The Bouguer-Rudzki-Hotine scheme for geoid computations

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The Rudzki inversion gravimetric reduction maps the Earth’s topographic masses inside the geoid in such a way that the inverted masses produce exactly the same potential as the topographic masses on the geoid. In other words, the indirect effect to the geoid is zero so that its computation is not needed. This paper proposes a geoid computation scheme that combines the Bouguer reduction and Rudzki inversion reduction under the spherical approximation and constant density assumption. The proposed computation scheme works with the Bouguer gravity field that is smooth and theoretically legitimate for the harmonic downward continuation. Then the Bouguer potential is compensated by the potential of the inverted masses, ensuring zero indirect effect to the geoid. The direct effect of the Rudzki inversion gravimetric reduction is added to the Bouguer gravity disturbance, resulting in the reduced gravity disturbance for geoid computation. A spherical harmonic reference gravity model is also developed so that the kernel modification/truncation can be applied to the Hotine integral. If the density of the topographic masses becomes available, the effect of density anomalies can be computed separately and added to the geoid computed under the constant density assumption. The combined ellipsoidal effect of the Bouguer and Rudzki inversion reduction should be insignificant because of the canceling effect between them.