

## ***Interactive comment on “An Extended Global Earth System Data Record on Daily Landscape Freeze-Thaw Status Determined from Satellite Passive Microwave Remote Sensing” by Youngwook Kim et al.***

**Anonymous Referee #1**

Received and published: 24 August 2016

The manuscript presents an improved global database of F/T surface state based on passive microwave observations at 37 GHz V-pol. The authors first depict the main features of the F/T maps, before assessing the agreement of the database against several in situ surface air temperatures, and other cryosphere data.

The study gives an interesting improvement of a long temporal series (1979-2014) of global F/T product based on TB at 37 GHz V-pol. The validation analysis also gives a good idea of the factor affecting the accuracy of the product. There are also some good analyses on temporal evolution of FT related parameters. However, the manuscript

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could be improved with a better explanation of the difference between this product and the Kim et al., (2011) product (see detail in the following report). Also, the FT definition should be precise in the manuscript. For example, at 37 GHz, the FT signal in fall probably come mostly for the soil freezing, while in spring the signal come from the liquid water in snow. On lakes, at microwave frequency, there is a FT signal coming from the liquid water in snow, and a signal from spring ice breakup (see Kang et al., 2010 and Roy et al., 2015). Some discussion on the physics behind the signal could thus be added.

Hence, I recommend publication in Earth System and Science Data following some revisions as outlined in the following report.

1. Line 80 : What zone are not included in the new version (only open water bodies : see Fig 1). What is the difference between open water inundated and open water bodies?
2. It is not clear what zone was not included in Kim et al., (2011) version and why they were excluded. It should also be clarify what was done in this study to monitor FT in these new areas, that was not done in Kim et al., (2011).
3. Line 81 : Do you mean SMMR and SSM/I operation as SSM/I only started in 1987? What time period is the Kim et al., (2011) product?
4. Line 127-128 : Continue your idea by developing on how these phenomenon will impact FT monitoring?
5. Line 156: So there is a threshold for each pixel and each year? At what point the product will be different than the ERA-Interim information that is used to implement the threshold. It seems to me that the passive microwave product is probably very dependent of the Era-Interim STA?
6. Line 263 : add units (days) to FS, it will clarify the “mean annual frozen season” term.

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7. Line 287-289 : it seems that there is a significant decrease of agreement in 1987 and 1988. Could it be related to the sensors transition?
8. Line 428 : is FS from lake dominated pixel or all pixels?
9. It should be noted that there is generally a delay between snow melt (passive microwave signal) and lake breakup. It should be mentioned and discussed.

#### References

K. K. Kang, C. R. Duguay, S. E. L. Howell, C. P. Derksen, and R. E. J. Kelly, "Sensitivity of AMSR-E brightness temperatures to the seasonal evolution of lake ice thickness," *IEEE Geosci. Remote Sens. Lett.*, vol. 7, no. 4, pp. 751–755, Oct. 2010.

Roy, A., Royer, A., Derksen, C., Brucker, L., Langlois, A., Mialon, A. and Kerr, Y. (2015). Evaluation of spaceborne L-Band radiometer measurements for terrestrial freeze/thaw retrievals in Canada. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 99, 1939-1404.

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Interactive comment on *Earth Syst. Sci. Data Discuss.*, doi:10.5194/essd-2016-27, 2016.