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Climate of the Past Discussions

Interactive comment on "Ice core precipitation record in central Tibetan plateau since AD 1600" *by* T. Yao et al.

T. Yao et al.

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Question 1: The authors say that depositional effects on snow accumulation can be neglected in this study. On what grounds is this statement substantiated? If there are glaciological studies on the upstream regime of the ice core than they should be should be discussed or at least the appropriate references should be provided. Reply: The Puruogangri ice core was drilled on a flat platform with an area of over 150 km2, so the horizontal topography has little effect on the redistribution of snow. The surface snow may be sublimated, but only count for a small proportion of glacial accumulation. It is therefore difficult to estimate the loss of snow through sublimation. Thus contributions of sublimation are normally neglected in previous studies when calculating glacial accumulation. That is also the case with our study.

Question 2 I guess there was 10mm precipitation between Nov. and April? Reply: Yes,

it was 10mm.

Question 3: The authors derive a mean annual temperature of close to -15℃ and mean summer temperature of -4℃. This seems to be warm enough to allow at least for percolation of melt water during summer times, which may alter the interannual variability in snow accumulation. It would be helpful to describe the snow stratigraphy somewhat more in detail to assess this effect. Reply: A mean summer temperature of -4℃ on the top of the glacier is estimated in the Tuouohe station. It is true that sometimes temperature is above 00C which will be a melting period. We did observe surface melting on the glacier in different melting periods during the drilling season. To see if there is mass loss caused by surface melting, we dug three snow pits at the core site to study the percolation process. From the snow pits we did observe surface melting water which penetrates 2-3 cm in each melting period. When the next snowfall comes after each melting pweiod, the surface melting stopped. The next surface melting starts on the new snow surface which produce water penetrates another 2-3 cm. This kind of process produces a few thin ice layers with thickness of 2-3cm in a year. However, there is no mass loss caused by surface melting water percolation, which means that the temperature on the top of the glacier is not warm enough to alter the interannual variability in snow accumulation.

Question 4: The authors state there are clear seasonal cycles in 18O. Given the fact that there is nearly no winter precipitation it appears astonishing that such clear cycles do exist. It would be helpful to show a graph with a high-resolution dust and  18O record to assess the dating accuracy. Reply: There are clear seasonal cycles in precipitation 18O as proved by ten-year observation in the Tibetan plateau. As far as the Puruogangri ice core is concerned, the dust concentration varies more seasonally. So a figure with a dust concentration is shown in the revised manuscript to assess the dating accuracy.

Question 5: It is unclear what the authors mean, when they refer to the continuity equation. This would be the place to thoroughly discuss the thinning function of the

CPD
4, S97–S100, 2008

glacier as well as the effect of lateral variability of snow accumulation in the upstream regime. Reply: We rewrote this section following the comment.

Question 6: The authors perform a correlation analysis on the raw data as well as on a 5 year running average. It appears that the significance level for the running mean analysis does not take the reduced degrees of freedom into account when averaging the data. Accordingly, the 99% significance level is probably overestimated. Reply: We revised this section by deleting the 5 year running average part.

Question 7: The use of a Cramer’s test seems not to be necessary here, because one can see with the naked eye where the layer thickness is higher/lower in fig.3b. Such a test would be worthwhile to investigate the significance of deviations from the long-term mean but again the reduced degrees of freedom have to be taken in account when using running average. Reply: We rewrote this part following the comment.

Question 8: NAO (North Atlantic Oscillation), this abbreviation has not been explained before. Reply: We revised it.

Question 9: Fig.1 the quality of this map is pretty bad. It is not clear which drill site is which. In fact a high-resolution map of the Puruogangri ice field also indicating the topography should be given here. Reply: We re-draw the map in the revised manuscript.

Question 10: Fig.4 what kind of smoothing has been used to create these plots. It is not clear how much of these long-term trends can be explained by glacier flow and upstream effects and how much is of meteorological origin. Reply: In this figure the decade averages of snow accumulation in the three cores are shown. No smoothing has been applied to these data. In the accumulation reconstruction the affection of glacier flow on the snow accumulation is considered in the glacial accumulation reconstructing model, as has been added in the revised manuscript (equation 1). So the reconstructed accumulations mainly reflect meteorological origin.

CPD

4, S97–S100, 2008

Interactive comment on Clim. Past Discuss., 4, 233, 2008.