Reply to report #1 by anonymous referee 2

Thank you very much for your reviewing our manuscript and providing us with valuable comments and suggestions. Hereafter, Cx represents the referee's comments and Rx represents the reply to Cx.

Major comments

C1) It may be valuable in the discussion around line 405-409 to discuss what the comparisons to both satellite data and the new RS41 product imply about whether this temperature difference may arise in the current RS92 processing.

R1) Thank you for the suggestion of the verification using third data (satellite or other types of radiosonde). But, the GNSS-RO temperature data are very limited and cannot be used for additional verification. And we have not conducted iMS-100 vs RS92 vs RS41 comparison flights. So this issue will be discussed according to the comparisons between RS92 vs RS41 and iMS-100 vs RS41 later.

So we add sentences like the below:

“Further discussion about the contributions of different radiation heating correction methods to the temperature difference needs other observation data like satellites or other types of radiosonde, like RS41. But GNSS-RO-based temperature data is very limited and no comparative observations have been made at Tateno between three sondes (iMS-100, RS92, and RS41). Therefore, additional discussion is expected after the results of comparisons between iMS-100 vs RS41 and RS92 vs RS41 are published.”

C2) It would be worthwhile considering whether a reason for the difference in RH behaviour in the presence of sharp gradients as discussed at the end of page 15 could be given. I assume it arises because of the difference between having a heated sensor or a passive sensor. I would furthermore hypothesise that the effect would be more marked in going from high to low humidity than from low to high humidity if this were the case. It is well known that passive sensors have issues of residual wetting on exit from cloud tops such that there is an asymmetry in the effect.

R2) As you mentioned, the iMS-100’s RH sensor shows residual wetting (termed as hysteresis, described in Section 2.2.2), but RS92’s RH sensor does not show hysteresis because of heating. I think you suggest this point must be emphasized. So the sentences like the below are added:

“As described in Section 2.2.2, the iMS-100's RH sensor has hysteresis with the large time constant, but RS92's RH sensor is heated and its hysteresis is negligible. This difference in characteristics of RH sensor could cause the large difference, especially in rapid decreasing RH case.”

Minor comments

C1) Line 7 I would say 0.5 K cooler rather than 0.5 K lower

R1) Rephrased.

C2) Line 106 hese –> These at start of the sentence

R2) This is typo. Corrected.

C3) Line 109 called as the -> termed the

R3) Rephrased.

C4) Line 146 change to 'near Japan is one of the regions with large differences'

R4) Rephrased.

C5) Line 184 it is unclear what you mean by supporting latitude and longitude. I assume you mean requiring latitude and longitude information or similar?

R5) Rephrased as "the initial wind speed wspeed0 and direction wdir0 are derived as motion vectors from longitude (λ; lon0 in Fig. 8) and latitude (ϕ; lat0 in Fig. 8) based on GPS positioning for IMS-100-GDP"

C6) Line 191 Each of these components [...]

R6) Rephrased.

C7) Line 198 convert -> converts

R7) Corrected.

C8) Line 205 which of the two correction models is [...]

R8) Rephrased.

C9) Line 248 uncertainty amounts -> quantified uncertainty estimates

R9) Rephrased.

C10) Lines 392-394 do you not need to make clear that the consistency ranks correspond to satisfying k<1, k<2, k<3 and k>3 respectively?

R10) I understand you pointed out that consistency ranks are k<1, 1<=k<2, 2<=k<3 and k>=3 in Table 8, not as 1, 2, 3 and 4. So I rephrased the text as so.

C11) Line 428 change ‘of’ to ‘the’
R11) Corrected.

C12) Line 432 reason for these difference could be [...]
R12) Rephrased.

C13) Line 473 different -> difference
R13) Corrected.

C14) Several of the figures have very small font size. Where possible increasing the font size would increase the figure readability.
R14) We increase the font size in Figs. 4, 12, 13, 15, 16, and 17. Fig. 1 is enlarged.

Reply to report #2 by anonymous referee 1

Thank you very much for your reviewing our manuscript and providing us with valuable comments and suggestions. Hereafter, Cx represents the referee's comments and Rx represents the reply to Cx.

C1) Line 91: Uncertainties - > error
R1) I'm sorry but I cannot find these points in the change-tracking file.

C2) Line 146-7: are -> is
R2) I'm sorry but I cannot find these points in the change-tracking file.

C3) Lines 394-397 are a quotation from Immler et al. 2010 and should be between quotes or, better, appropriately rephrased.

- Although Immler et al. words are a standard in the atmospheric measurement community, there is a confounding use of the term uncertainty as it is defined in metrology and of the concept of equality of measurements (m1_=m_2) as is specified in statistics and probability.
- According to standard terminology:
  - "uncertainty" is a spread parameter, in our case u_1 or u_2, related to the measurement error. Hence instead of "uncertainty is normally distributed", the sentence "measurement error is normally distributed" should be used.
  - "Assuming the hypothesis that m_1=m_2 is true" should be rephrased as "Assuming that the two measurements m_1 and m_2 have the same expectation (or mean)."
- To see this, note that the sentence of Immler et al., "the probability that |m_1-m_2|>k(u_1^2 + u_2^2)^0.5 occurs only by chance, is roughly 4.5% for k = 2 and 0.27% for k =3" is correct under the assumptions that the measurements m_1 and m_2 have independent errors with measurement uncertainties (or standard errors) u_1 and u_2, and the difference m_1-m_2 has a normal distribution.
- In fact, "the hypothesis that m_1=m_2 is true" is a confounding statement because, due to the normal distribution, the event m_1=m_2 has a zero probability of happening by chance. Also, it cannot be interpreted as "equality in distribution" or "equality of the two distributions" because u_1 and u_2 may differ.

R3) Thank you for your explanation. We revise this part as follows:
"Under the assumptions that the measurements m_1 and m_2 have independent errors with measurement uncertainties (or standard errors) u_1 and u_2, and the difference m_1-m_2 has a normal distribution, the probability that ... "