

# Geomagnetic Disturbance Report – Reeve Observatory

Event type: Geomagnetic disturbances due to coronal mass ejection preceded by a sudden impulse

Background: All dates and times are in UTC. This section defines the events covered.

A *coronal mass ejection* (CME) is a strong surge in the emission of charged particles with a resulting increase in the velocity and density of the solar wind. A CME must be directed at Earth for it to disturb the geomagnetic field. When the surge hits the Earth's magnetosphere, usually 2 – 9 days after the solar event, the magnetic field is disturbed and oscillates. This in turn generates electric currents in the Earth's ionosphere and near-Earth space environment. The electric currents in turn generate additional magnetic-field variations.

If the Interplanetary Magnetic Field (IMF) associated with the arrival of a solar-terrestrial disturbance remains northward (+Bz) behind the shock caused by a CME then there usually is no subsequent geomagnetic storm, and the shock stands alone as a *sudden impulse*. The sudden impulse mostly is the effect of enhanced solar-wind pressure associated with a CME and is caused by compression of Earth's magnetosphere. All interplanetary plasma parameters increase - solar wind speed, temperature and density. It is identified by a characteristic signature in terrestrial magnetometer data and is a positive pulse or jump in the horizontal component of the geomagnetic field. A sudden impulse is most clearly seen at low latitudes, where the field variations are generally less complex than at high latitudes. This means that a sudden impulse can be difficult to identify at high latitude observatories because it may be overshadowed by normal activity. If the IMF is directed southward (-Bz) behind the shock then a geomagnetic storm usually follows, and the impulse event is called a *sudden commencement*.

Activity: The sudden impulse event occurred at 0942 on 6 April 2011 and was identified as such by SWPC in their daily RSGA. CME impact was indicated by the onset of significant geomagnetic disturbance starting 20 min. later at around 1000. The CME was thought to be associated with a flare on 2 April. As indicated above, a geomagnetic storm ordinarily does not follow a sudden impulse; however, in this case, the disturbance reached storm level during the 0900~1200 time period with further increased disturbance in the 1200~1500 time period. The disturbances lasted 8~9 h. SWPC issued the following alerts:

SUMMARY: Geomagnetic Sudden Impulse  
Observed: 2011 Apr 06 0942 UTC

CONTINUED ALERT: Electron 2 MeV Integral Flux exceeded 1000 pfu  
Continuation of Serial Number: 1783  
Begin Time: 2011 Apr 03 0735 UTC  
Yesterday Maximum 2 MeV Flux: 24634 pfu

ALERT: Geomagnetic K-index of 4  
Threshold Reached: 2011 Apr 06 1058 UTC

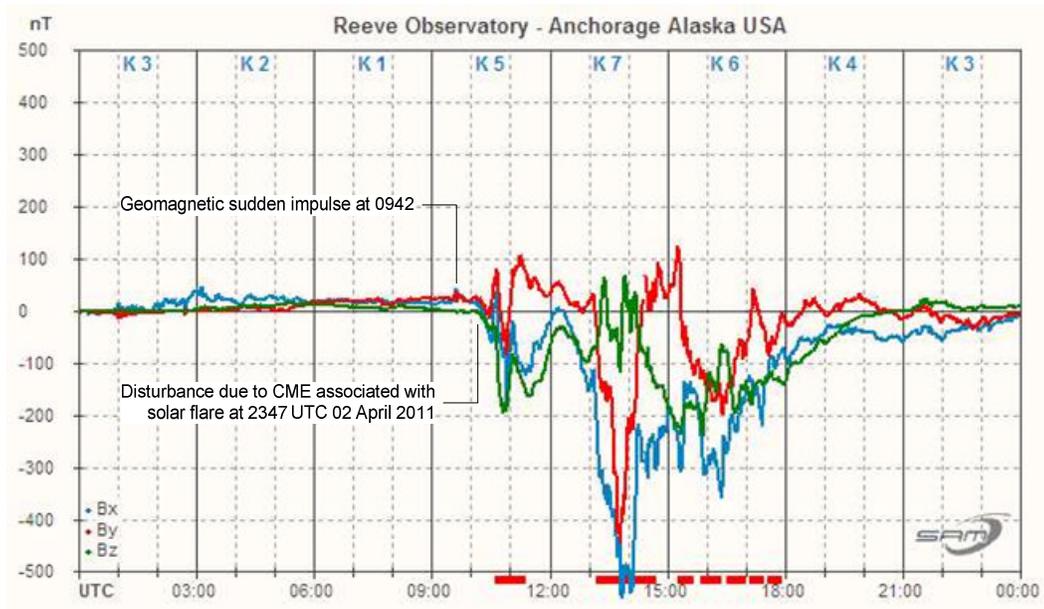
ALERT: Geomagnetic K-index of 5  
Threshold Reached: 2011 Apr 06 1347 UTC

SAM Data: The SAM\_VIEW image is for the 24 h period of 6 April 2011. The caption describes the events as they were reported by Space Weather Prediction Center (SWPC) with additional information specific to Reeve Observatory. SWPC issued the following alerts, in order:

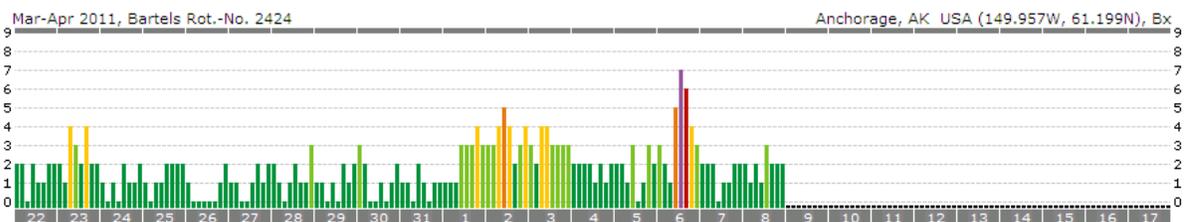
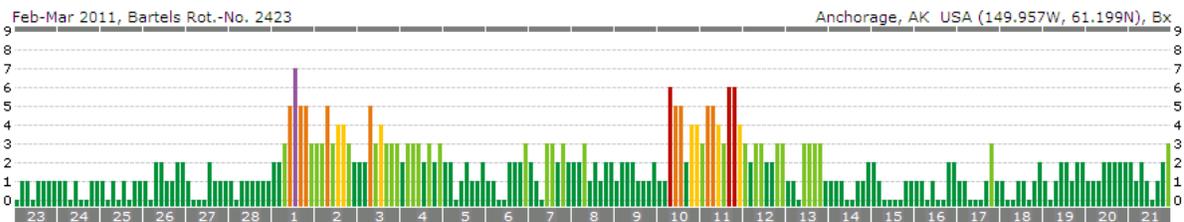
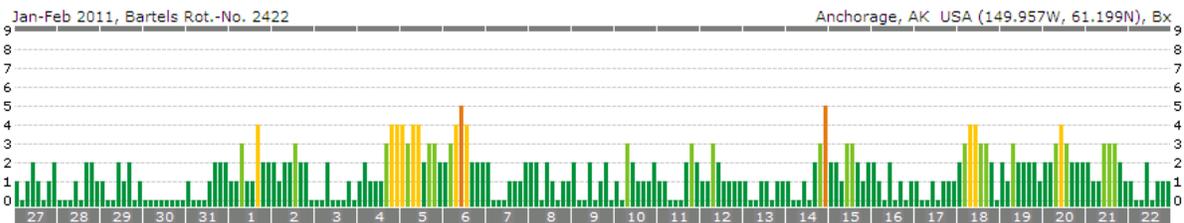
# Geomagnetic Disturbance Report – Reeve Observatory

6 April 2011 (below)

The geomagnetic field was at quiet to active levels with an isolated minor storm period observed at mid-latitudes and major storm levels at high latitudes. The increase in activity is due to a CME associated with a B8/Sf flare 2 April at 2347. The greater than 2 MeV electron flux at geosynchronous orbit reached high levels during the period.



Statistics: The following SAM\_STAT chart images cover Bartels Rotation 2422 through 2424 (27 January through 17 April, 2011). Rotation 2424 was not complete at the time of this report. Note the disturbances on 6 April are 27 d (one solar rotation) later than disturbances on 10 and 11 March.

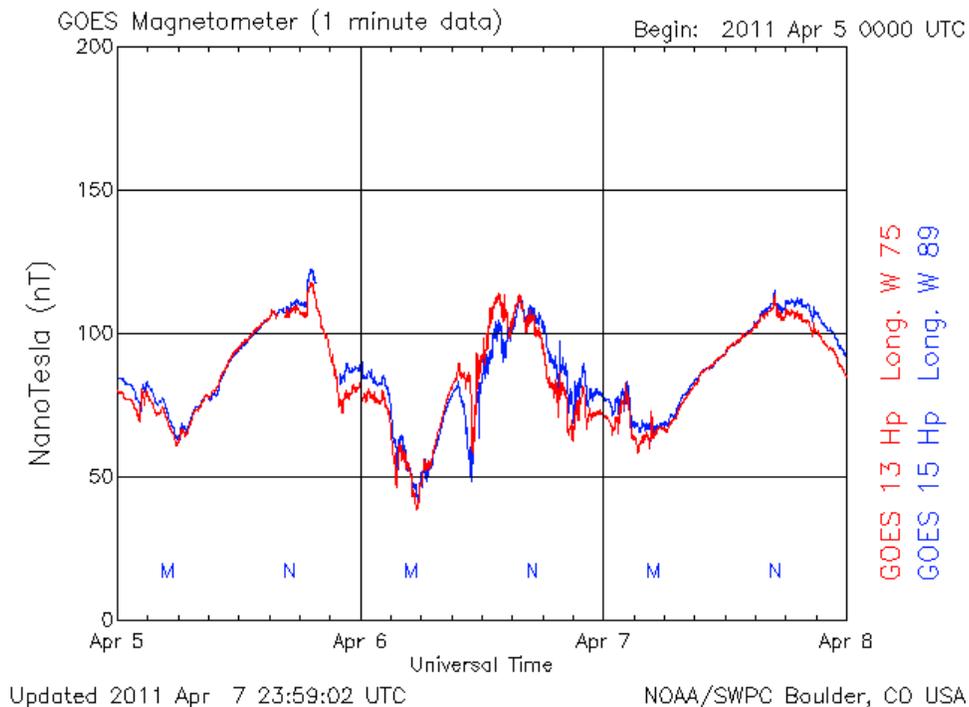


# Geomagnetic Disturbance Report – Reeve Observatory

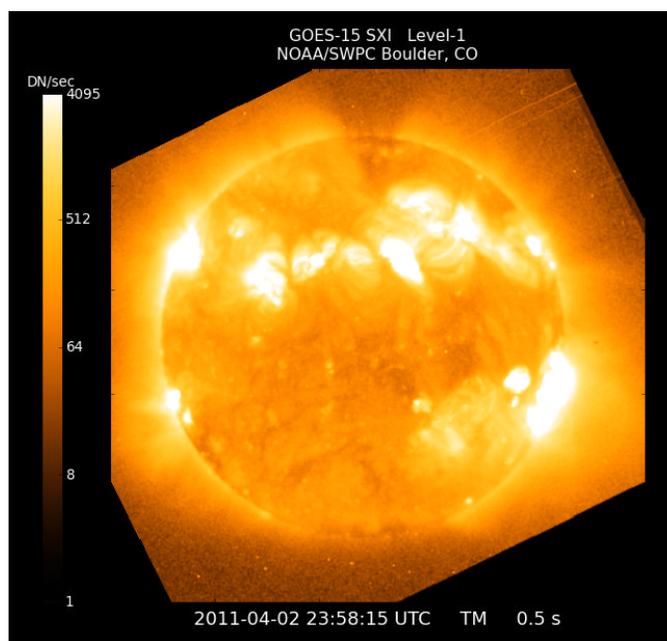
Alaska Magnetometer Chain: Gakona station (approximately 290 km ENE of Reeve Observatory) covering the period:

*Data not available*

GOES data (GOES 11, if shown, is most relevant to Reeve Observatory):



GOES 15 SXI (Solar X-ray Imager) for 2 April 2011:



# Geomagnetic Disturbance Report – Reeve Observatory

## Equipment:

Simple Aurora Monitor (SAM-III) located at geomagnetic coordinates: 61.63 °N : 262.89 °E

Equipment description: [www.reeve.com/SAMDescription.htm](http://www.reeve.com/SAMDescription.htm)

## Resources:

Reeve Observatory SAM-III real-time data: [www.reeve.com/SAM/SAM\\_simple.html](http://www.reeve.com/SAM/SAM_simple.html)

Alaska Magnetometer Chain – [137.229.36.30/cgi-bin/magnetometer/magchain.cgi](http://137.229.36.30/cgi-bin/magnetometer/magchain.cgi)

Geostationary Operational Environmental Satellites – [www.swpc.noaa.gov/rt\\_plots/mag\\_3d.html](http://www.swpc.noaa.gov/rt_plots/mag_3d.html)

Space Weather Prediction Center – [www.swpc.noaa.gov/](http://www.swpc.noaa.gov/)

SOHO – [http://sohodata.nascom.nasa.gov/cgi-bin/data\\_query](http://sohodata.nascom.nasa.gov/cgi-bin/data_query)

SDO – <http://sdo.gsfc.nasa.gov/>

## Geomagnetism Tutorial:

[www.reeve.com/Documents/SAM/GeomagnetismTutorial.pdf](http://www.reeve.com/Documents/SAM/GeomagnetismTutorial.pdf)

## Image sources:

GOES: NASA

Alaska Magnetometer Chain: University of Alaska Fairbanks, Geophysical Institute