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Managing Space Weather risks - the example of aviation

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As our dependency on technology has increased, we have become vulnerable to the effects of space weather. How badly we are affected depends on many factors; our ability to mitigate the effects depends on access to relevant informations on timescales that are usable. Aviation is one of the systems affected and with the growth of air travel the potential impacts of space weather must be understood and addressed. Mitigating the effects for aviation highlights the problems of forecasting space weather phenomena and disseminating the information and is used as an example.

Changes in the ionosphere caused by space weather effects can disrupt HF communications and also reduce the accuracy of satellite navigation systems. In addition, some intense solar flares can produced increased levels of cosmic radiation that add to the enhanced exposure already experienced at higher altitudes and latitudes. How seriously these effects affect a particular airline depends on where it is based and the route system it operates. Severe effects could present a hazard to the safe operation of aircraft, particularly those that could affect to aircraft movements in crowded airspace.

In common with the response to severe terrestrial weather, flights might be delayed or rerouted because of concerns over space weather - the need for airlines to support continued operations means that cancelling a flight is not a desirable option. The lead time need to plan flights and restrictions on how quickly air traffic management can respond to events limits how space weather information can be used. Given access to the necessary data, the onset of ionospheric effects caused by changes to the solar wind can be anticipated to an extent and changes to operations planned. Currently the onset of flares cannot be forecast - only the probability of occurrence can generated. When an event does occur, now-casting might permit air traffic management systems

to take action if it is required.

It is therefore important to examine the nature and severity of the hazards and investigate whether there are ways to mitigate the effects that do not require access to space weather information. This allows us to identify which effects are most important and what information must be gathered and on what times scales. Creating a data environment that facilitates forecasting and now-casting could enhance safety and has the potential of saving the airlines large amounts of money.

The same exercise is required for all areas affected by space weather so that any data system provides what is required and meshes into existing structures for decision making and dissemination.