

## ***Interactive comment on “A new Himalayan ice core CH<sub>4</sub> record: possible hints on the preindustrial latitudinal gradient” by S. Hou et al.***

**S. Hou et al.**

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We thank Referee 2 for the positive and constructive review. In the following, comments are addressed in the same order as in the review.

General comments: CH<sub>4</sub> is an important greenhouse gas, but the control mechanisms are not well constrained. CH<sub>4</sub> records from various latitudes may help us better constrain the source and sink budget, but until now reliable paleoatmospheric CH<sub>4</sub> records were obtained only from Greenland and Antarctic ice cores. The authors provide new ice core data sets from East Rongbuk Glacier, which is located in a low latitude (28°N). They also provide model simulations for the CH<sub>4</sub> latitudinal gradient. Although their results are not very conclusive, their work is very important for future studies and contributes to paleoclimate research community. The manuscript is concise and well writ-

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ten. *Climate of the Past* is an appropriate publication for this work. I suggest minor revision before publication.

We thank Referee 2 for the positive opinion of our manuscript.

Specific comments: Page 2472, Line 12: “small artifacts” can be specified with numbers (e.g., less than 40 ppbv).

Though we can not deny the possibility that the filtered CH<sub>4</sub> profile from the ER cores remains biased by small artefacts, it’s hard to quantify exactly at this moment. More works should be required for such a purpose.

Page 2472, Line 17: “wetland extent/CH<sub>4</sub> emissions” means “wetland extent AND CH<sub>4</sub> emissions”? Please reword it.

Changes have been made accordingly in the text.

Page 2475, Line 4: Need to describe updates in methods since Chappellaz et al. (1997). Chappellaz et al. (1997) is 16 years old!

In fact, the CH<sub>4</sub> measurements were performed in 2003, making use of the facilities as described by Chappellaz et al. (1997). It takes us quite a long time to decipher the true signals from the apparently biased CH<sub>4</sub> records. We clarified the measuring time in the revision.

Page 2476, Line 1-8: The artifact by melting can be roughly quantified with gas solubility and ‘fraction of bubbles filled with melt’ as shown in Figure 2 of Campen et al. (2003, *Geology*).

As shown in Figure 2, the filtered nine measurements covering the preindustrial period are not always those measurements with high gas contents (a parameter related with the relative frequency and intensity of melt phenomena, Hou et al., *CP*, 2007), i.e., less melting. Therefore, we suggest that the artifact by melting is not in a straightforward way, and be hardly quantified with gas solubility and ‘fraction of bubbles filled with melt’

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with dataset available at this moment.

Page 2478 Line 28-29 Page 2479 Line 1-4: Need to explain potential causes that made the difference in CH<sub>4</sub> records from ER Core2002 and Dasuopu ice cores.

The higher CH<sub>4</sub> mixing ratios of the Dasuopu core may be due to its including more biased CH<sub>4</sub> measurements than the ER core. We clarified this difference in the revision.

Page 2479 Line 24-25, Page 2480 Line 19-21: Discrete replicate sampling from same depth intervals would also help understanding the alteration of CH<sub>4</sub> records.

We agree with the reviewer, and changes have been made accordingly in the text.

Figure 2. Some of the filtered data points (out of 15 black dots) indicate high CH<sub>4</sub> with low gas content. The readers may think that even samples for the filtered data have experienced alteration by melting. This is misleading because the high CH<sub>4</sub> data are from industrial samples. I suggest the authors to plot only preindustrial records to better estimate the effect of melting in the CH<sub>4</sub> record.

We agree with the reviewer that even samples for the filtered data have experienced alteration by melting. For this reason, we suggest that there's possibility that the filtered CH<sub>4</sub> profile from the ER cores remains biased by small artefacts, and look forward to new robust methods to decipher a more reliable signal. In order to avoid the possible misleading, we slightly modified the original Figure 2, with the red solid circles standing for the industrial records and the black solid circles for the preindustrial records.

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