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What caused the CO_2 fluctuations of the preindustrial Holocene? Clues from the carbon isotopic composition of CO_2 from the EDML ice core

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The improvement of our quantitative understanding of the processes steering the atmospheric CO_2 concentrations in the past is a long-term effort of many disciplines. Ice cores provide a direct atmospheric archive of both the CO_2 concentration and its carbon isotopic composition (δ^{13}C). Precise and accurate measurements of δ^{13}C on ice cores can help attribute atmospheric CO_2 changes to fluxes from and to the reservoirs of the global carbon cycle. Ice core δ^{13}C measurements performed over the last 20 years already contributed to constrain and quantify the possible processes underlying the glacial/interglacial and the Holocene CO_2 dynamics. Methodological hurdles during the gas extraction of the trapped gases and the mass spectrometric measurement have so far limited δ^{13}C's interpretative power in global carbon cycle models. We developed a new sublimation-GC-IRMS system, which combines high-precision δ^{13}C analysis (0.06 permil) with a low sample demand ($\sim$6 g ice per measurement) to enable high-resolution δ^{13}C time series. The applied sublimation extraction technique allows us to quantitatively extract the trapped air in both bubble and clathrate ice. Using a gas-chromatographic separation prior to the measurement excludes troubles from isobaric interferences. To improve our understanding on the Holocene CO_2 fluctuations with regard to the Ruddiman hypothesis, new δ^{13}C data will be presented and discussed.