

Geomagnetic Disturbance Report – Reeve Observatory

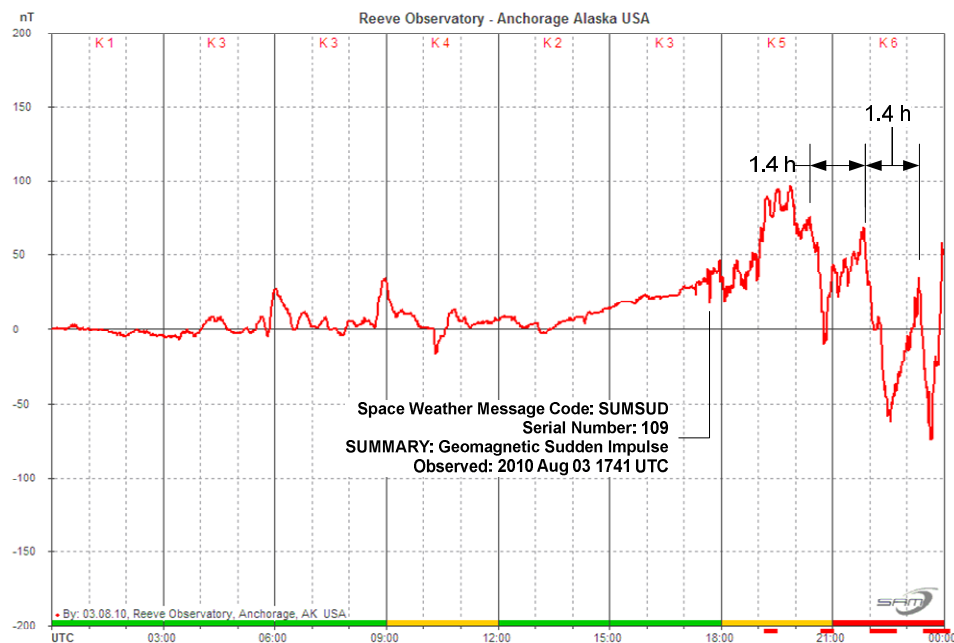
Activity: On 03 August 2010 the Space Weather Prediction Center measured an inter-planetary shock passage at 1656 (all dates and times in UTC) and issued the following warning:

WARNING: Geomagnetic Sudden Impulse expected
Valid From: 2010 Aug 03 1730 UTC
Valid To: 2010 Aug 03 1800 UTC
IP Shock Passage Observed: 2010 Aug 03 1656 UTC

The geomagnetic sudden impulse (see definition at end of this report) was felt on Earth 45 minutes later and reported in a SWPC announcement:

Space Weather Message Code: SUMSUD
Serial Number: 109
Issue Time: 2010 Aug 03 1753 UTC
SUMMARY: Geomagnetic Sudden Impulse
Observed: 2010 Aug 03 1741 UTC
Deviation: 21 nT
Station: Boulder

The sudden impulse was due to the arrival of a CME associated with the long-duration C3 flare on 01 August. The impulse amplitude at the Boulder Colorado station was 21 nT. The Reeve Observatory geomagnetometer (SAM) recorded it as a sharp drop of around 20 nT. The magnetogram image below shows the event. The CME had fairly high speed and required only 2 days to reach Earth (average speed of around 866 km/s).



Geomagnetic storms normally do not follow sudden impulses. However, in this case storm threshold (K-index of 5) was reached about 4.5 hours after the sudden impulse. The SWPC issued the following alerts leading up to and including the storm:

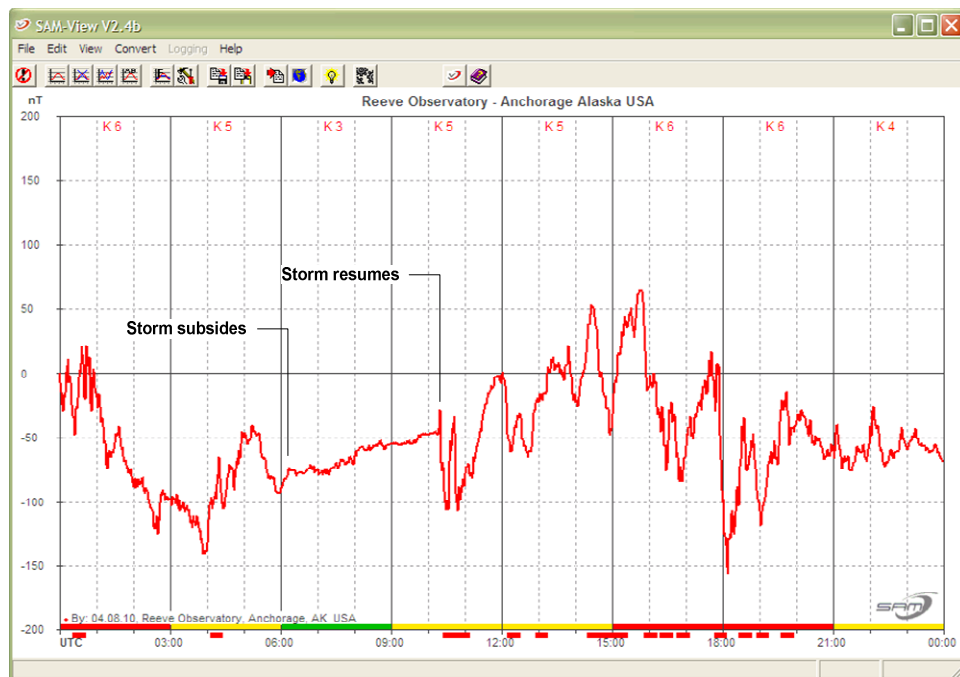
Space Weather Message Code: ALTK04
Serial Number: 1469

Geomagnetic Disturbance Report – Reeve Observatory

Issue Time: 2010 Aug 03 2043 UTC
ALERT: Geomagnetic K-index of 4
Threshold Reached: 2010 Aug 03 2042 UTC
Synoptic Period: 1800-2100 UTC
Station: Boulder
Active Warning: Yes

Space Weather Message Code: ALTK05
Serial Number: 643
Issue Time: 2010 Aug 03 2209 UTC
ALERT: Geomagnetic K-index of 5
Threshold Reached: 2010 Aug 03 2208 UTC
Synoptic Period: 2100-2400 UTC
Station: Boulder
Active Warning: Yes
NOAA Scale: G1 – Minor

The storm continued the next day (04 August) as seen in the magnetogram below.



The storm was reported by SWPC.

Geophysical Activity Summary 03/2100Z to 04/2100Z:

Geomagnetic field activity ranged from unsettled to major storm levels due to a CME passage associated with a long-duration C3 flare on 01 August. The major storm levels occurred during 03/2100 - 04/0300Z and were associated with increased solar wind velocities (peak 657 km/s), increased IMF BT (peak 18 nT), and a sustained period of southward IMF Bz (peak deflection -13 nT). Activity was at unsettled to minor storm levels after 04/0300Z.

Space Weather Message Code: ALTK06
Serial Number: 264
Issue Time: 2010 Aug 04 0049 UTC
ALERT: Geomagnetic K-index of 6

Geomagnetic Disturbance Report – Reeve Observatory

Threshold Reached: 2010 Aug 04 0046 UTC
Synoptic Period: 0000-0300 UTC
Station: Boulder
Active Warning: Yes
NOAA Scale: G2 – Moderate

At Anchorage, the storm did not appear to subside until about 0600 but it was followed by additional activity after 1000. This additional activity was reported as follows:

Space Weather Message Code: ALTK05
Serial Number: 644
Issue Time: 2010 Aug 04 1032 UTC
ALERT: Geomagnetic K-index of 5
Threshold Reached: 2010 Aug 04 1025 UTC
Synoptic Period: 0900-1200 UTC
Station: Boulder
Active Warning: Yes
NOAA Scale: G1 - Minor

Sun images: Refer to the following SOHO movie files:

100801_c3.mpg
100801_elt_195.mpg

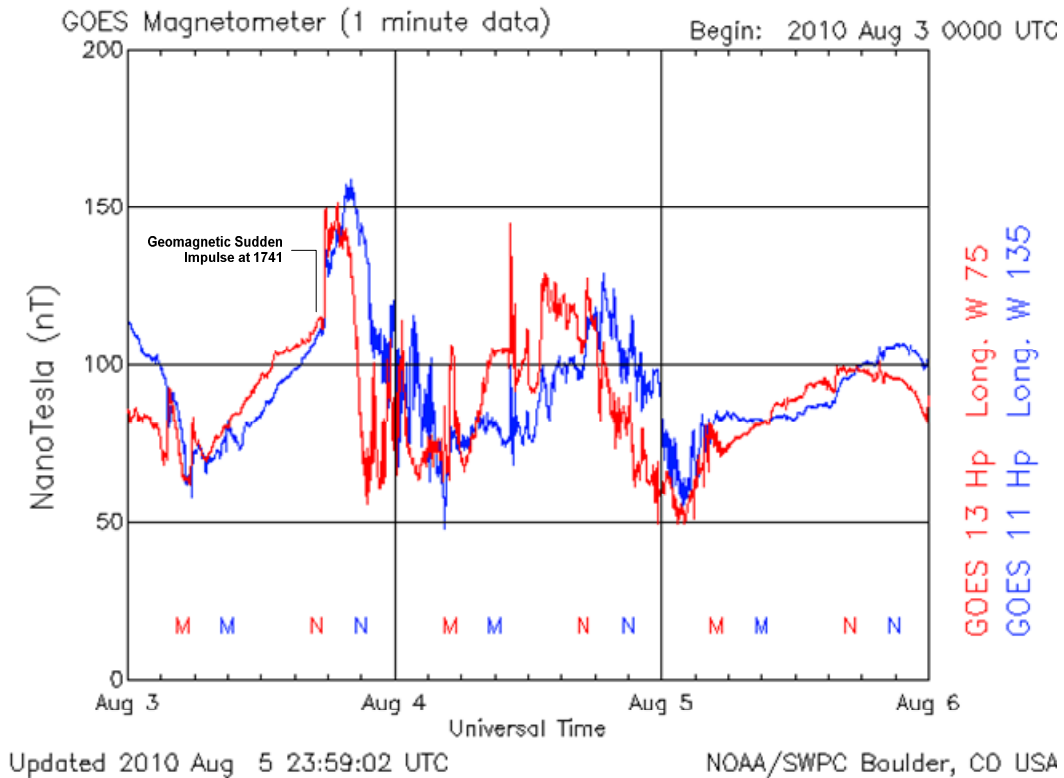
Equipment: Simple Aurora Monitor (SAM) located at geomagnetic coordinates: 61.63 °N : 262.89 °E
For equipment description and real-time magnetogram – www.reeve.com/MagnetometerM2.htm

Resources:

Alaska Magnetometer Chain – 137.229.36.30/cgi-bin/magnetometer/magchain.cgi
Geostationary Operational Environmental Satellites – www.swpc.noaa.gov/rt_plots/mag_3d.html
Space Weather Prediction Center – www.swpc.noaa.gov/

Geomagnetic Disturbance Report – Reeve Observatory

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



Geomagnetic Sudden Impulse: If the Interplanetary Magnetic Field (IMF) associated with the arrival of a solar-terrestrial disturbance remains northward behind the shock then there usually is no subsequent storm, and the shock stands alone as a *sudden impulse*. If the IMF is directed southward ($-B_z$) behind the shock then a geomagnetic storm usually follows the *sudden commencement*. The sudden impulse mostly is the effect of enhanced solar-wind pressure associated with a coronal-mass ejection (CME) and is identified by its characteristic signature in terrestrial magnetometer data. It 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. However, almost all sudden impulses within the last year have occurred during otherwise quiet periods and are clearly shown at the Reeve Observatory at 61°N latitude.

Acknowledgement: Jeffrey J. Love, USGS Advisor for Geomagnetic Research, assisted with the sudden impulse definition above.