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Propagation, in-situ signatures and geoeffectiveness of consecutive solar eruptions simulated in different solar wind conditions

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Coronal Mass Ejections (CMEs) are some of the most energetic solar events that expel plasma and magnetic field into the interplanetary medium. Stealth CMEs represent a special type of solar eruptions that, in most cases, can be clearly seen in coronagraph observations, but lack distinct source signatures. We simulate consecutive CMEs ejected from the southernmost part of an initial configuration constituted by three magnetic arcades embedded in a globally bipolar magnetic field. The first eruption is driven through shearing motions at the solar surface. The following eruption is either a stealth blob-like CME, resulting from the reconnection of the coronal magnetic field, or another shearing driven flux rope. All CMEs are expelled into a bimodal solar wind.

We analyse the parameters that contribute to the occurrence of the second CME, as well as its influence onto the first eruption during the propagation to 1AU by simulating also a single erupting flux rope.

We track the two double-CME cases until Mercury and 1AU, and compare their simulated signatures with the in-situ data of a similar multiple CME event that occurred between 21-22 Sept. 2009, obtaining a good correlation.

Furthermore, we impose the same shearing speeds along the polarity inversion line of the southern arcade, but immersed into a faster solar wind, to analyze the effect of the overall magnetic structure and of the wind onto the resulting eruptions, propagation and geoeffectiveness. The latter is studied via the Dst index, computed using an empirical model from the simulated parameters of the ICMEs.

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