The Cryosphere Discuss.,
doi:10.5194/tc-2016-113-RC3, 2016

The Cryosphere Discussions
Open Access
EGU

Interactive comment on "The past, present, and future viscous heat dissipation available for Greenland subglacial conduit formation" *by* K. D. Mankoff and S. M. Tulaczyk

Anonymous Referee #3

Received and published: 27 July 2016

In this manuscript, the authors calculated the viscous heat dissipation (VHD) generated as a result of runoff reaching the bed of the Greenland ice sheet, for the past and present, as well as for two future climate scenarios. The main findings are that VHD is becoming an increasingly large component of the basal heat budget – which is expected to contribute more significantly to subglacial conduits opening in the future.

I find the results novel and interesting, and a valuable addition to existing related work. However, the clarity of the text must be improved throughout, as the main or important points are often lost with too many details / repetitions / confusing sentences. Overall, I agree with comments aimed at clarifying the text, as given by AR1 and AR2. Below, I give a few more specific points below.

Printer-friendly version

Discussion paper

General points:

The discussion on the influence of subglacial hydrology and conduits formation on ice velocity (in particular under future scenarios), is over-simplified in the introduction and discussions (also pointed out by AR2). The overall effect of increased meltwater delivery to the bed of the ice sheet is unresolved. Some work suggest net deceleration (as already discussed), but other suggest a possible net acceleration (e.g., Bartholomew, NatGeo 2010; Doyle,GRL 2014). As the main implication from increased VHD concerns subglacial conduits formation, the authors should develop the potential implication of their findings more thoroughly.

Specific points:

P3 L12: define m

P3 L24: likElihood

P3 L27: suggest removing "(1-2 grid cells in our models)" – this is specified again later.

P4 L29: Bring "these processes" to the same place in the text (water captured by crevasses and. . .?).

P7: overall way too long, and hard to follow. What are the key points?

P8 L13-14: Suggest replacing the sentence with a recall of Eq. 2.

P8 L15: would write ". . .and 14.3 EJ year-1 (with 1EJ=1x1018J)"

P8 L17-18: last sentence not necessary in my view.

P8 L 30: remove "because"

P9 L25: sentence could be simplified – I find the use of statement such as " V times Eq (6)" clumsy.

P9 L31: "perfect line up" between model and observations are rare, but it sounds like you were expecting it. It would be more useful to state how far apart the freeze-on

packages are, and state where uncertainties might be coming from. Do you expect the errors from the model to relate to its physics, or input (GHF distribution, runoff distribution etc. . .)? . . . also, the advection argument seems far-fetched.

P10 L11-13: very long sentence, the point is lost.

P10 L14: numbered repeated from paragraph above. Suggest that section is re-organized to avoid repetition.

P10 L32: Use EJ

P11 L1-2: This statement should at least be moderated, or could be removed, as this is an argument made (in a much more balanced way) in the conclusion.

P11 L7: sentence describing the increase in GHF is not clear.

P12 L10: missing “and” after parenthesis

Figures:

Figure 1: Agree with AR1 and AR2, the bars and infos are vey small. Re-drawing with larger bars would help, as well as explicitly showing where VHD comes into the picture.

Figures 2 -3 -5: Not sure if there would be space for this, but I feel like these would beneficiate from being enlarged, e.g., as a 2 lines / 2 columns panels presentation. This is particularly true for Figure 5, where it is very hard to see any freeze-on.

Interactive comment on The Cryosphere Discuss., doi:10.5194/tc-2016-113, 2016.