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Observation-based modelling of the energetic storm particle event of 14 July 2012

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In this work, we model the energetic storm particle (ESP) event of 14 July 2012 using the energetic particle acceleration and transport model named PARADISE (PArTicle Radiation Asset Directed at Interplanetary Space Exploration), together with the solar wind and coronal mass ejection (CME) model named EUHFORIA (EUropean Heliospheric FORcasting Information Asset). The CME generating the ESP event is simulated by using the spheromak model of EUHFORIA, which approximates the CME's magnetic field as a linear force-free spheroidal magnetic field. The energetic particles are modelled by injecting a seed population of 50 KeV protons continuously at the CME-driven shock wave. The simulation results illustrate both the capabilities and limitations of the utilised models.

We find that for energies below 1 MeV, the simulation results agree well with the upstream and downstream components of the ESP event observed by the Advanced Composition Explorer (ACE). This suggests that these low-energy protons are mainly the result of interplanetary particle acceleration. In the downstream region, the sharp drop in the energetic particle intensities is reproduced at the entry into the following magnetic cloud, illustrating the importance of a magnetised CME model.

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