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Interactive comment on "What glaciers are telling us about Earth's changing climate" *by* W. Tangborn and M. Mosteller

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This is a very interesting paper. It is also very timely as many of us are concerned about the possible impacts of increased glacier melt. However, too little information is given on the PTAA model and the R-square values for six glaciers in Table 1 are not very convincing. I am especially concerned that no references are given to other glacier-climate modelling studies except for those by Dr Tangborn. Is the PTAA approach different from others? Is it better?

A number of workers have followed the lead of J. Oerlemans in calibrating glacier-climate models against some observed mass balance data ("tuning") and then perturbing the model by changing one or more of the model inputs to simulate the effects of climate change ("tweaking"). The models include energy balance and temperature

index models and have been tuned against observed mass balance as a function of altitude or as a time series. Tweaking has involved changing year-round temperature, summer temperature or annual precipitation in the model to simulate the effect of changing climate. The results for such sensitivity experiments suggest that glaciers in dry-continental environments (for example the High Arctic) have relatively low mass balance sensitivity to temperature change while glaciers in wet-maritime environments (coastal North America, Scandinavia and New Zealand) have relatively high mass balance sensitivity. Precipitation increases of 30-40% would be needed to offset the effect of a 1 K increase in temperature. For any revision of this discussion paper, the authors should compare and contrast their approach and results with those of Oerlemans and Hoogendoorn (1989), Oerlemans and Fortuin (1992), Laumann and Reeh (1993), Jóhannesson,et al. (1995), Jóhannesson (1997), Vallon et al. (1998), Oerlemans and Reichert (2000), Braithwaite and Zhang (1999 and 2000), Kuhn (2000), Braithwaite et al (2003), de Woul and Hock (2005), Braithwaite and Raper (2007), Shea et al. (2009), Anderson et al. (2010), Wu et al. (2011) and Rasmussen (2013) to mention just a few.

The above mass balance studies are based on models because we want to make future projections of increased melting before it happens. Although such models are tuned against observed mass balance data, we still need to verify the mass balance sensitivities that we get from the models. Braithwaite et al. (2013) look at recent mass balance variations in the Alps and claim they are consistent with earlier projections from models. We need much more of this kind of verification!

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