

Interactive comment on “What controls the isotopic composition of Greenland surface snow?” by H. C. Steen-Larsen et al.

Anonymous Referee #1

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This paper reports new data of water vapor isotopic measurements from the deep drilling site in Northern Greenland (NEEM). Continuous sampling of water vapor isotopic composition is highly relevant for paleoclimate research using ice cores. The systematic search for an explanation why isotope in surface snow follow that in atmospheric water vapor is convincing and defines new questions for future research.

This is a well written and well presented MS. The writing style is concise and the figures are of good quality. The science is original and important. My comments listed below are all relatively minor.

Minor comments For accuracy, please use 'near-surface' instead of 'surface' when you refer to measurements performed in the near-surface air (temperature, water vapor). For instance, p. 6037, l. 12 you use '...surface vapor d18O and air temperature...'

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suggesting two different levels, while in reality I assume water vapor and temperature were sampled/measured at the same (atmospheric) level. Along the same lines, also be specific about 'surface' (as modelled with CROCUS and measured by MODIS) vs. 'near-surface air' (as measured in the air) temperature, these are two very different things.

Why are not 2012 precipitation values included? Please explain.

Unexpectedly, sublimation as simulated by CROCUS is largest during precipitation events. During these events, surface to air temperature and humidity gradients are normally expected to be small, so we would expect small sublimation rates. As CROCUS is forced using ERA-Interim, have you checked that precipitation events are well represented (magnitude/timing) by the latter dataset? Unfortunately, as MODIS does not see the surface when clouds are present, CROCUS evaluation of skin temperature is not possible during precipitation.

Specific comments

p. 6038, l. 4: directly -> direct

p. 6039, l. 29: this sentence is unclear, please reformulate.

p. 6041, l. 20: remove one 'altogether'.

p. 6042, l. 19: if the standard deviation is 5 C (which comes across as a very large number) then the summers of 2011 and 2012, being four degrees warmer than average, are not 'significantly warmer'.

p, 6043, l. 5: '...from THE nearest building...'

p, 6043, l. 16: '...in THE beginning...'

p, 6043, l. 25: '...the 3 m level WAS measured...', also line 25

p. 6044, l. 23: previous -> previously

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p. 6044, sentence starting at l. 23: unclear, please reformulate.

p. 6046, l. 17: ' Its inputs are snowfall and frost and its outputs are melt, sublimation and calving.' This is unclear; by input and output you mean mass fluxes towards and away from the surface; please specify that this is not model in/output. How is calving defined here, a word normally used for the production of icebergs?

p. 6048, l. 13: ' to occur (indicated on Fig. 1 with grey band)'; confusing, as grey band indicates precipitation events in Fig. 1.

p. 6048, l. 15: remove 'been'

P. 6049, l. 19: ' We do not investigate further the comparison between LMDZiso and our data, as this will be the focus of a separate multi-model – data paper currently under preparation.' In that case consider to remove the LMDZiso results from Fig. 1, as they do not add anything to the discussion that follows.

p. 6050, l. 4: show all -> all show

p. 6053, l. 17: add 'is found'.

p. 6055, l. 12: lead TO changes

l. 6057, l. 7: condensation refers to the phase change between vapor and liquid; rime formation (riming) would be a more appropriate term here.

p. 6060, l. 11: (ii) -> (iii)

Interactive comment on Clim. Past Discuss., 9, 6035, 2013.