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# Vertical profile observations of greenhouse gases using AirCore and FTIR from the intensive RINGO campaign at Sodankylä, Finland

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Within the EU-funded Readiness of Integrated carbon observation system (ICOS) for Necessities of integrated Global Observations (RINGO) project, vertical profile measurements have been explored using both AirCores and the ground-based Total Carbon Column Observing Network (TCCON) Fourier-transform infrared spectrometers (FTIRs) to enhance the link between ICOS ground-based stations, TCCON, and satellite measurements. AirCore is a long coiled stainless steel tube used for atmospheric sampling up to heights of around 30 km, which is launched on a weather balloon with one end open and the other end closed, and collects continuously ambient air samples during descent. The analysis results of the air samples for greenhouse and other trace gases mole fractions combined with the recorded in-flight information, e.g. coil temperatures, ambient pressure and altitude, allow for the retrieval of the vertical profiles. As for TCCON FTIRs, two-layer vertical profiles will be derived either by optimal estimation profile retrieval or by the use of a different gas (HF, N2O).

In June 2018, an intensive AirCore comparison campaign took place at the TCCON site in Sodankylä, Finland. A total of 10 balloon flights were made, with combinations of different AirCores and/or the LIghtweight Stratospheric Air (LISA) sampler per balloon flight. The measured species include $CO_2$, CH4, CO, $O_2$, $H_2O$ by continuous cavity ring-down spectrometers (CRDS) at Sodankylä, and subsequent isotopic compositions of $CO_2$ and CH4 and halogenated trace gases by delayed analyses of collected stratospheric air samples conducted later in several individual home laboratories. Here we present the first results from this campaign and compare the different AirCore/LISA profiles. The analyses are focused on 1) the accuracy of AirCore measurements of $CO_2$, CH4 and CO mole fractions; 2) the accuracy of the altitude registration of AirCore profiles; 3) a comparison of AirCore observations with and without drying the air sample. Furthermore, we will evaluate the TCCON FTIR profile retrievals with collocated AirCore profiles.