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The 17 January 2005 complex solar radio event associated with interacting fast Coronal Mass Ejections

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On 17 January 2005 two fast coronal mass ejections (CME_1 and CME_2), in close succession, were recorded, during a 3B/X3.8 flare in NOAA AR 720 (N15° W25°). They were, both, accompanied by metre-to-kilometre type-III groups tracing energetic electrons escaping into the interplanetary space. Although the decametre-to-hectometre spectral signatures of the two type-III groups appeared similar, the metric radio emission reveals distinctive differences that corroborate evolving acceleration regions in the corona. Two decametre-to-hectometre type-II bursts detected on dynamic spectra were attributed to the shock waves driven by CME_1 and CME_2 respectively. A peculiar type-III burst was observed at the intersection, on the dynamic spectrum, of the two CME fronts (at $\approx$ 37) and it was, therefore, associated with the CME_1-CME_2 interaction. The flare/CME events under discussion were clearly related with enhanced fluxes of near-relativistic electrons at 1 AU, as observed by the EPAM experiment onboard ACE. The Sun to Earth transit-time estimation of the energetic electrons indicates two or three distinct injection episodes. This report provides evidence that a variety of acceleration regions contribute to energetic electrons escaping to interplanetary space. The role of shock acceleration is clearly established at low energies, by the type II radio emission. We compare the pros and cons of shock acceleration and acceleration in the course of magnetic reconnection for the escaping electron beams (type III bursts and in situ measurements). This work shows again that combined analyses of SEP and electromagnetic emission provide new insight into the solar origin of SEP events. To enable more systematic studies, a consortium of several European groups is starting the SEPServer project, funded by the European Commission's FP7 programme, which aims at building a database for SEP events and associated radio, gamma-ray and hard X-ray observations.