About SPP 1788

The system “Earth” changes continuously. Variations of the Earth’s interior, the atmosphere, oceans, and near-Earth space give rise to changes in global potential fields, particularly in Earth’s magnetic and gravity fields. The underlying processes can be identified and studied through monitoring and analysis of fundamental geomagnetic and gravity parameters.

Swarm mission and satellites

Geomagnetism

The focus of this topic is to study the dynamics and evolution of Earth’s magnetic field. The projects within this area focus on analyzing the magnetic field contributions from Earth core, lithosphere, magnetosphere, ionosphere, from oceanic currents and mantle induction. For this, they rely on data analyses, empirical modeling and geodynamo simulations.

Kalmag model – candidate for IGRF-13

New approach to derive a geomagnetic field model from direct measurements of the Earth’s magnetic field with CHAMP and Swarm data.

Using Kalman filter method to predict further spatio-temporal development.

Link to model of Potsdam university: https://ionocovar.agnld.uni-potsdam.de/Kalmag/

Baerenzung, Holschneider (2021)

More information about the Swarm mission:

earth.esa.int/eogateway/missions/swarm

www.spp-dynamicearth.de/en

Gravitation

In this subject area the global variations of mass and mass balance are investigated, as well as their interactions and exchange mechanisms (hydrological cycle, ice melting in the polar regions, sea-level fluctuations, groundwater, interaction with anthropogenic influences, tidal of crust and atmosphere). We will focus on gravity field variations and high-resolution models of the gravity field.

 doctorate and more realistic results for the dynamo equations.

Kalmag model – candidate for IGRF-13

We use the method of a Principal Component Analysis to extract the global trend of a geophysical field from satellite data, as well as mass changes in selected areas (right panel).

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Baerenzung, Holschneider (2021)

More information about all projects in SPP1788:

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Ionospheric Currents

This topical area addresses E-region ionospheric current systems and field-aligned currents. The topics of this area are the variability of the upper atmosphere, the interaction between ionospheric processes and neutral gas, and the role of the ionosphere on energy budgets of the atmosphere, oceans, and the Earth's magnetic field. For this, we will conduct measurements of ionospheric and field-aligned currents with the Swarm satellites.

Ionospheric/Thermosphere Coupling

This subject area is devoted to the quantification of solar contributions (CME, solar energetic particles) to the variability of the upper atmosphere, the interaction between ionospheric processes and neutral gas, and the role of the ionosphere on energy budgets of the atmosphere, oceans, and the Earth's magnetic field. For this, we will conduct measurements of ionospheric and field-aligned currents with the Swarm satellites.

Rodriguez-Zuluaga et al. (2021)

He, Chau et al. (2020)

Closing the 11-months-gap between GRACE/GRACE-FO

GRACE

Swarm-only

Swarm-Reconstruction

Equatorial Plasma Depletions in the Ionosphere

Field aligned currents (FAC) flow along the edges of the EPO zones in interhemispheric direction.

Magnetoospheric protons contaminate XMM-Newton X-Ray telescope

Using a machine learning approach we derive a model to predict the contamination and learn physics behind.

Future missions should minimize observations associated with high solar wind speed and avoid closed magnetic field lines.

He, Chau et al. (2020)

Kronberg et al. (2020)

More information about all projects in SPP1788:

www.spp-dynamicearth.de/en

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DynamicEarth

SPP 1788

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