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Differences in stable carbon isotopic composition in the fine bulk aerosol and gas phases based on seasonally resolved data at a Prague site

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Isotope fractionation between the gas and aerosol phases is an important phenomenon in terms of studying atmospheric processes. Here, we studied seasonal variations in the stable carbon isotope ratio ($\delta^{13}C$) of total carbon (TC; $\delta^{13}C_{TC}$) and water-soluble organic carbon (WSOC; $\delta^{13}C_{WSOC}$) in fine aerosol particles ($PM_{2.5}$) as well as in the total carbon of the gas phase (TCgas; $\delta^{13}C_{TCgas}$) at a suburban site in Prague, Czech Republic, Central Europe. The most ^{13}C enrichment was found in WSOC, followed by particulate TC, whereas the most ^{13}C depletion was found in gaseous TC. The clear seasonal pattern for all $\delta^{13}C$ values (with the highest values in winter and lowest in summer) provides evidence for the presence of different aerosol sources at the site during the year. Despite the different seasonal compositions of carbonaceous aerosols, the isotope differences ($\Delta\delta^{13}C$) between the analyzed bulk aerosol parts and phases were similar during the seasons. This shows that the fractionation of stable carbon isotopes is a predominantly physical process in which the chemical composition of individual compounds in bulk aerosols does not play a major role.

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