

## ***Interactive comment on “Basal buoyancy and fast moving glaciers: in defense of analytic force balance” by C. J. van der Veen***

### **Anonymous Referee #2**

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Overall, I find this manuscript to be clear and compelling. While I do not expect that the geometric force balance approach will supplant the analytical approach, this “defense” is likely to help readers to better understand the familiar equations. My comments thus do not contain any major objections, only requests for small clarifications and rewording of several phrases that appear (to me, at least) to contain sarcasm directed toward Hughes.

(33) While this analogy works for any specific type of sand, it is easy to imagine that one could “facilitate the forward motion” by pushing the cart onto more firmly packed sand, so the analogy does not consider variations in material properties of the bed. How (or whether) to modify this I leave to the author.

(45) Typo in equation, last term should have  $zz$  subscript.

C1

(99) It would be nice to also present equation (7) with the definition of the driving stress (equation 3) substituted, in order to make the comparison between equations (7) and (9) immediate.

(117) For Section 3, at what point do you begin to disagree with Hughes? This could easily be interpreted as indicating that you agree with equations (10)-(12), because disagreement becomes clear at line 134.

(128) Typo: The inequality is written backwards.

(139) It may be more clear to also insert equation (6) here, because this is the form in which  $F_S$  has appeared in most of the equations.

(142) While this is a good point, “The achievement here” is clearly sarcastic and should be rephrased.

(171) Does “This result” refer to the direction of the longitudinal stress gradient, the partitioning of the resistance, or both (in which case it should be plural)?

(187) In arguing against equation (16), it would be nice to point back to equation (3) for the driving stress for comparison, in addition to the reference to equation (7), after you have pretty much explained how to derive it.

(227) Based on what follows, it appears you are using equation (2) rather than (7).

(235) It would be helpful to include a short reminder that in introducing Glen’s law you are substituting an expression in terms of deviatoric stresses into an equation in terms of full stresses. While you make this clear earlier, the reminder might help readers more quickly understand why  $\sigma_{zz}$  appears in equation (19).

(248) “Thus, on a large scale...” doesn’t include effects of basal buoyancy on  $\tau_{bx}$ , so it looks like you’re contradicting yourself in the next paragraph.

(273) “The concept as presented by Hughes...” becomes unduly personal when the length of time and “has yet” are included.

C2

(273) “phantom force” appears sarcastic; “phantom” is unnecessary in stating that a term is missing.

(290) The history of the manuscript is not really an acknowledgement, and mentioning that a past version was considered a personal attack on Hughes only suggests that this version is as well. I suggest cutting the second and third sentences.

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