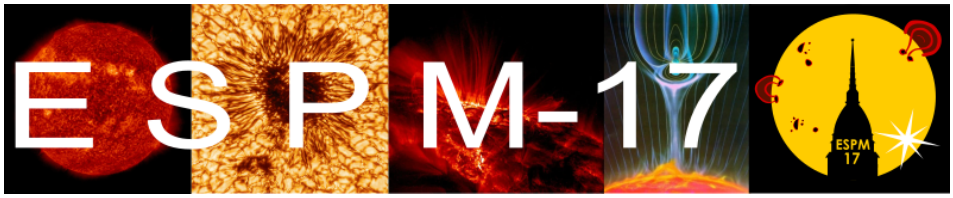

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Forecasting the propagation and evolution of CMEs using the space weather simulation chain: COCONUT + EUHFORIA

EUHFORIA is a space weather forecasting tool used to predict the geo-effectiveness of coronal mass ejection (CME) impacts. In this 3D MHD simulation, magnetic structures evolve in the heliosphere after being injected into the domain at 0.1 AU. The accuracy of EUHFORIA's predictions strongly depends on the coronal model used to initiate the solar wind and the properties of the CME model inserted to model real events. However, by inserting the CME at 0.1 AU, EUHFORIA does not account for the interaction of the CME with the solar wind near the corona.

These interactions, crucial for accurately assessing the magnetic and thermodynamic properties of the CME, can be studied using another simulation—a global MHD coronal model named COCONUT. COCONUT can track the evolution of flux rope models from the solar surface to 0.1 AU within a realistic description of the solar wind derived from observed magnetograms.

I will present how COCONUT can be coupled with EUHFORIA to dynamically track the propagation of a CME from the Sun to Earth. For this purpose, the outer boundary of COCONUT serves as the inner boundary for EUHFORIA. We tested the coupling through a series of joint runs. In all runs, the magnetic structure of the CME model used in COCONUT (either the Titov-Démoulin flux rope model or the RBSL model) successfully transfers from the coronal to the heliospheric model. The same applies to plasma properties. For example, the sheath that formed in COCONUT ahead of the CME continues to develop in EUHFORIA.

Primary author: LINAN, Luis (KU Leuven)

Co-authors: BARATASHVILI, Tinatin (KU Leuven); Prof. POEDTS, Stefaan (KU Leuven); Dr LANI, Andrea (KU Leuven); SCHMIEDER, Brigitte (Observatoire de Paris); BRCHNELOVA, Michaela (KU Leuven); Dr GUO, Jinhan (KU Leuven)

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