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Atmospheric Measurement Techniques Discussions

Interactive comment on "An automated setup to measure paleoatmospheric $\delta^{13}C-CH_4$, $\delta^{15}N-N_2O$ and $\delta^{18}O-N_2O$ in one ice core sample" *by* P. Sperlich et al.

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The authors describe a methodology to extract CH4 and N2O from ice core samples and to analyze the stable isotope ratios of the extracted gases. Measuring isotope ratios of CH4 and N2O in ice cores is of high scientific relevance since it places constraints on the paleoatmospheric budgets of CH4 and N2O which provides insight into present and future budgets of these important greenhouse gases. Although the methodology presented is in several aspects a combination of previously published procedures, the paper contains sufficient novelty to justify publication in AMT. The paper contains a detailed description of the methodology and tests conducted to determine

precision and accuracy of the automated set-up and the presented results convince me that the described methodology is a valuable alternative to existing methods. My only concern is the length of the paper and some problems in structure. I understand that most readers of a method paper will be interested in details and therefore a certain length cannot be avoided. Nevertheless, I think that there are some parts of the paper where redundant or unnecessary explanations can be avoided or condensed. There are also parts that should be reorganized to make the paper more readable.

A problem that, in my opinion, adds length and makes the paper sometimes difficult to read is an unusual structure. Chapter 2 is called "Experimental set-up". However, it already contains significant description of procedures. It also contains several statements explaining the purpose or intention of a specific step in the procedures or part of the set-up. In some cases the explanations are based on results that are only presented in a very general way. These statements are out of place in a method description and the reader will not know to which extent the stated purpose has been achieved, unless the subject is evaluated in the results and discussion section. In some cases those statements connecting method description with explanations also lack clarity.

Examples from 2.1 are: 2187/13: "The good performance of the.." 2187/23-24: "...that make a minimum path length through the glass beads of _50 mm" 2187/29-2188/3: "Intensive extraction tests using several charcoal adsorbents in T2 showed additional CH4 contribution and a high variability in isotopic analysis in our setup. We found that the speed of adsorption can significantly be increased with larger cross-sections of the adsorbing trap. Therefore,..." 2188/14-16: "...to increase the water vapour pressure so any ice core sample derived water can be more efficiently trapped in T1. " 2188/19: "...thereby minimizing the manual valve operation and analysis time." 2189/5-11"... to enable CH4 and N2O mixing ratio analysis from the total amount of air analysed and the trace gas peak areas in the IRMS analysis (note that we will not discuss the performance of this mixing ratio determination method as it is by an order of magnitude less precise than conventional GC-systems (Mitchell et al., 2011) or laser analyzers

(Stowasser et al., 2012); however, we mention it for its use when more precise mixing ratio data are not available as well as to monitor extraction efficiency and leakages)." 2189/14-18: "The dimensions of this trap combine a relatively long contact-time between the sample gas and the trapping material due to the column length with a relatively short time required to quantitatively flush the sample through the glass cavity due to the small inner diameter (the amount of trapping material was sufficient for 6 months)."

The other subchapters of "experimental set-up" contain similar statements. They should be removed from the method description. In cases where the authors consider the subject to be highly relevant for the performance of the methodology, it should be part of the discussion section using experimental results, theoretical considerations or information from literature to demonstrate to which extent the desired purpose is achieved. Several of the subchapters are a description of procedure and not so much an experimental set-up. This makes the separation between this chapter and other chapters that describe procedures or tests somewhat arbitrary.

Chapter 3 (System performance) also contains a mixture of material that I would expect either in a method section, or results and discussion. Chapter 4 also is mainly description of method, it is very short and consists of only one paragraph. Chapters 2-4 should be combined under in a "Method sections" and information referring to results and arguments about the rational for specifics of the set-up should be moved to the results and discussion section. The conclusions contain a significant summary component. Change the heading to "Summary and conclusions".

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 2183, 2013.