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Separation of fields and 3D inversion of gravity and magnetic data for the Thuringian Basin, Germany

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We have developed a new algorithm for the 3D inversion of potential field data, and we have applied it to gravity and magnetic data from the Thuringian Basin in Mid-Germany to obtain additional constraints for the basin structure. A detailed structural model is an essential boundary condition for models of fluid transport, one of the central goals of the INFLUINS project.

Our inversion approach separates the sources (i) in depth using upward and downward continuation, (ii) in the lateral direction by means of approximation with a field generated by 3D line segments, and (iii) according to the density and magnetization contrast on the basis of a pseudo-gravity calculation. Potential field anomalies are modeled either as depth variations of a density interface, or as restricted 3D bodies.

We have inverted gravity and magnetic data from the Thuringian Basin for short, intermediate and long wavelengths separately. We assume that the intermediate wavelengths are generated by anomalies in the crystalline basement ($\sim$10 km depth), while the short wavelength structure is caused by the variable thickness and structure of the basin sediments. Our 3D model for the main intermediate sources includes three low-density bodies that we interpret as granitic intrusions, and a density interface with topography within the crystalline basement. A significant arc-shaped anomaly, visible both in gravity and in magnetic data, is modeled as an uplift of the crystalline crust. More detailed models for the Tannrodaer anticline are indicative of salt tectonics: the corresponding 3D model includes an uplift of Bundsandstein and a salt deposit. We are currently working on including further constraints on the basin structure from a recently acquired reflection seismic survey.