

Reviewer #1

We sincerely appreciate the reviewer for carefully reading the manuscript and providing feedback. We have considered all the comments in the revised manuscript. A short answer to the comments is also given below.

- 5 Section 2 should include a listing of the frequencies associated with each channel number. I am assuming Channel 1 is 89 GHz, Channel 2 is 150 GHz etc., but this is not stated. Also, it is confusing that you say "fifth channel...89 GHz" when you do in a later section say that Channel 1 is 89 GHz. I would not use the labels of "first, second, etc." unless they directly correspond to Channels 1, 2, etc.

10 We revised Section 2 to avoid inconsistency in the text and also included the channel frequencies along with the channel numbers that we have used throughout the text. It now reads as follows:

AMSU-B channels 1-5 operate at 89.0, 150.0, 183.3±1.0, 183.3±3.0, 183.3±7.0 GHz, respectively and MHS Channels 1-5 operate at 89.0, 157.0, 183.3±1.0, 183.3±3.0, and 190.3 GHz, respectively. The combination of these channels can be used to derive a wide range of atmospheric and hydrological parameters.

- 15 Section 2, second paragraph, first sentence. AMSU-B is vertically polarized, while Channels 3 and 4 of MHS are horizontally polarized (you have these switched in the sentence).

We changed this sentence to

AMSU-B channels are all vertically polarized at nadir(Hewison and Saunders, 1996), but MHS Channels 3 and 4 are horizontally and the rest are vertically polarized at nadir (Kidwell et al., 2009).

- 20 I would like to see some more details about how the polar regions are used in the intercalibration. What kind of filtering was done for the area averaged brightness temperatures over the Antarctic and Arctic?

We have revised Section 3 to better explain the intercalibration method, especially the filters that we have used in polar regions. Please see the revised manuscript.

- 25 Is there a reference or some kind of evidence to show that the diurnal cycle of temperature and humidity is negligible in the polar region? Page 5, 1st paragraph mentions how the diurnal cycle in polar regions and tropics are negligible but only gives references to back up this claim for the tropics. Also, in the polar regions, some of the channels especially the window channels see the surface, which will change seasonally. How is surface variability accounted for in these channels so it doesn't impact your intercalibration and cause a seasonal signal?

- 30 We have included references (e.g., see Przybylak, 2016, Figure 4.3) that show the diurnal variation of temperature in polar region is negligible and more importantly the diurnal variation is not systematic. As mentioned by the reviewer, many of the channels would be significantly impacted by the surface during polar night because of dry atmosphere. Therefore the factors that would impact the brightness temperatures are surface emissivity and surface/skin temperature. Given that the surface temperature doesn't change much during polar nights and the emissivity remains significantly constant as the surface cover will not change systematically during day, we don't expect any signif-
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icant or systematic change in measured brightness temperatures over the course of the day. We are
40 collocating the observations in a daily basis so the seasonal variations should not affect our results.
We have revised the manuscript accordingly to better discuss these parameters.

In Figures 1 and 2 it is really hard to see any trends in the data as
its rather noisy and all the channels are plotted on top of each other.
Page 7, 1st paragraph refers to some trends that can be seen in Figure
45 2 but this is a bit hard to see. Perhaps you could do separate subplots
for each channel, and maybe plot a running average on top of the raw
data so that trends can be more easily observed?

We have plotted individual channels in separate plots (including weekly moving averages) to be
able to better show the change in the window channels. We appreciate the reviewer for carefully
50 reading and checking the text and the plots. Please see the revised manuscript for the new plots.

Is Figure 3 the intersatellite differences for the tropics? And it
sounds like Figure 4 shows the same thing as Figure 3 but is over land
while Figure 3 is over ocean only? Please make this more clear in the
text as well as the figure labels.

55 We have amended both the captions of the figures as well as the text to better reflect these differ-
ences. Now it reads as follows:

Figure 3 shows the inter-satellite differences for NOAA-17 AMSU-B and NOAA-18 MHS
versus FOVs averaged over tropical oceans for the entire period. The FOVs' numbers start
from the left side of the scan (FOV1), so that the nadir view is FOV45 and the most
right view is FOV90. Note that NOAA-18 overpass time is around 13:00 LT but NOAA-
17 overpass time is around 22:00 LT. As shown in Figure 3, the differences between the
two instruments significantly change with FOV especially for Channel 1. Figure 4 shows
the time series of the differences between the two instruments. As shown in Figure 4,
the differences exist for the entire period and other than some small variations, do not vary
with time. Figure 5 shows the difference between the two instruments over tropical land. If
the differences were due to different overpass times then the differences between the two
instruments should be larger over land. However not only are the differences generally
smaller over land but also they do not depend on the FOV. Since the ocean is a polarizer in
MW frequencies but the land generally is not a polarizer, the difference between Figures
4 and 5 particularly highlights the effect of polarization on the differences between the
two instruments over tropical oceans. Note that this exercise is not able to rule out other
factors that may affect the inter-satellite differences. One possible explanation is that the
weighting functions peak higher as the field of view moves from nadir to the edge of the
scan so that some of the FOVs peak high enough in the atmosphere to become insensitive
to the surface conditions.

Figure 5 does not appear to be referenced in the text except on page 8
(where it says "see Figure 5"), but there is no description in the text
60 for what exactly Figure 5 shows. Is it an average over the years for the
ocean measurements?

We have amended the text to better reference Figure 5. Please see our answers to the previous
comment and note that Figures are rearranged so Figure 5 is now Figure 3.

Figure 6 caption says "time series... tropical and polar regions",
65 however from the text it sounds like this is showing only the tropical
regions.

We have amended the figure caption to reflect the correct dataset.

Figure 7: The really light colors (for 50S-70S and 70S-90S) are hard to see. I recommend making the colors darker.

70 We have included a revised version of Figure 7.

Figure 7: The southern polar region (70S-90S) shows a lot of variability with some extreme outliers. Are all values averaged or some filtering done to remove these outliers?

75 Figure 7 now have all the channels included. Besides we have removed the data that were not used in the regressions (daytime polar regions as well as mid-latitude ocean averages). The outliers were from the day-time polar regions and don't exist in the new figure.

Figure 8: Channel 5 slope and intercept appear to have a seasonal signal associated with it. Any idea why this is? I would be concerned that a seasonal signal is being incorporated into the intercalibration.

80 There is generally a trade-off between regression coefficients (slope and intercept). In this case as well as Channel 4 early 2008 (for example) the coefficients can be stabilized by putting thresholds on the least square minimization but of course the results would be essentially the same. However we preferred to avoid constraining our regression coefficients and let the minimization fully be automated.

85 Technical Corrections:

Remove commas after the word "Although" when used at the start of a sentence (this happens many times throughout the manuscript). Page 11, line 267. Change "references" to "reference". Done!