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# Assessing the effect of the satellite polar gap on lithospheric field models using spherical Slepian functions

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In global models the magnetic field is typically represented using spherical harmonic functions weighted by a set of numbers known as Gauss coefficients. This representation allows global values of the field to be calculated at any point and height but has limitations when attempting to isolate the contribution to the field from specific areas or regions. Spherical Slepian functions provide an alternative mathematical basis to represent the field. They have the advantage of allowing an area of interest to be optimally described in a spatio-spectral sense. In addition, spherical Slepian functions can also be used to separate and decompose the Gauss coefficients from a magnetic field model into the components that represent the contribution to the model from individual regions of the globe.

Global spherical harmonic lithospheric field models produced from satellite data suffer from a lack of data in the polar gap regions ($\sim$3° latitude cap) due the specific orbital configuration of such missions. The gap affects the zonal harmonics at degree 60 and above, leading to aliasing of signal and issues between high degree lithospheric models. We use spherical Slepian functions to model the lithospheric field in the region where data are available ($\pm$ 87° latitude) thus excluding the polar gap. We investigate the differences between our derived model and other available lithospheric field models such as MF7 and CHAOS-4.

We first show that using spherical Slepian functions with simulated data from a lithospheric field model in a closed loop can recreate the input model. We then simulate the effect of a polar gap in the data. Finally, we show the resulting models using CHAMP and Oersted satellite data.