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GPS-based atmospheric sounding with CHAMP and GRACE: Preliminary results of comparative data analysis

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First GPS radio occultation (RO) measurements aboard the U.S.-German GRACE-B (Gravity Recovery And Climate Experiment) satellite were recorded on July 28 and 29, 2004. Globally distributed vertical profiles of refractivity, temperature and specific humidity were derived from 120 occultations. The profiles showed excellent agreement with meteorological analyses. Almost no refractivity bias was observed between 2 and 30 km on a global mean. The corresponding standard deviation is between 1 and 2%. The GRACE-B satellite clock stability is significantly improved in comparison with that of the CHAMP (CHAllenging Minisatellite Payload) satellite, which performs nearly continuously GPS occultation measurements since March 2002. It was found, that this improved clock stability allows for the application of a zero-differencing technique for the precise analysis of GRACE-B occultation data.

A second occultation campaign aboard GRACE-B with longer duration was performed between September 23 and 30, 2005. More than 1000 measurements were recorded. The measurements of this campaign allow for a more extended comparative analysis of the GRACE-B and the CHAMP data.

We use the operational orbit and occultation processing system of GFZ for the analysis of the GRACE-B and CHAMP data. A zero-differencing technique is used for the occultation analysis of GRACE-B, whereas the space-based single-differencing method is applied to the CHAMP processing to derive atmospheric excess phases from the occultation measurements. An improved version (006) of the GFZ inversion software is used for the data analysis of both satellites.

We compare the daily number of occultations, their global distribution and minimum altitudes of the derived atmospheric profiles. Due to slightly different antenna geometry and clock characteristics of both satellites we expect slightly different results for these investigations. Furthermore we compare CHAMP and GRACE-B results with data from ECMWF (European Centre for Medium-Range Weather Forecasts) and the global network of radiosondes to characterize it's quality.