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Interactive comment on "Extraordinary runoff from the Greenland Ice Sheet in 2012 amplified by hypsometry and depleted firn-retention" *by* A. B. Mikkelsen et al.

Anonymous Referee #1

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The authors of this manuscript produce a comparative study to explain why a large melt event in July 2012 produced large runoff in the Watson River basin near Kangerlussuaq, Greenland, versus lower runoff during a similarly warm year in 2010. They explain the change in runoff due to the formation of superimposed ice layers at relatively high elevations in the basin in 2012, which limited the ability of the firn to retain meltwater. Further, the authors demonstrate that the hypsometry of the ice sheet increased the meltwater available in 2012 than in 2010, as a larger portion of the basin was melting in 2012.

The manuscript is concise, well written, and provides useful graphics. I really enjoyed reading the manuscript. The authors make a compelling case that is well supported

by evidence with important implications about meltwater retention and buffering in a greenhouse enhanced climate.

My only concern was with regard to the presentation of the surface energy budget. The authors state: "The physical expression of atmospheric forcing in terms of energy available for surface melt can be represented by area-weighted cumulative positive degree-days (ΣPDD'). ΣPDD' had nearly equivalent totals by the end of the 2010 and 2012 meltseasons with 2012 just 5 % higher (Fig. 2b, Table 1)." on p. 4638. The discussion of energy available is made only with regard to PDDs, yet the model appears capable of providing a full energy budget (section 2.5), including radiative, turbulent, and conductive fluxes. Values are given in TW in Table 1. I assume the values in TW in Table 1 are not based solely on PDDs but on the full energy budget. I recommend that the authors provide additional detail on the van As (2011) model and explain how they arrived at the calculations in the bottom of Table 1. This is central to their argument, as they mention the relatively small difference in available energy between 2010 and 2012. It might be useful to even show the components of the energy budget for AWS_L and _U for 2010 and 2012 in a graphic, perhaps in the supplemental materials. There may be other components of the energy budget, not fully captured by the PDD values, that help explain part of the difference between 2010 and 2012.

Interactive comment on The Cryosphere Discuss., 9, 4625, 2015.