

# ***Interactive comment on “Mapping and morphometric analysis of glaciers in Jotunheimen, South Norway, during the “Little Ice Age” maximum” by S. Baumann and S. Winkler***

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Baumann and Winkler (2009) generate a Little Ice Age maximum reconstruction of glacier extent for Jotunheimen that documents glacier area, elevation range and length. The methodology is described in appropriate detail. This paper will be a useful contribution quantifying the regional LIA glacier characteristics. The data set is used for and will enable ongoing comparison with recent inventory data quantifying the magnitude of glacier change in the region since the LIA. There are several points that can add value to the paper, for which the data already are in hand.

One of the goals of the paper is to detect spatial differentiation in glacier behavior from

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the Little Ice Age to 2003. In three respects this goal can be better achieved.

1. In Andreassen et al., (2008) the map showing the percent change in glacier area over a more recent period is provided. This map illustrates the spatial differences in the changes around Jotunheimen, highlighting the greatest changes in areal extent occurring on the northern side and eastern side of the district. This same map should be included for the percent change in areal extent from the LIA maximum to 2003 in this paper. Is this same pattern of change evident? This comparison will indicate whether the spatial pattern of retreat from the LIA maximum to the mid-20th century has been different than the spatial pattern since. This will differentiate spatial variation in glacier response to post Little Ice Age climate both in the shorter term and longer term.

2. The minimum, maximum and mean glacier altitude were determined, only the mean minimum and mean maximum altitude are briefly reported, without any spatial analysis. In particular it would be quite important to report the change in these three mean altitudes from LIA maximum to the present. This would provide a useful measure of mean ELA change. As Raper and Braithwaite (2009) recently noted the median and mid-point altitude provide useful measures of both the ELA and through comparison the mass balance gradient. In particular the spatial pattern of midpoint or median altitude change would address the objective of identifying spatial differentiation of glacier behavior. The change in mid point altitude can if it is informative be related to aspect or glacier size.

3. Why is a value of 0.01 km<sup>2</sup> used for minimum glacier size? This is quite small. The overall impact on glacier area is insignificant of course. However, does inclusion of these small ice masses significantly alter the conclusion as to glacier disappearance? If 0.1 km<sup>2</sup> is used does the number of glaciers that disappeared change? Andreassen et al., (2008) indicate 35 glaciers in the less than 0.1 km<sup>2</sup> size class versus 26 noted for the LIA maximum. How many of these are the same glaciers? Of the 13 that disappeared what was their LIA maximum size? Recent papers from the North Cascades and Switzerland have noted greater percentage losses for smaller glaciers in the last

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50 years.

Minor Points: The timing of maximum LIA extent is discussed at length. The focus is on changes from the LIA maximum regardless of timing. Given that no rates of change are calculated the determination of a specific date is not vital. This section could be shortened.

A more appropriate regional comparison in terms of glacier size and climate setting is Garibaldi BC. A recent paper Koch et al., (2009) undertakes a similar study and notes a 51 decline in glacier area from the late 18th century to 2005.

Section 6.2 should be before the results.

A more detailed image illustrating a moraine wall in satellite imagery would be useful.

#### References:

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