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## ***Interactive comment on “Stable climate and surface mass balance in Svalbard over 1979–2013 despite the Arctic warming” by C. Lang et al.***

### **Anonymous Referee #2**

Received and published: 23 September 2014

The study presents a history of the Svalbard climate and the SMB of its glaciers. ERA-Interim re-analysis is downscaled with the MAR regional atmospheric model to get the spatial field over the archipelago. The output is validated with point observation of both SMB and near surface parameters. Care is taken to the effect of the topography resolution on SMB and intelligent corrections are applied to minimize those effects. Further the performance of the global model MIROC5 in presents climate is investigated to find possible biases in future simulations in a companion paper. Even though the overall impression of the paper is good I have some comments and expect a revised version.

### General comments

I agree to most of the comments by reviewer1 but in addition to those and with some oppositions as described below.

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Discussion Paper



Sections 5-6: I believe that section 5 fits this investigation as this is a validation paper and the companion paper can thus focus on the scenarios.

#### Specific comments

Introduction: Are you familiar with any WRF/PolarWRF simulations over the Svalbard area that can be used for estimations of the SMB, other than ASR? I see that you have compared MAR and WRF in EGU in 2012. Can you briefly mention the reasons why you use MAR instead of WRF in this investigation?

Why do you use both T700 and T850 in the analysis? Is the reason that T700 is more related to the precipitation amount and T850 to TAS? Please make this clear in the text.

#### Technical comments

How is percent presented in this journal? With or without space, e.g. 5% or 5 %? In English text there should be no space but in ISO standard there should be.

P4498, L22: Shepherd et al. (2012).

P4500, L14: What do you mean by "has not to be proved"? Does it perform very well over Greenland? Can you reformulate?

P4501, L6: de (lowercase) Ridder. Also in reference list.

P4502, L2: What is the vertical resolution in the lowest km?

P4502, Set ups section. What are the resolution of the forcing data from MIROC and ERA-Interim (in this case). Are they the same, 1.5°, and did you use the same resolution just to have similar forcing ? ERA-Interim is available down to 0.75°, what I know.

P4504. L6: Use a proper reference to ASR, e.g. Wilson, A. B., D. H. Bromwich, K. M. Hines, 2011: Evaluation of Polar WRF forecasts on the Arctic System Reanalysis domain: Surface and upper air analysis. J. Geophys. Res., 116, D11112, doi:

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10.1029/2010JD015013.

P4504, L12: 3 m, not 2? Is it always T3 you analyse in MAR? P4504, L13: Can you mention the source of the observations?

P4504, L27: TAS is underestimated by MAR but snowfall amount should be determined by the temperature in the clouds or at least above the surface layer. The humid air does not originate at the local surface. It is not necessarily a negative bias above the surface layer since it is probably the surface energy balance that leads to the negative T2-bias. You also state in P4505, L6, that the lateral forcing from ERA-Interim is warmer and therefore also the free atmosphere temperature over Svalbard is affected by this.

P4506, L6: In a sensitivity study with the WRF model by Claremar et al. (2012, Advances of Meteorology, ID 321649) the effect of resolution was investigated but for the parameters of wind and temperature. As here, one of the conclusions were that you really need high resolution to model wind speed and direction which is related to the precipitation pattern.

P4506, L17: too coarse P4506, L25: (MAR\_ERA) P4507, L17: however opposite to P4507, L24: Is it ERA-Interim or MAR\_ERA? In Figs 6-7 you present ERA-Interim. State the correct in the text. P4507, L24: Perhaps "south-westerly flow" better describe the mean flow (cannot understand the other reviewer's point here).

P4507, L27: or "north-western" P4508, L8: define TAS as 2/3-m temperature already here! Why not just call it T2/T3 hereafter?

P4508, L8: is it MAR\_ERA in the figure 7 or just ERA-Interim? P4508, L10: please use °C or K and not just °. P4509, L19: "it is" P4510, L9: remove "and more" P4511, L6/P4512, L11: Use TAS or T2/T3 hereafter instead of near-surface temperature as you defined it already.

P4513, L18: or "simulated" instead of modelled.

Figures

C1869

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Interactive  
Comment

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Decide on using T2/T3 or TAS Have a consistent way to present the units in the captions, for instance as "(in m)", "(in metres)" or just "(m)". Figure 4. Please do not use yellow line colour! 5a caption: (m) , not (m y<sup>-1</sup>) Figure 7. Comment to Reviewer 1: T2 can still be well above 0°C over snow and ice. Figure 7. Please state that you use MAR\_ERA. Right? Figure 10a. (m) instead of metres Figure 11. (in °C) Figure 15. Comment for Reviewer 1. For MAR\_ERA this is basically shown in Fig. 8a but but for the period 1979-2013

Tables

S1 caption: 10-km topography

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Interactive comment on The Cryosphere Discuss., 8, 4497, 2014.

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