



Quantitative Estimation of the Reproducibility of GPS RO Data for Climate monitoring: Inter-comparison of CHAMP Refractivity Climate Records 2002-2006 from Different Data Centers

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To claim that Global Positioning System (GPS) radio occultation (RO) observations can be used as a climate benchmark dataset, we need to quantify the uncertainty of GPS RO-derived variables to the ionosphere correction and inversion procedures. Currently, multi-year GPS RO climate data can be obtained from the GeoForschungsZentrum Potsdam (GFZ), Germany, the Jet Propulsion Laboratory (JPL), Pasadena, CA, USA, the University Corporation for Atmospheric Research (UCAR), Boulder, CO, USA, and the Wegener Center of the University of Graz (WegC), Graz, Austria. Different centers used different assumptions, initializations, and implementations in the ionosphere correction and inversion procedures, which may introduce refractivity uncertainties among centers. In this study, five years (2002–2006) of monthly mean climatologies (MMC) of inverted refractivity from the GPS RO experiment aboard the German satellite CHAMP (CHALLENGING Minisatellite Payload) generated by the above four centers were compared. The absolute values of fractional refractivity anomalies among centers are in general less than 0.2% below 25 km. The median absolute deviations among centers are less than 0.2% globally. This provides confidences of the feasibility of the inversion schemes among centers although the true atmospheric refractivity profiles are not available. Because the de-seasonalized fractional refractivity anomalies are very consistent in time, and with a periodical pattern, trends of each center at different vertical layers at different latitudinal zones agree well. The uncertainty of the trend for fractional refractivity anomalies among centers for the Global is within $\pm 0.04\%/5$ yrs. The primary causes of the trend uncertainty is owing to different quality control methods used among four centers. We used NCEP reanalysis in the same period to estimate the sampling errors. After removing the sampling errors, the uncertainty of the trend for refractivity fractional anomalies among centers is between -0.03 to 0.01 %/5 yrs. This can be considered as an upper bound for the usage of GPS RO data for the global trend monitoring.