Chas' Compilation

A compilation of information and links regarding assorted subjects: politics, religion, science, computers, health, movies, music... essentially whatever I'm reading about, working on or experiencing in life.

Saturday, August 08, 2009

Solar Flare: The "Carrington Event" of 1859

In a post I did a few days ago, about **sunspot activity**, the famous solar storm of 1859, often referred to as the "Carrington Event", was frequently mentioned. I've been reading up on that, and here is some of the information I found:

A Super Solar Flare

> At 11:18 AM on the cloudless morning of Thursday, September 1, 1859, 33-year-old Richard Carrington—widely acknowledged to be one of England's foremost solar astronomers—was in his well-appointed private observatory. Just as usual on every sunny day, his telescope was projecting an 11-inch-wide image of the sun on a screen, and Carrington skillfully drew the sunspots he saw.
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> On that morning, he was capturing the likeness of an enormous group of sunspots. Suddenly, before his eyes, two brilliant beads of blinding white light appeared over the sunspots, intensified rapidly, and became kidney-shaped. Realizing that he was witnessing something unprecedented and "being somewhat flurried by the surprise," Carrington later wrote, "I hastily ran to call someone to witness the exhibition with me. On returning within 60 seconds, I was mortified to find that it was already much changed and enfeebled." He and his witness watched the white spots contract to mere pinpoints and disappear.
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> It was 11:23 AM. Only five minutes had passed.
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> **Just before dawn the next day, skies all over planet Earth erupted in red, green, and purple auroras so brilliant that newspapers could be read as easily as in daylight. Indeed, stunning auroras pulsated even at near tropical latitudes over Cuba, the Bahamas, Jamaica, El Salvador, and Hawaii.**
>
> **Even more disconcerting, telegraph systems worldwide went haywire. Spark discharges shocked telegraph operators and set the telegraph paper on fire. Even when telegraphers disconnected the batteries powering the lines, aurora-induced electric currents in the wires still allowed messages to be transmitted.**
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> "What Carrington saw was a white-light solar flare—a magnetic explosion on the sun," explains David Hathaway, solar physics team lead at NASA's Marshall Space Flight Center in Huntsville, Alabama.
>
> [...]
>
> The explosion produced not only a surge of visible light but also a mammoth cloud of charged particles and detached magnetic loops—a

About Me

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I was born and raised in Connecticut, went to college in Boston, dropped out, moved west to San Francisco where I lived for 23 years. I now live in rural Oregon, enjoying a lifestyle I've longed for.

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"CME"—and hurled that cloud directly toward Earth. **The next morning when the CME arrived, it crashed into Earth's magnetic field, causing the global bubble of magnetism that surrounds our planet to shake and quiver. Researchers call this a "geomagnetic storm."** Rapidly moving fields induced enormous electric currents that surged through telegraph lines and disrupted communications.

"More than 35 years ago, I began drawing the attention of the space physics community to the 1859 flare and its impact on telecommunications," says Louis J. Lanzerotti, retired Distinguished Member of Technical Staff at Bell Laboratories and current editor of the journal Space Weather. He became aware of the effects of solar geomagnetic storms on terrestrial communications when **a huge solar flare on August 4, 1972, knocked out long-distance telephone communication across Illinois.** That event, in fact, caused AT&T to redesign its power system for transatlantic cables. **A similar flare on March 13, 1989,** provoked geomagnetic storms that disrupted electric power transmission from the Hydro Québec generating station in Canada, blacking out most of the province and plunging 6 million people into darkness for 9 hours; aurora-induced power surges even melted power transformers in New Jersey. **In December 2005, X-rays from another solar storm disrupted satellite-to-ground communications and Global Positioning System (GPS)** navigation signals for about 10 minutes. That may not sound like much, but as Lanzerotti noted, "I would not have wanted to be on a commercial airplane being guided in for a landing by GPS or on a ship being docked by GPS during that 10 minutes." [...]

From what I've read, Canada and many of the Scandinavian countries have experienced the most electrical damage from solar storms, because of their proximity to the North pole (these effects can emanate from the South pole too, I believe, but there are fewer people and electrical grids nearby to be affected). The affects of a larger solar storm could be farther-reaching.

The Biggest Solar Storm in History

It was the 2 September 1859. The clipper ship Southern Cross was off Chile when, at 1:30am, it sailed into a living hell. Hailstones from above and waves from all around whipped the deck. When the wind-lashed ocean spray fell away to leeward, the men noticed they were sailing in an ocean of blood. The colour was reflected from the sky, which, they could see - even through the clouds - was wreathed in an all-encompassing red glow.

The sailors recognised the lights as the southern aurora that usually graced the skies near the Antarctic Circle, just as their northern counterparts cling to the Arctic. To see them from this far north was highly unusual. As the gale subsided, they witnessed an even more astonishing display. Fiery lights loomed against the horizon as if some terrible conflagration had engulfed the Earth. Vivid bolts flew across the now clear sky in spiral streaks and exploded in silent brilliance, as if the very souls of all humanity were fleeing whatever cataclysm had befallen the planet.

Upon their arrival at San Francisco, the ship's company discovered that theirs was not an isolated experience. Two thirds of the Earth's skies had been similarly smothered. Also, there was a sinister side to the

> aurorae.
>
> The beguiling lights had disabled the telegraph system, wiping out communications across the world. For days, nature refused to allow these arteries of information to flow freely. It was as if today's Internet had suddenly, inexplicably shut down. Worse still, the aurora also threatened life and limb.
>
> In Philadelphia, a telegrapher was stunned by a severe shock. In some offices the equipment burst into flames. In Bergen, Norway, the operators had to scramble to disconnect the apparatus, risking electrocution. On top of this, compasses spun uselessly under the grip of the aurora, disrupting global navigation. [...]

It's obvious the flare caused considerable trouble back in 1859. What impact would such a solar storm have on our modern world, if it occurred today?

Blogger Neil Craig has some excerpts from Michael Brooks' **report in NewScientist Magazine** on what could happen if a solar storm the size of the "Carrington Event" were to happen today:

SEPTEMBER 1859 - CARRINGTON EVENT THE WORLDWIDE CATASTROPHE YOU NEVER HEARD OF

> [...] it is clear that a repeat of the Carrington event could produce a catastrophe the likes of which the world has never seen. "It's just the opposite of how we usually think of natural disasters," says John Kappenman, a power industry analyst with the Metatech Corporation of Goleta, California, and an advisor to the NAS committee that produced the report. "Usually the less developed regions of the world are most vulnerable, not the highly sophisticated technological regions."
>
> According to the NAS report, a severe space weather event in the US could induce ground currents that would knock out 300 key transformers within about 90 seconds, cutting off the power for more than 130 million people (see map). From that moment, the clock is ticking for America.
>
> First to go - immediately for some people - is drinkable water. Anyone living in a high-rise apartment, where water has to be pumped to reach them, would be cut off straight away. For the rest, drinking water will still come through the taps for maybe half a day. With no electricity to pump water from reservoirs, there is no more after that.
>
> There is simply no electrically powered transport: no trains, underground or overground. Our just-in-time culture for delivery networks may represent the pinnacle of efficiency, but it means that supermarket shelves would empty very quickly - delivery trucks could only keep running until their tanks ran out of fuel, and there is no electricity to pump any more from the underground tanks at filling stations.
>
> Back-up generators would run at pivotal sites - but only until their fuel ran out. For hospitals, that would mean about 72 hours of running a bare-bones, essential care only, service. After that, no more modern healthcare.

> The truly shocking finding is that this whole situation would not improve for months, maybe years: melted transformer hubs cannot be repaired, only replaced. "From the surveys I've done, you might have a few spare transformers around, but installing a new one takes a well-trained crew a week or more," says Kappenman. "A major electrical utility might have one suitably trained crew, maybe two."
>
> Within a month, then, the handful of spare transformers would be used up. The rest will have to be built to order, something that can take up to 12 months.
>
> Even when some systems are capable of receiving power again, there is no guarantee there will be any to deliver. Almost all natural gas and fuel pipelines require electricity to operate. Coal-fired power stations usually keep reserves to last 30 days, but with no transport systems running to bring more fuel, there will be no electricity in the second month.
>
> ...With no power for heating, cooling or refrigeration systems, people could begin to die within days. There is immediate danger for those who rely on medication. Lose power to New Jersey, for instance, and you have lost a major centre of production of pharmaceuticals for the entire US. Perishable medications such as insulin will soon be in short supply. "In the US alone there are a million people with diabetes," Kappenman says. "Shut down production, distribution and storage and you put all those lives at risk in very short order."
>
> Help is not coming any time soon, either....
> "I don't think the NAS report is scaremongering," says Mike Hapgood, who chairs the European Space Agency's space weather team. Green agrees. "Scientists are conservative by nature and this group is really thoughtful," he says. "This is a fair and balanced report."... [...]

The article goes on about some of the things we might do to lessen the threat, but also acknowledges the difficulties of convincing people of the threat, and taking the necessary precautions.

I have posted before about how our dependency on electricity and computer chips increases our vulnerability to EMP (Electro-Magnetic Pulse) weapons:

EMP Vulnerability: Could Advanced Electronics be the Achilles' Heel of our Western Civilization?

While the emphasis on that post was the danger posed from EMP weapons, the effects of large solar storm/flares share some similarities with EMP events. Both involve fluctuations in the Earth's magnetic field, that are damaging to electrical systems. And the safeguards needed to protect our electrical infrastructure from said fluctuations, be they from natural or man-made sources, are largely the same. Yet it's hard to convince people of the need to protect against something that has never happened in their own experience, or in the case of the Carrington Event, within living people's memory.

Even with the solar storm of 1859, there were no advanced electronics. The U.S. electric power industry didn't even exist yet (it only **began in 1882**). A comparison with today is difficult.

Today's advanced electronics, like computer microchips, are very vulnerable to magnetic field fluctuations, but we have only had them in wide use in recent decades.

People aren't likely to think of the consequences of them failing en-mass, until they do.

Some people argue that storms like the Carrington Event only occur every 500 years or so, so why worry? But the data and arguments on that assertion are disputed, it's by no means a certainty. Also, a storm or flare of lesser strength still might do a lot of damage nowadays, given the delicate nature of our advanced electronics. Oddly enough, there could be a blessing in that, if it makes people aware of the danger, and more likely to protect against a larger event. Hopefully we won't have to learn hard way, by the worst scenario.

Since 1859, several solar storms about half the strength of the Carrington Event have been observed; but none of those observed flares were moving in the direction of Earth. It may be just a matter of time before one does. Scientists are watching the sun closely. We've learned more about the sun in the past decade, than we have in the last 100 years, but we still can't predict solar flares yet. Hopefully our ability to do that will improve over time. And hopefully, the next big storm we do experience won't be as big as the Carrington Event.

Related Links:

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Solar cycle 24: solar flares & social collapse or 'crushing cold temperatures and global famine'?

Labels: **Carrington Event**, **Carrington Flare**, **EMP**, **EMP vulnerability**, **solar**, **solar flare**, **solar storm**, **space exploration**, **sun spots**

posted by Chas @ ***10:41 AM***

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