The authors thank Xavier Fettweis for his positive and interesting comments on this article.

RC: *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 25km 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.*

AC: The authors agree with the Reviewer that some bias in the RCM could be caused by circulation bias in the AGCM forcing and we will include some sentences that explain this point in the revised m/s. In an analysis we have performed for Greenland similar to that we present here, we find Greenland's sensitivity to surface forcing is in qualitative agreement with Hanna et al. (2009). Specifically, changes in local surface forcing do not greatly impact precipitation over Greenland and it is large-scale changes in atmospheric moisture transport, which dominate (Day et al., in prep). However, in Svalbard perturbations in surface forcing have a much greater impact on local climate due to the lower elevations and increased proximity to the ocean at most land points compared to Greenland. Thus in the authors' opinion the use of observed SSTs and sea ice as forcing to both the RCM and AGCM for Svalbard is more justified than, for example, the case of Greenland.

The main purpose of this study, however, is not a validation of the absolute climate fields in HadRM3. The key objective is to quantify the likely impact of declining sea ice on this sector of the high Arctic. Performing the ERA-interim simulation will undoubtedly inform our understanding of bias in the RCM itself, however it will not inform our understanding of the regional climate sensitivity to sea ice decline. Therefore, we propose to address the issue raised by the referee by extending the discussion of the AGCM as a source of potential bias rather than performing this additional simulation.

RC: *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.*

AC: The authors agree that the Seasonal Sensitivity Characteristics (SSCs) are unlikely to be robust in future climates. In the text we do emphasise that the calculated anomalies of SMB are subject to large uncertainty given the nature of this methodology. However we do think they have some use in describing, purely

as a first order approximation, the impact due to the climate perturbation. As such we propose to modify the text to include mention of the issue of increased uncertainty in the future when using such SSCs.

Day, J. J., Bamber, J. L. and Valdes, P. J.: The impact of a seasonally ice free Arctic Ocean on the climate and surface mass balance of the Greenland ice sheet,, in prep.

Hanna, E., Cappelen, J., Fettweis, X., Huybrechts, P., Luckman, A. and Ribergaard, M. H.: Hydrologic response of the Greenland ice sheet: the role of oceanographic warming, Hydrological Processes, 23, 7-30, doi:10.1002/hyp.7090, 2009.