

Geomagnetic Storm Scale

The NOAA Geomagnetic Storm Scale indicates the severity of geomagnetic storms. It is denoted by a G followed by a number from 1 to 5, with 1 being a minor event, and 5 being an extreme event.

The scale uses the planetary K-Index, K_p as it's physical measure, the scale levels are shown below:

Category	Possible Effects
G1 Minor $K_p = 5$	Power systems: Weak power grid fluctuations can occur. Other systems: Migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes.
G2 Moderate $K_p = 6$	Power systems: high-latitude power systems may experience voltage alarms, long-duration storms may cause transformer damage. Other systems: HF radio propagation can fade at higher latitudes, and aurora has been seen at 55° geomagnetic lat..
G3 Strong $K_p = 7$	Power systems: voltage corrections may be required, false alarms triggered on some protection devices. Other systems: intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen at 50° geomagnetic lat..
G4 Severe $K_p = 8$	Power systems: possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. Other systems: induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as 45° geomagnetic lat..

G5 Extreme $K_p = 9$	Power systems: widespread voltage control problems and protective system problems can occur, some grid systems may experience complete collapse or blackouts. Transformers may experience damage. Other systems: Pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen at 40° geomagnetic lat..
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Solar Radiation Storm Scale

The NOAA Solar Radiation Storm Scale indicates the severity of radiation storms. It is denoted by a S followed by a number from 1 to 5, with 1 being a minor event, and 5 being an extreme event.

The scale uses particle flux as it's physical measure, considering the flux level of particles with energies greater than 10MeV, measured in $\text{particles} \cdot \text{s}^{-1} \cdot \text{ster}^{-1} \cdot \text{cm}^{-2}$.

The scale levels are shown below:

Category	Possible Effects
S1 Minor Flux = 10^1	Biological: None. Other systems: minor impacts on HF radio in the polar regions
S2 Moderate Flux = 10^2	Biological: passengers and crew in high-flying aircraft at high latitudes may be exposed to elevated radiation risk. Other systems: small effects on HF propagation through the polar regions and navigation at polar cap locations possibly affected.
S3 Strong Flux = 10^3	Biological: radiation hazard avoidance recommended for astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. Other systems: degraded HF radio propagation through the polar regions and navigation position errors likely.
S4 Severe Flux = 10^4	Biological: unavoidable radiation hazard to astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. Other systems: blackout of HF radio communications through the polar regions and increased navigation errors over several days are likely.

S5 Extreme Flux = 10^5	Biological: unavoidable high radiation hazard to astronauts on EVA (extra-vehicular activity); passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. Other systems: complete blackout of HF (high frequency) communications possible through the polar regions, and position errors make navigation operations extremely difficult.
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Radio Blackouts Scale

The NOAA Solar Radiation Storm Scale indicates the severity of radiation storms. It is denoted by a R followed by a number from 1 to 5, with 1 being a minor event, and 5 being an extreme event.

The scale uses the GOES X-ray peak brightness by class as it's physical measure, the scale levels are shown below:

Category	Possible Effects
R1 Minor X-Ray = M1	HF Radio: Weak or minor degradation of HF radio communication on sunlit side, occasional loss of radio contact. Navigation: Low-frequency navigation signals degraded for brief intervals.
R2 Moderate X-Ray = M5	HF Radio: Limited blackout of HF radio communication on sunlit side, loss of radio contact for tens of minutes. Navigation: Degradation of low-frequency navigation signals for tens of minutes.
R3 Strong X-Ray = X1	HF Radio: Wide area blackout of HF radio communication, loss of radio contact for about an hour on sunlit side of Earth. Navigation: Low-frequency navigation signals degraded for about an hour.
R4 Severe X-Ray = X10	HF Radio: : HF radio communication blackout on most of the sunlit side of Earth for one to two hours. HF radio contact lost during this time. Navigation: Outages of low-frequency navigation signals cause increased error in positioning for one to two hours. Minor disruptions of satellite navigation possible on the sunlit side of Earth.

<div><div>R5</div><div>Extreme</div><div>X-Ray = X20</div></div>	<div>HF Radio:Complete HF (high frequency) radio blackout on the entire sunlit side of the Earth lasting for a number of hours. This results in no HF radio contact with mariners and en route aviators in this sector.</div> <div>Navigation: Low-frequency navigation signals used by maritime and general aviation systems experience outages on the sunlit side of the Earth for many hours, causing loss in positioning. Increased satellite navigation errors in positioning for several hours on the sunlit side of Earth, which may spread into the night side.</div>
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