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Connecting Coronal Mass Ejections to their Solar Active Region Sources

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Severe space weather events have the potential to significantly impact a range of vital technologies on Earth and in near-Earth space. Understanding the processes involved in the solar eruptions that cause these events is imperative to provide accurate space weather forecasts. Coronal mass ejections (CMEs) and other solar eruptive phenomena can be physically linked by combining data from a multitude of ground-based and space-based instruments as well as models, however this can be challenging for automated operational systems.

The EU FP7 HELCATS project provides data from heliospheric imaging onboard the two NASA/STEREO spacecraft in order to track the evolution of CMEs in the inner heliosphere. From a catalogue of nearly 2,000 CME events, an automated algorithm has been developed to connect the CMEs observed by STEREO to any corresponding solar flares and active region sources on the solar surface. CME kinematic properties, such as speed and angular width, are compared with active region magnetic field properties, such as magnetic flux, area, and polarity line characteristics.

This large database provides insight into the link between CME and flare events, as well as characteristics of eruptive active regions. The automated method may prove useful for future operational CME forecasting efforts.