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The Cryosphere Discussions

Interactive comment on "Frequency and distribution of winter melt events from passive microwave satellite data in the pan-Arctic, 1988–2013" *by* L. Wang et al.

Anonymous Referee #1

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Passive microwave satellite data are frequently used to identify changes of snow properties, especially timing of melt. Mostly spring snowmelt timing is addressed in non-glaciated areas and melt days are extracted over glaciers and ice sheets. This study seeks to detect melt days over non-glaciated snow covered areas as well as investigates options for detection of snow cover (winter) start and end. A range of weaknesses of the approach are revealed by comparison to in situ measurements. An interpretation of trends and patterns are provided but usefulness questionable (see comment below). Mid-winter patterns have been described before, as well as snow duration analyses. Kim et al. 2011 have also used SSMI to detect surface status.

It is stated in the introduction that little is known about the spatial and temporal vari-

ability of winter melt events at Pan-Arctic scale (line 44). There are however a number of re-analyses studies available on this topic (e.g. Liston and Hiemstra 2011, Rennert 2009) and also from active microwave satellite data (Bartsch 2010). The observed patterns found in the presented study agree with the above studies, what is not addressed in the discussion.

There are inconsistencies regarding terminology. The title and abstract refer to 'events', the text/method to melt days. Events might be of several days of duration. In addition, only afternoon data are used. The paper thus presents an account of melt 'afternoons'. The title and abstract should be revised and adjusted to reflect this.

The usefulness of the trend analyses of late afternoon melts is questionable. The authors should also include the morning measurements in order to increase the detection capability. Mid-winter melt events are not bound to diurnal-variations. This would still miss out events, but increase the number of samples. Previous studies have actually chosen the characteristic refreeze-pattern instead of melt detection (e.g. Bartsch et al. 2010). Detection of refreeze allows the inclusion of very short melt events which cannot be detected themselves due to the satellite data sampling intervals.

The abstract includes the information that results are compared to in situ measurements, but not the outcome. Especially short events from ROS are not detected, which are of major interest for wild live and climate change studies. The failure in such cases demonstrates the shortcoming of the approach to use melt only.

How does the performance compare to melt day detection performance commonly used over ice sheets and glaciers?

How does the approach of melt detection compare to results from Kim et al. 2011 (SSMI) or Naeimi et al. 2012 (ASCAT)? Kim et al 2011 showed that a dynamic threshold is needed.

Kim et al. 2012 also analyze passive microwave trend analyses for snow cover. How do patterns compare?

Other comments

Line 48: Semmens et al. 2013 also demonstrated the importance of fog

Line 60: add e.g. before the list of references as there are many more studies published on this Topic

Line 63: Semmens et al. 2013 also used passive microwave data. Grennfell and Putkonen also used passive microwave data

Section 3.2. – results agree with Bartsch 2010

Additional references

Kim Y, Kimball J S, Zhang K and McDonald K C 2012 Satellite detection of increasing northern hemisphere non-frozen seasons from 1979 to 2008: implications for regional vegetation growth Remote Sens. Environ.121472–87

Bartsch, A. (2010): Ten Years of SeaWinds on QuikSCAT for Snow Applications. Remote Sens. 2010, 2(4), 1142-1156; doi:10.3390/rs2041142;

Naeimi, V., Paulik, C., Bartsch, A., Wagner, W., Kidd, R., Boike, J. and K. Elger (2012): ASCAT Surface State Flag (SSF): ASCAT Surface State Flag (SSF): Extracting Information on Surface Freeze/Thaw Conditions From Backscatter Data Using an Empirical Threshold-Analysis Algorithm. IEEE Transactions on Geoscience and Remote Sensing. DOI: 10.1109/TGRS.2011.2177667.

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