Explained in 60 Seconds: Windy with a chance of flares

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Keywords
Space weather, solar wind

If you thought that weather forecasts here on Earth were changeable, spare a thought for those dealing with the even more unpredictable conditions of space.

It may sound odd to be considering what the weather is like in the airless and uninhabited emptiness of space, but it is an all-too-pressing issue for astronomers. Unlike the conditions we see here on the Earth's surface, in space, weather is an entirely different — and altogether more dangerous — animal.

As on Earth, in space, weather is driven predominantly by the Sun. Our star's surface is turbulent and powerful, and dense streams of charged particles speed away from it, forming the solar wind. This wind floods the inner Solar System, filling it with energetic particles driven outwards along densely packed magnetic field lines.

When this wind is particularly strong, we can see its effect directly as particles from the solar wind enter and interact with the Earth's atmosphere. They cause eerily beautiful phenomena such as the aurorae, commonly known as the northern and southern lights.

Occasionally, the Sun's magnetic field accelerates clumps of material to incredible speeds, resulting in a violent expulsion of high-energy particles known as a coronal mass ejection.

These high-energy particles can pass effortlessly through spacecraft walls, threatening the safety and health of any people on board and causing electronics to malfunction. They can also affect satellites, GPS systems, and power grids here on Earth. The International Space Station plans for scenarios like this, with areas shielded by extra-thick padding for astronauts to huddle inside.

Predicting space weather accurately is still a challenge, but many observatories constantly monitor the Sun in near real-time. They track the active patches of the solar surface — areas where the Sun's magnetic field is much stronger — in the hope of spotting warning signs for when these often unpredictable eruptions might take place.

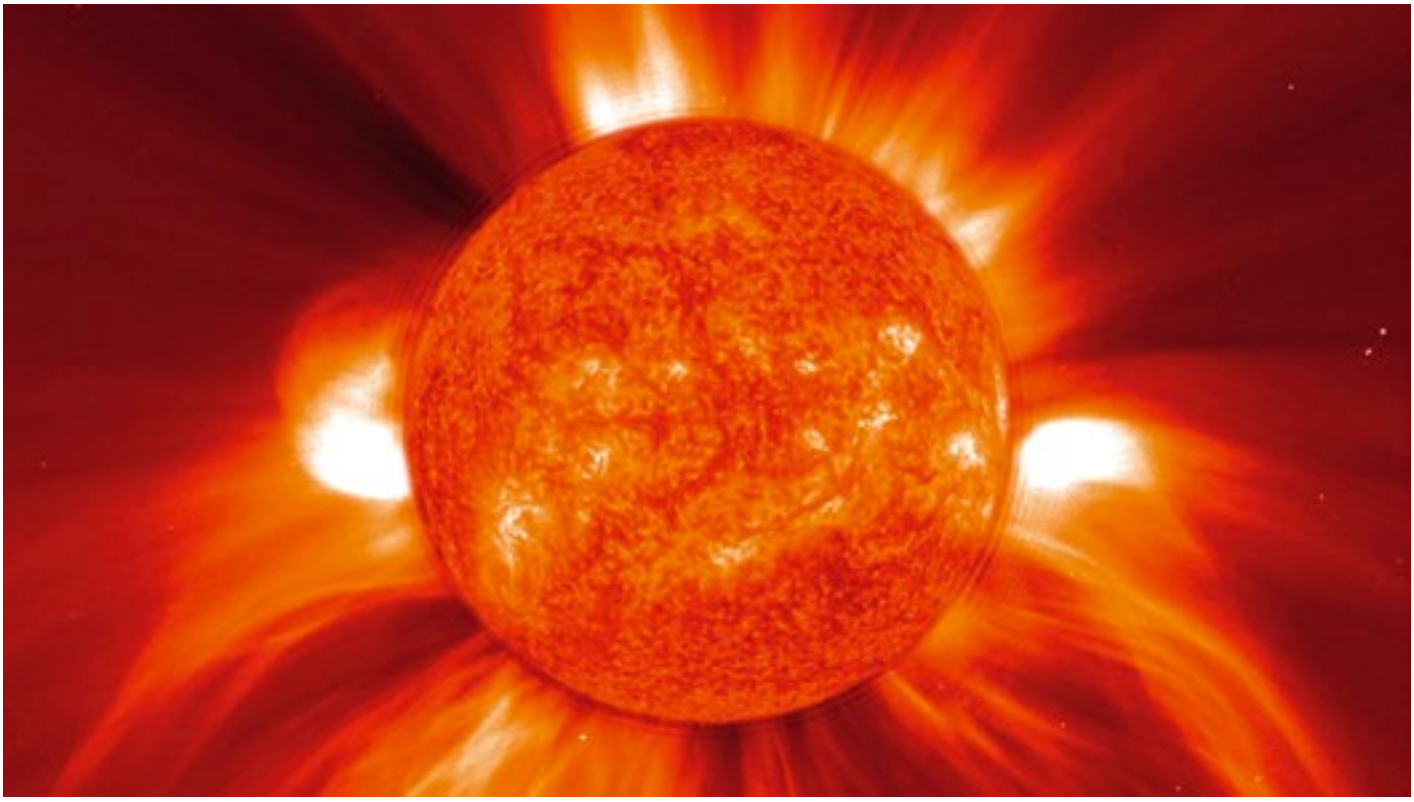

Figure 1. *In this image a widely spreading coronal mass ejection blasts more than a billion tonnes of matter out into space at millions of kilometres per hour. Credit: Courtesy of SOHO/LASCO consortium. SOHO is a project of international cooperation between ESA and NASA*