Geophysical Research Abstracts
Vol. 16, EGU2014-8454, 2014
EGU General Assembly 2014

Automated transient detection in the STEREO Heliospheric Imagers.

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Since the launch of the twin STEREO satellites, the heliospheric imagers (HI) have been used, with good results, in tracking transients of solar origin, such as Coronal Mass Ejections (CMEs), out far into the heliosphere. A frequently used approach is to build a "J-map", in which multiple elongation profiles along a constant position angle are stacked in time, building an image in which radially propagating transients form curved tracks in the J-map. From this the time-elongation profile of a solar transient can be manually identified. This is a time consuming and laborious process, and the results are subjective, depending on the skill and expertise of the investigator. Therefore, it is desirable to develop an automated algorithm for the detection and tracking of the transient features observed in HI data. This is to some extent previously covered ground, as similar problems have been encountered in the analysis of coronagraph data and have led to the development of products such as CACtus etc. We present the results of our investigation into the automated detection of solar transients observed in J-maps formed from HI data. We use edge and line detection methods to identify transients in the J-maps, and then use kinematic models of the solar transient propagation (such as the fixed-phi and harmonic mean geometric models) to estimate the solar transients properties, such as transient speed and propagation direction, from the time-elongation profile.

The effectiveness of this process is assessed by comparison of our results with a set of manually identified CMEs, extracted and analysed by the Solar Storm Watch Project. Solar Storm Watch is a citizen science project in which solar transients are identified in J-maps formed from HI data and tracked multiple times by different users. This allows the calculation of a consensus time-elongation profile for each event, and therefore does not suffer from the potential subjectivity of an individual researcher tracking an event. Furthermore, we present preliminary results regarding the estimation of the ambient solar wind speed from the automated analysis of the HI J-maps, by the tracking of numerous small scale features entrained into the ambient solar wind, which can only be tracked out to small elongations.