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Current-loop parameterization of external field sources for satellite induction studies

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In order to recover the three-dimensional distribution of electrical conductivity from the Swarm satellite data, an accurate model of the magnetospheric field is needed. Until now, the satellite signals of magnetospheric origin were parameterized using spherical harmonics. However, the 3-D inversions of Swarm data using this approach have not yet provided acceptable results. We propose to use an alternative parameterization based on a current-loop model of the external sources in the time domain, following a similar frequency-domain approach by Sun et al. (2015). Such approach should be able to achieve more detailed spatial description of the magnetospheric currents, while avoiding the use of large number of model parameters. As an added value, such a parameterization will permit us to account for the electric currents flowing in polar ionosphere (PEJ), and hopefully to extend the usefulness of high-latitude data. We will present the general methodology that allows for an arbitrary position and orientation of any number of current loops, taking into account the induction effect from an a-priori conductivity model. A Bayesian method based on the parallel tempering approach is used to solve the inverse problem. Our initial computations are aimed to exploit the ground-based observatory data, and to establish the sensitivity of model parameters.