

***Interactive comment on* “Quality assessment of Automatic Dependent Surveillance Contract (ADS-C) wind and temperature observation from commercial aircraft” by S. de Haan et al.**

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Dear Editor,

We thank both reviewers for their time and effort in reading and commenting our manuscript. We have looked at all items raised by the reviewers and were able to respond to each of them in a positive manner.

Please find below the detailed answer to the reviewers.

With kind regards, Siebren de Haan

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Answers to reviewer 1: Specific Comments (preceded by page/line number):

=====

5618/4-6: The sentence "The ADS-C messages..." is either missing something or not very informative. I suggest to remove it.

> The words "broadcast by the aircraft" are added

5618/6: insert: A comparison ...

> OK

5618/7: "Mode-S" is not introduced (in the abstract)

> OK

5618/8: prefer "16,000" to "16 thousand" (here and in the following)

> OK

5618/10: 76 days: consecutive? when (year, month)?

> OK

5619/1: insert: ... using extra software ...

> OK

5619/2: insert: ... by extra hardware ...

> OK

5619/2: not quite correct: replace "through ground stations (e.g. located at aerodromes)" by "through the ACARS (aircraft radio addressing and reporting system) network using either ground stations or satellite links (see Fig. 1)"

> OK

5619/9-20: this paragraph is quite confusing since it contains a lot of terms not ex-

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plained and some factual errors. It tries to explain that Mode-S data are another new source of data based on "ADS-something" but that are different from the data targeted in this manuscript. I suggest to rewrite the paragraph moving all information unnecessary here to section 2.1 Some issues to take care of: How does the term EHS (used in abstract and chapter 1) to relate to the term TAR (used in chapter 2)? ADS-B transmissions are not done by the aircraft transponder (Both use different frequencies (ADS-B 1090 MHz / transponder 978 MHz) and different protocols; as far as I know, they may just share the same transmitter). As far as I know, every ADS-B message contains the aircraft position. Does the ground base radar system (TAR or EHR) provide better position information (e.g. based on azimuth and time-of-arrival) or why is it needed to combine both ADS-B and some radar? Or is the radar just used as a trigger and receiver? To differentiate between ADS-B and ADS-C it would be helpful to name more clearly, where the "Mode-S data" are assembled from.

> This paragraph has been reworded.

5619/21-23: Since the information given is confusing in this place, I suggest to remove everything between "... Surveillance Contract)" and "is a surveillance technique..."

> we think this information is now more in place; the suggestion is therefore not followed

5620/3-4: To my knowledge, its the other way round: "Unlike AMDAR that uses its own algorithms (Painting, 2003), ADS-B and ADS-C wind and temperature observations are based on direct read outs from the FMS."

> Changed to : "ADS-B, ADS-C and AMDAR wind and temperature observations are based on direct read outs from the FMS, while AMDAR using its own algorithms (Painting, 2003)."

5620/7: add "aircraft" after "(KLM)"

> OK

5620/8: When were the 76 days?

> starting date added

5620/23: "position and flight track": since "flight track" may designate a sequence of positions, too, the wording should be changed, e.g. "ground speed (change of position with time) together with airspeed and heading".

> OK

5621/1: was called "Mode-S EHS" before, check consistency of wording

> OK

5621/2-5: repeated information, remove.

> OK

5621/24-5622/4: This paragraph would be more helpful if moved to the beginning of Sect 2.1

> OK

5621/27: "since limited by": I suggest "since Mode-S needs a direct line of sight which causes the lower bound for possible altitudes to rise with distance, due to"

> OK

5622/1-2: Is the position of ADS-B messages really discarded, although it uses 16bit (approx 500m) resolution?

> OK

5622/6: Change "ADS" into "ADS-C".

> OK

5622/7: To my knowledge, "ADS-C" messages are only generated by request. The request however may contain the query to report repeatedly at certain intervals.

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> That is correct see introduction, the text is changed accordingly

5622/8-18: This part describes ADS-B not ADS-C! Move up and change "ADS" into "ADS-B".

> This part has been revised and partly moved up.

5622/12: ADS-B re-definition unnecessary

> OK removed

5622/12: ADS-B satellite based? It uses only VHF (ADS-B out) and maybe TIS-B (ADS-B in) but no satellite links.

>Yes ADS-B can be transmitted over satellite

5622/15: add: "... of other properly equipped ..."

> OK

5622/17: The met block is called "block 2" not "block e)"

> I think it is block f) according to Doc4444 ATM/501,15th Edition, paragraph 4.11.5.1; the table has been updated accordingly

5622/16: This information is very hard to understand: Do you mean: ICAO Annex 3 obliges every signing country to provide aircraft-based upper air measurements. Since many countries do not have an AMDAR program that would fulfill this requirement, Mode-S could provide an easy way to provide such information, at least on a minimal level as defined in ICAO Annex 3 Part 5.3.1 (every 15s for 10min after takeoff, then every 15min) ?

> The text is restated in "In addition to the transmission of the ADS-C data block a) and b) for air traffic surveillance purposes, the Meteorological information data block may also be requested. The Meteorological information group f) may be requested to satisfy conditions specified in ICAO Annex3 (July 2010), Section 5.3.1, air traffic management

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applications, or airline monitoring systems, etc."

5622/19: Sect. 5.4.1 of ICAO Annex 3 (2010) does not contain such information. Possibly you mean Sect 5.3.1

> OK

5623/2-6: contains general information about ADS-C, move up.

> OK

5623/11: "meteor" -> "meteorological information"

> OK

5623/12: "called." -> "called, in the following"

> OK

5624/(3) and following: I suggest to change the letter alpha (ISO symbol for angle of attack) into (lowercase) phi (ISO symbol for heading) and to change the variable "Mach" into "M" or "v_M" (i.e. "v" with subscript "M")

> alpha is changed into phi > Mach is left as is, since this abbreviation conflicts with the symbol M for molar mass of dry air

5624/10: append ", in the following"

> OK

5624/18: Excess "The"

> OK

5624/20: Are the data interpolated to the aircraft position or is the nearest grid point used?

> Changed to "linearly interpolated bilinear in position and linear in time between two

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successive forecast."

5625/1-6: The first two sentences repeat information already given.

> For readability one sentence is kept; the other is removed.

5625/6-8: Does this mean that ADS-B and ADS-C transmissions from one single aircraft and taken at the same time are reported as separated in space? If not, please explain.

> The sentence is reworded expressing the difference in time creates a difference in space.

5626/6-7: The first two sentences repeat information already given.

> OK: removed "The Mode-S data is processed using the corrections described in \Citet{DeHaan2011}. Mode-S observations are obtained with a temporal resolution of 4 seconds. "

5626/7-11: Why do you get these numbers. Since every ADS-C transmission is supposed to contain position. I would have expected that it would be possible to get a "derived" wind from almost any transmission, but "direct" wind only from transmissions with a met group. Hence "direct" winds should be more or less a subset of "derived" ones.

> Not all reports are transmitted or requested

5626/18: The different spacial coverage has been well explained, but it cant be seen from the mean winds!

> ok

5626/21: bias against which reference?

> OK

5626/24 & Figure 3: To me Fig. 3 look as if the stdev is even lower. The data points in
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the upper left and lower right corner however might increase the calculated value. But they are not really that far way; it's just due to the cyclic nature of heading. I suggest to subtract 360 deg to ADS-C heading in case of ECWMF-heading < 180 deg and $(\text{ADS-C heading} - \text{ECWMF-heading}) > 180$ and to add 360 deg to ADS-C heading in case of ECWMF-heading > 180 deg and $(\text{ADS-C heading} - \text{ECWMF-heading}) < -180$ deg and redo the calculation.

> I have double checked the data, using the proposed algorithm, in the scatter and the standard deviation between ECWMF and ADS-C is indeed 11.2531. The algorithm I used had exactly the same answer.

5627/5: information repeated again.

> OK removed

5627/14: does the small standard deviation hold for observations of the same aircraft, for all aircraft in a volume or both?

> the small standard deviation is based on the the same aircraft.

5627/25: If the title promises, temperature profiles should be shown.

> Profiles are shown

5628/8: The statement "... both the Mach number and the aircraft heading match very closely." is not true; something misses here.

> Words have been changed (see ref2)

5628/10-11: "... could be realistic" which could be judged more easily, if temperature profiles - indicating stability - would be shown.

> Words have been changed (see ref2)

5628/14: I think that Fig. does not allow to conclude good quality of the data. However, it infers that ADS-C transmissions match well the Mode-S/ADS-B transmissions but in

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value and reflected vertical structures.

> Words on "good" as been added

5628/25-5629/2: just "good" is a too general statement. But you could state something like the differences between ADS-C and ECMWF are on the same order as ADS-B (calibrated?).

> Words on "good" has been added

5630: Several acronyms are lower case

> bibtex issue, this is solved

Table 1: ICAO Doc 4444 form 1996 is at least superseded by 15th ed. (2007), available at <http://www.bazl.admin.ch/dokumentation/grundlagen/02643/02644/> This document lists (Section 4.11.5) ADS-C contents starting with a) aircraft identification, b) Basic ADS, ...

Table 2: The choice of fonts appears erratic, please adjust.

> Adjusted

Tables 3-5: Mean temperature, wind speed and direction values are not a characteristic value for the comparison, hence I suggest to omit it.

> The mean temperature gives an indication on the height of the observation. WE think it can serve as an precursor.

Figure 3: see comment above

> ok

Figure 4: way too small (I had to zoom to 250% to be able to read the legend)! I suggest to split into two figures and enlarge both.

> OK splitted and enlarged.

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===== Answers to reviewer 2:

p5619 line3 - met messages are transferred to the ground via ACARS

> OK

p5619, lines 9-20 - this whole paragraph is quite confusing - consider rewriting to explain the different observation techniques more clearly and in a more methodical and simplified order.

> See ref1

p5620, line 8 - specify exactly when this 76day period was

> Ok

p5621 - Title should be 'Mode-S EHS' to be consistent with references to Mode-S earlier in manuscript

> ok

p5621, line 16 - 'these' observations should be reworded - specify exactly which observations

> Changed "these observations" to "Mode-S EHS observations"

p5621, line 19 - 'background winds' don't understand this - which winds - explain...

> Changed 'background winds' to 'NWP reference winds'

p5621, line 20-21 - Sentence 'Below.....period' is unnecessary - consider removing

> OK; removed

p5621, line 26 - Consider removing the word 'vertical' as also the horizontal coverage is also limited by the curvature of the earth

> OK: "vertical is removed"

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p5622, line 14-15 - need to explain what these 'additional streams' are, otherwise consider removing sentence from ', and streams....'

> OK; sentence is rephrased

p5622, line 23 - sentence '4934 messages contained both types' - need to specify what 'both types' are - clarify that air vector is Block C whereas met info is Block E

> OK; clarified

p5623, line 2 - consider rewording first sentence to make it more readable, or at least capitalize Meteorology Group.

> OK; sentence is rephrased

p5623, line 14 - reword, there is no 'Earth-reference' ADS-C Group, say 'Ground Vector and Air Vector Groups'

> OK

p5624, line 9 - 'form' should be 'from'

> OK

p5624, ECMWF title should be something about the data, not just the ECMWF, revise such as 'ECMWF NWP Data'

> OK

p5624, line 12 - starts with 'The observations' - which observations? - define...

> Changed "The observations" to "The Direct and Derived ADS-C observations"

p5624, line 13 - NWP has been references already - no need to explain it again - so has ECMWF on line 14

> OK

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p5624, lines 14 to 16, from 'This model..... all the way to.....air analysis' - combine these two sentences

> OK. Sentences are combined to "Satellite, radiosonde and aircraft observations are the main input for upper air initialization at analysis time."

p5625, lines 4/5 - the fact that the data has to be corrected according to de Haan (2011) has been stated already

> OK removed (see ref1)

p5626, line 22 - after '10 degrees' reference Table 4

> OK

p5627, line 25 - title 'Profile of wind and temperature' - I cannot find any profiles of temperature in Fig 3. Either add to Fig 3 or remove from title 3.3

> Temperature has been added

p5628, line 3 - From Fig 4 I would not say that Mach number and aircraft heading 'match closely' - they differ widely in some instances, revise sentence to say 'in some instances Mach number and heading compare well'

> OK

p2658, line 11 - consider using a different expression than 'realistic' - define it better

> OK, sub-sentence is removed.

p5628, line 12 - remove 's' at end of small scales and possibly add the word 'variability' (i.e. '.....wind speed shows more small scale variability.')

> OK

p5628, lines 21 and 22 - consider using numerics rather than words for 'thousand' etc

> OK

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p5628, lines 25 and 26 - Need to define 'good quality' and 'better quality'

> "good quality" is defined as "similar to AMDAR"; "better quality" is defined as "lower standard deviation"

p5628, lines 27 - would say that 'ADS-C reports have similar quality' rather than 'the same quality'. Also define these statements (bias, stdev etc)

> OK

p5629, line 3 - need to add 'ADS-C' in there somewhere to make sure the reader knows exactly which observations we are talking about.

> OK

p5629, line 9 - 'warmer than radiosondes' needs to be warmer than radiosondes'

> OK

p5629, line 10 - add the word 'radar' after 'wind profiler'

> OK

Please also note the supplement to this comment:

<http://www.atmos-meas-tech-discuss.net/5/C3261/2012/amtd-5-C3261-2012-supplement.pdf>

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 5617, 2012.

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