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Can one estimate a global crustal magnetic field model by successive regional analysis?

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Present, spherical harmonic models from CHAMP data accounting for the crustal magnetic field are not stable beyond degree 90. Therefore, they offer a maximum spatial resolution of about 400km at the Earth's surface. Regional analysis, on the other hand, may be able to detect small features of the magnetic field not properly modeled by global spherical harmonics. Using some theoretical arguments and a new regional modeling technique, we try to infer high precision geomagnetic information which should be particularly useful for local crustal magnetic studies.

Using four years of CHAMP satellite data, we compute a lithospheric model at 400 km altitude over the entire sphere by stitching together different regional models obtained in adjacent areas. The forward model computed on a quasi-regular grid over the Earth is then used as an input for a transform to spherical harmonics by direct integration. We especially focus on the comparison between this new crustal model and the corresponding models estimated by the conventional least squares spherical harmonic estimation. We also investigate the new model's reliability and stability with increasing degree and order of the spherical harmonic expansion.