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Atmospheric Measurement Techniques Discussions

Interactive comment on "Inter-calibrating SMMR brightness temperatures over continental surfaces" *by* Samuel Favrichon et al.

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The authors would like to thank the anonymous reviewer for the comments on the paper "Inter-calibrating SMMR brightness temperatures over continental surfaces". Indeed the Scanning Multichannel Microwave Radiometer (SMMR) is an important piece in the story of earth radiometric measurement that can still be useful for the remote sensing community.

Response to the review

The authors have developed a method for adjusting the calibration of the Scanning Multichannel Microwave Radiometer(SMMR) on the Nimbus 7 satellite. This instrument

was plagued with a multitude of problems making it very difficult to work with. However, problematic or not, it was the only microwave imager operating for almost a decade in the 1970s and 1980s. It is incumbent on the scientific community to salvage the data from this instrument as well as possible. The present paper is a significant contribution to this effort. In spite of the lack of a common observing period, they have chosen to use the GPM Microwave Imager (GMI) on the Global Precipitation Measurement satellite as a reference. The GMI is exceedingly well calibrated and is suitable as a reference instrument. They have to make assumptions in order to get around the lack of a common observation period. They have only dealt with two of the five frequencies on SMMR. The radio frequency interference problem would make any use of the 6.6 GHz channel very difficult and the 21 GHz channel is not very useful over land. However, it is disappointing that they did not include the 10.7 GHz channel in their study. The writing is not exactly native English but there is no problem with understanding.

Response The 10.7 GHz channel was not included in the study for two main reasons: First the goal to provide continuous times series of measurements cannot be achieved with this channel as the SSM/I and SSMIS radiometers do not include it. Therefore a 40 year series of 10.7GHz measurements is not possible. Second, the 10.7GHz channel is not used in our retrieval of the Land Surface Temperature that was the initial goal of this study. It could be studied in a similar fashion as GMI also has a channel at 10.65GHz (against 10.7GHz for SMMR).

The authors have tried to improve the writing to better fit the English standard.

Detailed comments

P4 Line20: "Njoku et al. (1980)" This reference is for the SMMR on SeaSat which only lasted for 99 days. It is of limited applicability to the SMMR on Nimbus 7 which is the topic of this paper.

R The reference was mixed up with another paper by E. Njoku in 1980. It will be replaced with the following "Antenna pattern correction procedures for the Scanning Multichannel Microwave Radiometer (SMMR)" E. Njoku 1980.

P5 Line 6: "...upgraded to SSMIS..." It's not good to lump the SSM/I and the SSM/IS together. They were manufactured by different companies and were very different in terms of the problems. In particular, the SSM/IS had a very large problem with emission from the main reflector. From a calibration point-of-view they are not at all the same sensor.

R Although the two instruments series differ on many points they still share some common characteristics such as the channels used, this was the intended meaning of this sentence. The updated sentence will make the distinction between these instruments more apparent. p.5 l.6 "In the following years multiple instruments were launched such as the Tropical Rainfall Measuring Mission's (TRMM) Microwave Imager (TMI) in 1997, or the Special Sensor Microwave - Imager/Sounder (SSMIS)"

P5 Line 13 "The fundamental...changes in the environmental conditions..." This is a necessary assumption for them to proceed, but it is also a severe limitation. The results cannot be used to look at secular changes over the 3 decade time difference between the two satellites. While this is a seemingly obvious limitation, they should highlight it. Otherwise somebody will waste a lot of time and effort drawing specious conclusions.

R As the reviewer noticed it is a very important assumption for us to proceed with the method. And as it is it should prevent any one from trying to perform trend analysis using the corrected SMMR data. The limitation has been more clearly stated to leave no doubt. p.12, l.22: "However, given the use of the more recent GMI instrument as a calibration reference any comparison between different epochs should be conducted with extreme care."

P6: They compare the various channels of SMMR and GMI directly with no algorithm to account for small frequency and view angle differences. They argue that these

differences are small. Given the problems of the SMMR, these differences are probably small relative to the other uncertainties in the comparison. However, for comparisons of higher quality sensors (e.g. Windsat vs GMI), this would not be adequate. When I agreed to review this paper, I was hoping that I would see some land surface modeling to support the intercomparison. Alas, 'twas not to be.

R The change of frequency and incidence angle are the two major differences between the two instruments. The change of surface emissivity with regard to these parameter has not been modeled but it could be done if trying to inter-calibrate other MW instruments that have a more reliable calibration.

P8 Line 2. "...erroneous warm calibration load temperature" Note that an error in correcting for the portion of the antenna pattern that misses the Earth would have the same form. Either one would result in an intercept of 2.7K and only slightly different slopes than given in Table 3.

R That is a good point, the sentence was changed to take into account this possible error source as well. p8, l1: "Different sources could cause such errors, for instance an erroneous warm calibration load temperature or an error in the correction of antenna pattern that misses the Earth."

Again the authors are grateful for the very good review that offered improvement to various parts of the paper as well as correcting some mistakes. The overall quality of the paper has been improved after taking into account these comments.

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