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Global and local high-resolution magnetic field inversion using spherical harmonic models of individual sources

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Inverting satellite and airborne magnetic data with a common model is challenging due to the spectral gap between the data sets, but needed to provide meaningful models of lithospheric magnetisation.

Here, we present a step-wise approach, where first spherical prisms (tesseroids) are used for global magnetic inversion of satellite-acquired lithospheric field models and second airborne data re inverted in their suitable spectral range for added details. For the synthetic test, the susceptibility model of Hemant (2003) was used as a starting point to calculate the spherical harmonic model of each tesseroid in the model. The resulting spherical harmonic coefficients were inverted for magnetic susceptibility in the global model, where the geometry is based on seismic or gravity observations. The projected gradient method is used to avoid negative susceptibilities in the result. After the global inversion, high-resolution local tile-wise inversion together with synthetic airborne data within a different wavelength range is performed for even higher resolution results.

The approach is applied to the Swarm-derived LCS-1 field model and for selected areas with high-resolution aeromagnetic coverage.