
First measurements of VOC fluxes by eddy covariance with a PTR-QI-TOF-MS on a wheat barley field at anthesis at the FR-GRI ICOS site

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Résumé

Fluxes of volatile organic compounds were measured with the Eddy Covariance method at the FR-GRI INRA-AgroParisTech crop site near Paris. The site is a wheat-barley-maize-oilseed rape rotation near a farm with 250 cows and 900 lambs which receives large amounts of organic fertilisation and pesticides. Measurements started over a 1 m height wheat field at around anthesis in June and ended during senescence in early July. The fluxes were measured using a 40 m long 3/8 ‘ internal diameter, 60°C heated PFA line (50 L min⁻¹) placed at 2.7 m above ground connected to a PTR-Qi-TOF-MS (Ionicon, AU), consisting of a proton transfer reaction chamber, a quad used to focalise the ions in the time of flight detector. The PTR-TOF-MS was operated at 10 Hz. The ion concentrations of more than 800 masses were synchronised with the sonic anemometer at 25 Hz using a Labview acquisition program developed in the lab. Mass calibration was performed every 5 minutes to maintain the best resolution possible. The lag time was computed online by covariance maximisation using the first water cluster ion (mass 37), and was around 2.3 s. The covariances were calculated for the 827 masses online. The experiment showed significant covariances of methanol, acetaldehyde, DMS, and other masses like 93 and 113, but also significant deposition at masses 75, 101, 187, 201. Additionally, we were surprised to see CO₂.H⁺ covariance coherent with CO₂ fluxes measured with the ICOS instrumentation although CO₂ is not supposed to be protonated in large quantities. The coherence of these measurements with respect to the literature is discussed. This work was funded by ANAEE-France.

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