

An introduction to space weather forecasting

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Abstract

The sun emits energy in many different forms – not only sunlight, but also other parts of the electromagnetic spectrum, as well as relativistic particles, and the bulk plasma and embedded magnetic field of the solar wind.

Many of these components are considerably more variable than sunlight, and these variations can have impacts on human activities – the sharp increase in UV and x-ray radiation from solar flares can ionise Earth’s upper atmosphere, hampering communication and positioning signals which need to travel through or bounce off the ionosphere. Likewise certain configurations of the magnetic field in coronal mass ejections (CMEs) are less benign than those of the normal solar wind, and can induce unwanted currents in conductors on Earth, such as power lines, potentially causing grid failures for extreme events.

“Space weather” is the term used for these short term variations from normal conditions in the space environment comprising the sun, interplanetary space, Earth and other planets. The impacts on human activities mean there is a need to forecast these variations, much as predictions are made for terrestrial weather in order to forecast damaging changes such as hurricanes.

The Met Office is one centre which issues space weather forecasts – forecasters from the Met Office Space Weather Operations Centre (MOSWOC) work 24/7 to interpret observations and models of the sun, interplanetary space, all the way down to Earth’s surface to issue forecasts and warnings for Earth and other planets. Providing accurate, timely and useful forecasts is as hard in space as it is on Earth, requiring strong science and models, good observations, and considerable forecaster experience in interpreting these, and issuing forecasts.

This session will give participants a practical and holistic introduction to space weather forecasting. You will not only perform some of the technical work underpinning flare and CME forecasts, but also issue an actual forecast, to gain experience in communication considerations vital to effective forecasting. The session does not assume that you have any prior space weather expertise – only that you are numerate and motivated!



A MOSWOC forecaster, hard at work. The various screens show observations and models of the sun, interplanetary space, and ionosphere, as well as the forecast being prepared (far left).