Ellipsoidal Corrections for Boundary Value Problems of deflection of Vertical with Ellipsoidal Boundary

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If the deflection of vertical is presented on the geoid, the earth's gravity field can be calculated with the inverse Vening-Meinesz formula under spherical approximation and the spherical harmonic coefficients of the gravity field can also be derived. Thus, if the boundary is exact sphere, the gravity field can be solved from the deflection of vertical. However, the geoid is closer to ellipsoid than sphere, so to solve the BVP of the deflection of vertical with ellipsoidal boundary is a useful work for improving the precision of the gravity field.

A comprehensive and systematic discussion for the BVP of the deflection of vertical with ellipsoid boundary is given in the study. By transforming the BVP with ellipsoid boundary to BVP with sphere boundary by making use of Taylor's expansion, the ellipsoid correction is derived for the BVP of the deviation of vertical with ellipsoid boundary. By adding the ellipsoidal correction, the BVP with ellipsoid boundary can be solved. Simulation computations are also presented and the computational results illustrate that the recovery precision of the gravity field can be raised at least one order of magnitude after introducing ellipsoidal correction.

Keywords: deflection of vertical; boundary value problems; ellipsoidal correction.