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Interactive comment on "Estimates of Mode-S EHS aircraft derived wind observation errors using triple collocation" *by* S. de Haan

Anonymous Referee #1

This paper uses the triple collocation method to assess the quality of aircraft derived observations using Mode-S EHS data. Two data sets are used, NWP/Mode-S/Radar winds and NWP/Mode-S/Sodar winds. These two datasets allow for an assessment of the quality of the wind from Mode-S over a large section of the atmosphere. The resulting error characteristics are consistent with those previously reported using other methods.

This paper adds to the ongoing work understanding the error characteristics of this potentially important new data source and should be published with some minor revisions.

In general the paper is understandable but some clarifications need to be added:

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Interactive Discussion

Discussion Paper

- I feel the reader would benefit greatly from a paragraph introducing how this work fits within the existing publications on aircraft derived data.

- There is currently no discussion of the time period or quantity of data used other than in the figures and a brief mention of "9 months" in section 3.2. This should be added. There may be some seasonal effects which cannot be seen due to the short time or limited amount of data for each season. It would be interesting to investigate any season effect although this would be a significant increase in the work and is more appropriate for a future study. Some comment on this should be added.

- I am also missing a futher discussion of the source of the data, I assume it is from the MUAC control centre as used for the authors previous work. Was there any attempt to correct any of the data as detailed in some of the authors previous papers and technical reports? This information is required to fully understand the quality assessment.

- Radiosondes are conspicuous by their absence throughout. These are often considered to be the best method for observing profiles of the atmosphere. It would be useful to know why these observations were excluded from the study.

- P12634 L16: It is unclear as to what the error estimates refer to, whether it is the error in the wind components, wind speed, vector error etc... In section 1 both the vector error and horizontal component error are used from previous studies. It would be useful to note this difference more clearly in the text and to discus later how these should be compared to draw out the conclusions more firmly.

- It is mentioned on page 12636 that temperatures can be derived from the Mode-S EHS data set, it would be interesting to know why no attempt was made to do a similar triple collocation study using the temperature data which is known to have a more complicated and interesting error characteristic.

- P12635: ACARS and AMDAR data are the same (although often ACARS is used to refer only to North American data), this is not clear from the text.

- P12635: In the previous collocation studies it would be useful to know the limiting horizontal distances used to compare to this study. I believe the author has conducted a study using the triple collocation method to compare AMDAR/Mode-S/NWP, this should be referenced in the text.

- P12636 L16 and L21: I would suggest introducing tracking and ranging radar and secondary surveillance radar at the same time. At the moment this section is a little unclear. Radar is introduced twice in two paragraphs. I would recommend rewording the end of the first paragraph in section 2.1 to be a less specific and introduce the details of the origins of the Mode-S EHS data in paragraph 2.

- P12637 L21: It would be useful for those who are unfamiliar with Radar to mention how the height above the ground will change with distance due to both the beam angle and curvature of the earth.

- P12637/12638: It would be good to include the altitude range over which the Sodar works.

- P12638 Section 2.3: In table 1 the observations that are assimilated into Harmonie are included, it would be useful to know whether the ECMWF model assimilates any of the observations used in this study.

- P12639 Section 3.1: I do not understand this paragraph. Is the time used for the NWP model the T+3 forecast time from each model run or the T+0 forecast, if T+0 is it a forecast or an analysis that is used?

- P12639 L15: GNSS altitude difference to pressure altitude is available from the majority of aircraft in the ADS-B data, is this available in your data stream? If so has any error checking been done to ensure the calculated heights are valid?

- P12640 L7: You are limiting the atmosphere to situations where the standard deviation of the Radar winds is less than 0.5 m/s does this not remove situations where the atmosphere is very variable when the Mode-S data is likely to have the largest impact due to its high temporal and spatial resolution?

- P12642 L19: You say that you've only used data from aircraft reporting a consistent altitude for 100 km, this seems like it would remove all profile data and data at low altitudes, this doesn't seem to be reflected in figures 6 and 9. Is this reduction in the data only for calculated the PSD used in figure 2 if so this should be clarified and a comment added on how this alters the spatial distribution of the data.

- P12646 L7: I'm not sure I would agree that the triangles are clearly different based on the figure. They are certainly different to the circles and squares, but it seems to be that the circles are a midway point between the triangles and squares, although there is clearly no consistency between the different altitudes. This may be due to the figure. This may be supported by producing a quantification of average difference from the "all" line for each of the six lines.

- P12646 L15: Was any attempt made at using a more scaled distribution so that duplication of data wasn't required?

- P12646 L25: Based on the numbers in Figure 9, the number of observations in each of the 10 subsets for the 538hPa level is only 48.7, this is not very many. How does the spread of the data vary if you only split it into say 5 subsets? This assumes that the 487 is the total number of observations (see below).

- The conclusions would benefit from a larger discussion of how these results influence the potential uses of the data.

- There appears to be something wrong with the first reference "doi:10.1175/2630-0434(1999)014<1032:AOAWT>2.0CO;2"

Figures:

- Figure 1: I cannot find this figure used anywhere in the text. It should either be used or removed.

- Figure 2: The font used for the labels is small compared to the body of the document and the other figures.

- Figures 6 and 9: The numbers on the right hand side need to be described in the figure caption.

Some effort needs to be made to clarify the acronyms used:

- P12634 L12: Mode-S EHS needs to be defined, it should also be mentioned in the abstract that this is derived data.

- P12635 L6: AMDAR is used here for the first time without being defined.

- P12635 L19: Mode-S EHS introduced here for the first time.

- P12635 L16: NWP introduced here for the first time.

- There are also some minor language corrections that should be made:

- P12634 L5: The inclusion of "the" between "comparison with" and "model equivalent"

- P12634 L21: "directly" instead of "direct"

- P12636 L8: "Since a few decades..." should be changed, I would suggest "For a few..."

- P12636 L14: "enHanced" should be "EnHanced" as both the E and H in EHS originate from here?

- Throughout: you use both "Figure" and "Fig." To refer to figures.

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