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Interactive comment on "Age of the Tibetan ice cores" *by* Shugui Hou et al.

Anonymous Referee #1

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Dear Editor,

this manuscript brings new valuable information about the Chongse glacier ice core extracted in Tibet that can be published in TC by making major corrections with a neutral review and comparison with other tibetan sites. However, the author needs to clarify his objectives. If through the information of Chongse, the author seeks to discredit the information extracted from other sites like that from Guliya ice core without bringing new, precise and concrete information on this same site, because Guliya doesn't fit with his conclusion, the manuscript has to be rejected.

General comments

In this manuscript, Hou et al. presents preliminary results of dating aa new ice cores extracted from the Chongse glacier in Tibet. Based on three radiogenic dating methods (3H, 210Pb, and 14C), the cores extracted from two different sites on the glacier

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would preserve samples dating as far back as the Holocene. This conclusion is mainly based on the deepest samples dating using a robust 14C dating method extracted from WIOC. The extrapolated dating on bedrock age is based on a simple 2-p flow model. The second discussion of this manuscript concerns the comparison of the various ice cores extracted in this Himalayan region and in particular the maximum age preserved in these archives. The author argues that since the majority of these archives, including Chongse, do not preserve more than Holocene ice, the particular site of Guliya displaying 700ky must be questioned.

General comments on both main manuscript sections:

1) Chongse ice cores dating: Chongse ice cores were dated using three different radiogenic methods, 3H, 210Pb and 14C covering different age scales with their own limitations. All methods were applied and results used in an adequate way for their interpretation. 14C method based on WIOC extraction allows to date quasi continuously over the oldest part of the core, reaching an age of 7.0ka ten centimeters above bedrock for deepest core (C4). At this stage of the dating, the use of a very simplistic model 2-p does not bring complementary information in view of the uncertainties related to the parametrization like constant accumulation over time. Using the maximum age of C4 to constrain the C2 model is not appropriate. What seems to be ignored in the manuscript concerns the difference in 14C age obtained between C4 and C2 at intermediate depths, between 2 and 4 ka on C2 (60-110m we) whereas they have rather 0.5-2ka on C4 (80-175m we). These data would rather show that there is no coherence between the two cores and that their records are discontinuous. Considering the data that appears to be available (surface and bedrock topography, surface flow velocity, temperature profile), the application of a 2D or 3D flow model should help to constrain the conclusions on the dating of ice layers.

2) Tibetan ice cores comparison: This paragraph summarizes the maximum ages obtained from the different sites of this region. In order to get a better idea of these points, it is necessary to provide a better description of each of the studied sites (topography,

bedrock temperature, flow) and to describe which methods were applied for the core dating. Special attention seems to be given to the Guliya site, which has an age of up to 700ka and is exceptional for this region. It is not acceptable in this discussion that the author calls into question Guliya's record without providing any additional new information on Guliya glacier, only based on the conclusion of a nearby and very different Chongse glacier.

Specific comments

Title: Not adapted to the content, too general. Suggestion "Chongse ice core, a contribution to Tibetan ice core age review"

Abstract: To review according to the objectives of the manuscript (see introductive comment to editor).

2) Chronology of previous ice cores": Dunde ice core: explain how original chronology was established and what led to the new dating.

Guliya ice core: if this record seems to disturb the author, it will be necessary to provide explanations and more complete arguments. Yao (1997) indicates ages at different depths (AC 1700 at 120m, LGM at 170m, 110ka at 268m) and explain how they were established. It should be noted at this point that the age of Guliya at 170m is of the same order of magnitude as that of Chongse for the same depth, but that Guliya has 100m of additional older ice. The deep dating of Guliya is established by a simple model passing by dated points (36Cl instead of 14C), the technique is similar to that proposed in this manuscript for Chongse, with just as many uncertainties. Even if the last point of 36Cl is very uncertain because of a low chloride concentration, the fact remains that the complete record could only reach 300ka. But in any case, an indisputable point is that the record of Guliya is more than 110ka and calls into question the inappropriate discussions on this point in this manuscript with inexistent ice older than Holocene in Tibetan region.

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Dasuopu ice core: explain how this core was dated? Give references like Yao (2002), on CH4 comparison, δ18O depletion missing...

Gregoriev ice core: according to Takeuchi (2014), there is in important difference between deepest ice core age (8.155 ka at 81.54m) and soil (12.656 ka). Take care on that potential important difference also on Chongse in your discussion.

Other cores are available, like from Geladaindong (0.5ka at 110m, total core 147m). Check all available data if you want to compare all regional ice core archives.

3) Chongce ice core What are the other characteristics of the Chongse site and ice cores? Density and temperature profiles useful for dating and modelling? From temperature profile, estimate the bedrock potential melting.

4) Measurements Provide a depth distribution table for the 14C samples. How deep were the last samples, how far from bedrock?

For 3H and 210Pb methods, provide uncertainties and references.

5) results About β-activity profile, how are you sure about the date of each peak without additional information? Did you use annual layer counting to theses depth? What do you know about surface age, did any annual layers disappeared?

For 3H profile in figure 2b, it seems for me that the plotted values are corrected from decay to reach such high numbers? 3237TU for the 1963 peak value is very high in comparison with other ice core data, mostly around few hundreds TU today value for the 1963 peak, see Gelaidaindong core (Kang, 2015). Give reference on the identification of maximum peak.

14C data interpretation: can you argue why in C4, 14C dates are only around 1-2ka for the intermediate depth (80-170m) and between 2-4ka in C2 at 60-110m? For me C4 is discontinuous, may be because of the particular bedrock topography (presence of bedrock canyon), with recent ice on the 0-110m over older dead ice.

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The use of a simplistic 2-p model is not appropriate for this kind of site where you know that the accumulation is not constant through the Holocene, but especially to be used on the bottom of the glacier where in principle its exponential approach is unrealistic. You have enough 14C data to trigger glacier bottom age using a simple exponential regression down to bedrock depth for C4.

Lines 234 and 245, you indicate tritium when it is from β-activity data.

Dating of C2: you are absolutely trying to match a curve from an unsuitable model with data from real measurements, and in addition you add values from other sites to try to force your conclusions. This reasoning and this method are not acceptable. Given the weakness of the model, it is reasonable to remove it from this manuscript.

6) Discussion This chapter is to be reviewed in its entirety. The author must clearly state the objectives of this manuscript. If it comes to presenting new results from the Chongse Core, in this case with major corrections these results could be published. If it's a matter of depressing previous works like those on Guliya glacier, as this manuscript does not bring any innovative data to this site, not the least substantiated discussion, there is no reason to publish it in TC.

On that stage of the review, various technical corrections can wait for a revised version of the manuscript.

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