Field measurements of the isotopic composition of atmospheric methane with IRMS at the Cabauw tower

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Isotope measurements can help constraining the atmospheric budget of methane because different sources emit methane with slightly different isotopic composition. In the past, high precision isotope measurements have primarily been carried out by isotope ratio mass spectrometry on flask samples that are usually collected at relatively low temporal resolution. During the EU project INGOS, we have developed a fully automated gas chromatography - isotope ratio mass spectrometry system (GC-IRMS) to measure the isotopic composition of CH_4 continuously in the field at atmospheric monitoring stations. The CH_4 pre-concentration and focusing system does not require liquid nitrogen for cooling and the system can perform about 50 measurements per day. The repeatability is better than 0.1 ‰ for $d^{13}C$-CH_4 and 3 ‰ for δD, and the mole fraction is determined with a repeatability of 10 ppb. The new system was deployed together with two laser instruments that also measure the isotopic composition of CH_4 during a 4-months campaign in the field at the Cabauw Experimental Site for Atmospheric Research (CESAR). More than 1600 measurements for both $\delta^{13}C$ and δD were obtained with IRMS during this period. Measurements show clear isotope signals associated with methane elevations both on the diurnal as well as on the synoptic scale. A first analysis and interpretation of the results from the campaign will be presented.