Role of the IMF $|By|/|Bz|$ in the appearance of the daytime high-latitude magnetic bays

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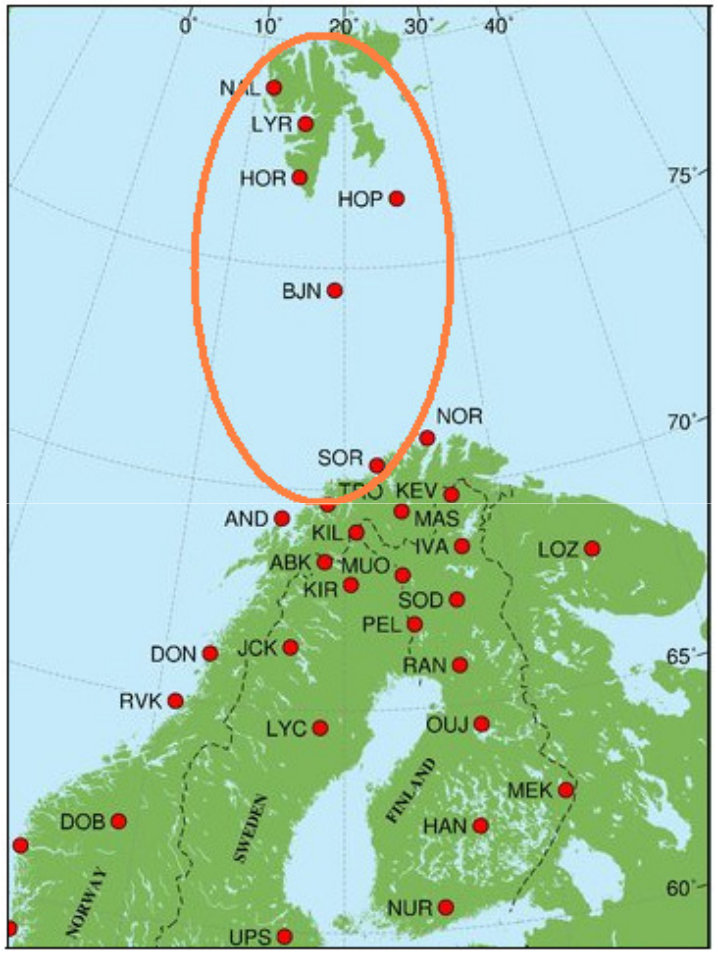
We present several dayside magnetic bays observed at the Scandinavian IMAGE high-latitude stations in the post-noon sector under $|By| > |Bz|$ and $|By| < |Bz|$, and different IMF orientation.

DATA

Our study is based on the data from

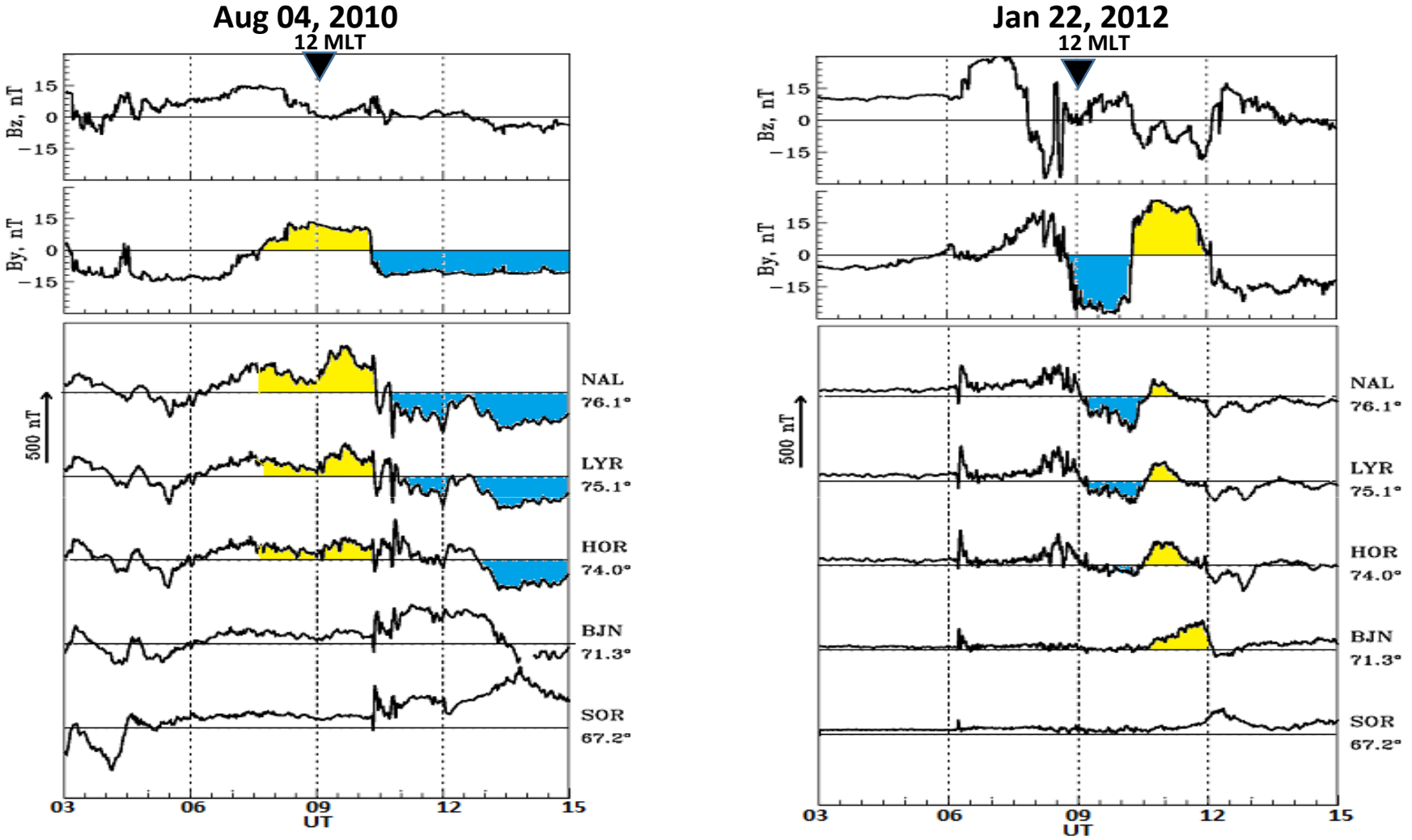
- **IMF data sets of the high resolution OMNI database (http://omniweb.gsfc.nasa.gov),**
- **the ground-based IMAGE magnetometer data (http://www.ava.fmi.fi/MIRACLE).**
- **the AMPERE data, based on the magnetic measurements on 66 low-altitude globally distributed Iridium communication satellites (http://ampere.jhuapl.edu/products/plots).**
- **maps of the ionospheric convection pattern determined from SuperDARN data (http://vt.superdarn.org).**

IMAGE MAGNETOMETER NETWORK



The map of the used IMAGE stations (orange circle on the map).

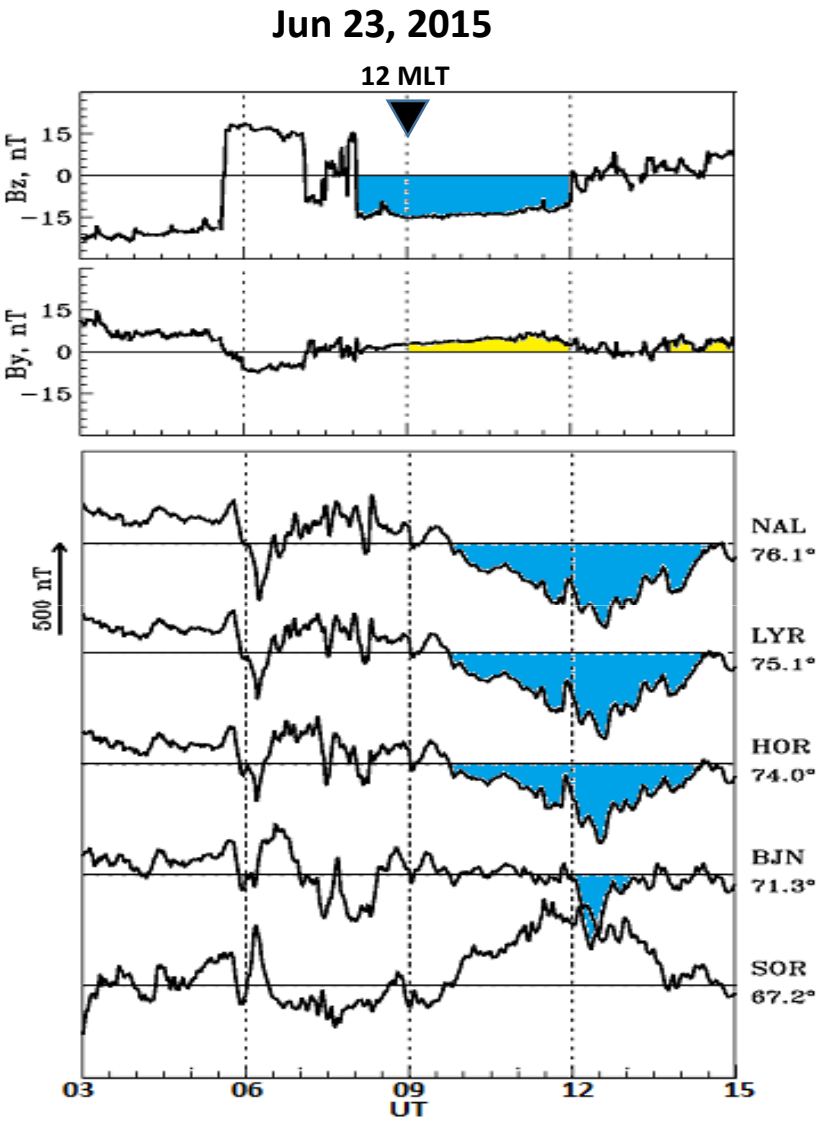
|*By*| > |*Bz*|



The IMF *Bz and By and* IMAGE *difference magnetograms. Examined dayside magnetic bays are marked by yellow/blue depending on* IMF *By or Bz component.*

The sequence of positive and negative bays occurred under the positive or negative IMF *By* be probably caused by the eastward or westward polar electrojets respectively.

|*By*| < |*Bz*|



The **IMF** *Bz and By and* **IMAGE** *difference magnetograms. Examined dayside magnetic bays are marked by yellow/blue depending on* **IMF** *By or Bz component.*

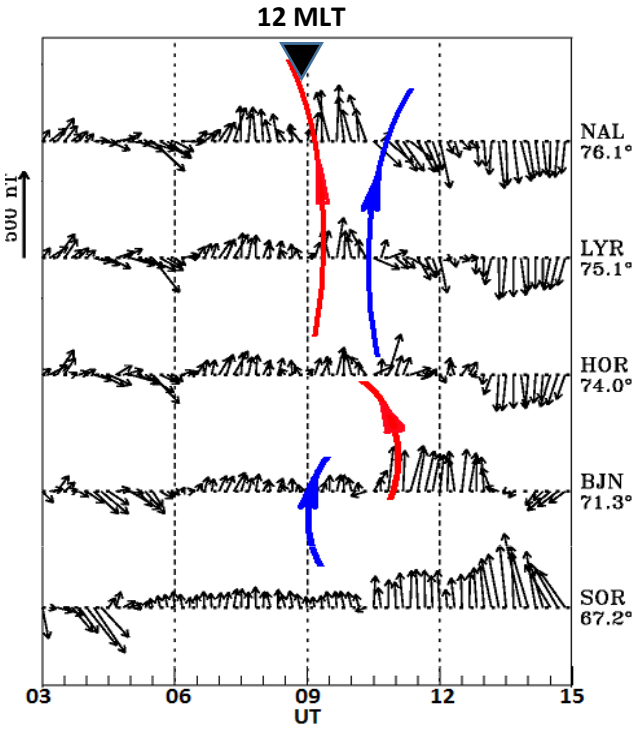
The strong long-duration negative magnetic bay was observed in the dayside sector of the polar latitudes.

The horizontal vectors of the geomagnetic field were constructed from IMAGE magnetometer chain (see orange circle on the map) data on the base of so called difference magnetograms that represent the magnetic variations compared to the most magneto-quiet 2009 level [Levitin et al., 2014].

Levitin A.E. et al., Geom. and Aeron., №3, c. 755, 2014

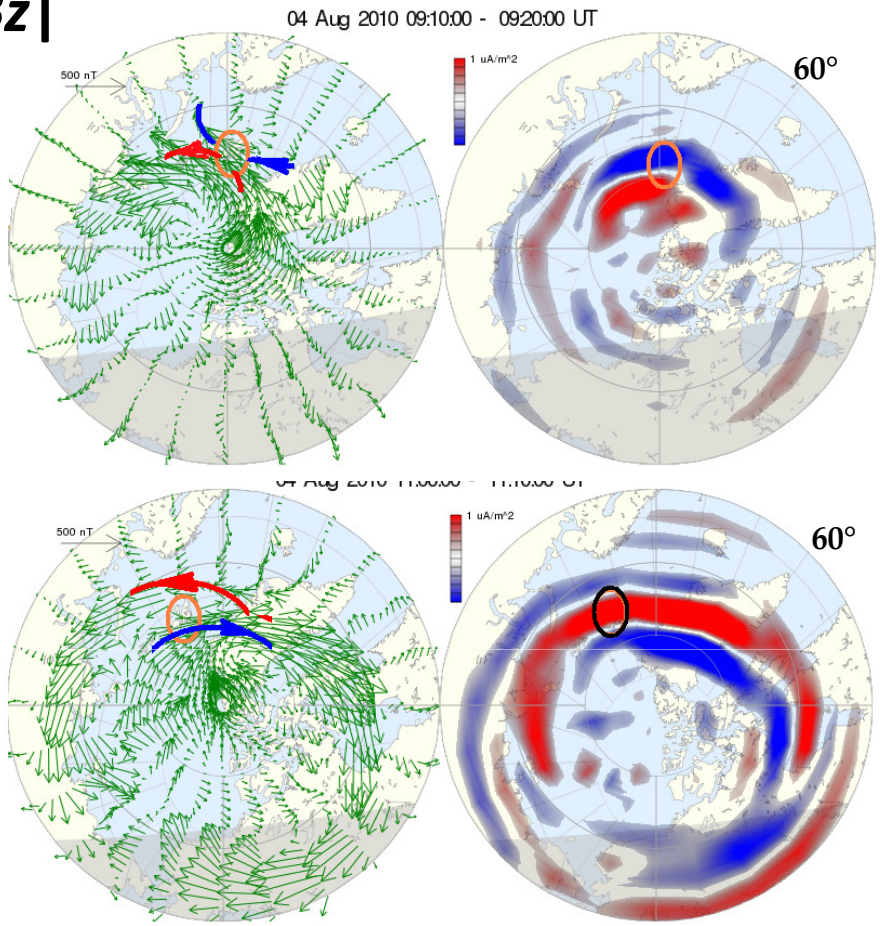
|By| > |Bz|

Aug 04, 2010



The horizontal vectors of the geomagnetic field.

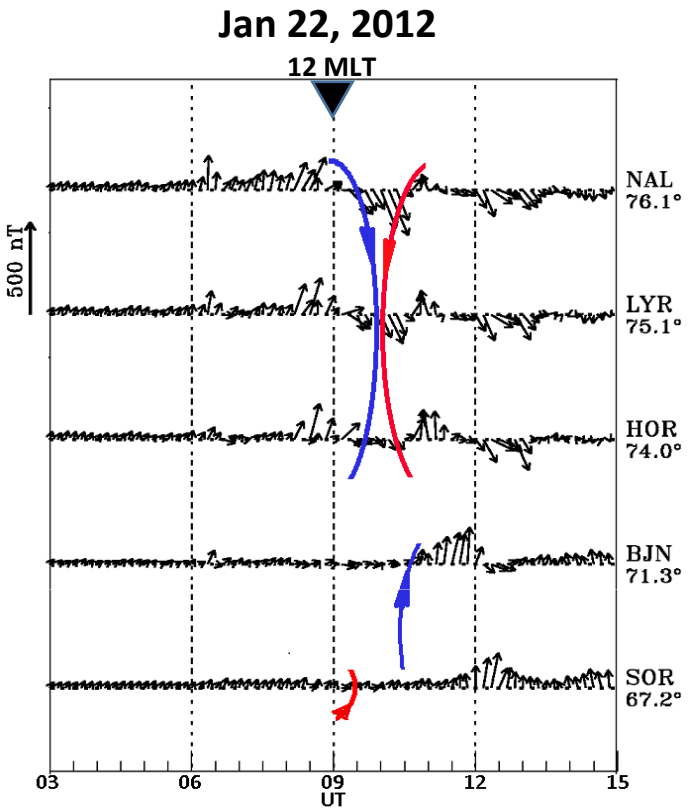
The ground magnetic vectors demonstrated counter-clockwise vortex above the high latitude IMAGE stations and clockwise one above the more low latitude stations about 09 UT and opposite one about 11 UT.



The AMPERE data. Upward currents are shown in red and downward currents in blue. Orange/black circles show the position of the high latitude IMAGE stations.

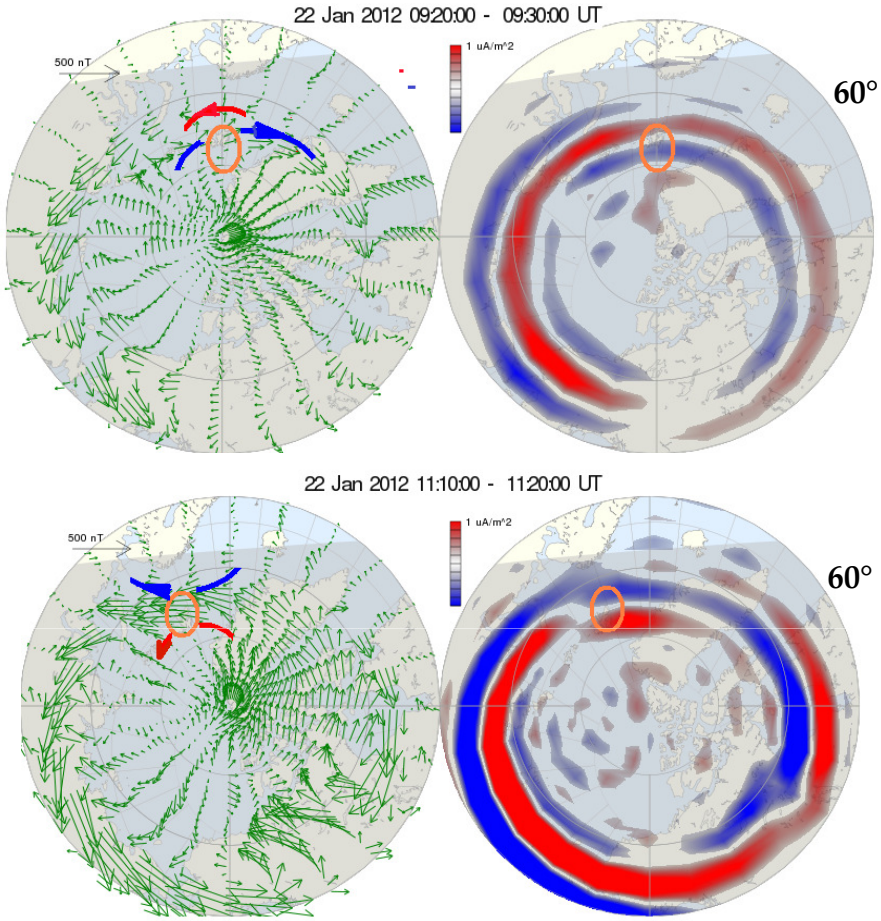
AMPERE model demonstrated increasing of the upward and downward *FACs* caused the polar electrojets enhancement.

|*By*| > |*Bz*|



The horizontal vectors of the geomagnetic field.

The ground magnetic vectors demonstrated the clockwise vortex above the high latitude IMAGE stations and the counter-clockwise one above the more low latitude station at 09 UT and opposite vortices about 11 UT.

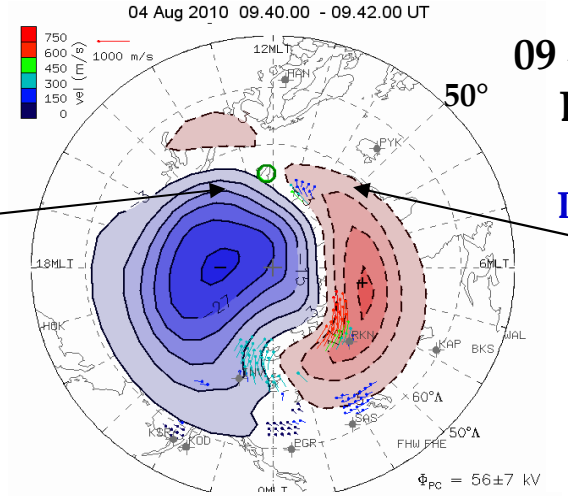


The AMPERE data. Upward currents are shown in red and downward currents in blue. Orange circles show the position of the high latitude IMAGE stations.

AMPERE model demonstrated increasing of the downward and upward *FACs* caused the polar electrojets enhancement.

|*By*| > |*Bz*|

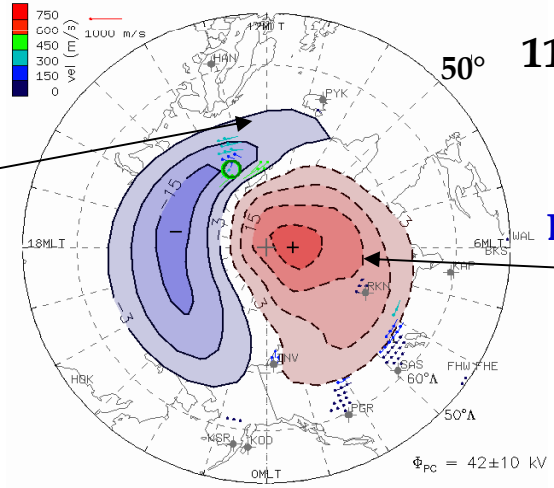
Aug 04, 2010



09 – 10 UT
By > 0

Upward FACs

Downward FACs

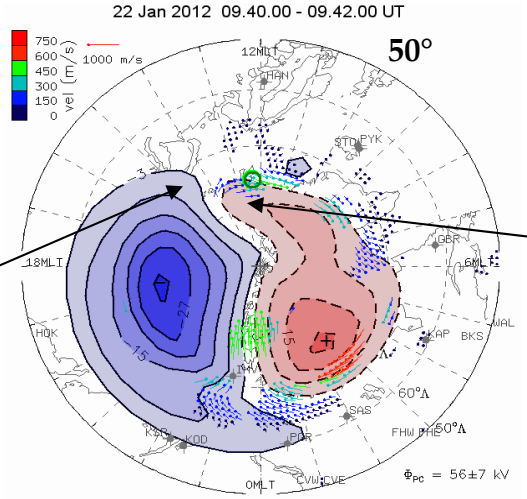


11 – 12 UT
By < 0

Upward FACs

Downward FACs

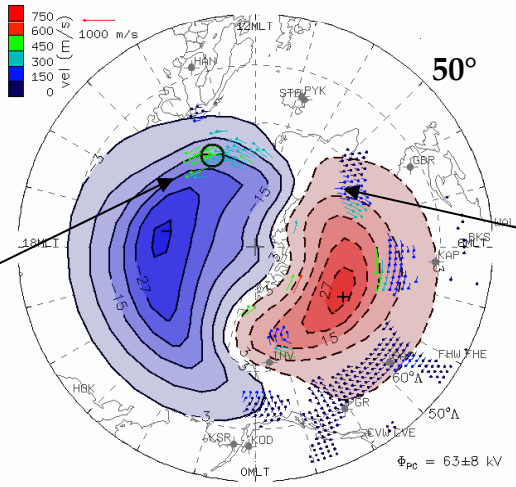
Jan 22, 2012



09 – 10 UT
By < 0

Upward FACs

Downward FACs



11 – 12 UT
By > 0

Upward FACs

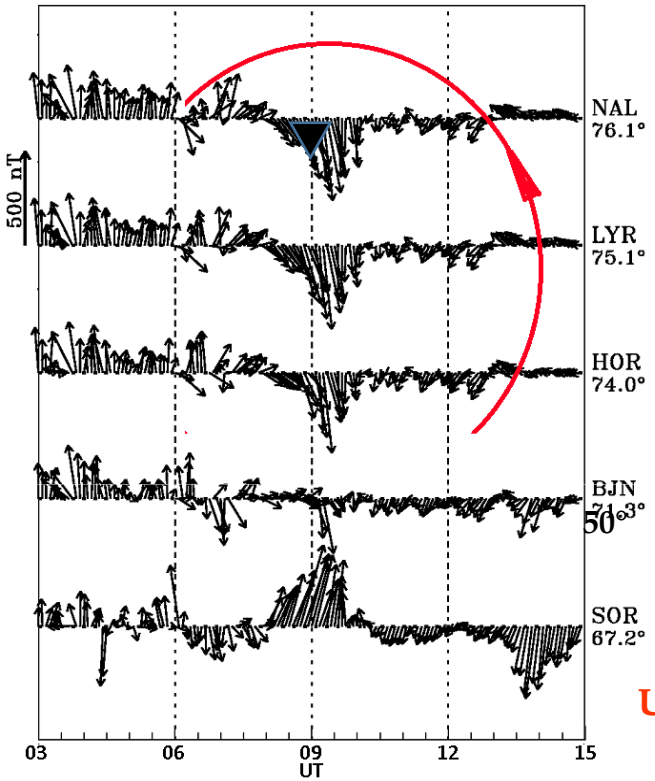
Downward FACs

The convection vortices above IMAGE stations. Green circle shows the position of the high latitude IMAGE stations.

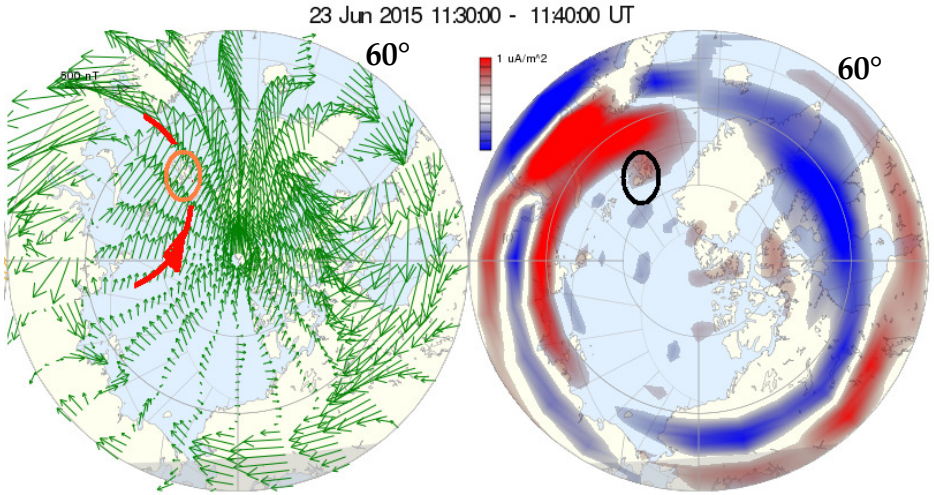
Convection maps demonstrated increasing the upward or downward *FACs* expanded to the pre-noon or post-noon sector depending on the IMF *By*.

|By| < |Bz|

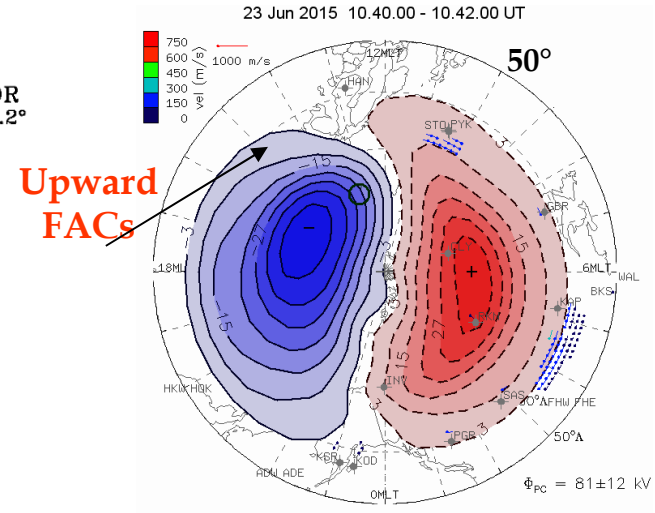
Jun 23, 2015



The ground magnetic vectors demonstrate the counter-clockwise magnetic vortex above high latitude IMAGE stations that corresponds to the upward FAC



The AMPERE data (upper) and convection distribution (below). Circles show the position of the used stations.



Upward FACs

The AMPERE model and the convection map demonstrated intensive upward *FAC*s expanded poleward.

SUMMARY

- ✓ **We found that when the sign of dayside polar magnetic bays (i.e. the direction of the polar latitude ionospheric current) is controlled by the IMF Bz or IMF By depending on the ratio of the IMF $|By|/|Bz|$.**

- ✓ **We showed that if the IMF ($|By|/|Bz| < 1$), the sign of the dayside polar bays are more often controlled by the IMF Bz sign. Such dayside bays could be mapped into the poleward expanding area of the ionospheric convection and upward FACs.**

- ✓ **However, if the IMF ($|By|/|Bz| > 1$), the sign of the dayside polar bays are controlled by the IMF By sign.**

- ✓ **We showed that under the positive IMF By the dawn convection vortex expanded to the afternoon sector, and the dusk convection vortex expanded to the pre-noon sector under the negative IMF By. The high-latitude *FACs* related to the ionospheric convection should increase in the near-noon sector that leads to an enhancement of the corresponding high-latitude ionospheric currents.**

- ✓ **We conclude that geomagnetic IMF effects in the dayside polar sector significantly depend on the IMF $|By|/|Bz|$ ratio.**