Dear Reviewer, Dear Ed,

We thank you for your comments and suggustions to improve the manuscript. We have taken the oppurtunity to add several things, some wanted by you some by other reviewers. The main changes in the manuscript are:

5
– we changed the title to "**EMADDC: high volume, high quality, and timely wind and temperature observations from aircraft surveillance data (Mode-S EHS)**

– We comparison with AMDAR data to the results section

– We included Vector RMS statistics in the results section

– We explain in more detail how the seperate steps for temperature corrections

– We revised the conclusion and added an outlook section

10
– Lukas Strauss has been added as co-author to give him the credits for inventing the Mach-Indicated Airspeed improvement.

We hope to have answered all remaining questions as good as possible.
Thank you sincerly for your time and effort, Best regards, Siebren de Haan and Co-authors

Answers

15 This paper has the potential to be a valuable contribution to the literature and I enthusiastically welcome the submission. However, it does leave the reader with some questions which I believe need to be cleared up before submission. Alongside some other smaller corrections and modifications which will make the message of the paper clear. From my understanding the paper contains two novel themes, 1. EMADDC as a source of high quality aircraft atmospheric observations. 2. An improved method for significantly improved temperatures from Mode-S EHS data.

20 The other parts are incremental, or explaining how methods previously published have been implemented by EMADDC. I have two significant concerns with the paper as it currently stands,

ok The conclusions do not adequately explain what is novel in the paper. If you were to read it without the context of the entire paper you would just write it off as not novel. The story needs to be made clearer throughout with the conclusions rewritten to draw out the importance and novelty of this work.
we have rewritten the conclusions

25 ok I believe there is a processing method which is mentioned but not adequately explained. The reported quality of the temperatures is significantly greater than that reported previously. It is suggested that this is via creating a corrected pressure and recreating the Mach number. This is never explicitly stated and the method to do this is in no way explained. It is hinted at several times in the paper e.g. Line 80 "derive the Mach number from indicated airspeed", Table 2 (6) the stated minimum Mach is below the resolution limit of the reported Mach and CCC – for CCC the contents of the personal correspondence needs to be detailed, or a further reference found. This is fundamentally the crux and key novel development for Mode-S EHS
30 processing. One of the problems seems to be that the novelty is contained in Straus 2020 which is a personal communication, this needs significant expansion.
we have rewritten the temperature derivation text. we contacted Lukas Strauss and added him as co-author of the importance of his .....

I have some less significant comments,

ok The abstract does not fully convey the novelty of the paper, it should also include some highlights of the results e.g. improvement of temperature
35 observations.
we added some text to the abstract

ok The use of 'Airspeed' throughout to mean (probably) True Airspeed, this should be stated explicitly at the first introduction or 'true airspeed' should be used throughout, else it is ambiguous with Indicated Airspeed, True Airspeed, Calibrated Airspeed or Equivalent Airspeed.

ok You use altitudes, flight levels and pressure levels in hPa. Please choose one and use it consistently, e.g. Line 262 refers to 858 hPa when refereeing to table 5, table 5 only has flight levels.

ok Section 2.3, this seems superfluous to the rest of the paper.

ok Line 81, where ATC combine the messages to create an observation, how is the time stamp of that 'observation' obtained? The aircraft never reports a time. This is followed up on Line 83 where you talk about it for the receiver, but surely the radar must work the same?

ok Table 1 should also include the reported resolution of the variables.

ok Table 1 it is unclear why there are two "Vertical Rates" in the third section and what each section refers to. It would also be good if this table included the reporting resolution. The BDS table refers to BDS numbers which are not discussed in the text, that makes it unclear, especially as I think some of them are ADS-B messages?

ok Table 6 needs column titles.

ok Lines 140 – 143, You need to explain how Pcor is used to make a new Mach number and/or Temperature? This appears to be phenomenologically derived, is there any physical or instrumental reason for it? I think you need to recreate some of the AMDAR plots for Mode-S to demonstrate it's also true. Can this method really deal with the spread at low M values (e.g. when the aircraft are flying slowly).
we added some words on this

ok Table 3, have you considered using the components of the wind rather than speed and direction? That may explain the larger wind direction standard deviations at lower altitudes where the winds tend to be lighter.
it has been considered...

And some more minor comments,

ok Figures 1 and 2 appear to not be referenced within the text.

ok Line 22 "The last decade..." – the sentence does not make sense.

ok Line 31, I would also include https://doi.org/10.1175/JTECH-D-15-0184.1 in the reference.

ok Line 40, remove "so called"

ok Line 41, the reference being a number makes it unclear.

ok Line 46, add "and broadcast" to the end, as the broadcast messages are also required.

ok Line 48, add "(where available)" after humidity.

ok Line 57, first use of ADS-B.

ok Line58, the sentence from "is not contained . . . ." Is unclear,you should also reference https://doi.org/10.1175/JTECH-D-15-0184.1 and https://doi.org/10.1029/2010JD

ok Line 66, replace "could be used in DA" with "contains atmospheric information" or similar and reference https://doi.org/10.1175/JTECH-D-14-00192.1

ok Line 77, what is the typical resolution of the Mach number in CAT62?

ok Lines 85 and 86 need rewording as they're unclear.

ok Line 88, your wording of "static pressure or pressure altitude" is somewhat difficult, the pressure altitude is never measured but calculated from the static pressure.

ok Eqn 1, requires referencing.

ok The use of both static and ambient temperature, whilst the meaning is consistent it is probably worth picking one to use consistently, potentially highlighting that it also means the other once in the paper. You may also want to state that this is what NWP/Forecasters expect.

ok Line 105, "arrival of information" – it is unclear as to where this arrives.

ok Line 116, over what time period was the standard deviation calculated?

ok Table 2, how can '6 Mach number smaller than 0.001' be true when the reporting resolution of Mach number is 0.04?

ok Line 132, does it not also result in a correction to the Airspeed?

ok Line 135, what evidence is there that pressure is less accurate at low altitudes? This needs to be referenced, or explained and evidenced.

ok L148 the WMM you are using is quite old, why? My assumption is that your heading corrections will deal with that. IIRC the Met Office uses the IGRF which tries to model the current fields and is updated every year.

ok Line 152, there's a Mirza paper that you should reference. https://doi.org/10.1002/qj.2864

ok Line 185-187, I'm a little confused, do you or do you not use the WMM tables? I'd be really interested to see o-b maps per aircraft.
yes we are using the world magnetic model

ok Line 204, could you estimate the order and size of each of the corrections, and reference to the current method of correction?
tas correction is of the order of -1 to 1 m/s

ok Line 208, are the ADS-B data decoded and stored in the same way where it's available? *This section is improved to clarify how data is handled for either receivers or radars*

ok Line 215, do you no longer do any interpolation between data points? You don't mention it here but it seemed like it was a significant part of your earlier papers processing methods and based on some recent data discussions it appeared you were still doing it. *We are not doing any interpolation on observations but for several corrections (e.g, TAS and temperature) we determine a mean value of a parameter and use this in the correction.*

ok Line 219, that's interesting. /emphUnfortunately, this was incorrect as the rolling window proved not to be performant. Hence, a simplier linear regression is applied. Futher work on 3.0 will improve this further

ok Lines 226-229, Have you compared these? Primary radar position is worse than ADS-B so why not do something clever in combining? *We have done some investigation into this in the past and concluded that both types of position have pros and cons. E.g, ads-b position is prone to GPS jamming and decoding issues (in case odd/even pairs are missed) whereas radar positions become less accurate further from a radar. Your comment is valid and future research might look into this and see whether we could blend both positions if available*

ok Line 234, "the tables below" which? Reference them, or edit this introduction sentence as it's a bit confusing.

ok Line 237, replace collected with derived as I suspect many more messages were collected!

ok Lines 240 – 244, is this good, bad or indifferent? How do those values compare to other measurement methods?

ok Line 247, do you have any explanations for this?
not really

ok Line 252, reference precisely which table.

ok Table 5, is this only the matched observations for EHS – NWP, you should be clear on this point.

ok Line 256, what are the average coherence lengths of wind and temperature fields for these?
don't know

ok Table 6 needs column titles.

ok Kube 284, middle panel doesn't seem to agree with the figure, unless I'm misunderstanding and therefore could you edit the words to make it clearer?

110   *done*