GPS BASED ATMOSPHERIC SOUNDING WITH CHAMP: HIGHLIGHTS AND RECENT RESULTS OF THE SCIENTIFIC DATA ANALYSIS

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Abstract:

The German geoscience satellite CHAMP (CHAllenging Minisatellite Payload) almost continuously provides global atmospheric measurements since early 2001. It currently generates an unique long-term set of GPS radio occultation (RO) data. More than 400,000 occultation measurements will be performed as of October 2005. Currently the mission is expected to last until 2008. Data and analysis results are provided to the international scientific community and stimulated several activities for GPS RO data analysis and the application in atmospheric research and weather forecasts. The data are currently in use by more than 40 research groups to prepare and improve analysis centers for future occultation missions (e.g. COSMIC, MetOp or EQUARS), to demonstrate improvements of global numerical weather prediction, to show ability to detect climate trends, and to improve or calibrate other satellite based atmosphere sounders.

We briefly review the highlights of 4 years radio occultation with CHAMP and characterize in more detail the recent status of the continuous scientific analysis of neutral atmosphere CHAMP data at GFZ and ionosphere occultations at DLR. The recent versions of data products are validated with meteorological data from ECMWF (European Centre for Medium-Range Weather Forecasts) and the global radiosonde and ionosonde network. Using results of these investigations advantages and weaknesses of CHAMP’s data in relation to the compared data are discussed.Further investigations, which will be reviewed are: simulations of the application of Open-Loop tracking techniques for the GPS signal acquisition to improve the data quality in the lower troposphere; derivation of global tropopause characteristics from CHAMP data and the analysis of their long-term behaviour, application of various techniques for the derivation of vertical water vapor profiles and their validation and also impact studies at ECMWF for the improvement of global weather forecasts using CHAMP data. Furthermore we introduce first occultation results from the U.S. American GRACE mission (expected lifetime until 2010), which were available in 2004. Together with CHAMP a small multisatellite configuration was formed during the activation periods of GRACE. A major result of the first GRACE measurements is the feasibility to calibrate the GPS data by utilizing a zero-differencing technique. The potential of this analysis technique for future occultation processing will be discussed using the results from GRACE.