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GPS radio occultation with CHAMP and SAC-C: global monitoring of thermal tropopause parameters

T. Schmidt, S. Heise, J. Wickert, G. Beyerle, and C. Reigber
GeoForschungsZentrum Potsdam, Department 1: Geodesy and Remote Sensing,
Potsdam, Germany

Abstract. In this study the global lapse-rate tropopause (LRT) pressure, temperature, potential temperature, and sharpness are discussed based on Global Positioning System (GPS) radio occultations (RO) from the German CHAMP (CHALLENGING Minisatellite Payload) and the U.S.-Argentinian SAC-C (Satelitte de Aplicaciones Cientificas-C) satellite missions. Results with respect to seasonal variations are compared with operational radiosonde data and ECMWF (European Centre for Medium-Range Weather Forecast) operational analyses. Results on the tropical quasi-biennial oscillation (QBO) are updated from an earlier study. CHAMP RO data are available continuously since May 2001 with on average 150 high resolution temperature profiles per day. SAC-C data are available for several periods in 2001 and 2002. In this study temperature data from CHAMP for the period May 2001-December 2004 and SAC-C data from August 2001-October 2001 and March 2002-November 2002 were used, respectively. The bias between GPS RO temperature profiles and radiosonde data was found to be less than 1.5K between 300 and 10hPa with a standard deviation of 2-3K. Between 200-20hPa the bias is even less than 0.5K (2K standard deviation). The mean deviations based on 167699 comparisons between CHAMP/SAC-C and ECMWF LRT parameters are (-2.1 ± 37.1) hPa for pressure and (0.1 ± 4.2) K for temperature. Comparisons of LRT pressure and temperature between CHAMP and nearby radiosondes (13230) resulted in (5.8 ± 19.8) hPa and (-0.1 ± 3.3) K, respectively. The comparisons between CHAMP/SAC-C and ECMWF show on average the largest differences in the vicinity of the jet streams with up to 700m in LRT altitude and 3K in LRT temperature, respectively. The CHAMP mission generates the first long-term RO data set. Other satellite missions will follow (GRACE, COSMIC, MetOp, TerraSAR-X, EQUARS) generating together some thousand temperature profiles daily.

[Final Revised Paper](#) (PDF, 2837 KB) [Discussion Paper](#) (ACPD)

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