Modelling coronal mass ejection flux ropes signatures using Approximate Bayesian Computation: applications to Parker Solar Probe

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We present an updated three-dimensional coronal rope ejection (3DCORE) model and an associated pipeline that is capable of producing extremely large ensembles of synthetic in-situ magnetic field measurements from simulated coronal mass ejection flux ropes. The model assumes an empirically motivated torus-like flux rope structure that expands self-similarly and contains an embedded analytical magnetic field. Using an Approximate Bayesian computation (ABC) algorithm we validate the model by showing that it is capable of qualitatively reproducing measured flux rope signatures. The ABC algorithm also gives us uncertainty estimates in the form of probability distributions for all model parameters. We show the first results for applying our model and algorithms to coronal mass ejections observed in situ by Parker Solar Probe, specifically the event on 2018 November 12 at 0.26AU, where we attempt to reproduce the measured magnetic field signatures and furthermore reconstruct the global flux rope geometry.