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Time-dependent, maximum entropy regularized core-field models from satellite data

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High precision magnetic measurements from the Oersted, CHAMP and SAC-C satellites are now available that span the past 8 years. This poses a challenge for those interested in understanding the origin and evolution of the main field generated in Earth's core: How should such data be modelled to extract the maximum information concerning core field structure, its evolution and the underlying magnetohydrodynamic processes?

In this talk, I will present 3 new core field models. All are constructed from the CHAOS data set (Olsen et al., 2006), with 1st order corrections applied for the large scale magnetospheric field and the crustal field (from the GRIMM model of Lesur et al., 2008). Account is taken of anisotropic errors due to the satellite measurement setup, and an attempt is made to take account of addition correlations due to fluctuations in ring and auroral oval currents (Holme et al, 2003, Fujii and Schultz, 2002). An L1 measure of misfit, without data rejection, is also employed to down-weight the influence of outliers. The 3 models are also regularized in space and time at the core mantle boundary so are suitable for future use in core flow studies. One model has quadratic regularization in both space and time, another has quadratic regularisation in time but maximum entropy regularization in space, while the remaining has maximum entropy regularization in both space and time. The method of Gillet et al. (2007) is used to carry out the maximum entropy regularization. The properties of these models and their limitations will be described. The importance of combining high resolution satellite field models with longer period historical field models will be discussed.