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Climate of the Past Discussions

Interactive comment on "High-resolution glacial and deglacial record of atmospheric methane by continuous-flow and laser spectrometer analysis along the NEEM ice core" *by* J. Chappellaz et al.

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The manuscript submitted by Chappellaz et al., is extremely well written and completely suitable for publication in Climate of the Past. While the manuscript is long, it is important to have a reference publication that spells out the nuts and bolts associated with this new technique for measuring CH4 continuously along an ice core. I thus recommend that the manuscript be published in effectively its present form with some minor changes for clarification.

Page 4, Line 23, Need to add a sentence or two on the Rhodes set up.

Pg 6, Line 11, the following sentence is unclear. "A built-in vacuum pump of the WS-

CRDS instrument maintains a pressure gradient through the two laser spectrometer cavities until the bundle of hydrophobic, gas-permeable membrane tubes within the module, which is sufficient to extract non-dissolved air from the sample stream."

Pg 17, L18. I'm a bit unclear about the following sentence:

The two raw laser spectroscopic CH4 datasets differ from each other on an absolute scale and are in general lower than discrete measurements on parallel ice sticks (up20 per left panel of Fig. 6), which mostly reflects a preferential dissolution of methane versus nitrogen during water/gas transfer from the CFA melthead to the MicroModule."

The Henry's law solubility coefficient for CH4 is >2x that of nitrogen. From the melthead, the bubble stream will approach equilibrium between the gas in the bubbles and the dissolved gas in the water. At equilibrium, the [CH4] in the bubbles in the bubble stream will be lower than in the bubble from the ice core. But this is a solubility issue not a dissolution issue. Also, this is an equilibrium effect. The kinetics associated with gas diffusion between the bubble and the water in the bubble stream must impact the partioning and one should not forget O2.

Pg 18, L10, "During the 8-week of coupled CFA-gas measurements of the NEEM 2010 field campaign, several changes affecting the analytical setup were made (Table 1). Notably a small leak at the OF-CEAS gas outlet contaminated with a varying amount the WSCRDS (and GC) measurements. This can be seen e.g. for the WS-CRDS data that was measured without the OF-CEAS being connected upstream (light blue in Fig. 6)."

The reader is left with a sense that the WS-CRDS data has been compromised throughout by this "small leak". I think it would be worthwhile quantifying the magnitude of the impact on the WS-CRDS data here as it is obviously not large.

Pg 18, L26, It is useful to compare the current CFA CH4 data with previous discrete data. My concern is the fact that those data sets were all measured by different people

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in different labs using different standards and different techniques on different ice cores with different age models. Issues associated with the blanks, solubility, and standard reference and age scales offsets are paramount and difficult to quantify. I would like to suggest some verbage highlighting the uncertainties associated with the older data sets values if correcting all the data is not reasonable.

Pg 23, L9, Probably need to specify northern hemisphere warming here as the SH warms throughout the GS events.

Pg 23, L15, Another plausible explanation might be other climate related forcing factors (Heinrich events of differing extents, orbitally driven monsoon intensity, sea level or changes in AMOC).

Interactive comment on Clim. Past Discuss., 9, 2517, 2013.