STORM-TIME EVOLUTION OF THE MAGNETOSPHERIC STRUCTURE INFERRED FROM A NONLINEAR SPATIO-TEMPORAL EMPIRICAL MODELING OF THE GEOMAGNETIC FIELD

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A recently developed novel technique based on an extensible model for the field of equatorial currents that uses large sets of spacecraft data has been shown to dramatically improve the spatial resolution of the empirical picture of the magnetospheric magnetic field. Since the data accumulation, necessary for high resolution in space, may be too long and smear out important dynamical effects, a new nonlinear data-binning technique has been devised, where the spatial structure of each state of the magnetosphere is described by fitting the model to a local subset of data. It includes both the actual data obtained for the given state and data from other time intervals (e.g., similar phases of other magnetic storms), neighboring the present state in the space of global parameters, solar wind electric field, geomagnetic activity index *Sym-H*, and its time derivative. New findings in the picture of magnetic storms emerging from the new model include a consistent description of the ring current density peak in the postmidnight sector during the main phase and the premidnight depression of the equatorial magnetic field. The model also shows a strong erosion of the ring current on the dayside at the early main phase and its enhancement in a broad area in the evening sector extending from the geosynchronous orbit to the magnetopause near the *Sym-H* minimum. Another interesting effect is a double partial ring current at the main phase, consistent with the energy density profiles derived from energetic neutral atom images.