



Towards an improved Lithospheric Field recovery through Magnetic Space Gradiometry

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In the near future, the Swarm constellation mission will provide a mapping of the Earth's magnetic field, which is superior to the one that is possible with the present missions Ørsted, CHAMP and SAC-C. However, no follow-up mission is presently planned to continue the geomagnetic field exploration after 2016.

In this study, we look towards the years after Swarm by simulating a magnetic gradiometry mission emphasising the benefits of measuring the full gradient tensor in space. Using simulated orbits from a low Earth-orbiting satellite, synthetic data of the magnetic field vector and of the nine elements of the magnetic gradient tensor are calculated using a given (input) magnetic field model for the various field contributions. These include the core field with its secular variation, the lithospheric field, and the magnetospheric as well as ionospheric primary and induced field. From those synthetic data, we estimate field models using either the magnetic vector field measurements only or full gradient observations, and compare our models' retrieval with the original (input) model.

The results show that a retrieval of primarily the lithospheric field (but also of the core field and its secular variation) is significantly improved when using gradient observations compared to vector field data only. Moreover, gradient data filter out the highly time dependant contributions of the magnetosphere and ionosphere, providing an accurate reconstruction of the main field without the need for explicit modelling of those field contributions.

This study shows qualitatively the scientific benefit of measurements of the gradient tensor in space.