The Cryosphere Discuss., 6, C378–C380, 2012
www.the-cryosphere-discuss.net/6/C378/2012/

The Cryosphere Discussions

Interactive comment on "Monte Carlo ice flow modeling projects a new stable configuration for Columbia Glacier, Alaska, by c. 2020" *by* W. Colgan et al.

Dr. Colgan

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Received and published: 24 April 2012

Dear Dr. Pelto – Thank you for your interest in our work.

You raise a good point regarding the paucity and reliability of in situ observations of surface mass balance at Columbia Glacier. At the time of writing, the only illustrations of the complete surface mass balance versus elevation profile of Columbia Glacier of which I was aware, were Figure 4 in Mayo (1984), which reaches a maximum accumulation rate of 6 mWE/a, and Figure 6 in Rasmussen et al. (2011), which reaches a maximum accumulation rate of 5 mWE/a. I have now read the Tangborn (1997) paper to which you refer, and I see that Figure 5 reaches a maximum accumulation rate of 3

mWE/a. The version available at http://www.hymet.com/docs/columbiaglacier.pdf does not appear to be part of a Byrd Polar Research Center publication. I will have to seek clarification from the author on its exact citation.

In any case, this is quite a diverse range of maximum accumulation rate given that all three studies primarily rely on the same late 1970s in situ observations! The observations you provide of maximum accumulation rate at other Alaskan Glaciers make the suggestion of a lower maximum accumulation rate quite compelling. I suppose the best way to acknowledge the diversity of opinion between Mayo (1984) and Tangborn (1997) is to increase the prescribed range of maximum accumulation rate from 4.5 to 6 mWE/a to 3 to 6 mWE/a. I imagine this would populate the upper left corner of our parameter suite figure (Figure 8) with more selected scenarios. A question to ask, however, is whether a uniform probability of maximum accumulation rate being anything between 3 and 6 mWE/a is a reasonable representation of the community's present understanding of the surface mass balance regime of Columbia Glacier?

Regarding equilibrium line altitude parameterization and validation. We would be most happy to include a remotely-sensed annual record of equilibrium line altitude as one of our validation datasets. I am not aware, however, of such a dataset for Columbia Glacier. The Pelto (2011) paper to which you refer tracks the transient snow line of Taku Glacier, Alaska. Producing such a dataset for Columbia Glacier lies well outside the scope of our paper, as our project seeks to assimilate diverse observational datasets in a predictive framework using ensemble selection and Monte Carlo.

Thank you for your interest, Liam Colgan

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