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A method to measure paleoatmospheric δ^{13}C-CH_4, δ^{15}N- N_2O and δ^{18}O- N_2O in one ice core sample

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Air bubbles in ice core samples represent the only opportunity to study the isotopic variability of paleoatmospheric CH_4 and N_2O, which is a tool to constrain the history of sink and source variability of both greenhouse-gases. The highest possible precision in isotope measurements is required to maximize the reliability of CH_4 and N_2O sink and source reconstructions. We present a new setup to measure δ^{13}C-CH_4, δ^{15}N- N_2O and δ^{18}O- N_2O isotope ratios in one ice core sample, with a precision of 0.1 ‰, 0.6 ‰ and 0.7 ‰, respectively. The isotope ratios are determined on 0.6-1.6 nmol CH_4 and 0.25-0.6 nmol N_2O, as extracted from samples of 200-500 g of ice i.e. 20-50 mL of air. We discuss aspects and new findings of our method that we find critical to the analytical precision and accuracy and will show the performance of the analytical setup.