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Upper air temperatures from satellite records: a comparison of MSU and CHAMP radio occultation data

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The principal source of satellite-based upper air temperature records for the last $\sim$25 years was the Microwave Sounding Unit (MSU) on U.S. NOAA satellites. The MSU channels provide information on layer-average stratospheric and tropospheric temperatures based on measurements of Earth's microwave emission at different frequencies. Comparisons of upper air temperature show discrepancies not only with respect to radiosonde data but also between MSU datasets stemming from different retrievals. MSU data are provided by two main groups, the University of Alabama in Huntsville (UAH) and Remote Sensing Systems (RSS), CA, USA. Based on the same input data the main issues addressed differently by the groups are the inter-calibration between the series of satellites and the correction for diurnal drift in their construction methodologies.

In this respect the Global Navigation Satellite System (GNSS) radio occultation (RO) technique offers new possibilities by providing high quality observations of the atmosphere. Besides high accuracy and vertical resolution in the upper troposphere and lower stratosphere region one of the most important properties regarding climate studies is the long-term stability due to intrinsic self-calibration. Based on RO observations of the German/U.S. research satellite CHAMP since late 2001, RO based temperature climatologies have been constructed at the Wegener Center/Uni Graz.

We performed a comparison of the most recent MSU temperature records from UAH (version 5.2) and RSS (version 2.1) with CHAMP RO climatologies based on monthly

and seasonal means over the 4 years from 2002 to 2005. In addition we compare to synthetic MSU temperatures from radiosonde data (HADAT2) as provided by the Hadley Centre, U.K. In order to enable comparison with MSU data we use static mean global weighting functions to compute synthetic MSU temperatures from the RO data. We focus on the lower stratosphere channel (T4) and the troposphere/stratosphere channel (T3), the latter only provided by RSS. The weighting functions are applied to zonal mean RO temperature climatology profiles at pressure levels with 10° latitudinal resolution. For further reference also a synthetic MSU record with identical sampling procedure is computed based on ECMWF analyses. The results will be discussed as time series of globally averaged temperature as well as for the tropics (20°S to 20°N) and the northern and southern hemisphere extra-tropics.