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Atmospheric Measurement Techniques Discussions

Interactive comment on "Radiocarbon analysis of stratospheric CO_2 retrieved from AirCore sampling." *by* Dipayan Paul et al.

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General comments: This manuscript presents a study of the proof-of-principle experiment showing that the AirCore sampling is a viable method for the determination of radiocarbon content in stratospheric air. The results presented in this paper are from two AirCore sample flights performed from Sodankylä, Finland on July 15 and 16, 2014. The sample air collected in the AirCore was first used to retrieve the vertical concentration profiles of CO2, CH4 and CO from about 26 km till the bottom of the atmosphere using a Cavity Ring-Down Spectrometer (PICARRO G2401). The sample air from the exhaust of the PICARRO was then collected by the homebuilt Stratospheric Air Sampler (SAS). This sampled air from the SAS was then analyzed later for the determination of the 14C using Accelerator Mass Spectrometry (AMS) at the laboratory in Groningen. The results of the Δ14C for the measurements on July 15 match well with

the current state knowledge of the tropospheric Δ14C values. The paper also points out the limitations (for the top layer) and error prone due to possible contamination of the SAS sampling and extraction process, which resulted in the incorrect values for the Δ14C for the AirCore measurements on July 16, 2014. It discusses the potential error sources and proposes for possible methods to overcome them. The paper describes the work very well and in a structured manner. Therefore I recommend it for the AMT publication with some minor additions as outlined below in the specific and technical comments.

Specific comments: Figure 1 b) shows the vertical concentration profiles of CO2 and CH4. The bottom and the top part of the profiles match quite well whereas the profiles differ for the altitude range between 5 km and 13 km. Can you comment on the cause of the variability?

A correction of the AirCore profile is performed and is used for the analysis in the paper. However, the correction method itself is referenced to a following paper in preparation (Chen et al.). Perhaps a very short description of the correction method here would be helpful for the reader to follow.

The SAS sampler comprises of a series of six connected stainless steel tubings which limit the resolution at which the Δ14C can be determined from the stratospheric air sample. Is it possible to increase the resolution by dividing the sample air into further tubing (helpful for seasons with lower tropopause levels)? May be you can discuss on the advantages or disadvantages of doing this?

Technical comments: Page 2: Line 12, I would include "(half-life (t1/2) = 5730 +- 40 years)"

Page 3: Line 13, I would replace "fills itself with atmospheric air" with "fills itself with air from different layers of the atmosphere.

Page 3: Line 15, I would modify "after the AirCore has landed and is recovered."

Page 3: Line 26, I would include “(at Standard Temperature and Pressure (STP))

Page 3: Line 31, I would mention the dates here “profiles collected on July 15 and 16, 2014 were preserved . . .”

Page 4: Line 17, please mention the full form of “sccm (standard cubic centimeters per minute)”

Page 5: Line26, I would mention the formula of Magnesium perchlorate “(Mg(ClO4)2)” here

Page 5: Line 28, I would write “μg C” together as “μgC” and “mg C” as “mgC” and please check the rest of the manuscript for this and change accordingly.

Page 7: Line 24, at the altitude “where” the sample was collected.

Page 10: Line 29, from the AirCore “is” moved into the SAS through . . .

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