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Accelerator Mass Spectrometric determination of radiocarbon in stratospheric CO_2, retrieved from AirCore sampling.

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In this decade, understanding the impact of human activities on climate is one of the key issues of discussion globally. The continuous rise in the concentration of greenhouse gases, e.g., CO_2, CH_4, etc. in the atmosphere, predominantly due to human activities, is alarming and requires continuous monitoring to understand the dynamics. Radiocarbon is an important atmospheric tracer and one of the many used in the understanding of the global carbon budget, which includes the greenhouse gases like CO_2 and CH_4. Measurement of ^{14}C (or radiocarbon) in atmospheric CO_2 generally requires collection of large air samples (few liters) from which CO_2 is extracted and then the concentration of radiocarbon is determined. Currently, Accelerator Mass Spectrometry (AMS) is the most precise, reliable and widely used technique for atmospheric radiocarbon detection. However, the regular collection of air samples from troposphere and stratosphere, for example using aircraft, is prohibitively expensive.

AirCore is an innovative atmospheric sampling system, developed by NOAA. It comprises of a long tube descending from a high altitude with one end open and the other closed, and has been demonstrated to be a reliable, cost-effective sampling system for high-altitude profile (up to $\sim$ 30 km) measurements of $CH_4$and CO_2(Karion et al. 2010). In Europe, AirCore measurements are being performed on a regular basis near Sodankylä since September 2013. Here we describe the analysis of two such AirCore samples collected in July 2014, Finland, for determining the ^{14}C concentration in stratospheric CO_2. The two AirCore samples were collected on consecutive days. Each stratospheric AirCore sample was divided into six fractions, each containing $\sim$ 35 μg CO_2 ($\sim$9.5 μg C). Each fraction was separately trapped in $^1/_4$ inch coiled stainless steel tubing for radiocarbon measurements. The procedure for CO_2 extraction from the stratospheric air samples; the sample preparation, with samples containing $<$ 10 μg C, for AMS measurements; and the resultant vertical profile of stratospheric $^{14}CO_2$ will be described.