



Gravity field contribution analysis of GOCE gravitational gradient components

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A gravity field model is estimated from the four accurate components of GOCE (Gravity field and steady-state Ocean Circulation Explorer) gradiometer, combined with kinematic orbit measurements, and some moderate constraint (or stabilization) in the polar areas where no observation from GOCE is available due to the orbit geometry. The normal matrix of each component is computed individually in order to study its contribution to the combined solution. The results show that the contribution of V_{zz} is the largest, with an average value of 32.74%; the second and the third largest are V_{xx} and V_{yy} , with average values of 28.04% and 26.08%, respectively; the component V_{xz} contributes with 11.81%. Validation with external data shows that all components have some values from the combined solution and their specificities, and the information content of the component V_{xz} is not negligible and should be included for gravity field recovery. The high-low satellite-to-satellite tracking (SST-hl) part contributes almost exclusively to the coefficients below degree and order (d/o) 20. The mean value of the contribution of the polar stabilization is the smallest with a value of 0.22%. In addition to the contribution analysis in terms of the normal matrices, the measurements of each individual component of the gradiometer are combined with SST and polar stabilization, to give a set of single-component gravity field models. These partially combined solutions are compared to the fully combined solution in terms of geoid differences. They show that the partially combined solution of V_{zz} is closest to the complete solution. In addition to the GOCE-only solution, a GOCE-GRACE combined gravity field model is derived and the information content of GOCE and GRACE is investigated. Results show that, as expected, GOCE contributes mainly to the short-wavelength part above d/o 120 with average value of 70% and GRACE mostly to the long- and medium-wavelength part with 30%.