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The Cryosphere Discussions

Interactive comment on "Glacier changes and climate trends derived from multiple sources in the data scarce Cordillera Vilcanota region, Southern Peruvian Andes" *by* N. Salzmann et al.

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Many thanks for the constructive review, which helps us to improve the manuscript considerably. Please find the replies to each point of your comments below.

Major points

- Method to fill mission data: We fully agree and believe there is a misunderstanding. We have calculated the value for Santa Rosa by using linear correlation estimates from several nearby stations. From these estimates we have then taken the arithmetic mean. We believe this approach is sound and in fact the same you are proposing. However, we will rewrite this part in the manuscript in order to better describe the approach and

make it more understandable.

- Figure 3: We agree and we will remove the seasonal cycle by running a Gaussian filter beforehand. Also, we will extend the discussion of the statistical significance of the trend. In Figure 3d, we will plot also the actual values.

- Tables 3 – 7: We completely agree and will give the values in its temporal context.

- Specific humidity: We are fully aware of the limitations related to Reanalysis data, and we have also mentioned some to these limitations in the current manuscript (section 4.2, 6.2). We will enhance the discussion on this issue.

Because of the known problems, we have for example not used precipitation from Reanalysis in our study. And for temperature (as well as for the other variables), we do not rely on Reanalysis only, but also on station data and finally compare our results with those from other studies in the Andes region. This multi-source approach is actually what we aim at proposing in our study for data scarce areas in order to reduce uncertainty.

Regarding specific humidity in Reanalysis we agree that the limitations are significant. Furthermore, there are also no reliable station measurements available for comparison purposes. That is, the Reanalysis data are the only data available for specific humidity for the CV region. This is part of the challenge studying regions such as CV. Nevertheless, we agree on removing figure 6 and instead refer to the article of Dessler and Davis, 2010 JGR.

- Glacier estimates: We will be able to provide some error estimates and will also include some references that provide general error estimates for the well established method we have applied in our study.

- Water vapor trends We agree on this, and remove Dessler et al. 2008 and instead refer to Dessler and Davis 2010 JGR as well as add some more general discussion on water vapor trends in the tropics.

- Precipitation and specific humidity: In the last paragraph, to which the reviewer is pointing to, we present a possible scenario of how climate in future might evolve. The focus of our article is in fact on past trends, and this assessment of future trends is only made in the âĂŽConclusion and Perspective' section. Actually, we believe we are in line with the reviewer, that for the tropical Andes and particularly for the CV region no clear future trends or consistent scenarios exist for precipitation. One of the few study is indeed Minvielle and Garreaud, 2011. In their article, they actually stress the large uncertainties associated with precipitation scenarios (including respective references), particularly on a regional scale. They furthermore show, that of 11 AR4 GCMs 5 show an increase and 5 a decrease in precipitation with an insignificant multi-model mean change of 1 mm month-1. They then take these 11 GCMs to apply a statistical downscaling using a zonal wind – precipitation relationship. Applying this relationship, a decrease in precipitation results. Although we appreciate the study of Minvielle and Garreaud, a great weakness of statistical approaches for climate scenario use is the assumed stationary of the statistical relation in the future. Therefore, we argue that in fact there is no sound basis for neither an increase nor a decrease of precipitation in future. Here, in the 'perspective' final part of our article, we have chosen to argue more for a future increase. However, we can add some more discussion on this topic and stressing somewhat more the high uncertainty.

We of course agree that it is possible that higher air temperatures can compensate a higher specific humidity by relative humidity.

Minor edits:

All minor edits were taken into account. Many thanks for your edits!

Interactive comment on The Cryosphere Discuss., 6, 387, 2012.