Sudden Impulse and Geomagnetic Storm Observed 5 June 2026

Whitham D. Reeve

A Sudden Impulse was observed at 0507 UTC at Anchorage, Alaska and followed 7 hours later by a geomagnetic storm starting at about 1200. The Sudden Impulse resulted when a mixture of three coronal mass ejections (CME) collided with Earth's magnetosphere. The CMEs erupted from the Sun over a 10 hour period on 3 June following M9.3, M7.7 and X1.0 x-ray flares. The CMEs had different speeds but they had magnetic and plasma components that could combine enroute and intercept Earth in its orbit.

The near-Earth space weather conditions in the first plot on the next page were recorded on 5 June by the ACE spacecraft located 1.5 million kilometers from Earth on the Earth-Sun line. The magnetogram following the ACE plot was produced by the Anchorage SAM-III Magnetometer. The images are arranged so their time scales are aligned, and both images are annotated to highlight significant aspects in the plotted parameters.

Discussion:

1) The transient from the CMEs is first indicated in the ACE data at 0424, 43 minutes before the Sudden Impulse at Earth. The Interplanetary Magnetic Field (IMF) total flux density (Bt) and the north-south component (Bz) increased rapidly from 7 and 6 nT to 17 and 16 nT, respectively. The solar wind speed, density and temperature also showed rapid increases at the same time;
2) Space Weather Prediction Center reported the Sudden Impulse at 0511, 4 minutes later than it was observed at Anchorage. The station they used was Meanook, Alberta in Canada. The time difference probably is due to data interpretation;
3) The Sudden Impulse was strongest in Earth's Bx (north-south) component but also significant in By (east-west). It was not obvious in Earth's Bz (vertical). Note that the Earth Bz component is not the same as the IMF Bz but they have the same name;
4) The IMF Bz rotated southward (negative Bz) a little after 1000, and stayed there for over an hour, allowing the IMF to merge with Earth's northward magnetic field. Approximately 1.6 hours were required for the movement of open field lines blown over Earth to the magnetotail where they reconnected and caused the geomagnetic field disturbance;
5) The sawtooth and periodic patterns in Earth's Bx and By components after 1200 are an interesting feature thought to be related to energy loading from the solar wind and magnetic substorms. The large negative deflection in Earth's Bz component is another interesting feature – it possibly is related to the northward position of the Auroral Electrojet with respect to the Anchorage ground magnetometer and fluctuating current. The electrojet significantly affects high latitude ground magnetic field measurements;
6) The storm was the strongest (highest K-index) during the 1200 to 1500 and 1500 to 1800 UTC synoptic time periods. These periods correspond to the local post-midnight to morning sectors at the Anchorage observatory. Generally, the Auroral Electrojet is westward during those times.

Station details:

Anchorage Radio Observatory, Anchorage, Alaska USA
Magnetic sensor elevation: 11 m AMSL
Geographic coordinates: 61.19928 °N : 149.95652 °W
Geomagnetic coordinates: 61.75 °N : 94.04 °W (2026)

Acknowledgements:

Space Weather Prediction Center (ACE Real-Time Solar Wind): https://www.swpc.noaa.gov/products/real-time-solar-wind

Space Weather Prediction Center (Forecast Discussion):
ftp://anonymous@ftp.swpc.noaa.gov/pub/forecasts/discussion/