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Technique for observation derived boundary conditions for Space Weather

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We propose a new efficient and accurate modelling technique suitable for the next generation of Space Weather predictive tools. Specifically, we put forward an approach that can provide interplanetary Space Weather forecasting models with an accurate time dependent boundary condition of erupting flux ropes in the upper Solar Corona. The unique strength of this technique is that it follows the time evolution of coronal magnetic fields directly driven from observations and captures the full life span of magnetic flux ropes from formation to ejection.

To produce accurate and effective boundary conditions we couple two different modelling techniques, MHD simulations with quasi-static non-potential modelling.

Our modelling approach uses a time series of observed synoptic magnetograms to drive the non-potential evolution model of the coronal magnetic field to follow the formation and loss of equilibrium of magnetic flux ropes. Following this a MHD simulation captures the dynamic evolution of the ejection phase of the flux rope into interplanetary space.

We focus here on the MHD simulation that describes the ejection of two magnetic flux ropes through the solar corona to the outer boundary. At this boundary we then produce time dependent boundary conditions for the magnetic field and plasma that in the future may be applied to interplanetary space weather prediction models.

We illustrate that the coupling of observationally derived quasi-static non-potential magnetic field modelling and MHD simulations can significantly reduce the computational time for producing realistic observationally derived boundary conditions at the boundary between the corona and interplanetary space.