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Aircraft-type specific errors in AMDAR weather data from commercial aircraft

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AMDAR (Aircraft Meteorological DAta Relay) is a WMO-coordinated program that provides weather reports from commercial aircraft. The daily number of observation has reached over 240.000 in 2007 and is still increasing. AMDAR data, in turn, represent an increasingly important input for operational numerical weather prediction models. However, only a few studies have investigated the quality and errors of AMDAR data.

It has been noticed in some of these studies that AMDAR data contain biases depending on the aircraft type. The algorithms to process AMDAR reports differ widely from airline to airline. Hence, it remains unclear, whether such a bias is caused by the data processing, the aircraft type, or other physical properties of the aircraft

In the present study, an experimental dataset is used to investigate the physical type-dependent errors of AMDAR reports. For this dataset, AMDAR measurements have been taken by all Lufthansa aircraft landing at Frankfurt (EDDF) on 22 selected days in 2003. All of these data have been processed by the same software. Hence, influences of different processing algorithms can be excluded.

Vertical profiles measured by individual aircraft are compared to hourly averaged aircraft profiles. By this comparison, it is shown that temperature measurements have systematic aircraft-type specific differences of up to almost 1 K. This is much more than the random temperature error of most types that was found to be around 0.3 K.

The errors identified in the AMDAR wind measurements can be regarded as aircraft-

type specific error vector, fixed to the aircraft reference system. I.e. a fixed wind bias in longitudinal (parallel to the flight direction) and lateral (horizontal, perpendicular to the flight direction) direction. The largest systematic errors in wind measurements were found to exist in longitudinal direction. The random error, however, was found to be larger in lateral direction, than in longitudinal direction.