

Review of:

Inter-and Intra-annual Surface Velocity Variations at the Southern Grounding Line of Amery Ice Shelf from 2014 to 2018

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General comments

I find the manuscript not suitable for publication in the present form. The two major shortcomings in my opinion concern: a) the reliability of the measurements and b) the lack of clear conclusions and of result interpretation.

The measurements are not very robust, since they rely on very few (11) Landsat-8 image pairs, and on some processing choices, which could further increase the sensitivity to measurement errors (e.g. short temporal separations and lack of spatial averaging). In particular the effects of measurement biases could be significant and only partially captured by the quality assessment approach.

The conclusions of the paper are unclear. In several parts of the paper the authors state with confidence that significant velocity variations are observed in their data, but this seems to be contradicted or at least significantly softened by the conclusions section. Furthermore, interpretation of the results is simply missing, and no hypotheses are put forward to explain the observations.

My detailed comments are provided in the following.

Specific comments

L86-93: You select a single image pair within each season, and state at L90 that the preferred temporal interval for each image pair is one month. This raises several questions, which would deserve further consideration and discussion:

- Can the average velocity over a month be assumed to represent the average velocity of a whole season in this region?
- What are your criteria for data selection, i.e. why do you select exactly those pairs? Why not process all the available cloud-free pairs?
- Why not increase the time interval between images? Based on equation (1), the larger the time interval the less sensitive you will be to errors in the measured N/S and E/W displacements.

L95-97: Can the Grounding Line Location be assumed to be unchanged between 2009 and the 2014-2018 period? Could an imprecise location have any impact on your results?

L102-117: I find this description redundant, as well as Fig. 2. The method is well established, and it would be sufficient to reference the relevant papers, which are already included in the reference list.

L126-127: If I understood correctly you carried out feature tracking only on “a set of location reference points” along the AIS grounding line. Would it reduce measurement noise to carry out the measurements on a 2D grid to allow for some spatial averaging of the measurements?

L148-153: This kind of error estimate will provide a lower bound for the actual errors, since the features which are cross-correlated on stable ice are not necessarily representative of those which are causing the cross-correlation peaks on faster flowing ice. A better error characterization would be provided by the standard deviation of measurements carried out using different image pairs.

L173-174: You state that Fig. 5 shows a “consistent ~5% inter-annual increase over the study period”. To me this is not at all obvious. Based on both Fig. 5 and Table 2 there seems to be a decrease between 2015 and 2016 and the increases observed between the other years are quite variable in magnitude.

L251-253: You mention that the “contribution of the measured magnitudes and directions of these uncertainties in our computed velocity and variability assessments did not lead to any significant adjustments to our measurements”. However, to me it seems like the error biases you show in Fig. 8, left panel, which vary between 0.1 and 0.25 m/d, are of the same order of magnitude of your inter-annual variabilities in Table 2, and would therefore be significant.

L255-256+L267: to me it seems a contradiction that you first state that there is little previous research, and then you state that your results are consistent with previous studies. At L255-263 you don't refer to other studies in the time period you consider, namely 2014-2018, so which studies do you refer to at L267 when you state “consistent with previous studies”?

L310-311: You state that “over the five year study period general stability in surface velocities were observed”. This seems to contradict several other statements, such as L266 and L173, as well as the abstract itself, where you state that there is a variability.

Technical corrections

Table 1: For someone to replicate your study, it would be useful for you to add the paths of each acquisition.

L179: In Table 2 you state 0.29 m/d, whereas here you state 0.31 m/y. These values should agree.

L183-184: Negative intra-annual velocity would mean winter velocity > summer velocity based on the definition you give here.

L240-241: It seems you are defining accuracy as the SNR expressed as a percentage. This is misleading and I would rather just refer to the SNR values, since you have defined the SNR in section 4.

L269: Both “m per year” and “m/yr” are used. Use the same notation throughout the paper.

English language: In all section besides the Introduction, the English language needs some minor revisions.