# 2012 solar storm points up need for society to prepare, scientist says

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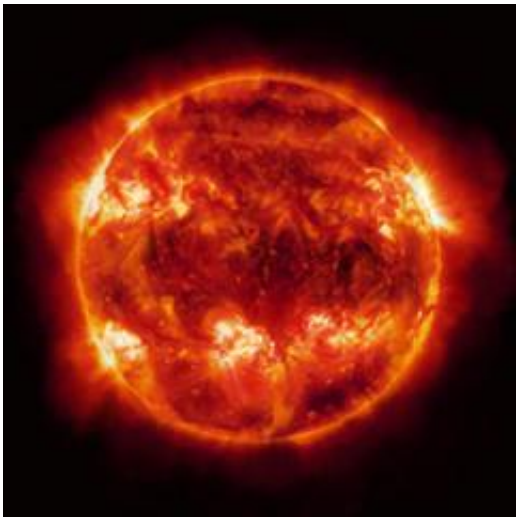

A massive ejection of material from the sun initially traveling at over 7 million miles per hour that narrowly missed Earth last year is an event solar scientists hope will open the eyes of policymakers regarding the impacts and mitigation of severe space weather, says a University of Colorado Boulder professor.

The coronal mass ejection, or CME, event was likely more powerful than the famous Carrington storm of 1859, when the sun blasted Earth's atmosphere hard enough twice to light up the sky from the North Pole to Central America and allowed New Englanders to read their newspapers

at night by aurora light, said CU-Boulder Professor Daniel Baker. Had it hit Earth, the July 2012 event likely would have created a technological disaster by short-circuiting satellites, power grids, ground communication equipment and even threatening the health of astronauts and aircraft crews, he said.

CMEs are part of solar storms and can send billions of tons of solar particles in the form of gas bubbles and magnetic fields off the sun's surface and into space. The storm events essentially peel Earth's magnetic field like an onion, allowing energetic solar wind particles to stream down the field lines to hit the atmosphere over the poles.

Fortunately, the 2012 solar explosion occurred on the far side of the rotating sun just a week after that area was pointed toward Earth, said Baker, a solar scientist and the director of CU-Boulder's Laboratory for Atmospheric and Space Physics. But NASA's STEREO-A, satellite that was flying ahead of the Earth as the planet orbited the sun, captured the event, including the intensity of the solar wind, the interplanetary magnetic field and a rain of solar energetic particles into space.

"My space weather colleagues believe that until we have an event that slams Earth and causes complete mayhem, policymakers are not going to pay attention," he said. "The message we are trying to convey is that we made direct measurements of the 2012 event and saw the full consequences without going through a direct hit on our planet."

Baker will give a presentation on the subject at the 46th Annual Fall Meeting of the American Geophysical Union held in San Francisco Dec. 9 to Dec. 13.

While typical coronal mass ejections from the sun take two or three days to reach Earth, the 2012 event traveled from the sun's surface to Earth in just 18 hours. "The speed of this event was as fast or faster than anything

that has been seen in the modern space age," said Baker. The event not only had the most powerful CME ever recorded, but it would have triggered one of the strongest geomagnetic storms and the highest density of particle fluctuation ever seen in a typical solar cycle, which last roughly 11 years.

"We have proposed that the 2012 event be adopted as the best estimate of the worst case space weather scenario," said Baker, who chaired a 2008 National Research Council committee that produced a report titled Severe Space Weather Events – Understanding Societal and Economic Impacts. "We argue that this extreme event should be immediately employed by the space weather community to model severe space weather effects on technological systems such as the electrical power grid.

"I liken it to war games—since we have the information about the event, let's play it through our various models and see what happens," Baker said. "If we do this, we would be a significant step closer to providing policymakers with real-world, concrete kinds of information that can be used to explore what would happen to various technologies on Earth and in orbit rather than waiting to be clobbered by a direct hit."

Even though it occurred about 150 years ago, the Carrington storm was memorable from a natural beauty standpoint as well as its technological impacts, he said. The event disrupted telegraph communications—the Internet of the Victorian Age—around the world, sparking fires at telegraph offices that caused several deaths, he said.

A 1989 geomagnetic storm caused by a CME from a solar storm in March 1989 resulted in the collapse of Hydro-Quebec's electricity transmission system, causing 6 million people to lose power for at least nine hours, said Baker. The auroras from the event could be seen as far south as Texas and Florida.

"The Carrington storm and the 2012 event show that extreme space weather events can happen even during a modest solar cycle like the one presently underway," said Baker. "Rather than wait and pick up the pieces, we ought to take lessons from these events to prepare ourselves for inevitable future solar storms."

Provided by University of Colorado at Boulder