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Interactive Comment

Interactive comment on "Summer temperature trend over the past two millennia using air content in Himalayan ice" *by* S. Hou et al.

Anonymous Referee #1

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General comments

The Hou et al. paper describes a reconstruction of summer temperature trend based on the air content recorded in an Himalayan ice-core over the past two millennia. This temperature proxy data indicate: a) an unprecedent warming trend in the 20th century b) similar trend with central tropical Pacific temperature as indicated by the Cobb et al. (2003) coral record . The reconstruction does not show high temperatures during MWP and low temperatures during LIA. The paper represent a valuable new contribution to a growing body of Himalayan ice-core research and contribute to the understanding of climate variability over the last two millennia. I have some comments and suggestions the authors may want to consider them to improve the manuscript.

1.Introduction

It is mentioned briefly that the usually proxy for temperature, d18O and dD are affected not only by temperature but also by other environmental parameters. The ice-core gas-content is proposed as a physically proxy for temperature. Would be very helpful to mention here what are the main advantages of such a temperature proxy relative to d18O and dD. Is the ice-core-gas-content less influenced by other parameters than temperature relative to d18O and dD?

2.Experimental methods

It is argued that some air is lost by cut-bubbles at the sample surface. For this reason a cut-bubble correction coefficient is calculated. Is this correction introduced here for the first time or this is a common technique to correct gas-content lost due to ice-cutting?

3. Dating It is not very clear to me what is the min, max and average time resolution of the temperature reconstruction. A more detailed description of the dating procedure would be very useful when the variability of this reconstruction is investigated with more sophisticated statistical tools for time series analysis.

3.Results and discussion

3.1.It is argued that during dry season, the negative latent heat generate strong sublimation which mentain the glacier cold. During wet season, the reduced short-wave radiation does not compensate the increase long-wave radiation and the humidity gradient is reduced. This last process, together with higher temperatures increased the probability of summer melting and therefore of less air content in the ice-core is recorded. A quantitative estimations of the anomalies related to ice-melt process (i.e. radiation flux anomalies, temperature anomalies, etc) would be useful to relate the gas-content-ice-core to specific climate phenomena.

3.2.The transition from the very detailed description of local physics of ice-core-gas-content to investigation of large-scale climate teleconnections related to the variability in this temperature reconstruction is too abrupt. A discussion of the physics of the gas-content in the ice core in one subsection followed by a discussion about the possible

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large-scale climate teleconnections during the last two millennia as suggested by the variability of this temperature proxy in other subsection will be useful. In this way the the detailed description of the experimental results is separate from the highly speculative discussion about the large-scale climatic teleconnections as suggested by this reconstruction.

3.3. The reconstruction of Cobb et al. (2003) supports a cool MWP and a warm LIA which better fit the Himalayan temperature as derived from this gas-contentent ice core temperature proxy. The two time series (Fig 3 b and c) suggest a tendency of the temperature to increase both in central Pacific and Himalayan region. These positive temperature trends seems to be out of phase with the northern Hemisphere temperature trend (Fig. 3c). The out of phase variations of tropics-extratropics temperature trends during the Holocene, as authors suggest here is supported by other temperature reconstruction (e.g. Lorenz et al. 2005 and the reference therein). The fact that temperature pattern during LIA and MWP is not uniform is also discussed in the review paper of Jones and Mann, 2004. However, the time scale of the variations of the reconstructions represented in Figure 3 are very different and a simple visual inspection of them is not enough to conclude about their common or uncommon variations. A separate analysis of the long-term trends and centennial variations will be very useful when compare the variability of these time series.

3.4 It is argued that the primary impact of solar activity is to change thermal gradients rather than direct solar heating. The Sun influence the climate via various processes, like the excitation of dominant modes of extratropical variability, modification of the tropical convection and related surface circulation (Waple et al. 2002) or many other mechanisms. The temperature proxies considered here suggest only that the connection between solar forcing and tropical and extratropical climate may be different. While the signature of the solar forcing is evident in the northern Hemisphere temperature reconstruction (Fig. 3d and e) it is not evident in Himalayan temperature reconstruction.

4. Conclusions

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In my opinion the proxies considered in this study suggest that only the long-term trends of tropical and extratropical temperatures are out of phase. The centennial variations are more complex and seems to be different in the tropics and extratropics.

5.Figures

5.1. While the unusual 20th century warming is evident in the original time series the filtered version (Fig. 3b) does not show clearly this unusual warming. Therefore I suggest to modify a little the filter parameters in order to better emphasize the unusual 20th warming.

5.2. It is difficult to compare the time series of radiative forcing associated to volcanic eruptions with the other time series represented in Figure 3. Therefore I suggest to use a linear plot also for this time series.

References

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