The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2017-162-AC4, 2017

The Cryosphere Discussions
Open Access
EGU

Interactive comment on "Potential permafrost distribution and ground temperatures based on surface state obtained from microwave satellite data" *by* Christine Kroisleitner et al.

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Received and published: 29 October 2017

We would like to add the following to our previous reply:

Reviewer comment: C2 - Does it provide an improvement over existing techniques?

Reply:

Existing approaches which use satellite data to model ground temperatures require gap filling which is usually done with re-analyses data (see page 2, lines 10-19). This applies to thermal infrared as well as passive microwave temperature measurements. The number of days for which re-analyses data are used exceed often the days with

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actual observations. Alternatively, only re-analyses are used (see state of the art summary on page 2), which are based on interpolation of in situ measurements.

Park et al. (2016) suggest using a simple 'frozen' days (not 'freezing degree' days) account from satellite data (SSMI) to estimate permafrost extent, but do not address the parameter ground temperature itself.

We tested data acquired at a different wavelength than used in Park et al. (2016). We can show that for ASCAT the account of frozen days varies with average ground temperatures below as well as above 0 degree Celsius (Figure 5). In case of SSMI, variation of frozen days are of lower range for mean ground temperatures below 0 degree Celsius (Figure 6). This results in lower correlation between mean ground temperatures and frozen days for this type of data.

Uncertainties of the frozen days approach are higher in areas where snow plays an important role, specifically in transition zones (page 8, line 27-30). The validation in these areas is difficult since in situ measurements are usually made in small isolated areas with permafrost which only make up a fraction of the satellite data resolution cell. This can be potentially addressed with SAR (Bergstedt & Bartsch 2007) but data availability (spatially and temporally consistent sampling) is limited. Further regional differences are shown in figure 11 (comparison to in situ data by region). Apart from Scandinavia, locations with in situ records relatively close to coasts and glaciers (see discussion page 10, line 9) show high deviations. A similar figure can be provided grouped by land cover, snow depth and soil type.

The advantage of the potential ground temperature estimation from the (coarse resolution) satellite record is that it does not require gap filling with interpolated data and therefore records are more consistent. This is relevant when long term changes are addressed. The existing record is only 10 years, but the type of sensor used is of high relevance for weather forecasting, what means that continuation of these type of records can be expected. At this stage records could potentially be used to assess

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traditional methods in regions with in situ data scarcity.

For references, see manuscript

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