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Two alternative integral solutions of the gravimetric geoid in the era of EGM08

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Despite recent advances in global gravity field modeling through gravity-dedicated satellite missions (CHAMP and GRACE) and the release of EGM08 by the National Geospatial-Intelligence Agency, ground and airborne gravity still remain irreplaceable sources of data to determine the fine resolution of the geoid. Standard methods to model the geoid from ground gravity data are based on Green's surface integrals that represent solutions to boundary-value problems of potential theory. In the classical approach, reduced gravity is continued to a known reference surface prior to conversion into the disturbing potential. The disturbing potential is obtained by surface-integrated convolution of continued gravity with a respective Green's function. Thus, two integral equations must numerically be evaluated with one of them representing an inverse problem requiring sophisticated numerical methods. Besides stipulating the mean mass density within topography, they represent the major complication in determining the fine resolution of the geoid model. In this study, this classical approach is compared with an alternative solution that combines continuation and conversion of ground gravity in one integral equation. Both approaches are used for evaluation of the local geoid over a test region in Western Canada. Numerical computations of both approaches are compared in terms of consistency, stability and efficiency. The geoid models are also evaluated for external accuracy by using measured GPS heights at leveling benchmarks available over the test area.