EGUsphere, referee comment RC1
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Comment on egusphere-2022-224

Anonymous Referee #1

Referee comment on "Brief communication: Classification of thawed/frozen topsoil state by spectral gradient methods based on SMAP and GCOM-W1 radiometric data" by Konstantin Muzalevskiy et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-224-RC1, 2022

I believe this is an interesting manuscript, which will contribute to the literature on freeze/thaw classification. However, I do believe revisions are necessary before publication. I noted some more detailed points below, but in summary I believe that some additional discussions on the frequencies/angles used, and the inclusion of the other study sites as well as some discussion on the differences between the sites and the impact of this on the results would be critical.

Major comments:

- Line 98: "The difference in observation angles 40° and 55°, respectively for SMAP and AMSR2, was neglected.": why was this neglected, and what is the justification. As far as I could tell, there is no discussion on this in section 4. I believe a thorough discussion of this is necessary as this is at the basis of this methodology.
- Figure 1: Only Happy Valley test site is shown. I would argue its critical to somehow show the other test sites as well. At the very least there should be an example of one of the sites where the methodology does not work as well according to the authors.
- In section 2, the authors describe differences and similarities between the test sites. I can not see any discussion on how those conditions influence the outcome except for 'surface water area' which is briefly discussed but not with a focus on the differences between test sites. Please elaborate in the discussion section the soundness of the results for those different sites as it speaks to the transferability of your approach.
- Line 122: "The physical basis for this effect is the observation angle of the AMSR-2 radiometer of GCOM-W1 satellite, which is close to the Brewster angle (55º)": please provide a citation(s) for this paragraph.
- Line 181-182: Does this mean that this method is not applicable in lower latitudes/sub Arctic regions? Please expand/clarify.

Minor comments:

There are several spelling/grammar mistakes. I noted some below, there may be others that I have not found.

- Line 134: ovals are not visible possibly replace with vertical line with a stronger color/stronger line width
- Figure 3: Figure caption to long, difficult to get the essential points from it. Please shorten. Also, it should be made clear in the figure caption that the different colors represent the different test sites.
- Line 188: swap identification with identify
- Line 198: "FT topsoil state identification possible with determination coefficient": missing 'is'
- The word 'region' is used several times incorrectly in my opinion. Specifically, line 138 where it should be replaced by 'time period' or something similar.