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Interactive comment on “Subglacial hydrology indicates a major shift in dynamics of the West Antarctic Ross Ice Streams within the next two centuries” by S. Goeller et al.

Anonymous Referee #1

Received and published: 25 August 2015

General comments

The paper presents results of subglacial hydrological modelling of water beneath the Ross Sea ice streams, and shows that hydrological flow paths may reorganise in the future due to elevation change in the ice streams. The paper is of interest, but the findings are not presently set in the context of underlying assumptions adequately enough. The main issue is that there is no consideration of how the ice surface may evolve due to deformational flow due to a changing surface/stress gradient. This may be a small effect, but must be discussed more explicitly in the paper. The application of the current trend to the next 200 years is not a prediction – it is simply an extrapolation, and as such the title especially is misleading. Without a coupled model of ice & water flow, this

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cannot be considered a future prediction. I suggest the title is reworded to reflect the content of the paper more appropriately. Also, on p4005, line 24 the term “computed future pathways” should be reworded.

Further, the paper mentions the “assumption” (e.g. in the abstract) that the subglacial hydrology is controlling the location of the ice streams. This is likely, but not completely proven, it could be that the water is just flowing down the hydropotential lows and not interacting with the ice flow. Nothing in the paper “significantly supports the assumption” (e.g. p4003, line 15), there is no process based understanding in the paper that provides anymore evidence of this link than already exists. A sentence should be added that clarifies this.

There is very little detail of the model formulation, there needs to be a short description of the exact nature of the routing algorithm, for example whether it considers 4 vs 8 flow directions. The nature of the algorithm will have an impact on the final results, see for example Le Brocq et al. (2006). Secondly, some of the findings of this paper cover material discussed in Le Brocq et al. (2009) which should therefore be referred to in the paper.

Specific comments

p3997, line 6 & Fig. 1: Add labels to the ice streams – you talk about the ice streams, but don’t provide a location map to describe which is which.

p3997, line 26: The sentence starting “But also the currently existing...” is not a very well written sentence, please revise.

p3998, line 26, clarify what you mean by ‘latter’ in this case.

p3999, line 5: “their exact locations seem to be defined by” is not very scientific language.

p4000, line 6: The sentence starting “However, the precise...” needs to finish with some references as it is currently structured. You then go on to describe the contra-

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dicting results, but it doesn't flow. Maybe a semi-colon could help, or restructure the sentences so they flow better.

p4000, line 13: Should be "...inland ice account for about 87% of the total melting..."

p4000, line 16: Sentence "...this melt water transports latent heat from beneath inland ice to the base of the ice streams, while temperatures at the bottom of the ice streams itself and accordingly the melt rates are low..." needs tidying.

p4002, line 1: As above, more details of the routing scheme are needed.

p4003, line 18: 1) Be consistent as to whether you use the name and/or the letter for the ice streams. 2) Do you mean Whillans (B) or Bindschadler (D)?

p4003, line 21: The sentence "This does not necessarily mean the model results are wrong" is not a very good way of putting this, consider re-wording to something along the lines of "The routing of some meltwater beneath Kamb ice stream is supported by evidence from airborne radio echo sounding..."

p4004, line 22: change the words "overspreads" and "heaviest" to something more appropriate.

p4005, line 23: It would be good to have a figure that demonstrates the fact that there is no difference at varying resolutions.

p4006, line 1: This is a very long sentence without any punctuation.

p4006, line 14: Consider "similarity" rather than "analogy".

p4007, line 17: "watersheds"

References:

Le Brocq AM, Payne AJ and Siegert MJ (2006). "West Antarctic balance calculations: Impact of flux-routing algorithm, smoothing and topography." Computers & Geosciences 32 1780–1795.

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Le Brocq AM, Payne AJ, Siegert MJ and Alley RA (2009) "A subglacial water flow model for West Antarctica" Journal of Glaciology. 55 (193) 879-888.

Interactive comment on The Cryosphere Discuss., 9, 3995, 2015.

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9, C1479–C1482, 2015

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