



Comparison of Upper-Air Observations from the *German Atlantic Expedition 1925-27* with the Twentieth Century Reanalysis

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During the *German Atlantic Expedition* (1925 to 1927), 801 pilot balloons (up to 21 km asl) and 217 kites (up to 4.5 km asl) were launched onboard the research vessel *Meteor* in order to explore the vertical structure of the atmosphere above the Ocean, extending over 14 W-E profiles from 20°N to 60°S. We compare the historical data, aggregated into latitude-altitude bins, with results from the Twentieth Century Reanalysis, a totally independent dataset that is based on the assimilation of synoptic pressure and hurricane tracks only, using monthly sea surface temperature and sea ice as boundary conditions. 20CR shows significantly higher temperatures than observations below 1-1.5 km asl from 30°S to 10°S, and above 2 km asl at 20°N, and significantly lower values at levels above 1-3.5 km asl from 50°S to 10°N (RMSE = 2.1 K, Si = 99%). Anomalies are well correlated south of 20°S ($\bar{r} = 0.77$, Si = 90%), but only weakly correlated between 20°S and 20°N ($\bar{r} = 0.37$). Differences with observed pressure are small (RMSE = 1.8 hPa), and the corresponding anomaly correlations high ($\bar{r} = 0.84$ south of 20°S, 0.72 from 20°S to 20°N). 20CR is wetter than the observations at the southern edge of the Tropics (20°S, mean +1.1 g/kg), but drier inside (10°S to 20°N, mean -1.0 g/kg). The average anomaly correlations for specific humidity are low ($\bar{r} = 0.54$ south of 10°S, 0.35 elsewhere). 20CR displays stronger than observed westerlies in the troposphere from 30°S to 40°S, weaker westerlies or even easterlies above 10 km asl between 10°S and the Equator, and weaker westerlies above 5 km asl from 10°N to 20°N. The anomaly correlations of the zonal/meridional wind are low, but again higher south of 20°S compared to the north ($\bar{r} = 0.55$ vs. 0.47/ $\bar{r} = 0.61$ vs. 0.30).