

## ***Interactive comment on “Drivers of Pine Island Glacier retreat from 1996 to 2016” by Jan De Rydt et al.***

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This paper attributes the speed up in Pine Island Glacier over a 20 year period to a combination of ice thinning, calving front change and rheological change. It concludes (as have others) that the PIG trunk appears to be subject to Coulomb sliding, at least in some parts. This is a well written paper based on sound methods. I do have some minor issues with the manuscript.

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## General Comments

L65 (eqn 2). The right hand side does not make sense to me for the reasons you point out later: you can't determine these things individually and then add them up. You can certainly (as you do) look at each in turn, and even talk about combinations. I can see why you want a notation like this, but at the end of the day, the equation is not correct given the usual definition of addition.

L165 : The inverse problem is solved for each  $m$ , and  $T_b$  is slightly different. But that would not be so if the velocity were the same in each case, and the velocity could be the same in each case (in the optimal case, equal to the observations). The differences must be due to optimization method or similar. Joughin's method is equally valid, so you should not claim that yours is more appropriate.

## Specific Comments

L30: "model studies have primarily focused on the important problem of simulating the response of PIG to a potential anthropogenic intensification of melt." Perhaps – but Joughin 2010 and 2019 were also concerned with attributing cause to observed change. This is mentioned later (from L42), so you have not neglected these papers, but it does make it makes 'primarily' incorrect

L95: Joughin et al. (2019) *and* Joughin 2010

2.2.1 Inverse experiments, and general use of inverse in a 'slang' fashion. These are optimization experiments, which involve solution of inverse problems. Ua does not have inverse capability, it has optimization capability.

Figure 3. Either have 'unaccounted' bars in every row, or none.

L362.  $m_{optimal} = f_2 / (f_1 - 1) ? 100\% \neq 100$ .

L500 “In a Bayesian framework, the regularization plays the role of a prior and is added to the misfit, which corresponds to the likelihood”. Tikhonov regularization can be seen as derived from Bayes rule with certain assumptions about the priors. But the methods used here are, I would say, not derived from Bayes rule because the prior is not determined from additional observation or theory: it is chosen to regularize the solution, and the relation to Bayes rule is incidental. Maybe a personal bugbear of mine.

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