

## ***Interactive comment on “A comparison between remotely-sensed and modelled surface soil moisture (and frozen status) at high latitudes” by I. Gouttevin et al.***

**Anonymous Referee #2**

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Abstract.

1. “In this study, . . .” is not a good way to start the abstract. The structure of the first sentence abstracts the meaning. Consider “We evaluate the ASCAT soil moisture and surface status products. . .”
2. Rather than present the ‘objective’, shamelessly present the great findings you have made ;-)
3. The justification embedded in the third sentence is somewhat lost. Consider re-phrasing to “Addressing the climate and ecological modelling communities need for

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improved estimates of soil moisture. . .”

4. The sentence “The spatial and temporal. . .” has the following problems (a) attempts a justification of an unknown spatial and temporal resolution and (b) ignores that fact that one could simply resample a spatial or temporal resolution NOT suitable for comparison against models. This point is weak and steals real-estate you should use to present your findings.
5. Sentence “Modelled and remotely-sensed . . .” is again cumbersome and again seems like an out-of-place justification. The sentence that follows it makes little sense to that which it proceeds. The two sentences hang in no mans land. Re-locate (to intro) or loose them.
6. Sentence “For unfrozen soils, . . .” reads like a discussion. If it’s a finding, present as such “We show. . .” If not, move it (to the discussion) or loose it.
7. In this last paragraph (by the way an abstract is normally 1 paragraph – in my opinion) you are basically discussing but also throughing in ‘quantitative’ claims like “weak performances”. Put the stats here, convince me of the efficacy of the products ability and the models flaws.
8. Sorry, but you should consider completely re-writing the abstract.

Rest of the manuscript. . .

1. 11244.1. You need to follow up your claim with either (a) a referenced and/or (b) why they are key variables. I would argue they drive ecosystem production and hydrological processes of evaporation, transpiration and run-off. After all you launch into the details of this link in following sentences. Justify your claim better.
2. 11244.2. When talking about productivity in the carbon cycle, include ‘respiration’. After all, this is the measure used in monitoring and modelling the carbon cycle.
3. 11244.15. Inclusion of the temporal dimensions of your study would be useful here,

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presently it is masked under the term 'evolution'. Perhaps something like 'Temporal shifts in freeze-thaw cycles...?'

4. 11224.20. Provide some examples of GCM LSM's that you are talking about. Consider citing the use of soil moisture from models as drought indices etc etc.

5. 11224.26. The disparity between the spatial variability of fluxes in soil moisture and GCM-LSM resolutions sprung to mind here... you don't mention this until line 11245.5. The story could benefit from tightening this up.

6. 11225.10 The term 'homogeneous patch' is mentioned. This term is ambiguous and speaks of both the soil composition and vegetation cover, both of which drive the carbon and water cycles. Perhaps prudent to identify how poorly both of these are generally represented in GCM-LSM's. For example, the use of coarse grid and classified (simplified) soil properties. The use of land use classes with assumed cover fractions OR remote sensing climatologies for cover and greenness.

7. 11246.10. This argument needs to be tightened up. What are the advances in remote sensing we thank? Explain the limitations of using areal averages. If the data are acquired at higher temporal frequencies than we have in-situ data to evaluate them, then do we not have an evaluation problem?

8. 11246.16 I don't agree that being of the same resolution provides an advantage other than not requiring to re-grid – which is almost always required and done anyhow. It is however, handy. If you really want to argue this perhaps you should make this an objective or re-word this to focus on quantitative arguments for the resolution compatibility (if any).

9. 11247.5 Reference for the LPJ use?

10. 11247.5-10 You refer to 'low correlations'. Show the numbers and define what range 'low' refers too or consider using the numbers themselves.

11. 11247.18 'It may be time' should be replaced with a more confidence-instilling  
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phrase, such as "it is timely".

12. 11247.27 Quantify the accuracy.

13. 11248.5 'The present study intends to...' should be re-written to be more direct... E.g. "The objectives..."

14. 11248.20 Remove the methodical description of the articles order, this is unnecessarily verbose, this is not a book or a thesis.

15. 11249.7 The last sentence of the paragraph needs to be broken down to tease out the three comments (1) DUE-permafrost studies are being conducted in the region (2) they are complimentary to ALANIS-Methane and this study and (3) they expose the limitations of remote sensing at these latitudes and our understanding of the state of the art.

16. 11249.18 Spell out the fundamental basis for the benefit of the story, otherwise the sentence "This contrast is the theoretical basis for the remote sensing of soil moisture and surface status" becomes an unsubstantiated claim.

17. 11250.12 Again, remove methodical directions to manuscript structure such as "see below".

18. 11250.12 Not enough emphasis is placed on the justification for the inclusion of MODIS snow-cover data and how this used with the ASCAT SSF product. Firstly, the two are not interchangeable. Most critically to your story, the case for ASCAT is the leading argument, i.e. "This contrast is the theoretical basis for the remote sensing of soil moisture and surface status.", starting at line 11249.15

19. 11251.1 Quantify or reference the statement "There are known limitations to both datasets affecting their accuracy over our study area."

20. 11251.3 "Concerns..." vague and not convincing. Quantify.

21. 11251.7 Reference and quantify "There are known limitations to both datasets  
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affecting their accuracy over our study area.”

22. 11253.21 Quantify “For simplicity, we will assume in the following that the solar energy input has an effect of the soil surface from 9 a.m. to 9 p.m., an approximation which has a physical meaning given the soil thermal inertia”

23. 11254.26 . i. Mask – Better clarify which mask, I assume the one you derived from ASCATT and MODIS as defined earlier

24. 11255.7-13 Sentences not clear, re-word.

25. 11255.15 Consider starting the sentence in another way and rewording it altogether.

26. 11255.15 onwards. Quantify each result, specifically when percentages are used. Include the actual values plus the standard deviations and include the mean so that the reader can evaluate the magnitudes of the differences.

27. 11226.14 : Biased positively or negatively? What magnitude? Significantly biased?

28. Summary of my concerns with the results. The tables and figures show the fruit of some excellent analysis. However, the rambling nature of the results abstracts these results. The “locations” and “X”s on maps used in the figures are not defined and justified sufficiently in the methods and referred to according throughout the remainder of the story. The authors delve into different types of analysis, site based (i.e. X’s locations), ‘spatial’ and ‘basin/ catchment’ or regional comparison. However, the results of each are discussed somewhat randomly. I suggest this is tuned to highlight the strengths and weaknesses of each and discussed quantifiably and systematically i.e. method a,b,c corresponding to result a,b,c etc. Then we can get a feel for the story on the comparison and efficacy of the model and product. Furthermore, the statistics (Pearson’s correlation coefficient?) needs to be defined. It is an “R” yes? Call it that. If you feel the need to define a normalized difference, why not R?

29. Section 3.2.3 after 11263. . . Zonal averages? Do you mean ARC GIS Zonal av-  
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verages? You need to calculate the complete statistics for each of the ‘spatial zones’, be wary of your scale and registration issues (i.e. weighted averages at least in your case!) You could make the plots better support section 3.2.3.

30. The discussion and conclusions need to be improved following the changes suggested in the above sections. Their present form is (a) under referenced (b) lacking the quantitative conviction the results are lacking and (c) hard to link to the overall story. What happened to the hypothesis? What about your addressing of objectives?

Some specific issues with the tables and figures. . .

Table 1. Standard deviations?

Figure 2. What does X1, . . . refer too? Locations?

Figure 3. Can you increase the size, rescale and label. The figure is unreadable in its present state.

All figures generally. . .

You need to be consistent in the presentation of your figures. Optimise them for the presentation format. Be consistent in your use of font, labels, colours and general presentation. Enhance them with as many labels and information as you can to improve their communication of your story.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 11241, 2013.