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Integral transformations of disturbing potential onto gradiometric data

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Integral transformations of the disturbing potential onto gradiometric data are derived and investigated in this study. The gradiometric data represent six components of the disturbing gradiometric tensor given in the local north-oriented frame (LNOF). Firstly, corresponding differential operators, that relate the disturbing potential to the six components of the disturbing gradiometric tensor in LNOF, are applied to the spherical Abel-Poisson integral. This provides six new integral kernel functions which are given in both spectral and spatial forms. Secondly, truncation error formulas for each of the integral transformations are derived in the spectral form. Expressions for truncation error coefficients are also provided. Thirdly, we investigate properties of the new isotropic kernels and respective truncation error coefficients. Forth, correctness of the derived integral formulas and their truncation errors are tested in a closed-loop simulation using synthetic gravity data. The new integral formulas can be applied for calibration and/or validation purposes of the gradiometric data, such as those provided by the GOCE satellite mission. The new mathematical expressions further extend the well-known Meissl scheme, i.e. the paradigm that relates various parameters of the Earth's gravity field.