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The Cryosphere Discussions



# *Interactive comment on* "Recent acceleration of ice loss in the Northern Patagonia Icefield based on an updated decennial evolution" *by* P. López and G. Casassa

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SpeciïňĄc Comments:

ïĆğ Abstract: Shorten. All speciïňĄc glacier details are not required in the abstract. The abstract will be reduced.

ïĆğ Section 3.1.2: I do not agree that C-band radar does NOT penetrate into snow (see again Berthier et al., 2006; Rignot et al., 2001). For your study, it may have little implications as elevation changes are mainly measured in the approximate ablation area (ice)... The penetration of the C-band radar into ice will be mentioned.

ïĆğ Section 4.2.1: Did you also estimate the c parameter of eq.1, and consequently correct for the mean bias between each DEM? According to Table 4, I can not see that this is done. Unless "Dh" is the mean difference over non-glacierized terrain? If yes, did you correct for this? The correction was done based on Dh which is the mean difference over non-glacierized terrain.

ïĆğ The mean elevation bias (between the DEMs) may be a correction just as imÂň-portant as the horizontal co-registration. You may estimate the mean bias either using the c parameter of Equation 1 and dividing it by the tangent of the mean slope used to solve for the a, b and c parameters (i.e. the second part of your equation 1), or by simply taking the mean of non-glacierized terrain after coÂňregistration only in the horizontal. In particular, this will have large impacts on the ice elevation change estimates! The mean elevation bias was corrected based on the mean of non-glacierized terrain.

ïĆğ Section 4.2.2 AND Section 5.1: Did you ïňĄnd any signiïňĄcant elevational biases? Figure 6 is not very convincing. Also, did you use ICESat for this, or did you use directly the DEM v. DEM comparison? Also, when ïňĄtting a polynomial, not only the interval of elevation (Pg. 3334, Ln4) can be solved, but every elevation pixel can be corrected... Granted that Fig. 6 is not very convincing, how does this adjustment affect your elevation change estimates of Table 8? A bias of 0.6 and 0.7 m/100 m were found for the comparison 1975-2000 and 1975-2005, respectively. It is necessary to take into account that data was compared for the low areas of the NPI due to the lack of data for the accumulation areas. I used the DEM v DEM comparison.

ïĆğ Section 5.1 (Pg 3335, Ln17-22) & Table 6: Care needs to be taken here due to the lack of high elevation (i.e. accumulation area) data in the 1975 DEM (Fig. 2). One option is to use only pixels available in all three DEMs for calculating the means. In that way, at least you are at least sampling the same areas/elevations. However, this will not conserve mass, and therefore interpretation of melt etc. is not possible. In addition, I suggest to combine table 6 with table 8 by showing a total average of all pixels (as described above) at the end of table 8. This will additionally save space and reduce the amount of tables. The obtained mean thinning rates will be interpreted with caution. Table 6 and Table 8 will be combined.

ïĆğ Section 5.1 (Pg 3336,Ln6-15): Can your estimates be directly compared with Rignot et al. (2003)? Your estimates are below the average ELA, but what about Rignot et al. (2003)? Please elaborate more on this. Our estimates below the average ELA were compared with the estimates of Rignot et al. 2003 below the ELA as well. This comparison will be more elaborated.

ïĆğ Also, to be consistent with your last statement of the paragraph, the validation of your results require error bars on your estimates (and their estimates) to deÂňtermine whether the differences between previous studies are not statistically signiïňĄcant... ïĆğ Section 5.1.2 and Figure 8: Consider changing this plot to elevation change rates (m a−1) and show the two to three time epochs 1975-2000, 2000-2005 (and potentially 1975-2005). As of now, this section provides little value to the study, besides suggesting thickening above 1300m. By showing the rates, the ïňĄgure will more conïňĄdently prove the "accelerating" trend... The plot will be changed to elevation change rates.

ïĆğ In addition, I suggest to expand Fig. 8 with individual glacier centerline (or eleÂňvation bin average) elevation change rates for some of the larger glaciers in the NPI, and maybe for those of varying aspects... This will provide the reader with even more concrete information about the individual glacier elevation changes. This will also aid to the results of the maximum thinning rates described in the previous sections (and it could be worthwhile, then, to combine the sections). Fig. 8 will be expanded with individual glacier centerline or elevation average elevation change rates for some of the larger glaciers in the NPI.

ïĆğ Section 5.2 and Section 5.3. Since I assume that most of the area changes are occurring at the fronts of glaciers, then area change and length change are saying pretty much the same thing. These sections and ïňĄgures described may be considerably shortened and possibly combined. These sections and figures will be shortened and probably combined.

ïĆğ In Section 5.2, All numbers that are present in tables are not required to repeat in the text. It makes the section un-interesting and difiïňĄcult to ïňĄnd the interesting aspects. Instead, focus on the retreat rates, those glaciers that have accelerated, decelerated retreat. How do these numbers compare to the elevation change rates? The section will be focused on glaciers that have shown an accelerated rate of retreat. Also numbers presented in tables will not be repeated in the text.

ïĆğ In Section 5.3, Similar to above, not all numbers are required to repeat in the main text. Focus on the important, interesting details. Also, maybe it would be interesting to see percent retreat per year in Fig. 11. Numbers presented in tables will not be repeated in the text. The percent of retreat per year will be showed.

ïĆğ Pg3341, Ln5: How did you calculate the 81% of ice loss? Is this your measured ice elevation changes between 2000-2005? The 81% mentioned correspond to a surface area loss of ice at the three fronts of Steffen glacier and not to ice elevation changes.

ïĆğ Pg 3345, Ln10-12: Any hypothesis why the west facing glaciers are wasting more? Yes, I will mention this in the reviewed version of the paper.

ïĆğ Table and Figures: All captions are not very helpful. Please ïňĄll in the captions with important information that helps the reader interpret your tables and ïňĄgures. See below for more speciïňĄc details and suggestions. I will modify as much as possible the figure and table captions.

ïĆğ -Combine Table 1 and 2? -Combine Table 6 and 7? -Combine Table 9 and 10? -Combine Fig. 1 and 3? Tables will be combined as much as possible.

ïĆğ -Is Fig. 4 necessary?, maybe it is enough with just a reference? Figure 4 will be deleted.

ïĆğ -Fig. 7: This is Mean elevation changes, correct? Yes, it is. The title of the figure will be modified. ïĆğ Also, are the same exact pixels used for calculating the means in both time periods? If not, maybe they should be. Yes, the same pixels were used for calculating the means in both periods.

ïĆğ -Fig. 8: As stated above, I suggest to show this ïňAgure using elevation change rates for all three time periods you have. Also, expand this ïňAgure to also show changes of the individual glaciers used in the results and discussion. Changes of individual glaciers will be included.

ïĆğ -Fig. 10 and 13: Maybe these ïňAgures could be more helpful if you use annual change rates rather than absolute change magnitudes? Both figures will be modified.

ïĆğ -Fig. 12 and 14. I would remove Fig 12, or have it as an inset in Fig. 14. For Fig 14, would it be more interesting to see the percent change per year? Figure 12 will be removed.

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Interactive comment on The Cryosphere Discuss., 5, 3323, 2011.