



Wind bias of the NCEP/NCAR 50-year reanalysis over the West African and Asian Monsoon Regions during the Years 1948-57

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Most recent studies on the variability of the Asian as well as the African monsoon are based on reanalysis datasets. However, while reproducing quite well the interannual variability, reanalysis products have been found to contain major biases in certain tropical regions before 1968. These lead to an unrealistic low frequency behaviour and might be explained by the lack of observations assimilated into the reanalyses, as is the case e.g. for tropical Africa, China and parts of South East Asia where only the much sparser radiosonde data have been assimilated into the NCEP/NCAR Reanalysis (NNR).

Here we present an analysis of the wind bias of the NNR relative to pilot balloon observations from the Comprehensive Historical Upper Air Network (CHUAN) over both the West African and Asian monsoon regions during the early period 1948-57. We have examined wind data from all stations located inside the domains (10°S - 30°N , 20°W - 20°E , West African monsoon region) and (10°S - 53°N , 45°E - 152°E , greater Asian monsoon region) on 5 levels up to the mid troposphere (corresponding roughly to the 925, 850, 700, 600 and 500 hPa pressure levels). We also compare the observational data to the Twentieth Century Reanalysis, which is based solely on the assimilation of sea level pressure and sea surface temperature.

For the West African domain, during the period 1948-57 the number of upper-air observations assimilated into NNR over the Sahel-Guinean region is much smaller than after the 1957 IGY, especially before 1952/53. A comparison of the NNR with the observational data for the whole domain and time period reveals spatially coherent and seasonally as well as diurnally varying significant wind biases relative to the observations over large parts of West and central Africa. The biases reach absolute values up to several m/s. The vertical bias profiles display different, regionally characteristic shapes. On the 925 hPa level, we find an overestimation of the low-level southwesterly monsoon winds over Sub-Saharan West Africa (SSWA) in all seasons and an underestimation of the northeasterly Harmattan winds over the Sahel region in winter. The analysis of the 850 hPa level points to an overestimation of the thickness of the low-level monsoon flow and an underestimation of the climatological easterly winds by the NNR, especially in the southern coastal region of SSWA. At 700 and 600 hPa, the data indicate a northerly to easterly bias in spring and summer over SSWA, which, superimposed on the relatively strong climatological easterlies, is equivalent to an overestimation of the monsoon return flow and the African Easterly Jet (AEJ) in the reanalysis. An easterly bias in the southern coastal region east of the Gulf of Guinea (SCR) implies a significant overestimation of the equatorial easterlies in this region.

Over the Asian monsoon region, the number of assimilated upper air observations in the NNR is very low in China, Mongolia and the whole of South East Asia (except the Philippines) before January 1951. Even after that month, the coverage stays at a low level for Indochina, Indonesia, Mongolia and the entire continental China, until July 1954 (Indochina, Indonesia) or even August 1956 (China). Therefore, we expect to find once again pronounced differences between the wind in the NNR and in observations above this region.