The Cryosphere

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Discussions

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Interactive comment on "Assimilating near real-time mass balance observations into a model ensemble using a particle filter" *by* Johannes M. Landmann et al.

Anonymous Referee #2

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Review of 'Assimilating near real-time...' By JM Landmann et al.

This manuscript describes the assimilation of surface elevation measurements into an ensemble of ablation models. The particular data assimilation (DA) technique used is a particle filter.

I think the manuscript is quite interesting, well written, and can become an important contribution to the community. On one hand, it tackles a very important and tangible issue (studying the loss of glacier mass). On the other, it uses an advanced DA method. I have some comments about the manuscript. I will be happy to recommend

this manuscript for publication once the comments are addressed.

– Major comments and questions – - What made you choose a particle filter as DA method as opposed to more traditional methods (e.g. variational methods and ensemble Kalman filter). It would complement the work if you discussed why a PF suits this problem. - Line 105. If I understood well, the observations are of a cumulative quantity. In this case, do observation errors need to consider time auto-correlations? - Line 255. I was a bit confused on where the uncertainties of the input variables are represented. Are they represented in the model error beta, in the observation error epsilon (as mentioned in line 258), or both? - The use of the PF in a multi-model ensemble context is quite interesting, especially since each model has different parameters one is trying to estimate. Is there previous work in this regard? Could you provide some references? - When discussing the particle filter, you introduce the concept of 'minimum contribution' for some particles. This is taken into account when weighting, as explained in appendix 2. There is a comment saying that the original weights are preserved 'in average'. Could you elaborate more on this statement? - Equation 21. How are mu_0 and Sigma_0 chosen?

– Minor comments and questions – - The title mentions 'mass balance observations', whereas the observations are of surface elevation. - Line 96. It is mentioned that the camera images are read 'manually' to obtain the daily cumulative surface height change. Is it literally reading the marks from the ablation pole? How could this be automated to be applied to more places? - Line 127. Can you say more about the 0.2 degree resolution? How does this compare with other products? Is it high or low resolution? - Figure 7. I think making the vertical axis larger for panels a and b could make the figure easier to read. - Figure 8. The individual circles are difficult to see. Please make the circunferences thicker, and maybe increase the size of the figure. - In pages 22-24 (approximately) there are several places where a quantity is written followed by () or []. It was not clear to me what the quantities in the parenthesis are, and why there are two styles.

– Typos and corrections – - Line 109. ... because it can happen that the camera construction sinks... -> ... because the camera construction can sink. (easier to read). - Line 118. melt during night -> nighttime melting - Line 190 on. When mentioning the models in an itemised list, start the sentences with capital letter. - Figure 5. Some of the words in the labels are split into two lines - In the title of table 2 it should say 'standard deviations' instead of 'covariances'.

Interactive comment on The Cryosphere Discuss., https://doi.org/10.5194/tc-2020-281, 2020.