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Volatile organic compounds sources and sinks in a wheat canopy. Analysis based on combined eddy-covariance fluxes, in-canopy profiles and chamber measurements with a PTR-TOF-Qi-MS

Benjamin Loubet (1), Lais Gonzaga (1), Pauline Buysse (1), Raluca Ciuraru (1), Florence Lafouge (1), Céline Decuq (1), Olivier Zurfluh (1), Alain Fortineau (1), Olivier Fanucci (1), Roland Sarda-Esteve (2), Nora Zannoni (2), Francois Truong (2), Christophe Boissard (2), and Valérie Gros (2)

(1) INRA, UMR ECOSYS, INRA, AgroParisTech, Université Paris Saclay, Thiverval-Grignon, France (benjamin.loubet@inra.fr), (2) LSCE, CNRS-CEA-UVSQ, Université Paris Saclay, Gif sur Yvette, France

Volatile organic compounds (VOC) are essential drivers of atmospheric chemistry. Many VOCs are emitted from and deposited to ecosystems. While forests and grasslands have already been substantially studied, exchanges of VOCs with crops are less known, although these ecosystems represent more than 50% of the surface in France. In this study, we analyze sources and sinks of VOCs in a wheat field (at the ICOS FR-GRI site near Paris) at anthesis based on measurements of fluxes, concentration profiles and branch chambers. The VOCs were measured using a PTR-TOF-Qi-MS (where Qi stands for Quad Ion guide). Air was successively sampled through lines located at different heights within and above the canopy, of which one was used for Eddy Covariance and located near a sonic anemometer. Additional measurements included the standard ICOS meteorological data as well as leaf area index profiles and photosynthesis curves at several heights in the canopy. We report fluxes and profiles for more than 500 VOCs. The deposition velocities of depositing compounds are compared to the maximum exchange velocity and the ozone deposition velocity. The sources and sinks location and magnitude are evaluated by inverse Lagrangian modelling assuming no reaction and simple reaction schemes in the canopy. The sources and sinks of VOC in the canopy are interpreted in terms crop phenology and the potential for reaction with ozone and NO_x is evaluated. This study takes place in the ADEME CORTEA COV3ER French project (http://www6.inra.fr/cov3er).