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The global density distribution, internal potential, and gravitational potential energy based on the Earth's fundamental parameters

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The Earth's global density model given by the solution of the 3D moments problem inside the ellipsoid of revolution was adopted to preserve in this way the external potential up to second degree/order, the dynamical ellipticity, the geometrical flattening, and six basic radial jumps of density as sampled for the PREM model. The Earth's mass and principal moments of inertia represent initial information for the unique solution of the restricted Cartesian moments problem providing in this way the density, the internal potential, and the gravitational potential energy E. The principal moments of inertia were estimated from the adjustment of the 2nd-degree harmonic coefficients of six recent gravity field models and seven values Hd of the dynamical ellipticity. A rigorous error propagation of this density was derived from the Earth's fundamental parameters. Thus, accuracy of the global density and potential energy was estimated especially to restrict the possible solution domain in such a way that a reasonable solution may be selected either from 3D-spatial or radial density inside the ellipsoidal or spherical planet. Comparison of lateral density anomalies with estimated accuracy of density leads to the same order values in uncertainties and density heterogeneities. Hence, four simplest radial density models were chosen for the computation of the Earth's potential energy E. The estimation of E according to the continuous density models leads to the inequality with two limits. The upper limit EH agrees with the homogeneous distribution. The minimum amount EG corresponds to the Gauss' radial density. All E-estimates give a perfect agreement between EG, E-values based on the four models separated additionally into core and mantle only, and the value E derived

from the piecewise density with 7 basic shells as sampled for PREM.