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Tracing Carbon allocated into BVOC emissions in drought stressed *Pinus sylvestris* trees using position-specific $^{13}CO_2$ labelling

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Plants are one of the major contributors to the carbon exchange between the biosphere and the atmosphere. Furthermore, they are the most important source for volatile organic compounds (VOCs) which play a crucial role in plant signaling and interactions and atmospheric chemistry. Especially under adverse environmental conditions, the link between plant photosynthesis and the use of carbon for the emissions biogenic VOCs, is poorly understood. Up to now, there is next to no information on biosynthetic pathways of the less abundant biogenic VOCs or how plants benefit from emissions of those compounds under less favorable environmental conditions.

Pyruvate is known to be tightly involved into the primary and secondary metabolism (e.g. the emissions of biogenic VOCs) of plants. Thus, we used position-specific pyruvate labelling to investigate biosynthetic pathways of the emissions of reactive hydrocarbons in *Pinus sylvestris*. In order to find a linkage between the production of biogenic VOCs and plant photosynthesis under different environmental conditions, we conducted the ^{13}C labelling experiments on well-watered and drought impacted *Pinus sylvestris* trees and recorded the carbon exchange of CO_2 and biogenic VOCs in real-time using $^{13}CO_2$ laser spectroscopy and a proton-transfer-reaction time-of-flight mass-spectrometer (PTR-TOF-MS).

Feeding the branches of *Pinus sylvestris* with pyruvate, labelled at the first carbon position, led primarily to increased $^{13}CO_2$ emissions. Pyruvate labelled on the second carbon position, however, was rapidly incorporated into emissions of some oxygenated hydrocarbons such as acetaldehyde (m/z 45.03) and acetic acid (m/z 61.03) indicating de novo emissions of these volatiles. In contrast, the pyruvate labelling of Pinus sylvestris branches was less noticeable in other, constitutively emitted biogenic VOCs, e.g. monoterpenes. This is probably due to increased emissions of these compounds from storage organs, like resin ducts and only a reduced amount of de-novo emissions.