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## ***Interactive comment on “The Sodankylä in-situ soil moisture observation network: an example application to Earth Observation data product evaluation” by J. Ikonen et al.***

**J. Ikonen et al.**

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We would like to extend our sincerest gratitude to the reviewer for the very useful comments and suggestions. We will respond to the comments and questions below in the order that they were presented. We will submit a revised manuscript after the review period has closed.

[QUESTION 1]: The abstract seems overly long and to my mind repeats the methods section more than communicates the findings and conclusions. I think a briefer abstract that highlighted the findings would grab the reader’s attention more.

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[RESPONSE]: Agreed, we will reduce the length of the abstract.

[QUESTION 2]: Furthermore the abstract mentions that removing a third of the data (2014) results in better correlation between the data sets. As a process modeller, I think it would be better to explain this i.e. to say that there is better correlation in years when there is a long term trend in the data or less short term variation.

[RESPONSE]: We agree with the reviewer in that this needs to be explained to the reader. Also, in order to reduce the length of the abstract we will remove this discussion from the abstract and add explanation of this issue to the discussion and conclusions section.

[QUESTION 3]: It is stated that soil moisture is a “main driver” of water, air and carbon cycles. I think this might be over stating the case. Soil moisture certainly influences these cycles but without rainfall and, in these latitudes especially, solar radiation it would not drive much.

[RESPONSE]: Agreed; this is clearly an overstatement and will be reworded.

[QUESTION 4]: A small thing CAL-VAL is used in the abstract before it is defined.

[RESPONSE]: Duly noted, this will be removed from the abstract.

[QUESTION 5]: In the method section 3.2 Figure 1 shows the geographical area covered by the ASCAT pixel and the soil moisture network. I am concerned that only a small number of the soil moisture stations are covered by the pixel.

[RESPONSE]: We acknowledge that the map provided in figure 1 could be clearer, since in-fact only 1 out of 8 automated in-situ observation sites used in the comparison are located outside of the ESA-CCI soil moisture data pixel. Further, the automated in-situ observation site located outside of the ESA-CCI soil moisture data pixel is only 10 km from the edge of the pixel. The 2 in-situ sites clearly located away from the cluster of other sites have been installed during 2015. These sites do not therefore have any impact on the comparison results. We will provide a clearer complimentary

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map showing the locations, names, installation year and weights of each in-situ station.

[QUESTION 6]: It seems to me that there is an assumption that the only factor influencing soil moisture is soil type and precipitation is not counted. If there is strong heterogeneity in the precipitation totals and intensity across the network this may explain, to some extent, the low correlation values.

[RESPONSE]: The reviewer provides a good and valid point. The single ESA-CCI soil moisture data pixel to which in-situ soil moisture network data is being compared to however only comprises an area of 26 km (north-south) by 10 km (west-east). The likelihood of significant daily scale variation in precipitation between the observation points and within the CCI pixel is rather low. Furthermore, in practice it is impossible to investigate this as the nearest precipitation gauges in reference to the Sodankylä CAL-VAL site (roughly at the centre of the CCI pixel) are located at distances of 30, 45, 46 and 48 km, thus far too faraway to draw conclusions on local scale variations in precipitation within the CCI data pixel. This part of Finland (as most parts of Finland) typically receives precipitation through low pressure fronts, distributing precipitation, at least on a local scale more or less evenly, while convective precipitation events are fairly uncommon at these latitudes. Therefore, a re-analysis of our results based on spatial variation in meteorological factors is neither warranted nor possible to do in practice.

[QUESTION 7]: Should more ASCAT pixels have been used? If not, plot the rain gauge data to show how homogeneous it is across the network. Maybe the averaging of a number of ASCAT pixels would increase the correlation.

[RESPONSE]: With regard to rain gauge data, please see our response above. With regard to using more ASCAT pixels and averaging the results, this has in-fact already been done. The ESA-CCI soil moisture product already consists of the average of all ASCAT pixels within the ESA-CCI product pixel. Despite this, we consider the reviewer's suggestion as interesting. We have conducted a comparison in which we compare

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raw ASCAT backscatter data correlation from all ASCAT pixels within the ESA-CCI pixel against ASCAT backscatter data from the pixel in which all of the in-situ stations are located in. These in-situ stations comprise of only the ones used to derive ESA-CCI comparison results, i.e. nearly at the centre of ESA-CCI data product pixel. The correlations were calculated from the years 2007-2014. The correlations range from 0.37 to 0.50. The rather low correlations clearly point to significant spatial variability of ASCAT data within the ESA-CCI pixel. Whether or not this is caused by variations in meteorological conditions or variations in soil textural properties and/or land cover types cannot however be explicitly determined from these results. In our opinion the latter is more likely since the area under investigation is rather small at 26 km (north-south) by 10 km (west-east). In practice what this means in terms of comparison against the ESA-CCI soil moisture product is that perhaps ideally the in-situ observation locations should be spread through-out the pixel instead clustered near the centre.

[QUESTION 8]: I agree with reviewer 1 that the main finding, that the CCI product should not be used as an absolute value of soil moisture should be stated more prominently.

[RESPONSE]: Agreed; we will move this sentence into section 4.

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Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., 5, 599, 2015.

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