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Initiation of Stealth CMEs: Clues from Numerical Modelling and In-Situ Comparisons

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Coronal Mass Ejections (CMEs) are huge expulsions of magnetized plasma from the Sun into the interplanetary medium. A particular class of CMEs are the so-called stealth CMEs, i.e. solar eruptions that are clearly distinguished in coronagraph observations, but they don't have a clear source signature. Observational studies show that about 60% of stealth CMEs are preceded by another CME whose solar origin could be identified.
In order to determine the triggering mechanism for stealth CMEs we are using the MPI-AMRVAC code developed at KU Leuven. 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 a stealth CME resulting from the reconnection of the coronal magnetic field. Both CMEs are expelled into a bimodal solar wind.
We analyse the parameters that contribute to the occurrence of the second CME. We obtain 3 different eruption scenarios and dynamics by changing the shearing speed with only 1%. The difference between the 3 cases consists in the characteristics of the second CME, which can be a failed eruption, a stealth CME, or a CME with a traceable source.
Furthermore, we compare the simulated signatures of the CMEs with the measured in-situ data from Messenger and ACE spacecraft and obtain a good correlation in arrival time and magnetic field components.
This study aims to better understand the triggering mechanism of stealth eruptions and improve the forecasting of their geomagnetic impact.