Geophysical Research Abstracts
Vol. 16, EGU2014-11951, 2014
EGU General Assembly 2014

Analysing the accuracy of airborne gravity field observations and their contribution to regional gravity field models

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Airborne gravity field observations show different accuracies and data gaps due to flight turbulences; their irregular spatial distribution leads to a variable spatial resolution. However, the measurements contain precious information of the Earth's gravitational potential in the high frequency domain, i.e. degree values of at least 1000 and thus deliver a valuable contribution to enrich gravity field models.

We present regional gravity field models for Northern Germany computed from BKG/DNSC airborne data sets based on two different flight campaigns in 2006 and 2007/08. Our intention is to detect and overcome less accurate measurements, data gaps and inconsistencies in spatial resolutions. For the generation of regional gravity field models we use series expansions in terms of localising basis functions. Entire error propagation enables analysing variances and covariances of the estimated series coefficients and further of evaluated functionals of the Earth's gravity field.

Furthermore, we present the combination of the airborne measurements with partly overlapping terrestrial and altimetry data sets as well as with observations from global satellite gravity field missions such as GOCE. For the relative weighting of the different observation types we use the method of variance component estimation.
We study the resulting regional gravity field models using (1) only high-resolution airborne data, (2) the combination with terrestrial data and (3) a combination with altimetry and GOCE data which are more sensitive in the mid and low frequency domain. Furthermore, we compare the results with regional models without the airborne data sets in order to analyse the impact and the contribution of the high-resolution airborne observations.