

Interactive comment on “Strong ELA increase causes fast mass loss of glaciers in central Spitsbergen” by J. Małeckı

P. Holmlund (Referee)

per.holmlund@natgeo.su.se

Received and published: 18 December 2015

Climate warming affects glaciers all over the world which contributes to sea level rise. The present and future climate effects are expected to be most significant at high latitudes but regional differences occur so the simple view of a latitude governed melt off is not evident. However, such regional pattern cannot be clear as the climate which governs the glacier size includes all climatic parameters, not just temperature. On Spitsbergen large differences in response to late warming can be observed and it is of great value to expose spatially distributed observation sites in order to understand how climate is changing. We need to know how well the long time series of glacier changes represent a larger region. In this perspective this paper addresses highly relevant issues for TC-readers and the results are useful for the research community.

C2512

The author make use of DTMs constructed from aerial photos in 1990 and 2009/11, photogrammetric maps from the 1960s and reconstructions of LIA-maximum stages based on moraines. The concept has been used by others, but not in this region and the data is new. The paper is not quite clear in its structure. The ELA reconstruction and its importance for the conclusions are not sufficiently described. If there is a clear trend in increasing ELA:s this should be clearly stated. It is clear that the differences between the latest DTM:s indicate a high ELA is rather clear, but how do you know that ELA was lower during the 1960s. The 60% AAR-method is based on a steady state situation! The slight unclearness of the handling of the ELA is probably in part a linguistic matter which easily can be adjusted, but it also a matter of how it is handled in the text. If the title expresses the key element of the paper I would suggest a better analysis, with supporting observations, of this specific matter and a reduction of the other analyses. Another issue which may need some clarification is the results on changes between LIAMax and the present indicating a 37,9 % decrease in area and 8,4 % in glacier length. This is a remarkable difference which may need some explanation and/or discussion to be reliable. Most glaciers are situated within a valley or a cirque and area and length use to be of the same order of magnitude, unless you include perennial snow fields and snow patches in your calculation. This is in a need for clarification. There is not a perfect match between abstract, discussion and the conclusions. This may be a linguistic matter, but it needs to be improved. One detail is that the contribution of increased melt off is more important to sea level than to Spitsbergen mass balance. The references are fair and the math and the methods used are also in good order. To summarize my criticism I suggest an increased focus on the ELA issue, a general shortening and some explanations to the results mentioned above. Details Page 1, line 15-17. Rewrite this sentence. It is unclear at the moment Page 1, line 17-20. Is this a gradual trend or is it a static situation? Page 3, line 24. Reformulate "...hence their dynamics are low." Page 3, line 43, "...subtile..." Page 8, line 11, Omit "their" Page 8, line 13. Replace "decreased" with "increased". Page 14, line 4-8. Are there any observations of the non-existing accumulation areas or is

C2513

only a result of your calculations? Page 14, line 47-50. You may need to rephrase this sentence a little. You may say that some glaciers in Nordenskiöld Land show similar responses to your observations which may indicate that your results are valid for larger areas than just Dickson Land. Just make it more vague. Page 15, line 1. "...mass balance contribution..." To what? Add for example sea level change. Page 15, line 8-10. Some unclarity here, both in the word contribution and the last part about "...changing functioning of their valleys...". Explain what you mean. Page 15, line 32. Change the word glaciology to glacier coverage or type of glaciers. Glaciology is a subject. Page 15, line 32-34. Change this to something more relevant such as sea level contribution.

Interactive comment on The Cryosphere Discuss., 9, 6153, 2015.

C2514