



Inverse Problems in Geodesy and Geomagnetism — Ill-Posedness, Regularization and Trial Functions

Volker Michel

University of Siegen, Geomathematics Group, Department of Mathematics, Siegen, Germany
(michel@mathematik.uni-siegen.de)

Typical examples of inverse problems in geodesy/geomagnetism are the downward continuation of satellite data (of the gravitational or the magnetic field) and the inversion of gravitational data for mass density anomalies. The latter is mathematically related to the inversion of magnetic field data for electric currents. These two tomographic problems are furthermore linked to particular inverse problems in medical imaging (inversion of EEG and MEG data).

In this presentation, we have a closer look at these inverse problems, their ill-posedness and their relations. Numerous regularization methods are known for handling these problems. Commonly, they rely on particular systems of basis functions like polynomials (such as spherical harmonics) or reproducing kernel-based functions (like radial basis functions, splines and wavelets). Also these functions have interrelations and have known pros and cons.

This talk is an attempt at a systematic approach from basic geophysical laws (like Newton's Law of Gravitation or the pre-Maxwell equations) via a better understanding of gravitational/magnetic field modelling and inversion to eventually a categorization of different types of methods and trial functions.