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Spheroidal integral equations for recovery of the geopotential from its gradients measured by ground, airborne and satellite sensors

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First- and second-order gradients of the geopotential are measured by ground, airborne and satellite sensors. These observables are often used in geodesy for recovery of the geopotential at the Earth's surface approximated by the mean geocentric sphere using mathematical tools derived in spherical approximation. Given the Earth's flattening, surface integral equations based on Dirichlet's boundary-value problem of the potential theory for the harmonic geopotential are formulated for the geocentric biaxial ellipsoid. Numerical differences between spherical and spheroidal forms of integral kernel functions demonstrate the higher accuracy of spheroidal approximation, especially in cases of more flattened bodies than the Earth. Since ground, aerial and satellite data are collected with different accuracies, spectral contents, temporal and spatial distributions, they must be combined in order to explore their full potential for getting as complete information on the Earth's gravitational field as possible. The observation model can also be used for combined inversion of currently observable geopotential gradients while exploring their characteristics.