The availability of high-quality data during the past decade from low-Earth orbiting satellites has allowed development of geomagnetic field models which well fit the observed magnetic field at low to mid latitudes. However, in the polar regions, due to the highly variable nature of field sources in the magnetosphere and ionosphere, significant differences (here referred to as residuals) are observed between the recorded data and the models.

The aim of this study is firstly to investigate the nature of these polar residuals, and then to find a method to improve the global models. We consider three models: CHAOS-2, T01 and CM4, and data from two satellites: Oersted and CHAMP.

We see consistent features at high latitudes in the residuals for all three models. These appear in both amplitude and direction and so are not easily interpretable as field aligned currents. We examine the implications of these consistent features for modelling of both the external and lithospheric fields at high latitude. Motivated by these results we are identifying methods to improve the models, including improved data selection criteria and the removal of spherical elementary current systems (SECS), towards the generation of better global geomagnetic field models.