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Tropical tropopause variability from four years of CHAMP radio occultation data

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Radio Occultation (RO) data have been recorded continuously since March 2002 onboard the CHAllenging Minisatellite Payload (CHAMP) satellite. From these RO data the meteorological parameters refractivity, pressure, geopotential height, and temperature were retrieved and analyzed at the Wegener Center/Uni Graz. The resulting four year CHAMP temperature climatology was compared to operational analysis fields from the European Centre for Medium-Range Weather Forecasts (ECMWF). This comparison showed, amongst other, a systematic warm difference of up to 2 K in the tropical tropopause region. To examine this difference, tropical tropopause parameters comprising the height and temperature of the lapse rate tropopause as defined by the World Meteorological Organization (WMO) and the cold point tropopause were extracted from both the CHAMP and ECMWF data. We hypothesize that the warm difference is not a measurement error but may rather be caused by a better resolved representation of atmospheric wave activity and tropopause height variability by the CHAMP data as compared to the ECMWF data. To check this hypothesis we started with determining the intrinsic vertical resolution of the RO retrieval. Results show that in the tropopause region the vertical resolution of the RO profiles is comparable or moderately finer compared to ECMWF profiles. Secondly, a closer look at the variability was determined by separating the tropical region into eight longitude areas, which were chosen to cover either land masses or the ocean. Profiles which were measured over the ocean in a longitude area covering mostly land were excluded from the analysis, and vice versa. The results show that the CHAMP tropopause temperatures

clearly exhibit more variability than the ECMWF analyses and are in average warmer, resulting in a systematic underestimation of the mean tropopause temperatures by the ECMWF data. This provides evidence that the cold bias seen in ECMWF tropopause climatologies compared to CHAMP may indeed be caused by the ECMWF analyses representing less wave activity in the tropical tropopause region.