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# Validation of semi-airborne 3D inversion results using airborne and ground-based EM methods, as well as geological models and borehole measurements

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In the DESMEX (Deep Electromagnetic Soundings for Mineral Exploration) project geophysical surveys were carried out in a mining area in Thuringia, Germany. The aim was to test two semi-airborne systems developed within the project. The semi-airborne concept combines the advantages of high power ground-based electric dipole transmitters with airborne magnetic field receivers. For this purpose, highly sensitive induction coils and SQUID magnetometers were designed and integrated as receiving sensors in the flight probes. The new semi-airborne systems will be used to investigate the electrical conductivity at depths down to 1 km and will thus primarily serve the exploration of deep deposits.
A preliminary investigation in 2015 using BGR's well-established geophysical helicopter measurement system included helicopter-borne electromagnetics (HEM), magnetics and radiometry. From this campaign information about the electrical conductivity distribution down to a depth of 150 m, the magnetic properties of the substrate and the composition of the near-surface material was determined. The HEM resistivity models are used to validate the semi-airborne models at the near surface. Since the HEM has limited exploration depth, the preliminary prospection also included large-scale ground-based measurements (Electrical Resistivity Tomography (ERT) and Long-Offset Transient-Electromagnetics (LOTEM)) for validation of the deep conductivity structures of the semi-airborne models.
Additionally a geological 3D model and a number of lithological and resistivity logs enable developing an integrated subsurface model. The logs were statistically analyzed to determine specific resistivity ranges for the different lithological units. The acquired resistivity maps were blended with the geological map and statistically analyzed.
The 3D inversion results of the two semi-airborne systems show good agreement with the HEM, ERT and LOTEM models. Near the surface, an excellent match of the resistivity models with the prevailing geology was found. Conductive structures can be reliably traced down to a depth of about 1 km.