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Including Variometers in Geomagnetic Field Interpolation

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One of the best tools we have in geophysical modelling is the ability to interpolate the horizontal geomagnetic field at the surface of the Earth. This is especially useful in regions, such as southern Africa, where there is a sparse array of absolute magnetometers available for geomagnetic field measurements. In terms of geomagnetic field interpolation, the spherical elementary current systems (SECS) spatial interpolation scheme has shown to be very successful, and the planar approximation of this method adequate for modelling at mid-latitudes. The SECS interpolation scheme is physics based, making use of the Biot-Savart law and equivalent ionospheric currents to interpolate measured geomagnetic field data. As with most interpolation methods, more data points result in lower error. Therefore, we adapt the SECS method to work with variometers. These instruments measure variations in magnetic field and are more abundant in southern Africa. Merging the two resulting interpolated datasets, the initial absolute geomagnetic field interpolation can be significantly improved. This improved interpolation scheme is incredibly useful locally where a sparse magnetometer array is a challenge, but can be applied just as effectively in other cases across the globe where there are numerous magnetometers and variometers available.

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