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Poster
Understanding Coronal Mass Ejections (CMEs) and their impact on the geomagnetic environment is among the most critical questions of space weather. The recent advances in physics-based CME modeling resulted in the development of extensive simulation datasets covering a broad range of scenarios and allowing data-intensive techniques, such as machine learning, to assist with the exploration and understanding. In this work, we present the machine learning-ready dataset constructed based on the existing grid of the GAMERA-GL simulations of the CMEs propagating in the inner Heliosphere. The dataset has three background solar wind options (corresponding to the solar activity minimum, and its rising and falling phases) and has the Gibson-Low flux rope of varying properties initiated at different locations, resulting in ?23,000 complete simulation runs and ~7.4M unique timeseries of solar wind properties at hypothetical L1 locations. We consider the applications of this dataset to two problems: (1) development of the surrogate model for the CME time series at L1 point, and a related problem of the forecasting of geoeffective CME properties, and (2) development of the inverse model constraining magnetic field properties of the CME close to the Sun based on the L1 time series dynamics and CME geometry. The results highlight how combining the extensive simulation grids and machine learning approach can help us understand the CME dynamics and enhance space weather forecasting.
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