Comparison of isotope ratio and trace gas measurements from FTIR and NDIR instruments on ambient air

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Infrared spectroscopy has been used for a long time to measure vibrational modes of gas species, but also concentrations can be extracted from the molar extinction of these species, if a calibration is performed. The Non-Dispersive Infra-Red (NDIR) technique uses thermal expansion of the gas (photo acoustic detection), whereby only one or a view components can be measured at a time. The Fourier-Transform Infra-Red (FTIR) technique records the interferogram which covers a selected spectral range with one measurement, allowing to detect all gas species which absorb insid this range. Because of the lower sensitivity the NDIR technique is usually only used for rough measurements but isotope ratio determination for CO_2 has been improved to 0.2 δ per mil[1,2]. The FTIR technique can push the limits at least by a factor of two[3,4] and is able to also detect trace gases at the same time.
Because of the ease of use of these techniques they are both good candidates for outdoor instruments. Care has to be taken for gas handling and stability of measurements and an adequate data analyis has to be performed for the FTIR measurements. The biggest challange for both IR techniques is the sensitivity, limitting the precision to be achived, compared to those achivable by mass spectroscopy. The limits of both IR techniques to detect the isotope ratio $\delta\ ^{13}C$ of CO_2 and trace gases CH_4, N_2O and CO will be discussed.

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