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Interactive comment on "A Fundamental climate data record of SMMR, SSM/I, and SSMIS brightness temperatures" *by* Karsten Fennig et al.

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General comments:

This paper presents a detailed and careful analysis of the original observations from SMMR, SSMI and SSMIS, to produce a high quality Fundamental Climate Data Record of passive microwave brightness temperatures. It summarizes a long term effort from the Climate SAF group. This FCDR is widely used by the passive microwave community, for multiple applications including reanalysis exercises in NWP centers. The document is a very informative and well written description of the different steps needed to obtain the FCDR, with a clear and honest quantification of the errors. This paper has to be rapidly published, after minor corrections.

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Discussion paper

Our group uses this FCDR extensively. We appreciate the quality of the data, as well as the responsiveness of the Climate SAF to answer any question related to the dataset.

Minor comments:

- Sections 3.6.3 and 3.6.6. These subsections might be too detailed. The figures include a lot of information that is not fully explained (e.g., axis, color scales). It should be possible to improve these figures. The orbit position is mentioned several times in the text. In the legend of the figures it is called fractional revolution. Can you clarify?

- P 23. DMSP F11 is used as the reference, with different reasons to justify this choice. However, it might be worth mentioning that the overpassing time of this instrument drifted significantly during its life time, with large time differences with F08, F10, F13, and F14 during their overlapping periods. That can have potential effects on the inter-calibration, especially over land.

- P 25. L 740. The warm surface types are only considered for their polarization differences. Checking the inter-calibration of the polarization differences over warm scene is certainly informative, but how can it make sure that the TbV and the TbH are independently correctly inter-calibrated from an instrument to the next? The warm and stable targets are usually selected over the Amazon forest that shows a very small polarization difference (both TbV and TbH warm). Over deserts, it would be possible to have rather high polarization difference with TbV high and consequently TbH rather low, but over deserts, the diurnal variation of the surface temperature is large and would make it very difficult to compare instruments that do not have the same overpassing times. As a consequence, it is difficult to understand how the inter-calibration takes into account the full temperature range, including the warm scenes. Can the authors elaborate on this point?

- P 37. L 1118. Uncertainty of the radiative transfer model due to scattering effects... Scattering can play a role, but limited for frequencies below $\sim$50 GHz. Uncertainties are more likely due to the lack of realistic cloud and rain information to feed the radiative

transfer model, for all cloud and rain effects (emission, attenuation, and scattering).

- P 38. L 1149 1150. FCDR... includes all possible surface types... Would it be relevant to mention that over land the inter-calibration might be less robust than over ocean, given that some procedures are only applicable over ocean (L 712-714), and some others are only taking into account part of the warm scene signal (L 740)? A word of caution for the users of the FCDR over land could be helpful.

- Figures 2 to 10 would certainly benefit from some additional work. The axes should be clarified, with mention of the units. The legend of the different line colors should be added to the figures.

Technical corrections:

- P 5. The spatial resolution of the SMMR instrument is not mentioned, whereas this information is provided for the other instruments

- P 6. L 181. MD5 hash: can you provide a reference and / or a few words of explanation?

- P 9. L 268-270. Channel numbers are not used elsewhere. Better mention their frequencies?

- P 13. L 387. ... each scan pair that passES the quality control...

- P 13. L 400. ... Earth'S counts

- P 26. L 798. ... trends cloud have been not accounted for... Rephrase?

- P 31. L 933. The on-orbit calibration IS...

- P 32. L 972. Instrument design (suppress the S).

- P 33. L 1009. A factor of 1.48. Where does this factor come from?

- P 35. L 1044. This means that most....

- P 35. L 1052. . . . and showS very similar. . .

- P 35. L 1057. This variability is caused by. . . Which variability are the authors talking about? The increase variability with frequency or the fact that the H polarization variability is larger than the vertical one? Rephrase to clarify?

- P 37. L 1112. It was further shown that. . . suppress the coma.

- P 37. L 1133. It becomes clear that. . . suppress the coma.

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