WORLD METEOROLOGICAL ORGANIZATION

WMO AMDAR PANEL WORKSHOP ON AIRCRAFT OBSERVING SYSTEM DATA MANAGEMENT

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Workshop on Aircraft Observing System Data Management/Doc. 5.1

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DATA QUALITY MANAGEMENT

AMDAR Air Temperature Bias, Background on the Issue, Corrections in NWP

(Submitted by Brad Ballish, NOAA)

SUMMARY AND PURPOSE OF DOCUMENT

Provides an outline of the AMDAR Air Temperature Bias issue.

ACTION PROPOSED

1. The Workshop is invited to note the information contained in the document.

BACKGROUND

There are a number of major issues related to aircraft temperature biases:

1. Aircraft with significant temperature biases relative to the background is one of the most common problems with using the AO
    a. What criterion do different centers use to decide when a bias is bad enough to add the aircraft to the reject-list (RJL)?
    b. Can we decide on an optimal criterion for adding to the RJL?
        i. This criterion should be coordinated with our criterion for when an aircraft's temperature is considered suspect in our reports
        ii. Has anyone performed impact tests or adjoint estimates of impact based on RJL criterion?
    c. How quickly can we best add or remove AO from the RJL?
    d. How effective is our feedback to data providers such as airlines?
    e. Do we have historical records on when biases go bad or are fixed?
    f. Can we and should we flag the aircraft data with suspect temperatures before putting on the GTS?
2. Bias correction of aircraft temperature biases is clearly needed, but has many difficult issues:
    a. Ballish and Kumar (BAMS 2008) showed that aircraft temperature bias, versus the model background, and collocations with radiosonde temperatures depend on the aircraft type and the phase of flight (POF).
        i. However, biases can vary considerably among aircraft of the same type.
        ii. For many aircraft, especially from certain countries, we do not have aircraft type information.
        iii. Other metadata such as time averaging, sensor type and location maybe important but are often unknown.
        iv. Can the WMO require countries to provide such metadata and who will be in charge of archiving and sharing this information?
    b. At NCEP, various problems were found in early attempts at bias correction:
        i. The NCEP model background appeared to have low level temperature biases that vary considerably with the time of day and locations making bias corrections uncertain at lower levels.
        ii. Many aircraft have several reports all with the same time, which makes estimating vertical ascents and descent rates difficult to estimate.
        iii. Based on work by Clemens Drue, maybe we do not need detailed aircraft vertical velocities since each airline has prescribed rates of ascent and descent based on aircraft types.
        iv. Plans were made to use the exponentially weighted averaging technique to update bias correction every GDAS model cycle, but there were concerns about how to handle sudden changes in biases.
    c. The ECMWF implemented aircraft temperature bias corrections in November 2011 (Drasko can provide further details)
        i. They use corrections based on the aircraft type and vertical velocities.
        ii. No big improvements in forecast skill were reported, but the model analyses and forecast fit radiosonde and GPSRO temperatures much better.
