Severe Magnetic Storm

January 6, 2025 16:00 Eastern Time

A severe magnetic storm commenced at 11:18 Eastern on December 31, 2024. The storm continued into the new year, and it attained a maximum strength on January 1, 2025. The storm is now over. According to the [NOAA Space Weather Prediction Center](https://swpc.noaa.gov) geomagnetic disturbance index, which classifies storms on a scale from G1 (minor)-G5 (extreme), the storm attained a G4 (severe) level of disturbance.

Storms of this intensity can interfere with aeromagnetic surveys, directional drilling for oil and gas, satellite operations, GPS positioning and timing signals, and over-the-horizon radio communication, but they do not usually cause interruption of electric-power-transmission.

Aurorae were seen as far south as Mexico.

In comparison to this storm, the magnetic storm of May 10-12, 2024 attained a G5 level of disturbance, and the magnetic storms of June 27-28, August 11-12, September 16-17, and October 10, each of 2024, attained a G4 level. Since we are presently at about maximum in the solar cycle, there is a high chance of several additional G4 storms occurring in the next year or two. There is also a good chance that another G5 storm will occur.

The storm was monitored at USGS magnetometer stations. Geomagnetic declination at College (Fairbanks), Alaska, varied by 6.4 degrees, enough to be seen on a compass.

A conventional measure of magnetic-storm strength is the (low-latitude) disturbance index known as Dst. This index measures disturbance relative to quiet, non-stormy conditions. The USGS calculates a real-time Dst index useful for diagnosing the state of space weather during magnetic storms.

Soon after this storm commenced, USGS Dst increased to 39 nT, indicating the development, in response to solar-wind pressure, of electric currents on the magnetopause (outer boundary of the magnetosphere). This was followed by a gradual descent into the storm's main phase, and amplification of the magnetospheric ring current, as indicated by Dst declining to negative values. Dst attained a minimum of -221 nT at 11:09 Eastern on January 1, 2025. The Kyoto World Data Center Dst index also attained -215 nT. For comparison, the storm of May 10-12 attained a Dst of -422 nT.

The great storm of March 1989, which caused widespread interference to technological systems around the world, including power systems in the U.S. and a power blackout in Québec, attained a Dst value of -589 nT. The Carrington superstorm of September 1859, which caused widespread interference to telegraph systems, attained a Dst value of about -900 nT.

The USGS Geomagnetism Program operates 14 magnetic observatories across the U.S. and territories; the Program collaborates with the Albuquerque Seismological Laboratory in operation of variometers across CONUS; and it supports magnetotelluric surveys. The Geomagnetism Program disseminates magnetic data in real-time to governmental (both

civilian and military), academic, and private institutions. Program scientists conduct research into the nature of geomagnetic variations for purposes of scientific understanding and hazard mitigation.

A recent factsheet on the solar cycle, geology, and geoelectric hazards for power grids can be accessed here: https://doi.org/10.3133/fs20243036

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