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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 #1

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Review of Tidally-induced velocity variations of the Beardmore Glacier, Antarctica, and their representation in satellite measurements of ice velocity

This paper presents a nice set of results for a seldom measured glacier (last measurements 50 years prior).

I think the organization could be improved so that there is a results section that includes all the measurements (with appropriate sub section headings for gps, speckle tracking, etc). Then present the tide model based analysis, which now breaks up the measurements. I also recommend pulling out past results on Beardmore out in to separate "study area" section, which reviews what is known already and why this area is

important.

There is not much of a discussion section, though a fairly large conclusions section. I think the paper would be improved by moving much of the conclusion into a discussion section and beefing that up a little. There is also some material in the earlier parts of the paper with the data, which could be moved to the discussion section. Basically, I am talking about some careful cutting and pasting, not adding large chunks of text.

While it by no means diminishes the quality of the paper, the TerraSAR-X speckle-tracked range offset data have been used previously to estimate the grounding line of Pine Island Glacier (see Joughin, Smith, and Holland, GRL, 2010 and supporting online material). It also might be good to include a reference or two earlier in the paper to early work by Rignot on gl mapping where methods discussed, since this essentially the same technique except using less noisy phase data (there is one reference later in paper).

The paper could also use some word-smithing to improve readability. I have included several specific comments below.

Specific Comment 1762-3: suggest ". . ., both linearly and non-linearly." (not quite clear what is meant by patterns).

1762-5 add "," before ". . . which. . ."

1762-8/9 remove "shown here to be present in speckle tracking measurements" people have been correcting for tidal affects in speckle-tracked measurements for more than a decade (range displacement measurement is same in speckle tracking as in insar, just more poorly resolved).

1768-12 Add something after "This.. " (This variability, or This fluctuation, don't just assume this applies automatically back to the previous sentence).

1768-17 Remove "new method" (see comments above)

1768-20-21 don't compare kmˆ3 and Gt, which aren't equivalent. It's easy enough to convert both numbers to either units of mass or volume (Gt is better since there is no ambiguity)

1763-1 remove "The" before "discharge". At something like "typically" or "often" before calculated (some estimates are near calculated near not right at the GL).

1763-2/3. This statement about "positive mass balance state" seems to confuse mass balance with surface mass balance (the former can be negative at the same location where the latter is positive). If this statement were true as written, ice sheets would be gaining mass.

1763-5 would be better to say "observed" here rather than "calculated"

1763-11 Would be appropriate to cite "Joughin VOL. 32, L22501, doi:10.1029/2005GL024319, 2005" as they do an analysis of such biases in their estimates based on GPS observations from Whillans(see Figure 2).

1763-16 You might add Bindschadler ref here too (even though it is included elsewhere).

1764-1 modify to "several days to weeks" many observations have been made with ALOS, which has an $\sim$6week repeat period and RADARSAT has 3+weeks.

1764-2 remove "aim to" you actually do this, not just "aim to"

1764-13 remove "a new method" (see general comments)

1764-25 "seasonal variability" is not the right choice to use when comparing measurements $\sim$50 years apart.

1765-25 add "at all sites. . ." after "Data" since you just referred to GPS-3 exclusively in the previous sentence.

1765-28 Can you be more specific as to the type of "Artifacts" (don't include detailed

description, just something a bit more descriptive e.g., Atmospheric artifacts).

1766-11 "At GPS-3, 6 h mean velocities vary between 0.5md$-$1 and 1.5md$-$1 during spring tides." Figure 2 shows about a +/-3% variation, but the data have been filtered with a 72-hour filter, which should have reduced most of the daily signal, which is important for the discussion of longer term, but kills of the diurnal. Therefore, it would be good to have an extra panel in this figure showing the unsmoothed results. Especially since this variation is highlighted in the abstract, it then is somewhat underwhelming not to see a plot of the actual variability. Perhaps include the other sites, to show how the diurnal signal dies off with distance inland.

1768-10 "repeat" is probably a better choice than "duty" to describe cycle.

1768-26 add a "," before "which" Tables and Text. Why not just refer to the images using their date (ie Dec 16/27) instead of Dec 1/2, which while clear from the captions, tend to look like dates and could be confusing.

1768- "signal-to-noise ratio below 5 are discarded" just say with "poor signal-to-noise ratio are discarded" since it unclear how the ratio was calculated, there is no point in specifying a value.

1769-Par starting at 12: see comments on novelty of grounding line detection and amend appropriately. Also some of this text would be better moved to the next section on GL detection.

1770-9 "," before which

1770-15-17 "but without the need for the very high coherence required by InSAR in the often crevassed shear zones around the grounding line." This is not strictly true. The fact that you can speckle track indicates you have good coherence, although estimates of such coherence may be low due to fringe gradients. The problem is not the low coherence but that fringes are too dense and aliased by the strong motion.

1772-21 "," before "which"

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