Solar storms can disrupt internet connection

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(Mains GS 1 & 3 : Important Geophysical phenomena such as earthquakes, Tsunami, Volcanic activity, cyclones etc. & General awareness in the fields of IT, Space, Computers, Robotics, Nanotechnology, bio-technology)

Context:

- According to a new study presented at the ACM SIGCOMM 2021 Conference, a powerful solar storm can cause a disruption of the internet, damage submarine cables and communication satellites.
- Previous studies have shown that there is a 1.6 to 2 per cent chance of an extreme space weather event happening within the next decade.

About solar storms:

- A solar storm or a Coronal Mass Ejection is an ejection of highly magnetised particles from the sun.
- These particles can travel several million km per hour and can take about 13 hours to five days to reach Earth.
- Earth's atmosphere protects humans from these particles.
- But the particles can interact with our Earth's magnetic field, induce strong electric currents on the surface and affect man-made structures.

Previous experiences:

- The first recorded solar storm occurred in 1859 and it reached Earth in about 17 hours and it affected the telegraph network and many operators experienced electric shocks.
- A solar storm that occurred in 1921 impacted New York telegraph and railroad systems and another small-scale storm collapsed the power grid in Quebec, Canada in 1989.

- A 2013 report noted that if a solar storm similar to the 1859 one hit the US today, about 20-40 million people could be without power for 1-2 years, and the total economic cost will be $0.6-2.6 trillion.

Solar activity:

- The rapid development of technology took place in the last three decades when the Sun was in its period of low activity and there are very limited studies on whether our current infrastructure can withstand a powerful solar storm.
- The Sun goes through an 11-year cycle of high and low activity and it also has a longer 100-year cycle.
- During the last three decades, when the internet infrastructure was booming, it was a low period.
- And very soon, either in this cycle or the next cycle, we are going towards the peaks of the 100-year cycle.
- So it is highly likely that we might see one powerful solar storm.

India vs Internet:

- Study reveals that longer submarine cables may be susceptible to higher risks.
- Modelling studies to understand how connectivity will be affected country-scale showed that the majority of cables connecting India will be unaffected.
- Even under the high-failure scenario, some international connectivity remains (e.g., India to Singapore, Middle East, etc.).
- Unlike in China, the key cities of Mumbai and Chennai do not lose connectivity even with high failures.
- Compared to the US, India is less vulnerable, but it all depends upon the strength and power of the storm.

Save our internet:

- Recently, it was assessed that Internet disruption for a day in the US can cause about $7 billion economic loss.
- The new paper mentions a ‘shutdown strategy’ that can help minimise the connectivity loss during and after a solar storm impact.
- Similar to power off of power grids, a temporary Internet shutdown can protect our equipment during a solar event and ensure the continuation of services.

Early warning:

- Both NASA and the European Space Agency have probes now that can detect a solar storm by getting about 13 hours of warning.
- Experts from different fields need to come together to design protocols for power companies and internet service providers.

- Today’s health care system depends on power and the internet, so a fallback strategy is necessary.

The vulnerability:

- The vulnerability of “our critical internet backbone, namely undersea fibre-optic cables” needs to be understood properly.
- At ground level, solar storm-induced geomagnetic variations can induce large currents in networks that can conduct electricity; this is potentially harmful.
- Although fibre-optic internet cables are themselves not conductors, the study claims that electronic components that are part of such networks can still be rendered useless by a very strong solar storm.

Conclusion:

- Independent solar observations show that solar superstorms capable of such large-scale damage may occur only a few times in a century.
- Given their potential to cause large-scale disruption to our modern society, stakeholders need to be highly cautious.