DATA-DRIVEN MODELING OF SOLAR ERUPTIONS

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The knowledge of the magnetic field is a crucial parameter in understanding the formation, eruption and subsequent evolution of coronal mass ejections (CMEs) as well as their various effects in planetary space environments. However, coronal magnetic fields within CME flux ropes cannot be yet routinely measured. In this work, we present our data-driven modeling principle designed to tackle specifically the question of predicting the magnetic structure of CME flux ropes. Our modeling scheme consist of 1) non-potential model of the coronal magnetic field up to 2.5 solar radii from the Sun, which uses high-quality photospheric vector magnetograms from Solar Dynamics Observatory (SDO), 2) a versatile flux rope magnetic field model, and 3) a three-dimensional MHD model that computes self-consistently the dynamics in the inner heliosphere from 0.1 AU up to the orbit of Mars (Euhforia). The key feature of this modeling scheme is that we will obtain magnetic field parameters within the flux rope self-consistently from the data-driven inner coronal model. We showcase results of the modeling using well-observed case studies and discuss future horizons of our model-