



Sources and sinks of VOCs in wheat and oilseed rape crops by inverse Lagrangian Stochastic modeling

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Volatile organic compounds (VOCs) are essential compounds for atmospheric chemistry that contribute to the production of pollutants harmful to human health and the environment, in particular ozone (O_3) and secondary organic aerosols (SOA). The fluxes of most VOCs, 90 % of which are biogenic (BVOCs), are not fully quantified. Managed ecosystems, which represent about 50 % of the land area in Europe, are the largest potential VOC source. Today, it is estimated that forests account for 55 % of the total VOC emissions, crops 27 %, and grasslands, wetlands and shrubs 18 % (Karl, 2009). However these estimates lack of data measured at the ecosystem scale, especially regarding crops.

In this study we report measurements of VOC profiles in wheat and oilseed rape crops together with whole ecosystem fluxes measured by eddy covariance. Measurements took place in June and July after anthesis. The VOC profiles were used to infer sources and sinks in the canopy by inverse Lagrangian dispersion modelling. Assuming, in a first order approach, that no chemical reaction occurs in the canopy, the method was applied to the most emitted compounds from these crops. Chamber measurements [1] and eddy covariance both showed that the first three emitted compounds are methanol, acetone, and acetaldehyde.

The first results show a good agreement between eddy covariance and integrated canopy fluxes evaluated by inverse modelling for methanol. The whole canopy contributes to the overall fluxes for that compound, except the bottom height, which shows some deposition events. The sensitivity of the method to turbulence parameterisation, and first order chemical reaction are investigated. The divergence between whole canopy fluxes, estimated by inverse dispersion modelling and by eddy covariance, is discussed in terms of in-canopy chemical sources and sinks.

Acknowledgments

We acknowledge funding by ADEME (COV3ER, n°1562C0032), the EU ICOS Research Infrastructure and ANAEE-FR services (ANR project n°11-INBS-0001).

References

[1] Lais Gonzaga Gomez, Benjamin Loubet, Florence Lafouge, Raluca Ciuraru, Pauline Buysse, Brigitte Durand, Jean-Christophe Gueudet, Olivier Fanucci, Alain Fortineau, Olivier Zurfluh, Céline Decuq, Julien Kammer, Sandy Bsaibes, François Truong, Valérie Gros, Christophe Boissard. 2019. Fluxes of biogenic volatile organic compounds by wheat, maize and rapeseed with dynamic chambers and PTR-Qi-ToF-MS in northern France. Submitted to Atmospheric Environment.