

Interactive comment on “Development of the HadISDH marine humidity climate monitoring dataset” by Kate Willett et al.

Anonymous Referee #1

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This manuscript introduces a new dataset for surface marine humidity. Clearly the production of this dataset was a major effort and it should prove useful as a climate dataset. The manuscript generally does a good job of describing the many methodological choices. However revisions are required to make the description of the process of making the dataset clearer and to improve the discussion of the resulting global trends.

Major issues:

1) The paper isn't sufficiently clear about whether data that is flagged for quality control issues like the buddy check or supersaturation are actually included in the final results or removed. On pages 12-13 some QC issues lead to "failures removed" but many issues lead to "failures flagged" rather than removal. It is later implied that the flagged

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values have been cleaned from the data (e.g. lines 718 and lines 966-968) but this doesn't seem to be explicitly written down as part of the process earlier in the paper and it is not clear that all flagged data is removed (e.g. the whole number flag). Please add a paragraph relatively early in the paper to explain in one place whether the flags and which ones are used to remove data (and at which iteration). Also some issues on page 13 are listed as "base qc" but the term "base qc" is never referred to again. In particular, state whether "raw (noQC)" includes the "base qc".

2) A central feature of the dataset is that it involves three iterations. The iterations are mentioned throughout the paper but do not seem to be properly introduced (unless I've missed it). Please add a paragraph early on in the paper where you introduce the iterations, how they differ from each other, and why you use three iterations (rather than say 2 or 4).

3) The paper seems to conclude that whole number rounding is not causing the pre 1982 positive bias and thus the negative trend in relative humidity, but I don't find this very convincing given that there is a large change in frequency of whole numbers in Td around 1980 (Fig S1b). Please address this issue in two ways: i) Calculate the trend in relative humidity for 1982 onwards to see if it is significant and include it in the paper. ii) Remove the whole-number flagged data and check if the trend in relative humidity remains negative.

4) line 768-769: You don't mention correcting for serial correlation when calculating the uncertainty of the linear trends. Correcting for serial correlation could substantially increase the size of the 90th percentile confidence interval. Therefore, you should correct this estimate for serial correlation (or mention it if you are already doing so).

5) Equation 3: Does the $\sqrt{9}$ result from the Gaussian distribution rather than assuming a uniform distribution (which would give $\sqrt{3}$)? Note 1 on page 14 of the cited BIPM document seems to suggest $\sqrt{9}$ would be correct for a 3 sigma range rather than a 1 sigma range as used here, so this could be an error.

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Minor issues:

line 49: "In these regions": Does this mean the region outside the northern mid latitudes or does it mean the northern mid latitudes?

lines 210-211: NOCS is not always lower in specific humidity over 1973-1981 - correct?

line 225: It would be clearer to say "conversions between different units (e.g....) and between different variables" (currently it reads as a conversion between a unit and a variable which does not make sense)

line 270: Please clarify in the paper whether the absence of metadata from 2015 onwards is a temporary issue or something that is expected to persist.

line 281: "pentad gridbox" is used without pentad being introduced. Please move the explanation for pentad from line 290 to here (i.e. that you mean pentad in time).

Table S1: Introduce what Pmst is (not sure what mst stands for, Ps is used in the text). Also it is said in the table that e/es can be replaced by q/qs but these are clearly not equivalent. Clarify if you use e/es or q/qs.

line 356-357: Add a sentence to say how you determine if the track is 'plausible'

line 481-482: I assume 'f' is being used here as a symbol for a generic function. Please instead explain (in words if necessary) what the function is.

line 501-502: Is 'f' being used as a generic function? If so, writing 'a function of $f(10/L)$ ' doesn't make sense and should be 'a function of $10/L$ '.

line 508-509: Why does using T for SST mean that T is not adjusted?

lines 516-524: Multiple units are missing for temperatures and lengths in this section of the text (0.2, 50 etc. should all have units)

line 532: 0.001 should have a unit

line 538: Introduce that 'x' could be 'T, q, etc.'

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line 565: "and uncertainty"->"an uncertainty"

line 587: Why is Nobs=10 the worst case scenario?

line 616: Say how the gridding is done. Is it just a simple average of all data inside the grid box for those 3 hours?

line 721-: I don't understand why you are showing results for the 2nd iteration rather than the 3rd iteration.

line 772-773: Explain the abbreviations noQC, NBC, BClocal. I can guess the first two. I don't know why BClocal is "local".

line 783: A little more care is needed to discuss and cite expectations from theory and models. The first cited paper Byrne and O'Gorman 2013 indeed does show results for weak positive changes in marine relative humidity. However, it doesn't seem to give a theory for changes in marine relative humidity; it instead cites for theory the papers by Held and Soden 2010 and Schneider et al 2013 which could be cited here. The cited Byrne and O'Gorman 2018 paper does seem relevant in that it shows that the land changes in temperature and humidity are broadly consistent with simple theory and no changes in marine relative humidity.

line 801-804: BClocal etc. include the quality-control step and the bias adjustment so they should be compared to the quality-controlled data but not the raw data when seeking to determine the effect of the bias adjustment.

line 818-819: I support the authors wise choice to focus on the ship data for the final product.

line 845: "compares well" Be more specific here about what aspect compares well. For example, the trends are quite different in magnitude.

line 868: The decreasing trend in relative humidity over ocean is said to be consistent with the decreasing trend over land. I don't see why this is "consistent" rather than

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just "similar". The papers cited earlier on models and theory suggest that land relative humidity can decrease even if marine relative humidity stays constant or increases slightly. Also, it would be helpful to give a value for the trend over land to compare with the trend over ocean to see how similar they are in magnitude.

fig 1: Why does JRA have values before 1980 for land but not marine relative humidity? How is missing data dealt with in this figure?

fig 5: Might be less confusing if you use the same y axis range for both panels

fig 6: The blue path goes through the Quality Control box but then it later is labelled "no QC" which seems to be contradictory. Also "noQC" and "bias adjusted" are labelled for blue and yellow but not red.

fig 7: Annual mean climatologies are deemed acceptable if 9 months of the year are present. Couldn't this lead to a very large bias if for example November and December were missing given the large seasonal cycle?

fig 8: It is probably less confusing to keep the same vertical order for the legend and the trends (currently they seem to be reversed).

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