

***Interactive comment on “The impact of a
seasonally ice free Arctic Ocean on the climate
and surface mass balance of Svalbard” by
J. J. Day et al.***

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This paper presents results over Svalbard of the regional model HadRM3 forced by HadGEM1. The discussion about the impact of the sea ice extent on temperature and precipitation over Svalbard is interesting and original. The TC journal is just right for this kind of paper. Moreover, the number of publications using RCM over Svalbard is small and therefore I suggest to accept this paper for publication if the authors can respond to the remarks of other reviewers. In addition to the remarks from the other reviewers, one of my majors issues is that the HadGem1 forced simulation is used over current climate for validating HadRM3.

As shown with the RCM simulations made for ICE2SEA over the Greenland ice sheet, a part of detected biases in HadRM3 by comparison with observations could be due to the forcing fields and only a reanalysis (ERA-INTERIM) forced simulation should be used for validating a RCM with observations. It is true that the authors use SST and sea ice from observations but it is not enough. Biases in general circulation from HadGEM1 will impact more the precipitation pattern and temperature in HadRM3 than the SST and sea ice (The impact of SST changes in RCM simulations over the Greenland ice sheet is shown in Hanna et al., 2009). In addition, this will allow to compare directly the same period than the observed one (see Section 3.2). It is clear that 25 km is not enough for resolving the Svalbard topography but all the simulations do not have to be restarted at a higher resolution. Only a simulation forced by the reanalysis and a comparison of HadGEM1 forced HadRM3 and ERA-INTERIM forced HadRM3 over current climate is needed here. Finally, the statistically based estimation of SMB could be not robust in future climates and therefore the paper should focus only on precipitation and temperature.

Reference: Hanna, E.; Cappelen, J.; Fettweis, X.; Huybrechts, P.; Luckman, A.; Riber-gaard, M. H, Hydrologic response of the Greenland ice sheet: the role of oceanographic warming, *Hydrological Processes* (2009), 23(1), 7-30.

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