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Magnetic vector inversion using XYZ measured by fluxgate magnetometer in UAV

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Traditionally, the inversion of magnetic data assumes the magnetization of the local geology to run parallel to the Earth's internal magnetic field that is usually modelled using International Geomagnetic Reference Field (IGRF). Assuming the magnetization parallel to the main field, only the total (scalar) magnetic data are the sufficient input for the inversion of source susceptibility.

Local magnetization may alter from the main field direction in areas of remanent magnetization. Recently, magnetization vector inversion (MVI) using the total field has become an important tool trying to distinguish magnetic data affected by remanenence. Total field as a scalar field exclude all information of the direction of the internal magnetization and more information is required to reveal any remanent magnetization from the main field direction. Compared to total field using the 3-component XYZ vector magnetic measurements provide more information of the source. More measurements increase the unambiguous nature of data and may reveal the areas of possible remanence.

To measure XYZ vector magnetic field we use fluxgate 3-component magnetometer with rigid installation on a fixed-wing UAV. With the help of accurate inertial measurement units the measured magnetic field can be determined in the direction of fixed coordinate system. The components of the measured magnetic field rotated into the geographical coordinate represent the magnetic field at survey area.

UAV survey provided the data as the input for the inversions. We made the inversion separately for both susceptibility and magnetization vector. Susceptibility inversion means inversion of induced magnetization, i.e., a single component of magnetization parallel to the main field direction. Magnetization vector inversion, however, resolves all three components of magnetization, which may or may not include remanent magnetization in addition to induced one.

The benefits from utilizing XYZ components of the magnetic field with magnetization inversion seem promising in finding remanenence magnetization.