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The Cryosphere Discussions

Interactive comment on "Glacial areas, lake areas, and snowlines from 1975 to 2012: status of the Cordillera Vilcanota, including the Quelccaya Ice Cap, northern central Andes, Peru" *by* M. N. Hanshaw and B. Bookhagen

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Hanshaw and Bookhagen (2013) provide a detailed assessment of glacial lake change, glacial area change and snowline in the Quelcaya Ice Cap and Cordillera Vilcanota Region. This data set once the analysis has been refined can be of value, but at present is not reliable enough to have value. The comments here focus on two significant issues that must be addressed for the data set validity to be demonstrated

The plots of glacierized area indicate significant interannual variation that is simply not

realistic for these tropical Andean glaciers that have relatively limited precipitation and low velocity. The glaciers have no mechanism to rapidly expand in area from one year to the next. Similarly given the limited ablation rates in the region and lack of potential for dynamically driven retreat, glacier area losses will also not be particularly rapid. The plots of glacierized areas in Figure 10-12 indicate specific changes in glacier area that defy reality. Figure 10 indicates rapid changes in glacier area for the QIC for 2002 and 2011 of 5-10 km2, which is 10-20% of the entire ice cap area lost or gained. In Figure 11, the CV-2 is noted as losing over 50 km2 in area from 1985 to 1989, this is approximately 20% of the entire area noted. Following 1998 the CV-2 is noted as gaining more than 20 km2 in area by 2002. In Figure 12 CV-1-7 and 9-10, there is nearly a 100 km2 loss in glacier area that is then regained between 1997 and 2001, followed by a loss of a similar magnitude from 2001 to 2006. This represents 25% of the glacier area lost or gained in a few years. Obviously none of these values of rapid glacier area change representing a significant percentage of total glacier cover is realistic. If we are measuring minimum snow and ice covered area and not glacier extent, fine.

For the snowlines on QIC, the authors note, "On some images from the mid-late ablation season, the snowlines are clearly visible. Classifying these snowlines, however, proved difficult". I am not sure why if the snowlines are clearly visible classification proved difficult. In fact I agree that there are many Landsat images from the region where the snowline is quite visible and does not require using MESMA. If we look at four images from 8/15/2010, 8/23/2010, 9/8/2010 and 9/16/2010 (see Figure 1), the snowline is quite evident in three of the images and the TSL is nearly in the same location on 8/15 and 9/16. However, on 9/8 a snow event has clearly obscured the snowline. Snowline identification is not as difficult as described, but the interpretation is not as simple as presented. The authors note a trend in Figure 18 in snowline and elevation that does not exist. There is an increased frequency of years with a snowline above 5400 m, compared to earlier observations, but there is insufficient data continuity to declare a trend. The importance of the snowline is as an indicator of mass

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balance via the accumulation area ratio. No AAR data is presented here. What AAR does a snowline of 5400 m or 5500 m equate to? What does this imply about QIC equilibrium? Figure SM C12, indicates a snowline in 2009 that does not match the actual snowline all that well and further is indicated as higher than in 2009, but a simple overlay indicates it is not lower on 10/15/2009 than on 9/16/2010. The snowline assessment has to be either removed or reevaluated.

Interactive comment on The Cryosphere Discuss., 7, 573, 2013.

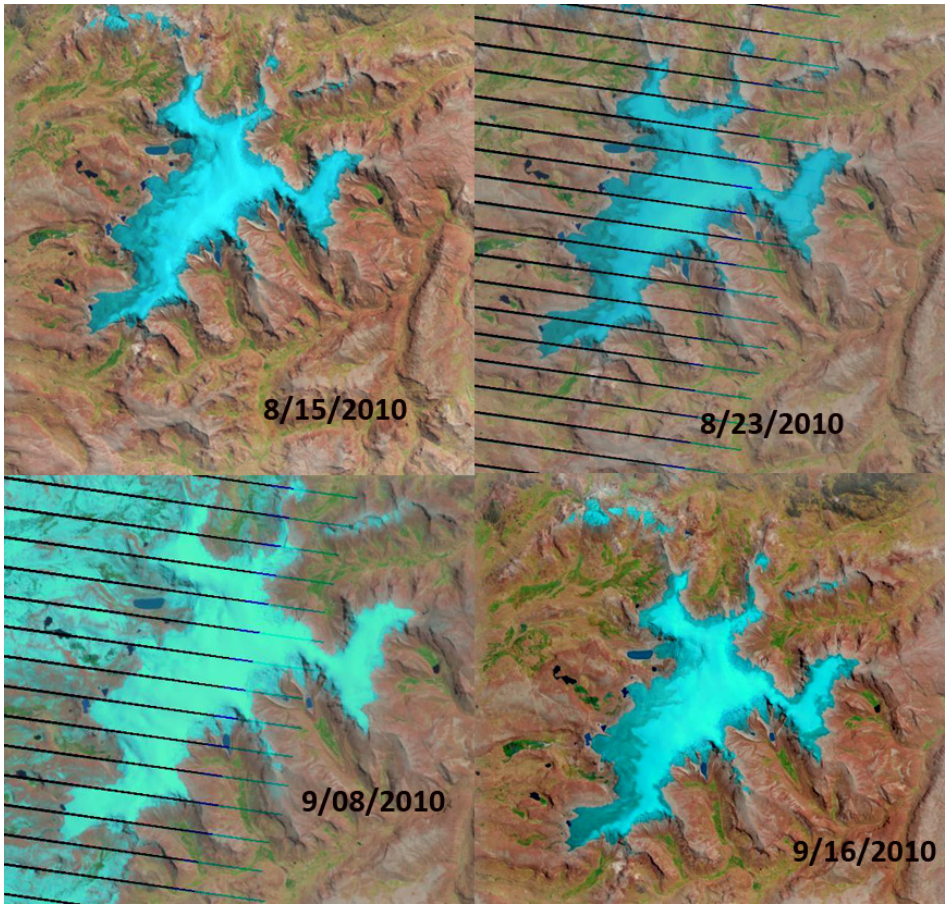

Fig. 1.

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