Space weather threatens Earth's high-tech life

By Roger Dube, The Conversation, adapted by Newsela staff on 04.23.18
Word Count **970**
Level **1060L**

Image 1. A coronal mass ejection erupts from the sun in 2012. Image from NASA.

Around 4 a.m. on a clear September morning in 1859, the sky above what is now Colorado erupted in bright red and green colors. Gold-rush miners woke up and started making breakfast. They were fooled by the brightness into thinking it was an early dawn.

What happened in more developed areas of the planet was even more disorienting. It carries a warning for the high-tech world of the 21st century.

Telegraph systems worldwide went crazy. They clacked nonsense code and shot large sparks that ignited fires in nearby piles of paper tape. Telegraph operators suffered electrical burns. Even disconnecting the telegraph units from their power sources did not fix the problem, because the transmission wires themselves were carrying huge electrical currents. Modern technology was no

match for a fierce space weather storm arriving from the sun, the largest ever recorded. It was named the Carrington event, after a British astronomer who recorded his observations of the sun at the time.

Today's electronics and satellites would be devastated should an event like that occur again. The world would be thrown back to the life of the early 1800s, and it would take years to fix everything.

A Solar Explosion

Space weather storms have happened since the birth of the solar system, and have hit Earth many times. They are caused by huge explosions on the surface of the sun, called coronal mass ejections. Each explosion sends billions of protons and electrons out into the solar system in a superheated ball.

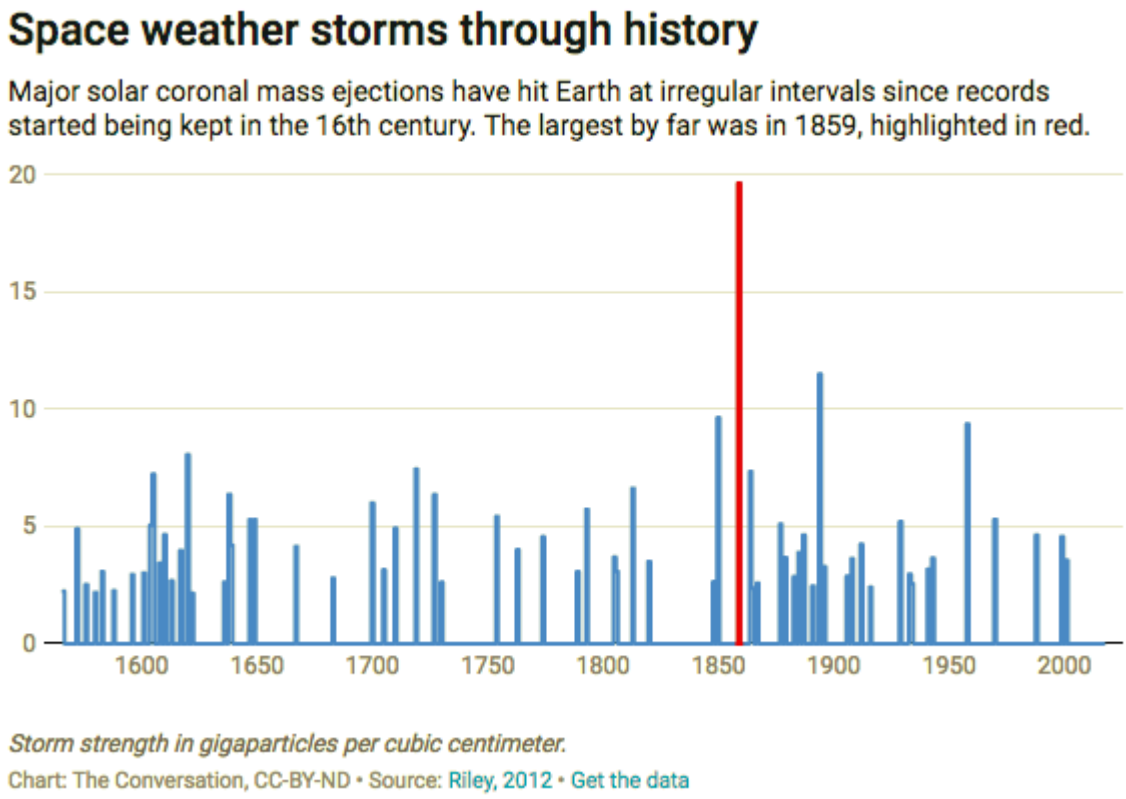
About 1 in every 20 coronal mass ejections heads in a direction that intersects Earth's orbit. About three days later, our planet's magnetic field is disrupted. While these events are described using terms like "weather" and "storm," they do not affect what it is like outdoors on Earth.

Hitting Earth

When the coronal mass ejection arrives at Earth's atmosphere, it generates heat and light called an aurora.

When moving electrical charges hit a magnetic field, it creates a sudden electrical current in anything that can carry electricity. This can cause large currents on long wires on the ground, like the one that overloaded telegraph circuits in 1859.

On March 13, 1989, a storm only about one-fifth as strong as the Carrington event hit Earth. It left 6 million people without power for nine hours. Another storm-induced power surge destroyed part of a New Jersey nuclear plant. This one took six months to repair. In October 2003, a rapid series of solar storms made GPS navigation difficult and interrupted communications connections.



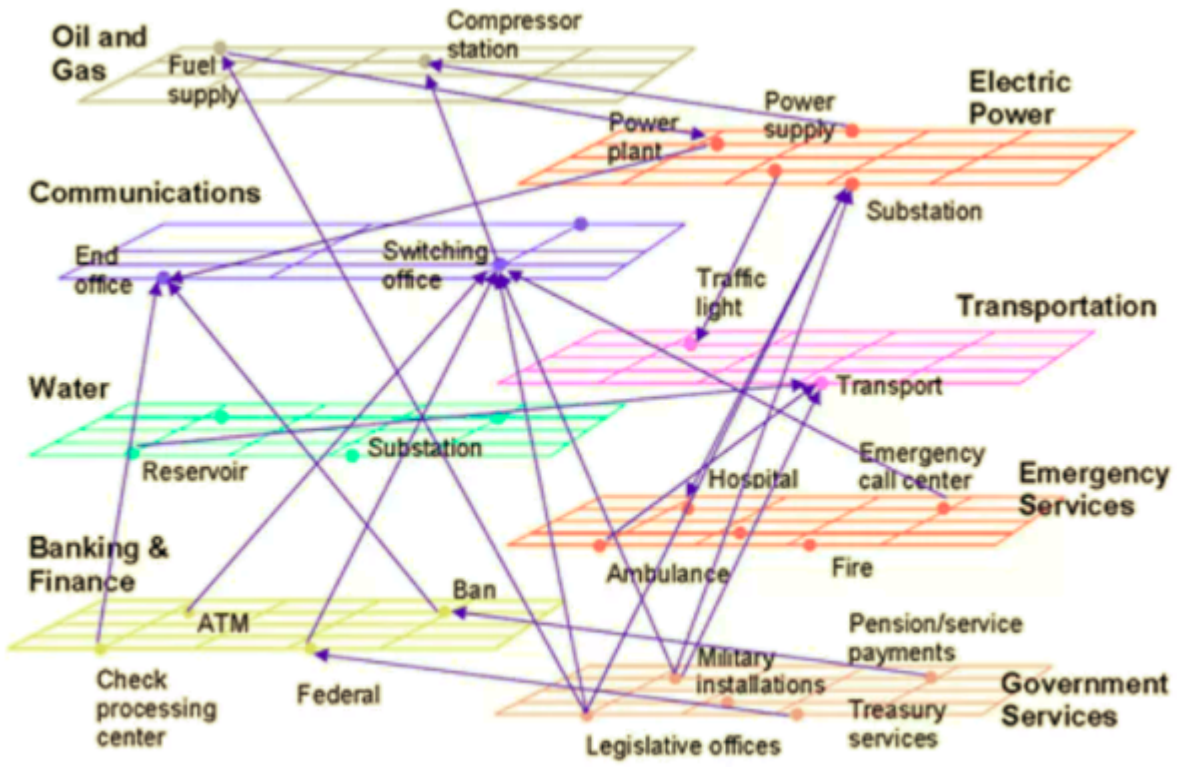
Larger storms will cause more damage and take longer to repair.

Wide-Reaching Effects

A space weather storm typically lasts for two or three days. A truly bad storm would damage power grids and communications networks worldwide.

After the storm passed, there would be no simple way to make repairs and restore power. Manufacturing plants would have no electricity. Trucks needed to deliver materials necessary for repairs would not be able to fuel up, either, because gas pumps run on electricity. Pumps would soon dry up anyway, as electricity is needed to get oil from the ground and turn it into usable fuel. People would have no running water or refrigerated food, and no way to get anything transported from far away.

It could take four to 10 years to repair all the damage. In the meantime, people would need to grow their own food, find and purify water, and cook meals over fires.



Electricity, shown in the upper right, is integrated into every aspect of modern life. Federal Communications Commission

Preparing And Protecting

The longer a wire that is exposed to a moving magnetic field, the larger the current that is created in that wire. Larger systems would be in greater danger than small systems.

In 1859, the telegraph system was so heavily affected because it had wires stretching from city to city across the United States. Today, there are long runs of wires connecting power generators to consumers that would be in similar danger.

Changing the power grid is the only way to protect ourselves. Today, it is a vast web of wires that spans continents. We need to split it into much smaller parts, each serving a town, a neighborhood, or an individual house. These "microgrids" can be connected to each other, but they should have protections to allow them to be disconnected quickly when a storm approaches. That way, the length of wires affected by the storm will be shorter, reducing the potential for damage. There would still be problems, but we would have a better chance of dealing with it.

A family using solar panels and batteries for storage and an electric car to get around would likely find its water supply, natural gas or Internet service disrupted. But they could still drive and use electric lights to work after dark.

When Will The Next Storm Hit?

It's only a matter of time before there is another one like the Carrington event. The most we will likely get is a three-day warning when something happens on the surface of the sun.

Scientists are studying the sun to better predict these storms. The research has not yet yielded a reliable prediction, but it improves each year.

The safest course of action involves developing microgrids based on renewable energy, like solar or wind power. That would not only improve everyone's quality of life on the planet right now but also provide the best opportunity to maintain that lifestyle when these events happen.

Roger Dube is a professor at Rochester Institute of Technology in New York.

Quiz

1 What is the MAIN reason the author includes the sections "A Solar Explosion" and "Hitting Earth"?

(A) to emphasize how frequently space weather storms occur and to predict when the next storm will be

(B) to discuss several different ways that technology can worsen the effects of space weather storms

(C) to explain in detail how space weather storms are formed and how they can affect Earth

(D) to describe two different space weather storms and how they affected technology at the time

2 Read the section "When Will The Next Storm Hit?"

What does this section show that others do NOT?

(A) It shows that space weather storms are caused by activity on the sun and in Earth's atmosphere.

(B) It shows that there are steps people can take for protection from space weather storms.

(C) It shows that space weather storms can have negative effects when they hit Earth.

(D) It shows that scientists still have more to learn about space weather storms.

3 How does the author convey the importance of smaller power grids and alternative power sources like solar and wind power?

(A) by explaining how the current setup of power grids leaves them susceptible to damage that would be both extensive and long lasting

(B) by explaining that alternative energy sources like solar and wind power are cleaner than electricity and less likely to attract space weather storms

(C) by examining the probability that the next space weather storm will be the worst one and could completely destroy current power grids

(D) by examining other countries' power grids and questioning whether they could be replicated successfully in the United States

4 Read the paragraph from the section "Wide-Reaching Effects."

> *After the storm passed, there would be no simple way to make repairs and restore power. Manufacturing plants would have no electricity. Trucks needed to deliver materials necessary for repairs would not be able to fuel up, either, because gas pumps run on electricity. Pumps would soon dry up anyway, as electricity is needed to get oil from the ground and turn it into usable fuel. People would have no running water or refrigerated food, and no way to get anything transported from far away.*

Why did the author include this paragraph?

(A) to highlight how electricity has changed over time

(B) to emphasize a point about society's reliance on electricity

(C) to indicate a growing awareness about the limitations of electricty

(D) to introduce the viewpoint that electricity is not essential for survival