Geophysical Research Abstracts
Vol. 20, EGU2018-19297-2, 2018
EGU General Assembly 2018

Corrections to absolute gravity observations

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In 1988, Gerd Boedecker published the International Absolute Gravimeter Basestation Network (IAGBN) data processing standards. The standards have been immensely successful; practically all absolute gravity work ever since has been in the "IAGBN system". The key items in the standard were (i) tidal correction with Cartwright-Tayler-Edden and observed tidal parameters (= including ocean loading) if available, zero system for the permanent tide, (ii) polar motion corrected to the IERS pole with gravimetric factor 1.16, (iii) atmospheric effects corrected with the coefficient 0.3 microgal/hPa to the DIN 5450 standard atmosphere (practically identical with the U.S. Standard Atmosphere). As geodesists using these standards have understood, the essential part is not the sophistication of the correction models; they are ever improving. Rather it is the targets of the corrections, "the standard earth", i.e. zero tide system, IERS pole, standard atmosphere. In my view they (taken together with the SI system of units) define the gravity reference system, or if you like, the definition of "gravity" as distinct from the "acceleration of free fall" (which only requires the SI). The correction models are about the realization, i.e. the frame.

The gravity reference system defined by the IAGBN standards is simple and straightforward. In the realization of the new global absolute gravity reference system, the question of standardized corrections for many geophysical phenomena may arise: say a correction for global hydrology and a more sophisticated correction for the atmospheric gravity effects. What could be the reference system, the "standard earth" for such corrections? Some idea may be obtained by looking models implicit in the International Terrestrial Reference Frame ITRF or in Earth geopotential models (EGMs). In generating an ITRFxx, many time-variable effects are essentially averaged using the time span of the coordinate time series. When de-aliasing models of geophysical phenomena are used to generate EGMs from satellite missions, the "standard earth" is then typically the time average of the de-aliasing model. In terrestrial gravity, long time series for averaging are seldom available, and using model averages would essentially incorporate the numerical model results into the gravity reference system, i.e. into the definition of gravity. I discuss various options to define the reference under such circumstances.