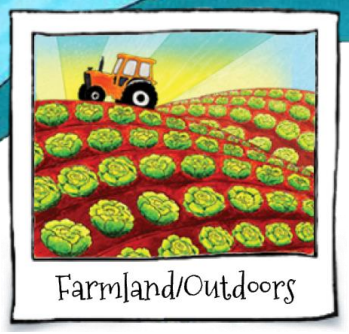

Radiation From Solar Activity

Solar flares, coronal mass ejections (CMEs) and geomagnetic storms from the sun can send extreme bursts of ionizing radiation and magnetic energy toward Earth.

About Radiation From Solar Activity

Solar flares, CMEs and geomagnetic storms are examples of extreme sun activity that can send bursts of energy toward Earth. Some of this energy is in the form ionizing radiation and some of the energy is magnetic energy.

SUNSPOTS

Sunspots are areas of very strong magnetic fields on the surface of the sun. These magnetic fields can become twisted, storing energy like a rubber band. Scientists don't fully understand why, but sunspots can become unstable and explode, releasing huge amounts of energy into space. According to the U.S. National Air and Space Administration (NASA), the energy released is "the equivalent of millions of 100-megaton hydrogen bombs exploding at the same time!" This is called a solar flare.

SOLAR FLARES

Solar flares contain different forms of energy: heat, magnetic energy and ionizing radiation. The ionizing radiation released during solar flares includes x-rays and gamma rays. The ionizing radiation from these bursts can damage satellites, which travel above the protection of Earth's atmosphere. Damage to communications satellites could disrupt communications on Earth. The magnetic energy from solar flares could also interrupt radio communication on Earth. While solar flares are massive explosions, you still need specialized equipment to see them on the surface of the sun.

Coronal mass ejection, as observed by the Solar and Heliospheric Observatory spacecraft.

CORONAL MASS EJECTIONS (CMEs)

The most powerful solar flares are huge bursts of x-rays and electrified hot gas called coronal mass ejections, which can create proton storms. Protons are the positively charged particles from the nucleus of an atom. The explosion that creates the CME accelerates the protons around the sun to nearly the speed of light. These protons are a form of ionizing radiation. Protons carry dangerous amounts of energy that can break chemical bonds.

Proton storms can interfere with ham radio communication and damage satellites, causing short circuits in electrical systems and shutting down computers. An astronaut outside the International Space Station (ISS) during a proton storm would become sick due to the ionizing radiation exposure. The light and x-rays from CMEs reach Earth's atmosphere in about 8 minutes. Usually, the atmosphere protects people on the surface from the proton storm.

The charged particles from a proton storm interact with the atmosphere and cause spectacular changes to the atmosphere known as the aurora borealis or northern lights.

In 1859, a proton storm from CMEs was so powerful that people in Cuba and Hawaii saw the northern lights. The increase in charged particles caused such strong electrical currents in telegraph wires that some offices caught fire. Because such a powerful proton storms could cause a lot of damage to technology that we rely on today, NASA tracks the sun's activity so we can prepare for large proton storms.

Aurora borealis or northern lights.

Rules and Guidance

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

Solar activity can cause commercial airlines' navigational equipment to report the location of planes incorrectly. Fortunately, there are systems available to pilots that are not sensitive to solar activity. If navigators are alerted to the storm, they can switch to a backup system. The FAA routinely receives alerts of solar flares. These alerts allow them to be prepared for potential communication and navigation problems.

U.S. NATIONAL AERONAUTIC AND SPACE ADMINISTRATION (NASA)

NASA's Solar Particle Alert Network (SPAN) consists of multiple radio and optical telescopes that stream continuous data on solar flare activity. Solar flare eruptions are difficult to predict. However, the instruments used by SPAN can provide some warning. They can detect solar material as it makes its way from the sun to Earth. This information also allows astronauts in space, who lack the protection of Earth's atmosphere, to move to well shielded areas of their spacecraft.

U.S. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

NOAA's Space Environment Center provides real-time monitoring and forecasting of solar and geophysical events. They also develop techniques for forecasting solar and geophysical disturbances.

What you can do

Radiation from solar activity is a natural part of our environment and does not threaten our health on a day-to-day basis. UV rays from the sun pose a much more common, ongoing risk to human health. You should take steps such as wearing sunscreen and protective clothing to protect yourself from UV radiation.

Where to learn more

You can learn more about radiation from solar activity by visiting the resources available on the following webpage: http://www3.epa.gov/radtown/solar-activity.html#resources.