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The CROSTVOC project – an integrated approach to study the effect of stress on BVOC exchange between agricultural crops and grassland ecosystems and the atmosphere

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Global changes in atmospheric composition and climate are expected to affect BVOC exchange between terrestrial vegetation and the atmosphere through changes in the drivers of constitutive BVOC emissions and by increases in frequency and intensity of biotic or abiotic stress episodes. Indeed, several studies indicate changes in the emission patterns of constitutive BVOCs and emission of stress-induced BVOCs following heat, drought and oxidative stress, amongst others. Relating changes in BVOC emissions to the occurrence of one or multiple stressors in natural environmental conditions is not straightforward and only few field studies have dealt with it, especially for agricultural crop and grassland ecosystems.

The CROSTVOC project aims to contribute in filling this knowledge gap in three ways.

Firstly, it aims at performing long-term BVOC emission field measurements from maize (Zea mays L.) and wheat (Triticum aestivum L.), two important crop species on the global scale, and from grassland. This should lead to a better characterization of (mainly oxygenated) BVOC emissions from these understudied ecosystems, allowing a better representation of those emissions in air quality and atmospheric chemistry and transport models. BVOC fluxes are obtained by the Disjunct Eddy Covariance by mass scanning (DEC-MS) technique, using a hs-PTR-MS instrument for BVOC analysis.

Secondly, the eddy covariance BVOC flux measurements (especially at the grassland site) will be accompanied by ozone flux, chlorophyll fluorescence, photosynthesis and soil moisture measurements, amongst others, to allow linking alterations in BVOC emissions to stress episodes. Simultaneously, automated dynamic enclosures will be deployed in order to detect specific abiotic and biotic stress markers by PTR-MS and identify them unambiguously by GC-MS.

Thirdly, the field measurements will be accompanied by laboratory BVOC flux measurements in an environmental chamber in order to better disentangle the responses of the BVOC emissions to driving factors that co-occur in field conditions and to determine the influence of single abiotic stressors on BVOC emissions.

Next to a general presentation, some preliminary results of the project will be shown.