E-AMDAR evaluation.

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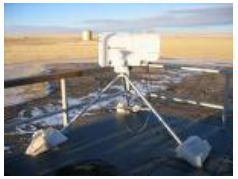
Next Generation Upper-Air Network

- ‘Large-scale’ project to produce costed options for the future (2010 – 2020)

- <u>Benefits</u>
- Optimize current network.
- Meet User Requirements. (i.e. High resolution)
- Reduce costs.



FUND – Future Upper-air Network Development

Introduction

- The purpose of this study was to use data from operational radiosonde ascents to examine whether radiosonde data would provide a good comparison for AMDAR data.

Data processing procedure

- AMDAR units EU4593, EU5331, and EU6564 were used as these were capable of recording humidity.
- Radiosonde ascents from UK and German stations were selected. All the radiosonde stations selected flew Vaisala RS92 radiosondes.

Data processing procedure

- Radiosonde ascents were selected from stations that were closely located to airports where aircraft fitted with AMDAR units operate, and radiosonde ascents chosen that were within an hour of take off or landing.
- The Radiosonde data was retrieved from the University of Wyoming web site at http://weather.uwyo.edu/upperair/sounding.html The raw temp message was used to identify the type of radiosonde and the time of launch, and the text data containing selected points, was opened in an excel spreadsheet and saved as a comma separated file to enable it to be used by the RSKOMP radiosonde comparison software.

Data processing procedure

- AMDAR data was retrieved in text format, from the Met Office database. The data used was the altitude, temperature, converted from Kelvin to Centigrade, and the Mixing ratio, converted to grams per kilogram (g/kg). Once converted the data was saved as a comma separated file, to enable it to be used by the RSKOMP radiosonde comparison software.

Data processing procedure

- During the comparison period, June 2007 to March 2008, 49 Comparisons were made, of which 34 where within the one hour period.
- Of these 34 comparisons 2 were rejected, as their profiles were suspect, the remaining 32 comparisons have been used in the statistics.
- 14 comparisons with EU5331
- 14 comparisons with EU6564
- 4 comparisons with EU4593
- We suspect that EU4593 had the humidity function removed during the comparison period.

GOOD AND BAD examples

- The following 4 slides show examples of good and bad matches.
- The Radiosonde is the blue trace and the AMDAR is the red trace.
- Temperature is on the left, and Mixing ratio on the right.
- The Y axis is height from 0 to 11km, the temperature is in degrees Celsius, and the mixing ratio in grams per kilogram (g/kg).

Good Comparison (24)

- The following slide shows the Temperature and Mixing Ratio (g/kg) plot for comparison 24.
- AMDAR Unit EU6564, take off from Munich 10:42 3rd Feb 2008.
- RS92 radiosonde from Muenchen-Oberschleissheim (10868) 10:45 3rd Feb 2008.
- Sonde station and airport are approximately 18km apart.

Comparison 24

Bad Comparison (4)

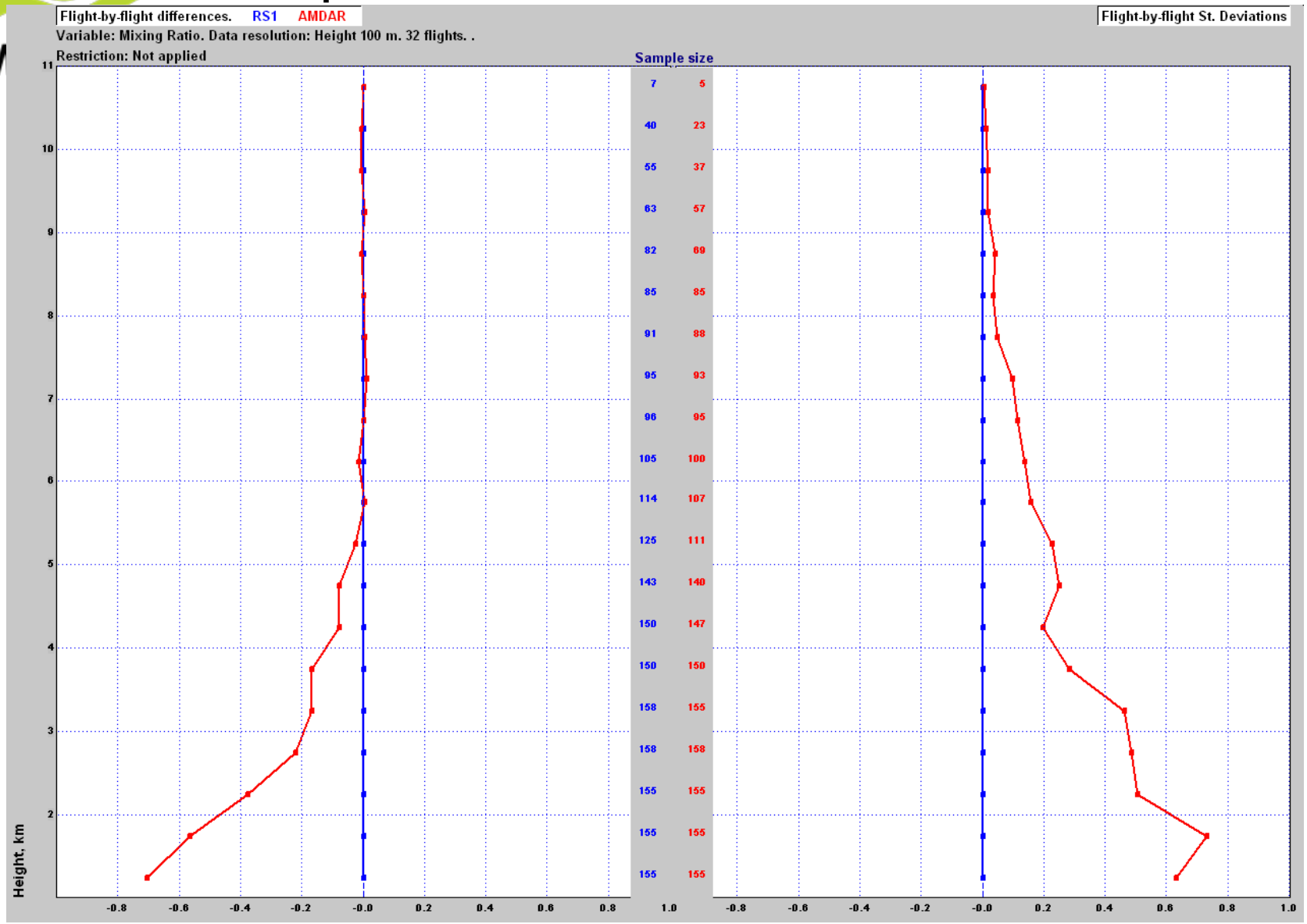
- The following slide shows the Temperature and Mixing Ratio (g/kg) plot for comparison 4.
- AMDAR Unit EU6564, landing at Manchester 11:49 22nd August 2007.
- RS92 radiosonde from Watnall (03354) 11:15 22nd August 2007.
- Sonde station and airport are approximately 78km apart.
- This comparison has been removed from the statistics.

Comparison 4

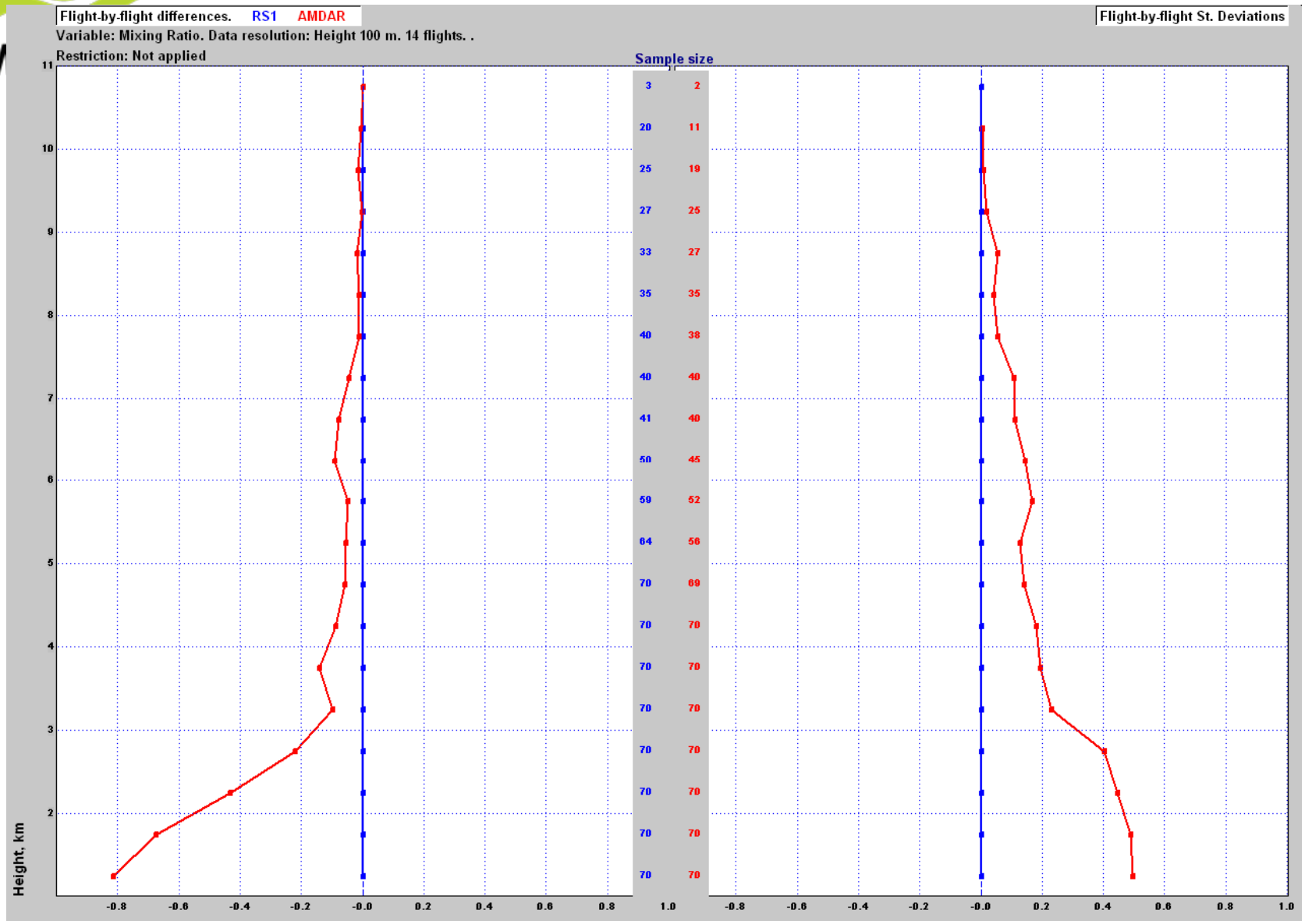
Mixing Ratio Statistical analysis

- **<u>The following 3 slides show the Mixing Ratio statistics</u>.**
- The statistics produced show the flight-by-flight differences (left plot) and the flight-by-flight standard deviations (right plot) as a function of height, with the humidity expressed as a mixing ratio in grams per kilogram (g/kg). Direct differences are the results of taking all the samples in a given category [each 100m in the vertical] and computing the average value for the difference and the standard deviation. In flight by flight differences, differences for a given collocation (comparison) are averaged for a given category and then the individual averages are combined to estimate the overall average and the flight by flight standard deviation.
- In the following mixing ratio statistics graphs, the radiosonde (link reference) mixing ratio is the blue line, and the AMDAR mixing ratio is the red line. The Y axis is height from 0 to 11km, and the red and blue numbers on the graph are the corresponding sample sizes.

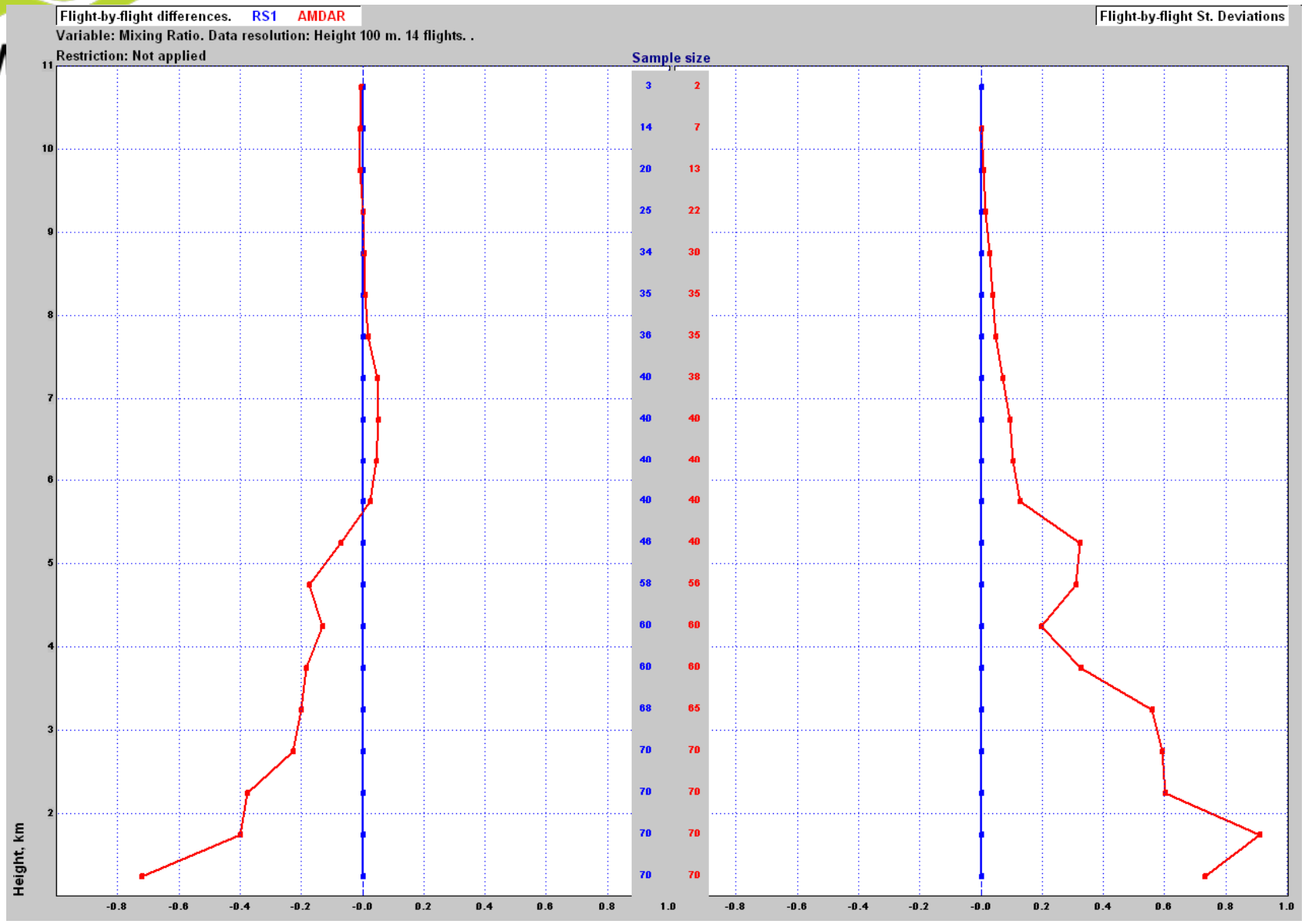
Mixing Ratio statistics for all 32 comparisons



Mixing Ratio statistics for EU5331



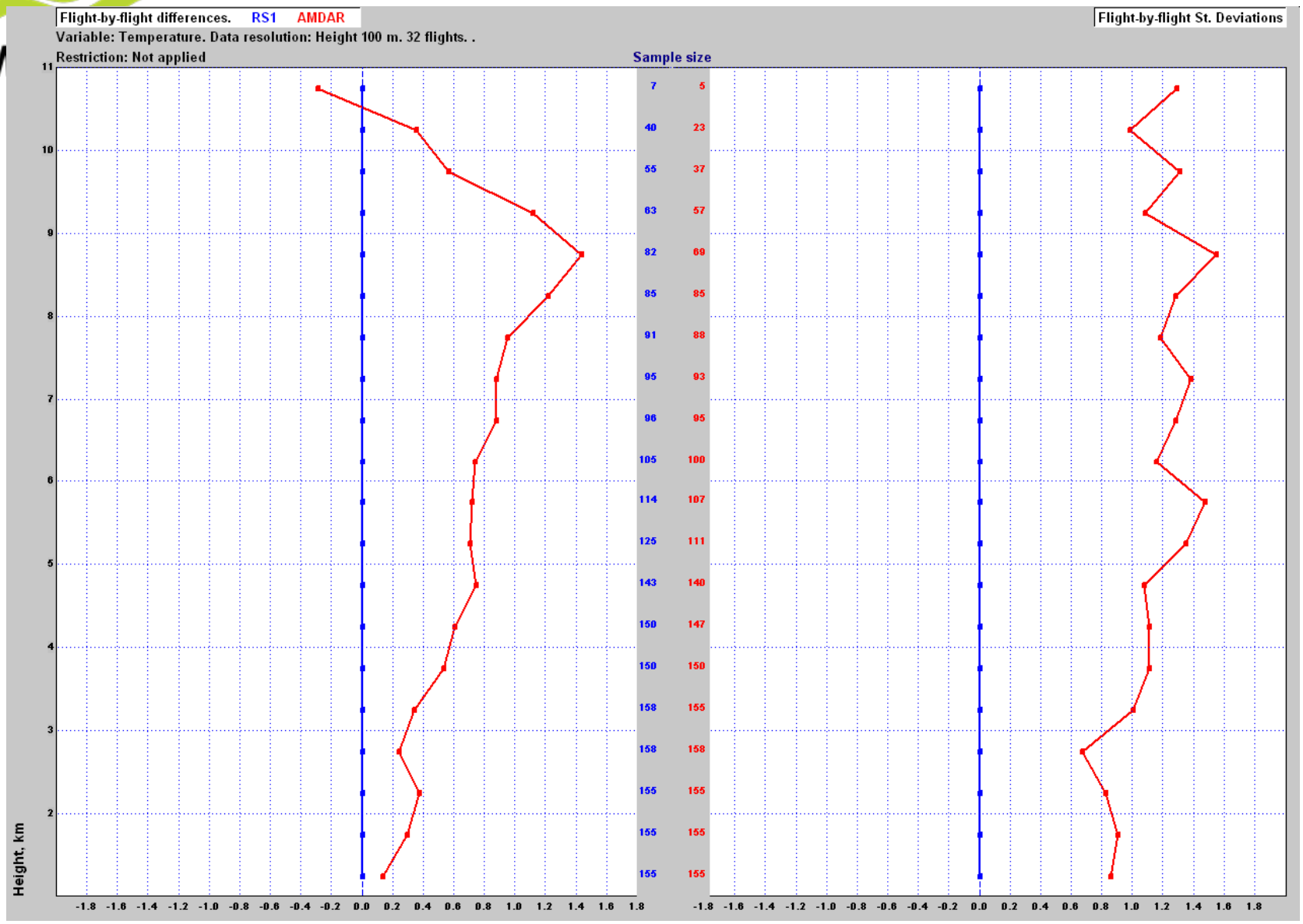
Mixing Ratio statistics for EU6564



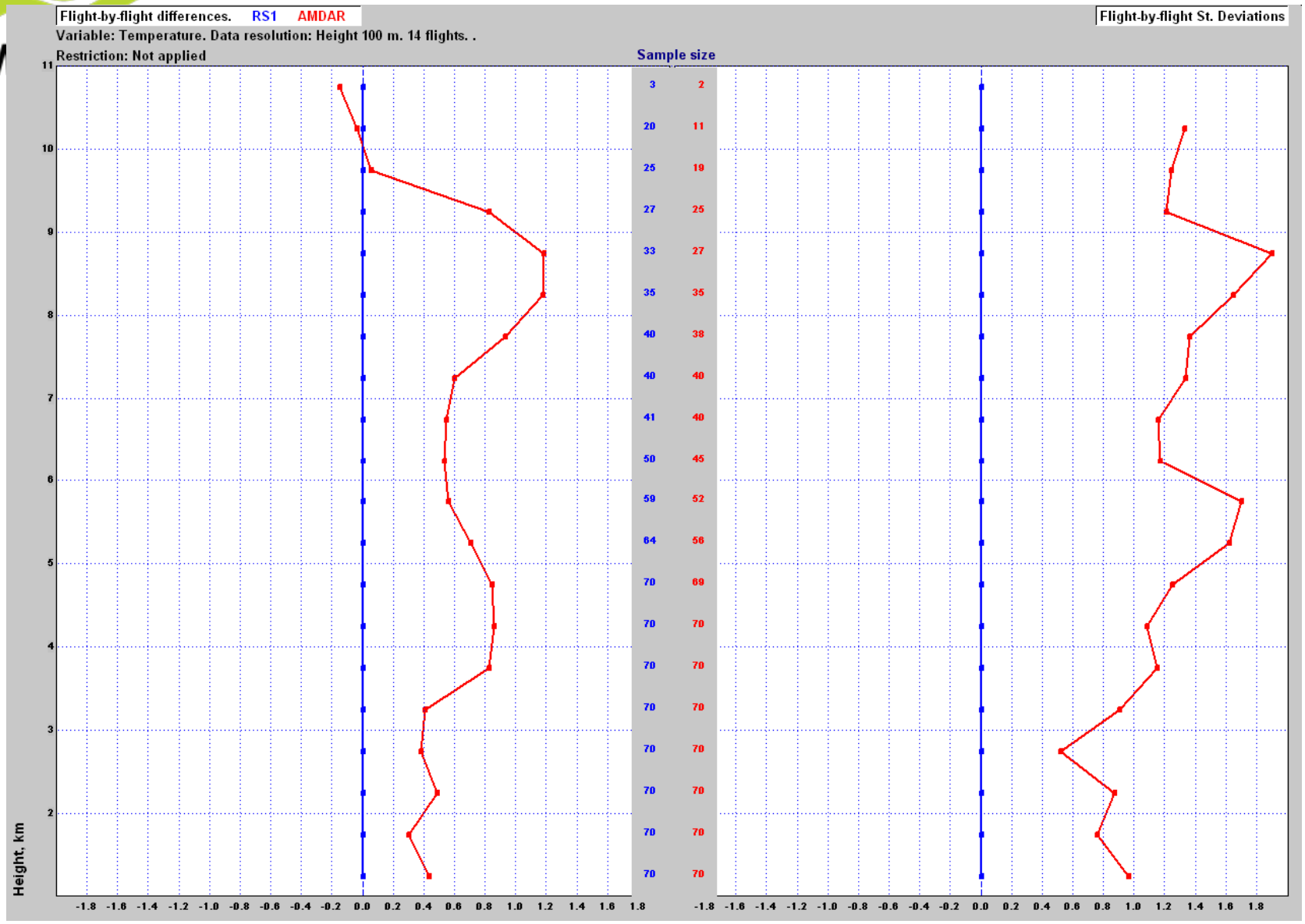
Temperature Statistical analysis

- **<u>The following 3 slides show the Temperature statistics</u>.**
- The statistics produced show the flight-by-flight differences (left plot) and the flight-by-flight standard deviations (right plot) as a function of height, with the temperature in degrees Celsius. Direct differences are the results of taking all the samples in a given category [each 100m in the vertical] and computing the average value for the difference and the standard deviation. In flight by flight differences, differences for a given collocation (comparison) are averaged for a given category and then the individual averages are combined to estimate the overall average and the flight by flight standard deviation.
- In the following temperature statistics graphs, the radiosonde (link reference) temperature is the blue line, and the AMDAR temperature is the red line. The Y axis is height from 0 to 11km, and the red and blue numbers on the graph are the corresponding sample sizes.

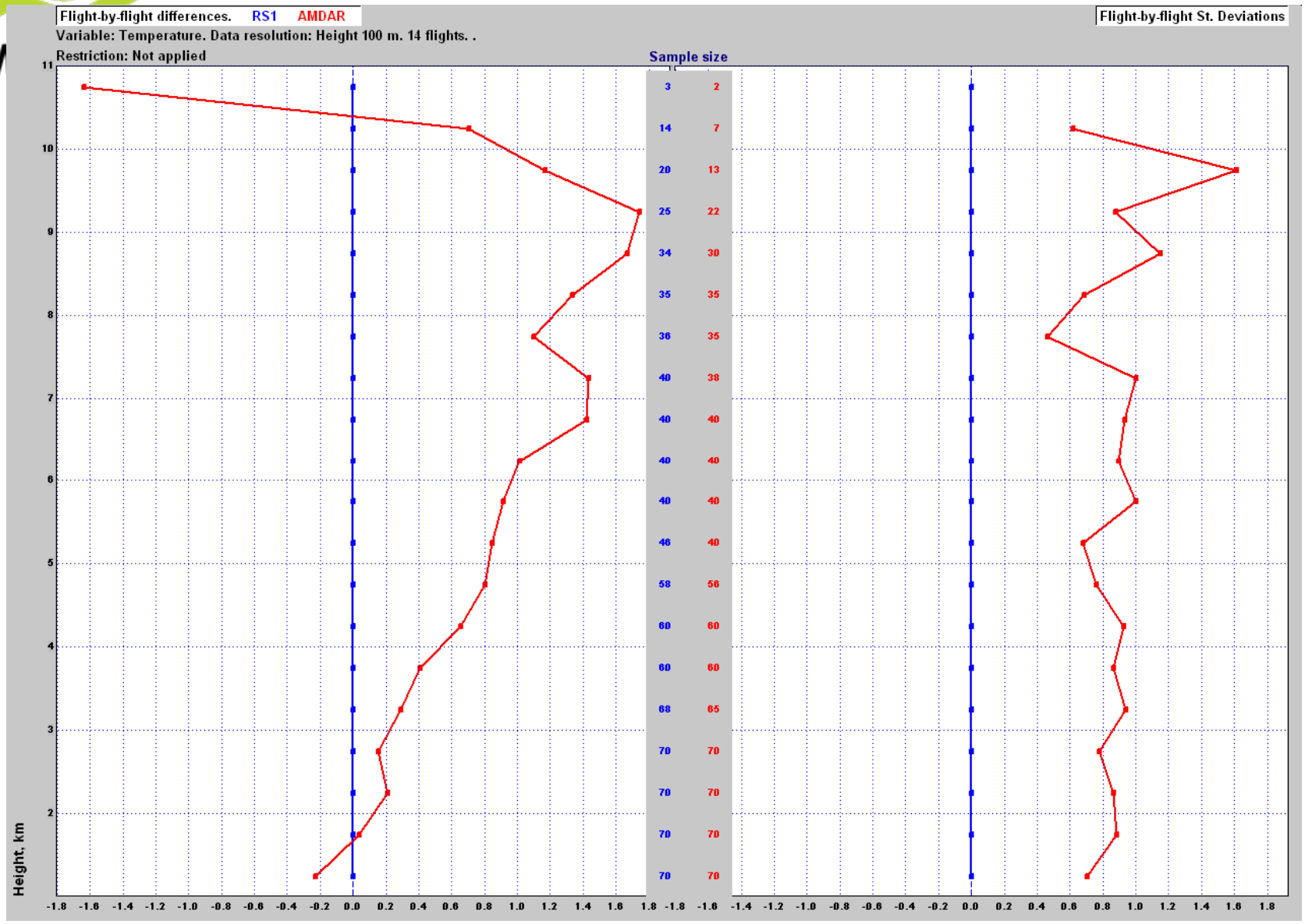
Temperature statistics for all 32 comparisons



Temperature statistics for EU5331



Temperature statistics EU6564



Comments and Observations

- We were limited to aircraft flights that took off or landed at the launch times for radiosondes.
- Humidity measurements vary rapidly in space and time, even when the basic vertical structure is not changing rapidly. Unlike temperature it is unwise to interpolate over relatively large distances, therefore precise validation of humidity would require radiosondes launched close to an airport as near as possible to landing or take off time.
- It would be better if we could use high resolution radiosonde data, e.g. BUFR or 2 second ASCII data.
- Also it would be advantages to increase the AMDAR resolution during ascent and decent.
- Of the 49 AMDAR reports 9 had their altitude at landing or take off below zero. This was not restricted to one AMDAR unit, or individual airport.
- I had to apply height offsets to some of the profiles to get them to match, for this I used distinct turning points, such as inversions.

Comments and Observations

- We suspect that EU4593 had the humidity function removed during the comparison period. (It has subsequently been confirmed that this sensor had to be replaced.)
- No account was taken of the weather at the time of comparison.
- The number of samples at higher altitude is limited.
- Not all radiosonde stations are located close to an airport.
- Most of the comparisons were during daylight. There was no separate comparison between day and night. There are small variations between day and night radiosonde readings.

Future Work

- Increase data samples, concentrating on flights into Munich airport.
- Work with E-AMDAR team to access GPS heights and increase the vertical resolution of data near the surface.
- Proposal to E-AMDAR to produce statistics on a more formal agreement.
- Discuss this work within the CIMO ET on Intercomparisons.

Questions & answers