The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2017-242-RC2, 2018

The Cryosphere Discussions
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Interactive comment on "Basal drag of Fleming Glacier, Antarctica, Part B: implications of evolution from 2008 to 2015" *by* Chen Zhao et al.

Anonymous Referee #2

Received and published: 6 March 2018

The Cryosphere TC2017-242 *"Basal drag of Fleming Glacier, Antarctica, Part B: implications of evolution from 2008 to 2015"* by Zhao and others.

This paper, using diagnostic inverse modeling of basal conditions, discusses the possible causes of the retreat of Fleming glacier observed between 2008 to 2015. In particular, the potential acceleration induced by the production of water by frictional heating at the base of the glacier is discussed. This paper is well written, even if some sentences are too long and some figures can be improved. I have made below some suggestions that I believe could improve the manuscript.

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Discussion paper

line 62: nearly twice or more than twice?

line 95: I don't really see where in Gladstone et al. (2017) inverse methods are used?

line 123: define what is bed_zc

line 127: S_{2008} is not the "surface DEM in 2008" but the "surface elevation in 2008".

line 134: (on the same line) The "2008 velocity" should be "The 2008 velocity dataset"

line 155: the assumption that all the ice is grounded is for the inverse method? May be you can specify already here that floating ice will be deduced as the place where basal stress is lower than a threshold? It is not clear all along the manuscript if there is still a floating part or not on Fleming glacier and it would help if it could be mentioned more clearly in the introduction.

line 175: it should be mentioned that Eq. (4) is valid under the assumption of $N = 0$

line 186: here it should be mentioned that Eq. (6) is derived under the assumption of a perfect connectivity of the basal hydrology system with the ocean

line 192: C is not a vector (not in bold)

line 380: The increase of the amount of melt water should be quantified by integrating the frictional heating over the bedrock. But it should be also discussed that more melt doesn't necessarily induce an acceleration of the glacier as the basal hydrology system is evolving dynamically to adjust this surplus of water. The link of basal sliding with basal water should be clarified, and specifically is

should be mentioned that the important variable is not the amount of water but its pressure. And this later quantity is not evaluated in the present work.

line 430: Can the buttressing exerted by the pining band in 2008 be quantified in a more rigorous way? A complementary experience would be to remove this band of high friction (by setting no friction there) and to see how the velocity field is modified upstream. This would directly quantify the increase of velocity induced by an instantaneous loss of the pining band. The difference between this velocity field and the 2015 one would indicate places where a decrease of basal shear stress is necessary to explain the 2015 velocity field.

line 528: Schaëfer is not spelled correctly

Âăcaption Fig. 1: inset (c) should be located in (b) and in (c) the front position in 2008 and 2016 should be added to visualise a potential ice-shelf?

Fig. 3: the grounding line in 2014 seems to have a different form than the one of Friedl et al. (2017) in their Fig. 6?

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