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CONTROL ID: 968638

TITLE: CHAOS-4 – A high-resolution geomagnetic field model derived from low-altitude CHAMP data

PRESENTATION TYPE: Poster Requested

CURRENT SECTION/FOCUS GROUP: Geomagnetism and Paleomagnetism (GP)

CURRENT SESSION: GP03. Geomagnetic Field Modeling and Interpretation of Satellite, Observatory, Marine, and Aeromagnetic Data

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Title of Team:

ABSTRACT BODY: Data from the CHAMP satellite provide an excellent opportunity to model small-scale structures of the crustal field, due to the relatively low altitude of the satellite. Of special interest for this are data from the last months of the mission, when satellite altitude was below 300 km.

We present CHAOS-4, a new version in the CHAOS model series, which aims to describe the Earths magnetic field with high spatial resolution (terms up to spherical degree n=85 for the crustal field, and up to n=16 for the time-varying core field are robustly determined) and high temporal resolution (allowing for investigations of sub-annual core field changes).

More than 11 years of data from the satellite Ørsted, CHAMP and SAC-C satellites, augmented with ground observatory monthly mean values have been used for this model. Maximum spherical harmonic degree of the static (crustal) field is n=100. The core field time changes are expressed by spherical harmonic expansion coefficients up to n=20, described by order 6 splines (with 6-month knot spacing) spanning the time interval 1997.0 to 2011.0. The third time derivative of the squared magnetic field intensity is regularized at the core-mantle boundary. No spatial regularization is applied for the core field, but the high-degree crustal field is regularized for n>85.

As part of the modeling effort we co-estimate a model of the large-scale magnetospheric field (with expansions in the GSM and SM coordinate system up to degree n = 2 and parameterization of the time dependence using the decomposition of Dst into external (Est) and induced (Ist) parts) and perform an in-flight alignment of the vector data (co-estimation of the Euler describing the rotation between the coordinate systems of the vector magnetometer and of the star sensor providing attitude information).

The final CHAOS-4 model is derived by merging two sub-models: its low-degree part has been derived using similar model parameterization and data sets as used for previous CHAOS models (but of course including newer satellite observations), while its high-degree crustal field part is solely determined from low-altitude CHAMP satellite observations after 2009.
http://www.spacecenter.dk/files/magnetic-models/CHAOS-4/

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