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Field version of the fully automated system for δ13C IRMS analysis of atmospheric methane

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In order to measure CH4 carbon isotope ratios continuously at rural locations, we developed a robust, fully automated extraction system for field IRMS measurements. We based our system on the iSAAC design from the MPI-BGC, with its cold traps mounted on a cryocooler. Because this new extraction system makes no use of liquid nitrogen, it is possible to leave it working unattendedly for more than one week.
Alternately, 50 mL of reference air from a cylinder, and 50 mL of dried local air is measured with the same pre-concentration trap and focus unit. Up to 60 measurements per day can be performed in this way. This will give a temporal resolution in CH4 isotope measurements that cannot be maintained for extended periods with flask samples. The CH4 (and other compounds) are frozen on the pre-concentration trap, while the air matrix is flushed out. Then the CH4 is transferred to the smaller focus trap, and released by controlled heating into the combustion oven. A post combustion GC is used to separate the CO_2(CH4) peak from Krypton and other compounds.
Under laboratory conditions we achieved well over 500 measurements without attending the system. The precision of the δ13C-CH4 measurements is better than 0.07‰ and the mole ratio is determined within 10 ppb. The system is to be employed in a fieldwork comparison of several CH4 isotope analyzers, to be held in Spring 2014 at the Cabauw tower, Netherlands, as part of the InGOS WP16: Innovation in isotope measurement techniques.