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Tracking heliospheric transients –paths towards space weather services

This paper will explore at a conceptual level how the tracking of heliospheric transients (coronal mass ejections and co-rotating interaction regions) can lead to novel space weather services that can mitigate impacts on power grids, satellite navigation and timing systems, HF radio communications and spacecraft. The aim is to go beyond the usual bland statements about space weather impacts from heliospheric research –and look at the complex chain of physics that links the solar wind to space weather environments in Earth's radiation belts, plasmasphere, ionosphere, atmosphere, oceans and lithosphere. An awareness of this chain is critical to the practical exploitation of our growing ability to track heliospheric transients and can help us identify critical issues for future work. The paper will show that two kinds of alerts are feasible in the short- and medium-term: (a) Amber alerts –linked to the predicted time of arrival of a transient at Earth and raising awareness that the risk level is increased, but not yielding details specific to particular applications; and (b) Indices –predictions of key solar-terrestrial indices, providing statistical estimates of future risk levels linked to space weather environmental parameters that are directly relevant to particular applications. We will also show that more sophisticated services will be possible in the long-term, but these are dependent on advances in space weather modeling.

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