

SPACE WEATHER

The most interesting dangerous weather you've probably never had to think about – until now.

Space weather is activity on the sun's surface resulting in a great burst of ionising radiation and powerful magnetic fields being flung out into the solar system and, occasionally, towards Earth.

The Earth's atmosphere and magnetic field usually shield us from the everyday effects of the sun. But when powerful solar explosions occur, the potential effects on our planet and technology range from the beautiful

to the incredibly disruptive – and can have very serious outcomes for the critical systems used in aviation.

To understand how the sun's activities can affect aviation, first we need to understand the role of Earth's ionosphere. The ionosphere extends upwards from 80 km above Earth's surface and consists of charged particles. Satellite-based communication, navigation, and surveillance systems rely on transmissions of signals



through the ionosphere. Solar events that modify the density and structure of the ionosphere can make the signals of one or more satellites impossible to track. This 'loss-of-lock' may result in reduced positioning accuracy or, in worst case, a denial of global navigation satellite system (GNSS) service.

High-frequency (HF) radio communications also utilise the ionosphere, with radio waves bouncing off it to enable long-range communication systems. When solar activity results in the ionosphere losing its ability to reflect those waves, HF communications are disrupted.

It's not only navigation and communications that can be affected by space weather. During a solar radiation storm, highly energetic charged particles can slip past the earth's magnetic field, resulting in amazing shows of aurora or, more seriously, potentially dangerous levels of radiation affecting aircraft occupants and on-board electronics.

During an extreme space weather event, these types of effects could occur simultaneously. The last recorded was the 'Carrington event' of 1859, when brilliant aurora were observed in tropical latitudes. Telegraph systems across Europe and North America failed as currents were induced

along the lines by changes in Earth's magnetic field. The likelihood of a similar event occurring in the next 50 years is estimated to be around 30 percent, with the global economic impact likely to be trillions of dollars.

Recognising the technical and safety risks of space weather, the International Civil Aviation Organization (ICAO) Meteorological Panel set up an advisory system to alert the aviation industry on probable occurrence of space weather events caused by the sun, and expected impacts on the system.

These space weather advisories will be provided from late 2019, issued as necessary, and covering effects on HF or satellite communications, on GNSS-based navigation and surveillance, and on the intensity of radiation levels affecting crew and passengers.

Anticipating and planning for degraded performance of communication and navigation systems adds to the margins of safety. Often degraded performance is unavoidable, but being ready to respond to it with a pre-conceived plan is the safest way to go.

For more information on space weather and the new space weather advisory system for aviation, search for 'space weather' on our website. ➡