Practical comparison of formulae for computing normal gravity at the observation point with emphasis on the territory of Slovakia

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A b s t r a c t : Modern theory in gravimetry requires the computation of normal gravity at the point of observation of actual gravity. Closed formulae for normal gravity above the reference ellipsoid, making use of Jacobi-ellipsoidal and geodetic coordinates are reviewed. Various systematic errors in computing the normal gravity are assessed at the topographical surface on the territory of Slovakia. First the systematic error committed by using only the free-air gradient term as the height-term in computing normal gravity is calculated and displayed. Second the systematic error caused by using local geographical latitude not referred to the mean earth ellipsoid, but to a local (non-geocentric) reference ellipsoid, is evaluated for two reference ellipsoids commonly used in Slovakia – the Bessel and the Krassovsky ellipsoids. Third the systematic error in computing normal gravity introduced by failing to use the geodetic heights, and using the "sea-level" heights instead, is assessed. This systematic error is also known among geophysicists as the "free-air geophysical indirect effect".

Key words: international gravity formula, reference ellipsoid, equipotential ellipsoid, Somigliana-Pizzetti gravity field, geophysical indirect effect

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