Referee report for 'Application of a two-step approach for mapping ice thickness to various glacier types on Svalbard'

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In this study, Furst and others present an updated method for solving the problem of inferring ice thickness from sparse observations coupled with surface data. They then apply this method to three glacial systems on the Svalbard Archipelago. The validity of the resulting estimations of ice thickness are established with a detailed error analysis.

The paper is clearly relevant and within the appropriate scope for the journal. Contemporary interest in methods for inferring ice thickness are of great interest to the community, as evinced by numerous recent publications on the subject, including a comprehensive intercomparison (Farinotti et al., 2016). This papers contribution to the field stems primarily from its presentation of a way to circumvent some of the arduous data requirements required by the method on which it is based (Morlighem et al., 2010), and also provides an interesting real world application of the method, providing an important window into the performance of a promising algorithm with the various nuances of real observations.

In my review of the discussion paper I raised a number of points, primarily about inconsistencies in the mathematical methods and in the interpretation error. The authors have done an excellent job of correcting their methods where appropriate, or at least providing substantive discussion of the method's limitations when my requests were felt outside the scope of work. The organization of the paper has also been adapted, and the result is very clear and easy to follow. Outside of a few very minor points, I suggest publication of this manuscript.

On temporal errors

My comment on non-contemporaneous measurements producing an additional source of error was intended to suggest to the authors that the error bounds that they are using might generally be too small, and that they should be made larger because of this effect. My intent was not to provoke a reference to my paper, since the effect I mentioned is a pretty general principle and not a result. Instead of the reference, I'd like to see a short discussion of how (or if) non-contemporaneous measurements might increase uncertainty estimates.

Divergence operator notation

∇ is the gradient operator, $\nabla\cdot$ is the flux divergence operator. Section 2.3.2 uses $\nabla[\ldots]$ as the divergence operator. Please ensure consistency and correct usage, or make the appropriate definitions.

Typos

P2L14 loose $\rightarrow$ lose

P7L30 Eq. 10 appears to be missing some things.

P9L11 to $\rightarrow$ too