

Solar Storm

A solar storm is a disturbance on the Sun, which can emanate outward across the heliosphere, affecting the entire Solar System, including Earth and its magnetosphere, and is the cause of space weather in the short-term with long-term patterns comprising space climate.

Why in the news?

It was reported in July 2021 that a large solar storm was to hit earth, and once it did, it would affect GPS, internet and communication satellites. While alarming, NASA reported that on July 3rd a large Solar Storm had passed the earth, and it only caused minor radio disruption.

This article will further elaborate on solar storms. The information gained will be useful in the Science and Technology segment of the UPSC Exam.

What are Solar Storms?

A solar storm is used to refer to the atmospheric effects that are visible on earth through certain events that occur on the surface of the Sun.

Solar Storms happen when a Sun emits large bursts of energy in the form of solar flares and coronal mass ejections. These phenomena send a stream of electrical charges and magnetic fields toward the Earth at high speed.

One of the effects of a solar storm striking Earth is the creation of the “northern lights” which are seen in the regions around the Arctic Circle. An adverse effect of solar storms is the disruption of satellites and other electronic means of communications.

Types of Solar Storms

Solar Storms come in the form of the following types:

1. Solar Flares: A solar flare is a sudden flash of increased brightness on the Sun, usually observed near its surface and in proximity to a sunspot group. Powerful flares are often, but not always, accompanied by a coronal mass ejection. Even the most powerful flares are barely detectable in the total solar irradiance (the “solar constant”).

2. Coronal Mass Ejection: A coronal mass ejection (CME) is a significant release of plasma and accompanying magnetic field from the solar corona. They often follow solar flares and are normally present during a solar prominence eruption.

3. Geomagnetic Storm: A geomagnetic storm (commonly referred to as a solar storm) is a temporary disturbance of the Earth's magnetosphere caused by a solar wind shock wave and/or cloud of magnetic field that interacts with the Earth's magnetic field.

4. Solar Particle Events: A solar particle event or solar proton event (SPE), or prompt proton event, occurs when particles (mostly protons) emitted by the Sun become accelerated either close to the Sun during a flare or in interplanetary space by coronal mass ejection shocks.

Effects of Solar Storms on Earth

Solar Storms can have the following effects on Earth:

- Very high-energy particles, such as those carried by Coronal Mass Ejections, can cause radiation poisoning to humans and other mammals.
- When a coronal mass ejection strikes Earth's atmosphere, it causes a temporary disturbance of the Earth's magnetic field.
- It can throw satellites off course and cause them to fall to the surface of the earth, putting many urban centers at risk.
- Some scientists have speculated that migrating animals which use magneto reception to navigate, such as birds and honey bees, might also be affected.
- Rapidly fluctuating geomagnetic fields can produce geomagnetically induced currents in pipelines. This can cause multiple problems for pipeline engineers. Pipeline flow meters can transmit erroneous flow information and the corrosion rate of the pipeline can be dramatically increased.

Frequently Asked Questions about Solar Storms

How dangerous are solar storms?

While invisible and harmless to anyone on the Earth's surface, the geomagnetic waves unleashed by solar storms can cripple power grids, jam radio communications, bathe airline crews in dangerous levels of radiation and knock critical satellites off course.

What effect do solar storms have on living beings on earth?

Fortunately, no matter what, flares do not have a significant effect on Earth. The Earth's atmosphere more or less acts as a shield to prevent the cosmic radiation from reaching the surface. There can be measurable effects at ground level, but the amount of radiation is pretty insignificant.

