

Interactive comment on “Tidally-induced velocity variations of the Beardmore Glacier, Antarctica, and their representation in satellite measurements of ice velocity” by O. J. Marsh et al.

Anonymous Referee #2

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This is a nice piece of work that I enjoyed reading.

This is to my knowledge the first such long record of tidally induced flow variations along a flow line across the grounding line on an ice stream feeding the Ross Ice Shelf. The data is therefore of great interest and very valuable for testing models of tidal response.

The authors correctly point out that based on the model by Gudmundsson, significant M_{sf} is not to be expected because 1) semidiurnal amplitudes are small and 2) mean basal stress is large compared with expected perturbation in basal stress due to tides. As shown in Gudmundsson (2011) the σ_1/k_1 do not produce m_f response, in the same

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manner as s_2/k_2 produce m_{sf} response. Furthermore, since there is almost no s_2/k_2 in the forcing it is not surprising that m_{sf} signal is not seen.

What I find missing is a direct tidal analysis of the in-line displacements. I suggest that the authors conduct a tidal analysis using some standard package such as `t_tide`. It would be helpful to have the a figure showing the strength of the six tidal components ($\sigma_1, k_1, s_2, k_2, m_f, m_{sf}$) in (detrended) horizontal displacement as a function of distance from the grounding line. This would make it much easier to follow the discussion, and it would allow for more quantitative statements about the relative sizes of the tidal constituents.

I expect that it might be difficult to solve for both m_{sf} and m_f from a 35 days record (Rayleigh criterion) but `t_tide` will give error estimates for each component.

As suggested by reviewer #1 the paper could benefit from some restructuring. Measurement could for example better be described in a separate section on data.

Once the the authors have responded to these comments I am happy to give the paper a light re-review.

Interactive comment on The Cryosphere Discuss., 7, 1761, 2013.

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