The Cryosphere Discuss., 5, C554–C557, 2011
www.the-cryosphere-discuss.net/5/C554/2011/

The Cryosphere Discussions

Interactive comment on "Deriving mass balance and calving variations from reanalysis data and sparse observations, Glaciar San Rafael, northern Patagonia, 1950–2005" *by* M. Koppes et al.

Anonymous Referee #1

Received and published: 7 June 2011

GENERAL COMMENTS:

The paper by Koppes and co-workers is a good and appropriate contribution to The Cryosphere. The authors calculate a mass balance time series of a Patagonian tide-water glaciers, which provides a useful basis to interpret mass balance and forcing history at this site. The study is original and carefully conducted, so I recommend publication of this manuscript after the suggestions below have been addressed in a revision. These suggestions include one major point that I would ask to re-consider, which identifies one weakness in the methodology.

The point is that, for construction of the statistical models (eq. 1, 2, 4), all field data

are used for model training but none of them for model evaluation. In my mind this is a general problem in the geosciences with short data records and statistical downscaling (so cryospheric sciences should be amongst the first to resolve it!), where people use all data to fit the statistical relation, but do not check its validity on independent data.

For longer data sets (e.g., 30 years) it is commonly known to divide into a training period (e.g., 15 yrs) and a validation period (the remaining 15 yrs not used for fitting). This also works for short records through so-called cross-validation, a concept that has been used for a long time in statistical weather forecasting (Michaelsen, 1987). You omit one data point from your record (and a few subsequent points depending on autocorrelation strength), construct the statistical model from the other data points, and then test it on the omitted data point (repeat this procedure until every data point has been omitted and validated once). If you do this in the present paper you will obtain a range of model parameters for each statistical model, and this range could be used to define different cases in Table 1 – more objectively than now (and I would delete case #1; it's not very meaningful physically).

To my knowledge the first study which made use of cross-validation for cryospheric application was Hofer et al. (2010) (their sections 3.5 and 3.6). As their topic is downscaling NCEP/NCAR renanalysis to data measured on a glacier, I think this could be a stimulating reference.

Hofer, M., Mölg, T., Marzeion, B., Kaser, G. (2010), Statistical-empirical downscaling of NCEP/NCAR reanalysis to high-resolution air temperature and specific humidity above a glacier surface (Cordillera Blanca, Peru). Journal of Geophysical Research, 115, D12120, doi:10.1029/2009JD012556.

Michaelsen, J. (1987), Cross-validation in statistical climate forecast models. Journal of Climate and Applied Meteorology, 26, 1589-1600.

Minor points in the "general comments" are: (1) could you discuss more explicitly why the local relation between calving and front retreat differs from other places? (2) The

TCD

5, C554–C557, 2011

description of models used in the study is distributed throughout the text. I think the fluency would be enhanced if there is one section for all models employed. But this is the authors' decision. (3) Replace "manipulation" in the acknowledgments (media can misuse such words ...). You mean "analyses" or "post-processing".

SPECIFIC COMMENTS AND TECHNICAL CORRECTIONS:

1) Please don't use the term "most equatorial" for a glacier at 46 deg latitude, it is confusing (and not important for the study). Something like "northernmost Patagonian glacier";

2) P 1127-1128: You should mention that air temp. and precip. in the reanalysis data are of different quality by nature (type A versus type C variable), so a poor performance of renanalysis precip. (Fig. 2b) can almost be expected.

3) P 1132, L 3: "derived" (typo)

4) P 1133, L 17-18: Can you clarify what you mean by "change in retreat rate"? The slope of this curve prior to 1980 shows similarly steeps sections than afterwards.

5) Equation 4a: needs to start with the symbol for ablation (as 4b does);

6) Equation 5 and associated text: please clarify if you want to show specific or total mass balance in this equation;

7) P 1136, L 6-7: "calving and mass loss due to melting": any idea if sublimation is important at the terminus face?

8) Section 5.1: please make an immediate reference to Table 1 (not at the end of the first paragraph);

9) P 1138, L 13: +1.06 m/year – is this figure from Table 1? I cannot find it there.

10) P 1141, L 25: "1960-1976" (as in Table 1);

11) Equation 9: are roh_sw and roh_i defined in the text?

TCD
5, C554–C557, 2011

12) P 1143, L 13: "estimate" (typo)

13) P 1143, L 18: what does "consistent" mean? (constant?);

14) Figure 3: please provide the altitude of Laguna San Rafael in the caption;

15) Figure 12: "grey shading" – I cannot see shading in this figure. Please revise;

Interactive comment on The Cryosphere Discuss., 5, 1123, 2011.