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The Cryosphere
Discussions

Interactive comment on "Area and volume loss of the glaciers in the Ortles-Cevedale group (Eastern Italian Alps): controls and imbalance of the remaining glaciers" *by* L. Carturan et al.

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Carturan et al (2013) provide a valuable detailed analysis of changes in glaciers from 1987 to 2009 in the Ortles-Cevedale Group of Italy. This time period is well chosen since the beginning of a period of substantial negative balances and dominant retreat in the Alps began in 1985. The level of detail on the changes in the Italian Alps in an area where many glaciers area and will be lost is an important documentation of the specific characteristics of the area and volume losses of these glaciers. Below is a series of specific points. The main point focusses on the need to specify the disequilibrium nature of the response for many of the glaciers. Further that the lack

of an accumulation zone will lead to glacier loss with current climate. Both points are important context that will strengthen the future forecast discussion and the current response discussion.

Specific Comments: 270-16: Changes in velocity also fit in with the thickness area and length changes.

270-22: This decoupling in terms of equilibrium condition is more appropriately noted as a disequilibrium response. Paul et al., (2004) identified glaciers in the Swiss Alps that are disintegrating due to massive down-wasting, as undergoing a non-steady state response. Pelto (2006) noted that North Cascade glaciers experiencing a disequilibrium response to climate had thinning in the accumulation zone that was approximately equal to that of the terminus.

273-6: There is considerable hydropower on the Adda River, Noce River and Adige River. It would be worth noting the output if possible.

277-20: Temperate alpine glaciers survival is dependent on the consistent presence of an accumulation zone. If a glacier does not have a persistent accumulation zone, all areas of the glacier will experience thinning, including the former accumulation zone (Pelto, 2010). Low mean AAR values indicate glaciers that lack a significant consistent accumulation (Pelto, 2011). These glaciers cannot survive and are undergoing a disequilibrium response to climate.

278-15: What is the suspected error in snowline altitude (SA) given the patchiness of the accumulation zone for many of these small glaciers with low SCA?

279-4: An AAR of 1 as the equilibrium is not realistic for glacierets. Such an AAR year after year would lead to expansion before long. Instead given the no motion criteria these glaciers have years where they are dominantly snowcovered and years when they lose almost all their snowcover. This is the only mechanism that allows a stable area and volume.

282-17: The transition from glacier to glacieret is an important observation here. This is a uniquely large such identified group. Are there any key characteristics of the glaciers than ended up in this group?

283-8: Retreat of the head of a glacier was noted by Pelto (2006 and 2010) as a key characteristic of glaciers in disequilibrium since this occurs due to thinning of what was the accumulation zone.

283-10: Negligible changes in glacier slope suggest thinning along an entire longitudinal profile that is not significantly different. How negligible is the difference in thinning with elevation?

284-23: The similar thinning and lack of any snow cover across the entire glacier again indicates a glacier without a consistent accumulation zone and one that cannot survive (Pelto, 2010).

287-20: Ranzi et al (2010) should be referenced for the Madrone and Adamello Glacier changes that are also similar.

289-20: These glaciers then do not have a persistent accumulation zone, are experiencing disequilibrium and cannot survive (Pelto, 2010).

292-28: The 50% reduction assumes a collective response. Given that many glaciers will be lost completely since they have no accumulation zone. The percent area remaining would seem to be more accurate, if it was determined for the group of glaciers that have a significant SCA, assuming total loss of the other glaciers.

Figure 1: Need latitude and longitude.

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