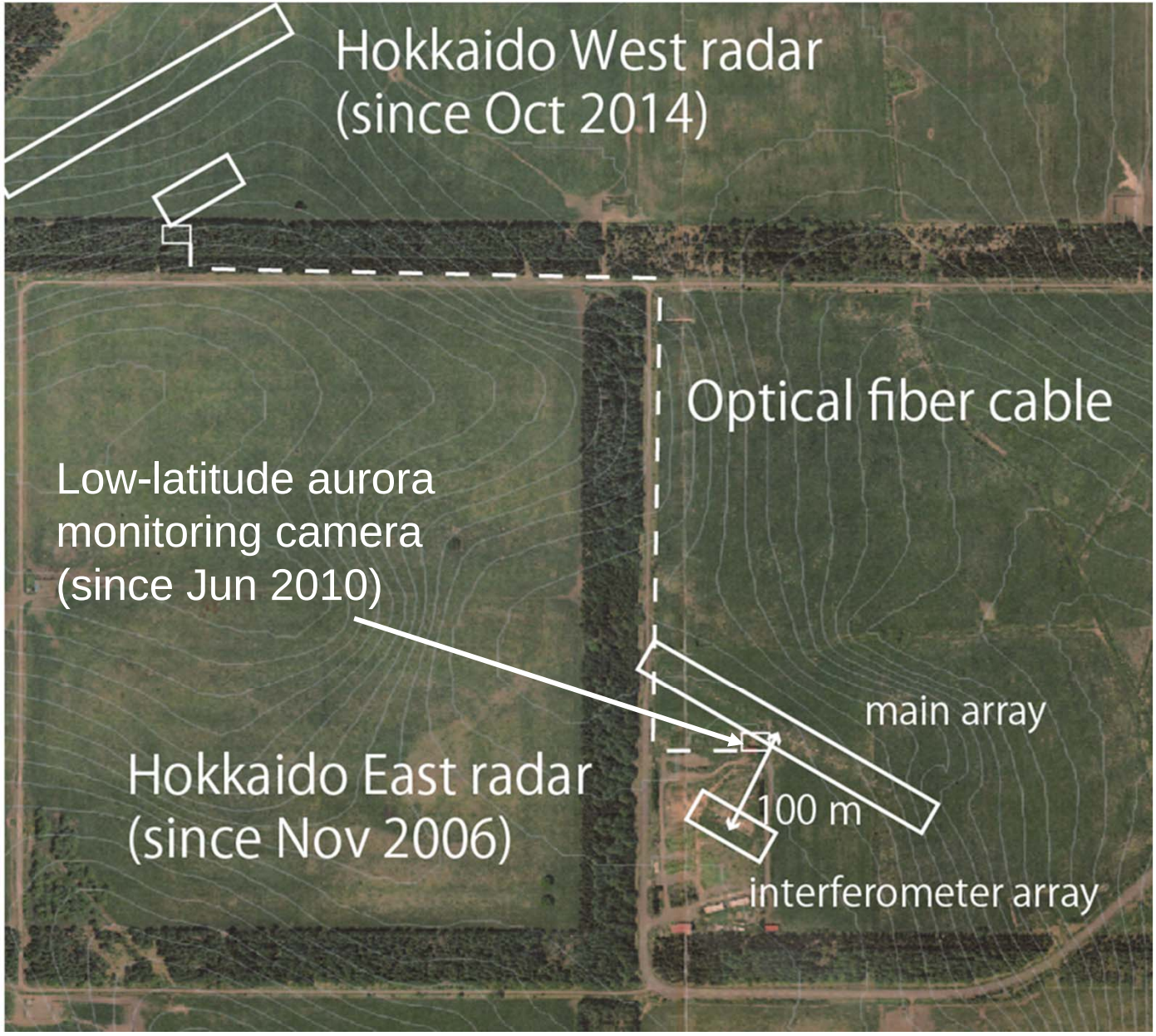
Super Dual Auroral Radar Network (SuperDARN) (1995-present)



Number of operating HF radars: 33 (22 in the northern and 11 in the southern hemispheres) as of Oct 24, 2014

Standard temporal resolution: 1-2 min

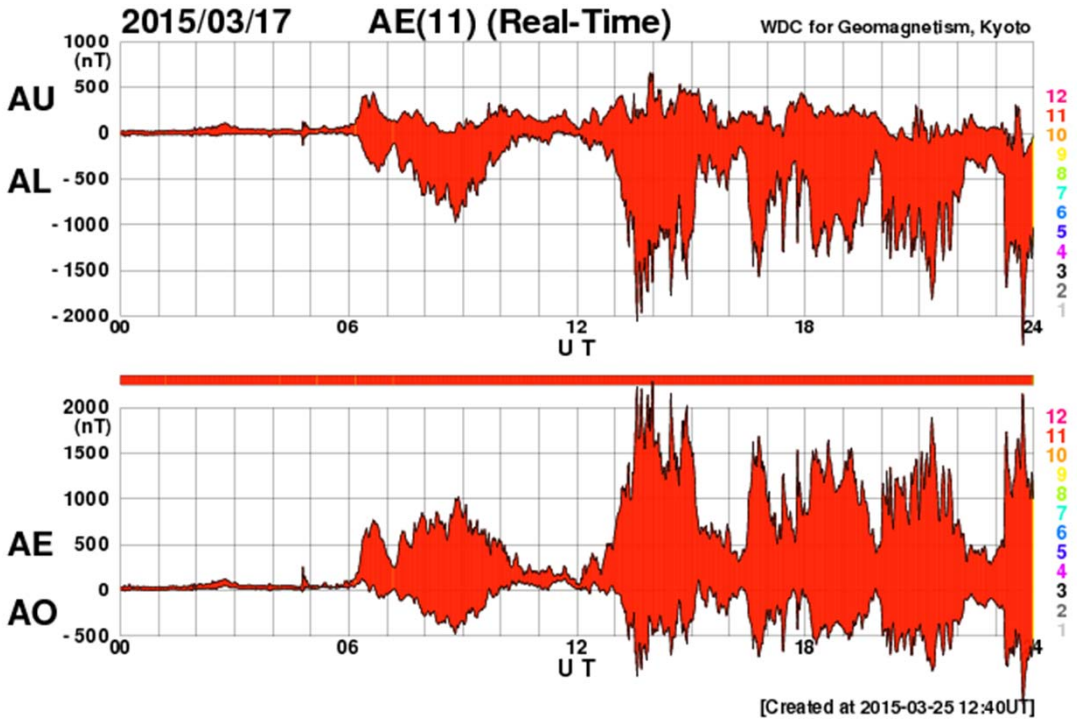
Hokkaido East / West radars



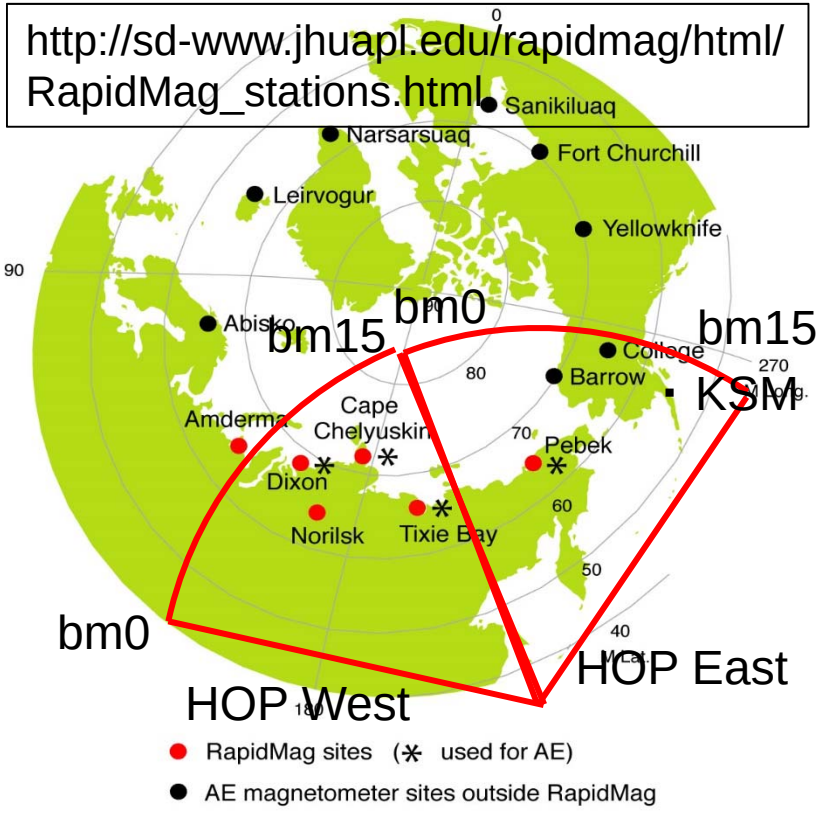
Aurora photographed at Rikubetsu radar site (1400-2030 UT, 5 min int., 25 s exposure)

Camera: Nikon D700 ISO-3200, F/2.8

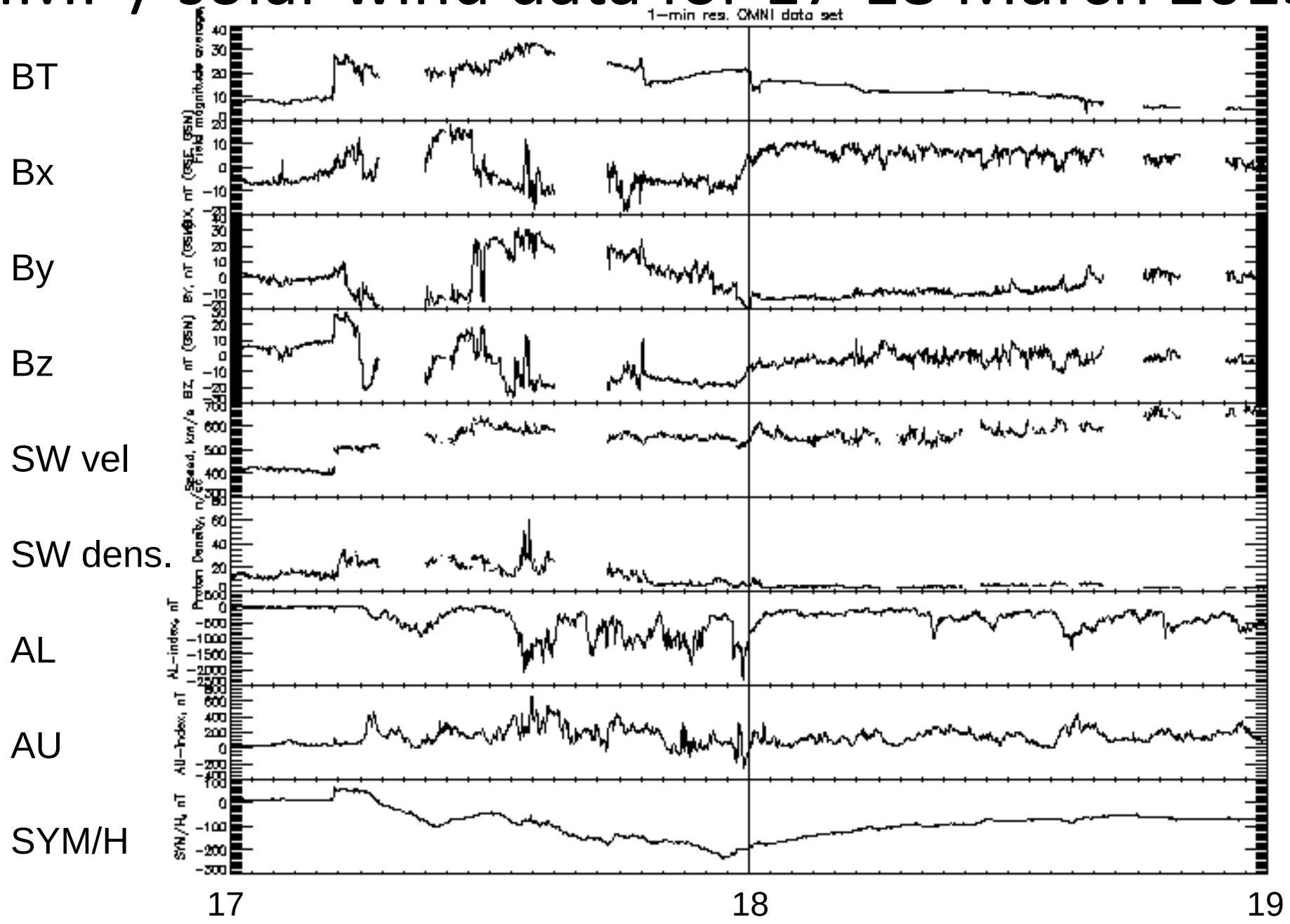
Rikubetsu aurora Event: 17 Mar 2015



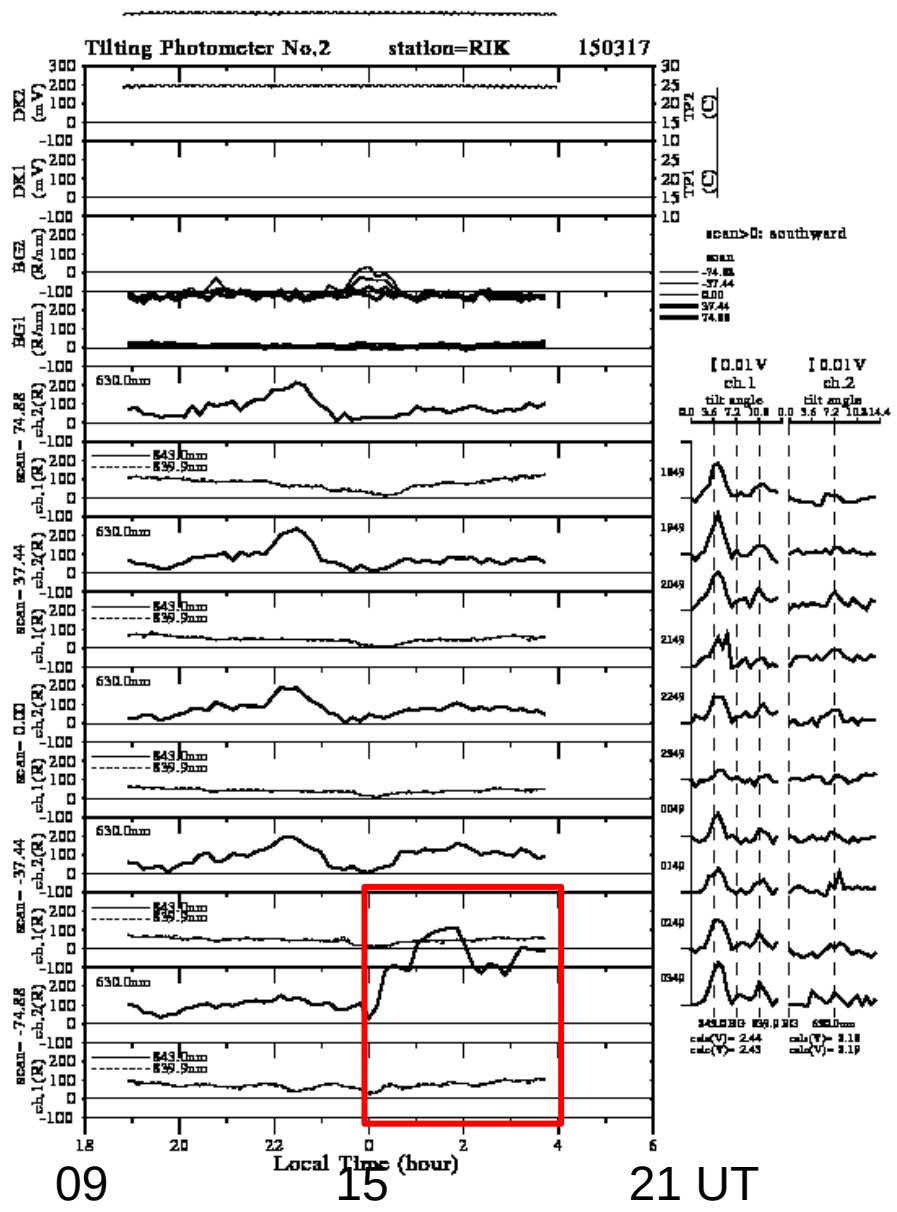
http://sd-www.jhuapl.edu/rapidmag/html/RapidMag_stations.html



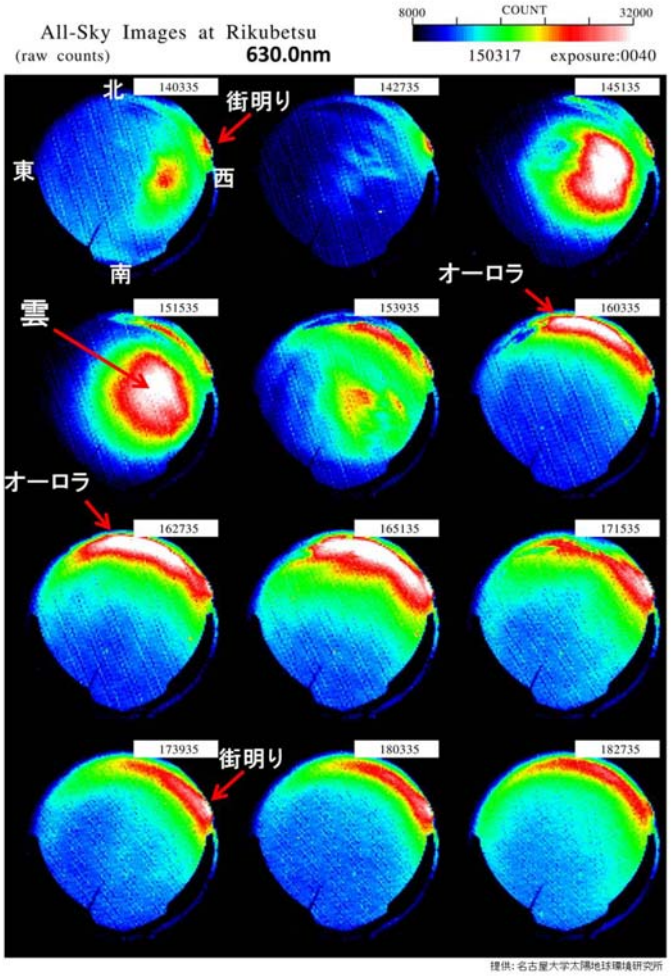
IMF / solar wind data for 17-18 March 2015



Tilting photometer / camera data

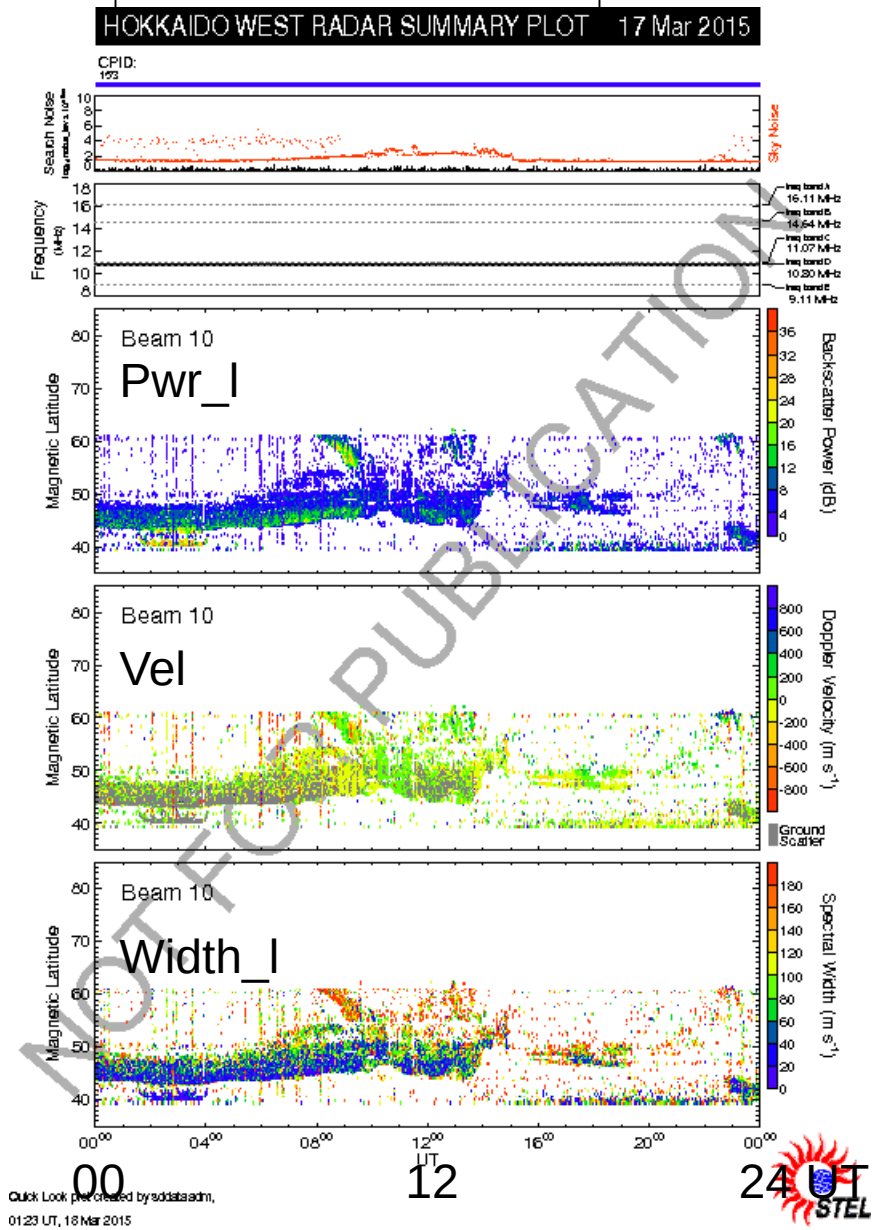


- Auroral emission enhancements at 15 elev occurred at about 1600 and 1800 UT

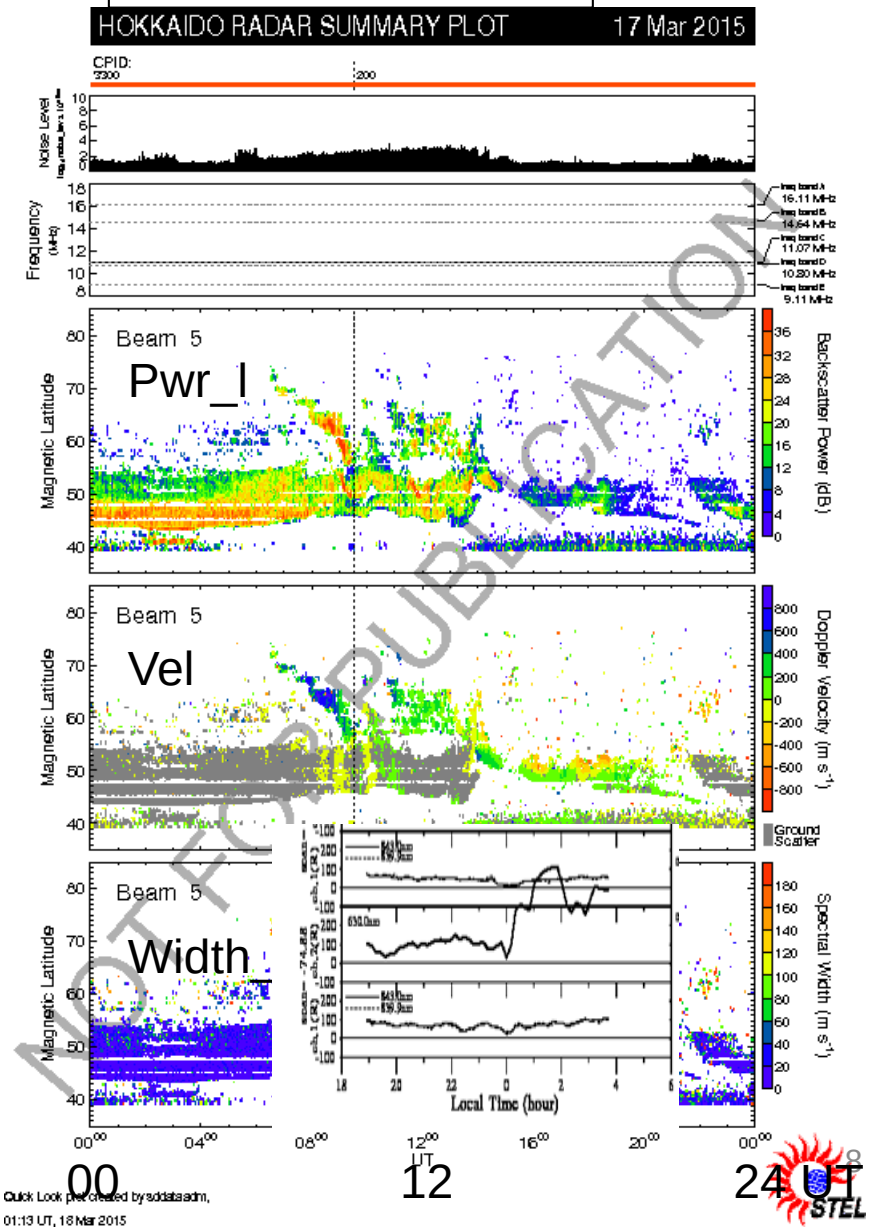


HOP West / East quicklook plots

HOP West beam 10



HOP East beam 5



Discussion

- Fast (500 – 1000 m/s) equatorward flow during the first appearance of low-latitude aurora
  - Dawn-dusk electric field penetration to < 50 ML
    - Energetic particles penetrating into lower latitude (e.g., Tanaka and Ohtaka, 1996) and /or
    - Ring current particles transported inward to plasmasphere regions (e.g., Shiokawa et al., 2005)?
- Auroral emission boundary is located around the boundary between moderately fast (~500/s) westward flow region (equatorward side) and fast (1000 m/s) eastward flow (poleward side), sometimes accompanied by another westward flow further poleward of the eastward flow
  - Electric field structure maintained to keep the auroral emission?
  - Similar to the description by Foster et al. (1994, JGR) for ionospheric convection associated with SAR arcs in the morning sector

NLC at Rikubetsu (also at several points in Hokkaido)
(further expanded, 1725 UT, 20 June 2015)
(Suzuki et al., in preparation)

Summary

- Ionospheric / magnetospheric disturbances during the March 2015 storm event accompanied by low-latitude aurora in Hokkaido
  - Flow shear structure near the auroral emission boundary (equatorward side:~500 m/s westward flow, poleward side: ~1000 m/s eastward flow, sometimes accompanied by westward flow on the poleward side)
  - Fast(500-1000 m/s) equatorward flow around the initial appearance of low latitude aurora
  - fast (> 200 m/s) flows up to 48 ML (L=2.23), which is difficult to simulate with the existing models such as Tanaka (1995) with L=2.5 inner boundary
  - Traveling Ionospheric Disturbances
  - Disturbance dynamo effects
  - Etc.
- Global dynamics of ionospheric convection (in combination with other SuperDARN radars) is very interesting (see the movie)