

3.6.2.6 GeoForschungsZentrum Potsdam (GFZ)

Inclusion of low degree gravity coefficients into reference frame solutions

Low degree/order gravity coefficients are closely related to the definition of a reference frame. Actually, degree one coefficients define the geocentre, C21 and S21 fix the position of the rotation axis of a reference frame, etc. Theoretically, these coefficients should be included as part of the reference-frame-related products, just like EOP and station positions. It had been impossible in practice, since EOP and site positions can be determined on daily (or weekly) basis, the gravity solution could not be estimated so densely and accurately. It was the long term aim of GFZ to make it be realized.

Within the report period, GFZ has used its newly revised EPOS software and the data from LEO satellite missions (CHAMP, GRACE) to solve this problem. A three months period (Jul–Sep 2004) has been taken as the test period. The tracking data from the ground stations to GPS satellites plus the GPS and K-band data from GRACE were used to solve GPS and LEO orbits, site positions of the GPS stations, EOP, gravity coefficients up to degree/order 10/10 (altogether 120 gravity coefficients) simultaneously on a daily basis.

The test results are very positive:

- 1) gravity coefficients can be solved on a daily basis;
- 2) they are solved simultaneously with other reference frame products (EOP, site positions), therefore these products are homogeneous and consistent;
- 3) the daily gravity coefficients have similar accuracy as EOP and station coordinates, the daily repeatability of gravity coefficients is 1×10^{-9} for degree one, 1×10^{-10} for degree two, and around $2\text{--}5 \times 10^{-11}$ for degree 3 to 10 coefficients.

This three months test solution can be extended to an operational procedure, if enough man power is available. It is recommended that in the future low degree/order gravity coefficients should be officially adopted as part of the IERS reference frame products.

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