The Cryosphere Discuss., 7, C13–C17, 2013
www.the-cryosphere-discuss.net/7/C13/2013/

The Cryosphere Discussions

Interactive comment on "Spatial and temporal variations of glacier extent across the Southern Patagonian Icefield since the 1970s" *by* A. White and L. Copland

Anonymous Referee #1

Received and published: 24 January 2013

This manuscript is dealing with an important topic of research, especially because it has been recently confirmed that the Patagonian Icefields are among the worldwide glacier areas with higher contribution to sea level rise due to increasingly negative mass balances. In spite of the above and understanding that this manuscript is not aiming to provide a comprehensive literature review, the paper lack of critical references. Also there are explaining factors not properly considered. In general I think this manuscript needs a lot of work due to major reviews.

In my point of view, the paper has the following problems:

1.- The poor reference list considering previous research. Most of the work presented

in this manuscript has been done by other authors at regional or local levels (Davies and Glasser, 2012; Aniya and Naruse 2012; Rivera et al, 2012a; Raymond et al, 2005 among many others).

2.- The connection with climate is weak and it is not considering several recent papers describing this issue; like regional trends, the use of NCAR reanalysis data, automatic weather stations, radiosonde data or satellite images (Carrasco et al, 2002 and 2008; Bown and Rivera 2007; Rasmussen et al 2007; Falvey and Garreaud 2009, Garreaud et al, 2013; Aravena and Luckman, 2009; Monahan and Ramage, 2010; De Angelis et al, 2007) among many others. For example regarding precipitation changes, there is a clear contradiction between this manuscript and the recent one by Garreaud et al, 2013.

3.- The weak explanation and consideration of calving as a driving factor. For example, the Tidewater calving cycle described for some of the SPI glaciers is not even considered, as well as other hydrological and bathymetric factors (Rivera et al, 2012 a; 2012b; Sugiyami et al, 2011).

4.- The volumetric changes are said to be connected to ice thickness. This is true, but these data are very poorly available in Patagonia, therefore most of the volumetric changes are measured using ice elevation changes or gravity changes. This topic is poorly included in this manuscript. Please have a look to Chen et al, 2007, Jacob et al, 2012; Dietrich et al, 2010. Regarding ice thickness, there are few data as I said, but some papers are available (Zamora et al, 2009; Rivera and Casassa, 2002).

5.- The used glacier names are not all of them widely accepted, and many are just known by mountaineers. This is explained by the use of touristic sources for naming glaciers. I think it is better to keep the names available in the recent bibliography or databases.

References quoted in this review:

Aniya, M. and R. Naruse (2012): Glaciological and Geomorphological researchs in Patagonia 2003-2009. Isebu, Inc. Tsukuba, Japan, 213 pp. (This book includes several papers related to the main issue of the reviewed manuscript)

Aravena, J. C., and B. H. Luckman, 2009: Spatio-temporal rainfall patterns in southern South America. Int. J. Climatol., 29, 2106– 2120.

Bown, F. & A. Rivera (2007): Climate changes and recent glacier behaviour in the Chilean Lake District. Global and Planetary Change, 59, 79-86.

Carrasco, J. F., G. Casassa, and A. Rivera (2002): Meteorological and climatological aspects of the Southern Patagonia Ice Field, in The Patagonian Ice Fields: A Unique Natural Laboratory for Environmental and Climate Change Studies, edited by G. Casassa, F. Sepúlveda, and R. Sinclair, pp. 29–65, Kluwer Acad., New York.

Carrasco, J. F., R. Osorio, and G. Casassa (2008): Secular trend of the equilibrium-line altitude on the western side of the southern Andes, derived from radiosonde and surface observations, J. Glaciol., 54, 538–550.

Chen, J. L., C. R. Wilson, B. D. Tapley, D. D. Blankenship, and E. R. Ivins (2007): Patagonia Ice Field melting observed by Gravity Recovery and Climate Experiment (GRACE), Geophys. Res. Lett., 34, L22501, doi:10.1029/2007GL031871.

Davies, B.J. and Glasser, N.F., (2012): Accelerating recession in Patagonian glaciers from the Little Ice Age (c. AD 1870) to 2011. Journal of Glaciology, 58 (212): 1063-1084.

De Angelis, H., F. Rau and P. Skvarca. (2007): Snow zonation on Hielo Patagónico Sur, Southern Patagonia, derived from Landsat 5 TM data. Global Planet. Change, 59(1–4), 149–158.

Dietrich, R, E.R. Ivins, G. Casassa, H. Lange, J. Wendt and M. Fritsche (2010): Rapid crustal uplift in Patagonia due to enhanced ice loss. Earth and Planetary Science Letters 289, 22–29.

Falvey, M., and R. D. Garreaud, (2007): Wintertime precipitation episodes in central Chile: Associated meteorological conditions and orographic influences. J. Hydrometeor., 8, 171– 193.

Garreaud, G., P. Lopez, M. Minvielle, And M. Rojas (2013: Large-Scale Control on the Patagonian Climate. Journal of Climate DOI: 10.1175/JCLI-D-12-00001.1

Glasser, N.F., Harrison, S., Jansson, K.N., Anderson, K. and Cowley, A., (2011): Global sea-level contribution from the Patagonian Icefields since the Little Ice Age maximum. Nature Geoscience, 4 (5): 303-307.

Ivins, E. R., M. M. Watkins, D.-N. Yuan, R. Dietrich, G. Casassa, and A. Rülke (2011): On-land ice loss and glacial isostatic adjustment at the Drake Passage: 2003–2009, J. Geophys. Res., 116, B02403, doi:10.1029/2010JB007607.

Jacob, T., J. Wahr, W. T. Pfeffer, and S. Swenson (2012): Recent contributions of glaciers and ice caps to sea level rise, Nature, 482, 514–518.

Masiokas, M., Rivera, A., Espizúa, L.,Villalba, R., Delgado S., and J.C. Aravena. (2009): Glacier fluctuations in extratropical South America during the past 1000 years. Palaeogeography, Palaeoclimatology, Palaeoecology 281, 242–268.

Monahan, P. A., and J. M. Ramage (2010): AMSR-E melt patterns on the Southern Patagonian Ice Field, J. Glaciol., 56(198), 699–708.

Raymond, C., T. Neumann, E. Rignot, K. Echelmeyer, A. Rivera, and G. Casassa (2005): Retreat of Tyndall Glacier, Patagonia, over the last half century, J. Glaciol., 51(173), 239– 247.

Rasmussen, L. A., H. Conway, and C. Raymond (2007): Influence of upper air conditions on the Patagonia Ice Fields, Global Planet. Change, 59, 203–216.

Rivera, A. & G. Casassa. 2002. Detection of ice thickness using radio-echo sounding on the Southern Patagonia Icefield. En: The Patagonian Icefields: a unique natural lab-

oratory for environmental and climate change studies. Eds. Casassa, G; Sepúlveda, F. and Sinclair, R. Series of the Centro de Estudios Científicos. Kluwer Academic/Plenum Publishers, New York, 101–115.

Rivera, A., J. Corripio, C. Bravo and S. Cisternas (2012a): Glaciar Jorge Montt dynamics derived from photos obtained by fixed cameras and satellite image feature tracking. Annals of Glaciology, 53(60), 147-155.

Rivera, A., M. Koppes, C. Bravo, and J. Aravena (2012b): Little Ice Age advance and retreat of Glaciar Jorge Montt, Chilean Patagonia. Climate of the Past, 8, 403-414.

Sugiyama S and 7 others (2011): Ice speed of a calving glacier modulated by small fluctuations in basal water pressure. Nature Geosci., 4(9), 597–600 (doi: 10.1038/ngeo1218).

Zamora, R., D. Ulloa, G. García, R. Mella, J. Uribe, J. Wendt, A. Rivera, G. Gacitúa & G. Casassa. 2009. Airborne radar sounder for temperate ice: initial results from Patagonia. Journal of Glaciology, 55(191), 507-512.

Interactive comment on The Cryosphere Discuss., 7, 1, 2013.