Are BVOC exchanges in agricultural ecosystems overestimated?

Insights from fluxes measured in a maize field over a whole growing season

Aurélie Bachy, Marc Aubinet, Niels Schoon, Crist Amelynck, Bernard Bodson, Christine Moureaux, and Bernard Heinesch

Monday Apr. 18th 2016 - EGU conference 2016

Source: LTO site

Why studying BVOC ?

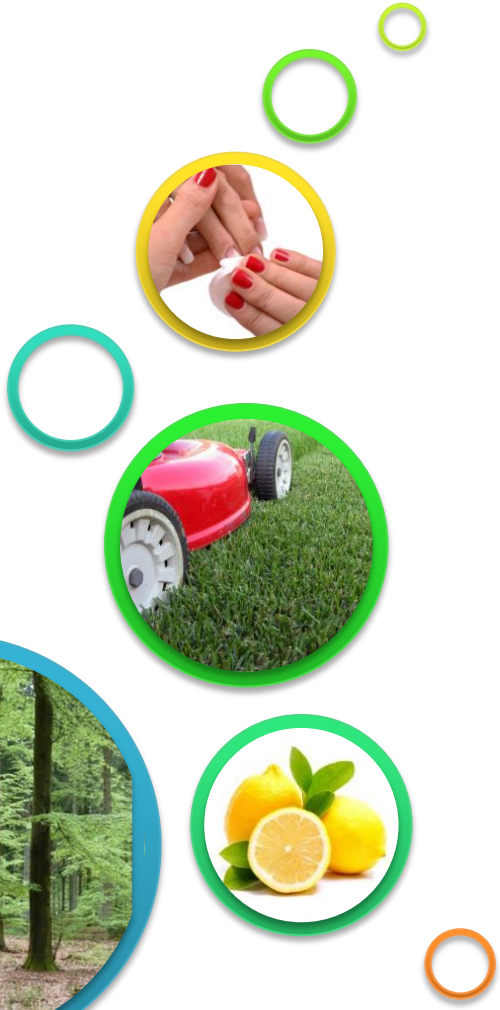
Source: LTO site

Biogenic

Volatile

Organic

Compounds



Implications:

- Methane lifetime
- SOA formation
- Tropospheric ozone

Main source: terrestrial ecosystems (plants)

Sources: Google image and Vielsalm Terrestrial Observatory (forest)

Why studying maize ?

Source: LTO site

- Second most important worldwide crop…

Data: FAOSTATS 2015

- … but little information for BVOC exchanges

(Graus et al., 2013; Das et al., 2003)

Study goals

Source: LTO site

- Which BVOC are exchanged by a maize field ?
- Are BVOC exchanges important regarding:
  - Other maize studies ?
  - Other crop studies ?
- Do BVOC flux values used by up-scaling models match values measured on the maize field?

Site

Source: LTO site

Source: Google image

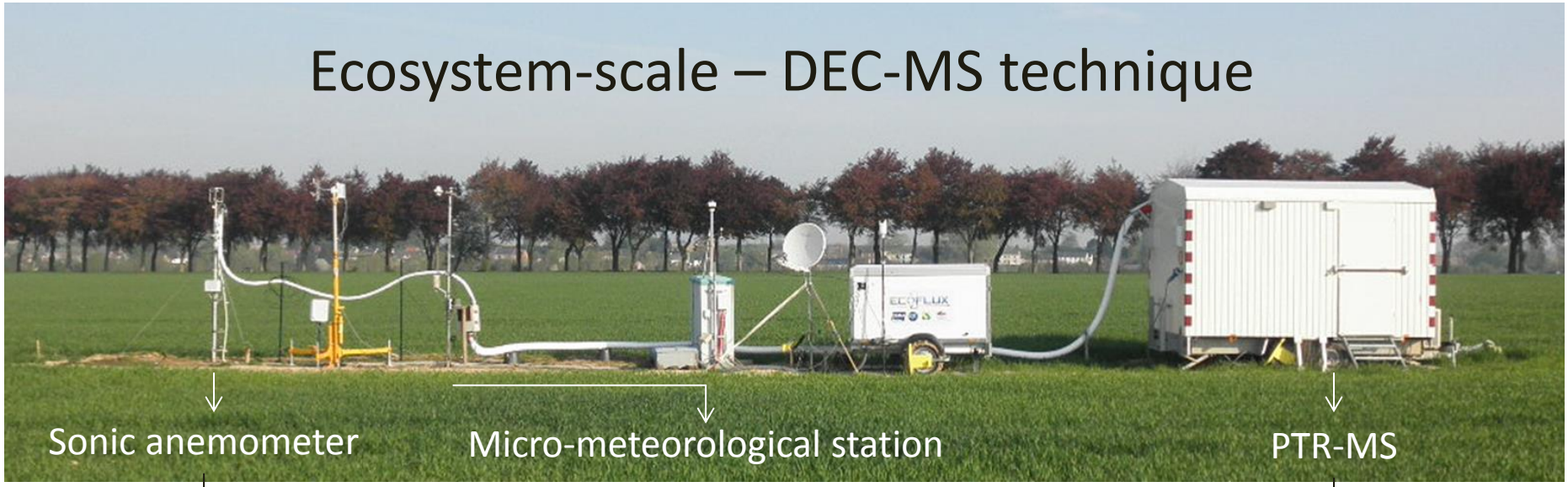
Source: LTO site

The Lonzée Terrestrial Observatory (LTO)

- Agricultural field with conventional cropping system
- Size: 10 ha in 2012
- CO_2 fluxes since 2004 - ICOS candidate site

Experimental set-up

Source: LTO site



Source: LTO site

Measurement campaign

Source: LTO site

- Silage maize (European varieties)
- 11 BVOC compounds
- 1 flux per ½ h during 185 days

Start: 17 May 2012

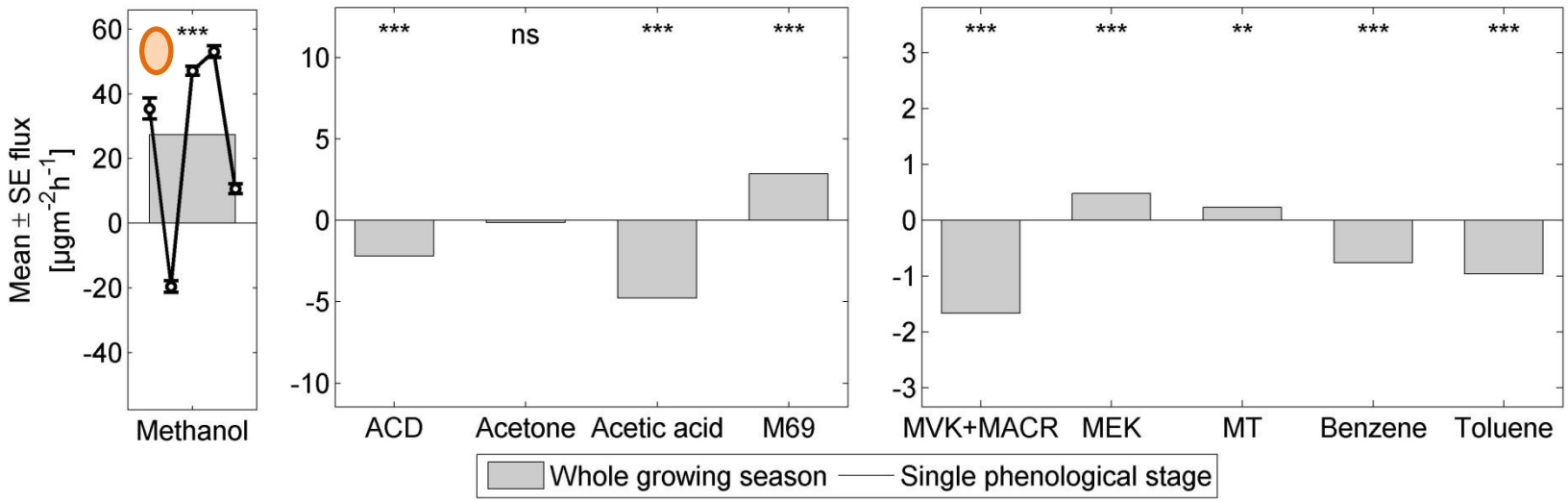
End: 12 Oct. 2012

Jun. Jul. Aug. Sep.

Source: LTO site (phenological camera)

BVOC composition

Source: LTO site

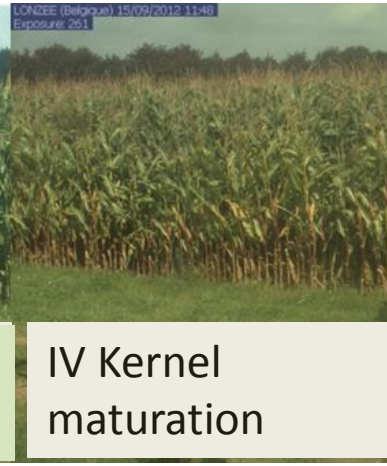


I Bare soil

II Leaf unfolding

III Stem elongation

IV Inflorescence kernel forming



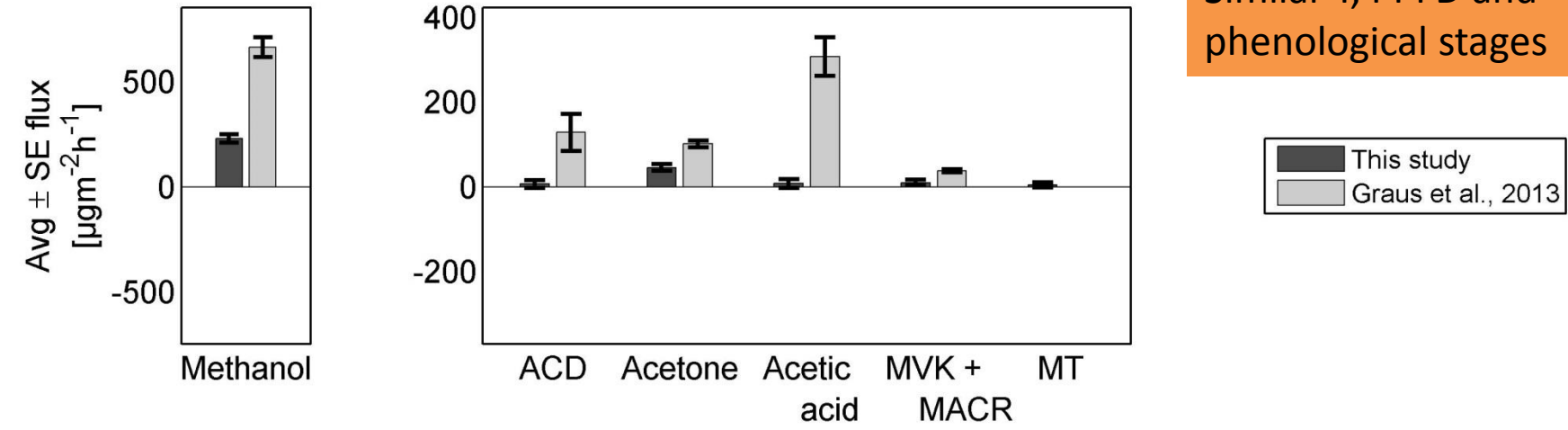
IV Kernel maturation

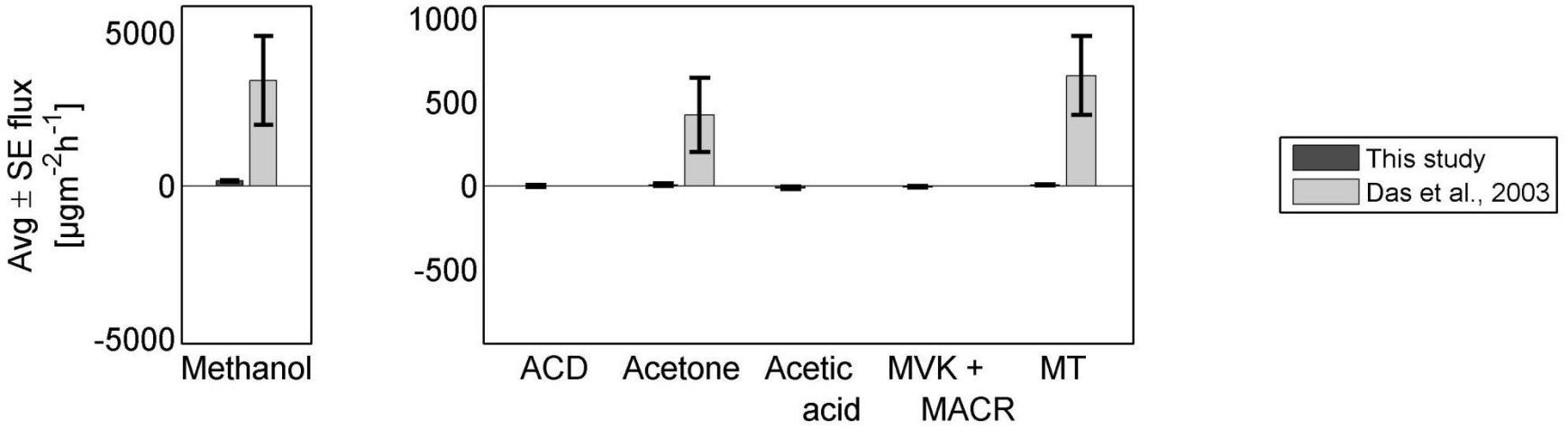
Source: LTO site (phenological camera)

Comparison with other maize studies

Source: LTO site

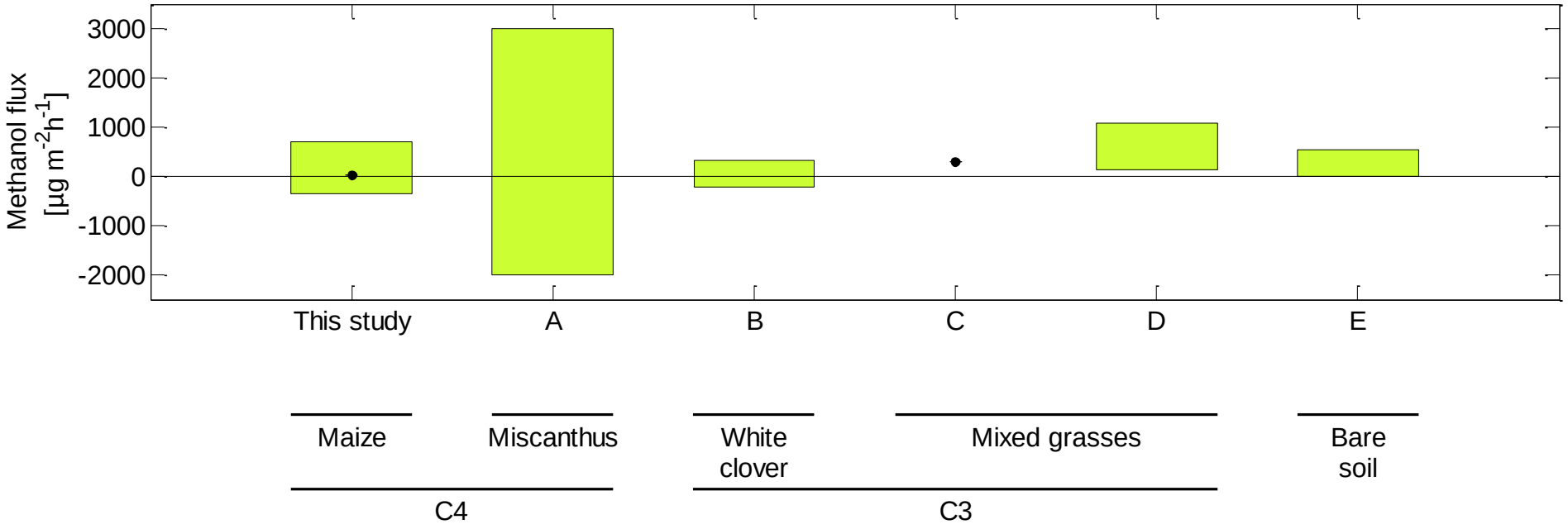
Similar T, PPFD and phenological stages





Comparison with other crop studies

Source: LTO site



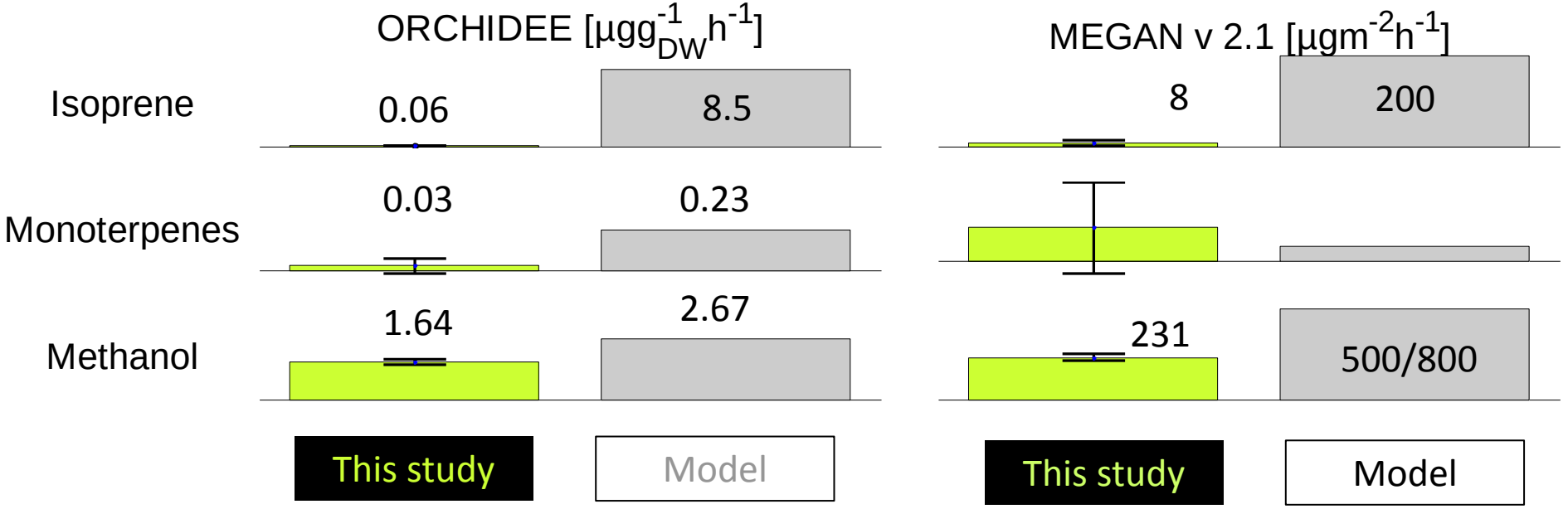
Sources:

A Copeland et al., 2012
B Custer et al., 2007
C Bamberger et al., 2010
D Ruuskanen et al., 2011
E Schade et al., 2004

Agricultural BVOC fluxes studies in Europe

Standard emission factors

Source: LTO site



Sources: Lathière et al., 2006 for ORCHIDEE and Guenther et al., 2012; Stavrakou et al., 2011 for MEGAN

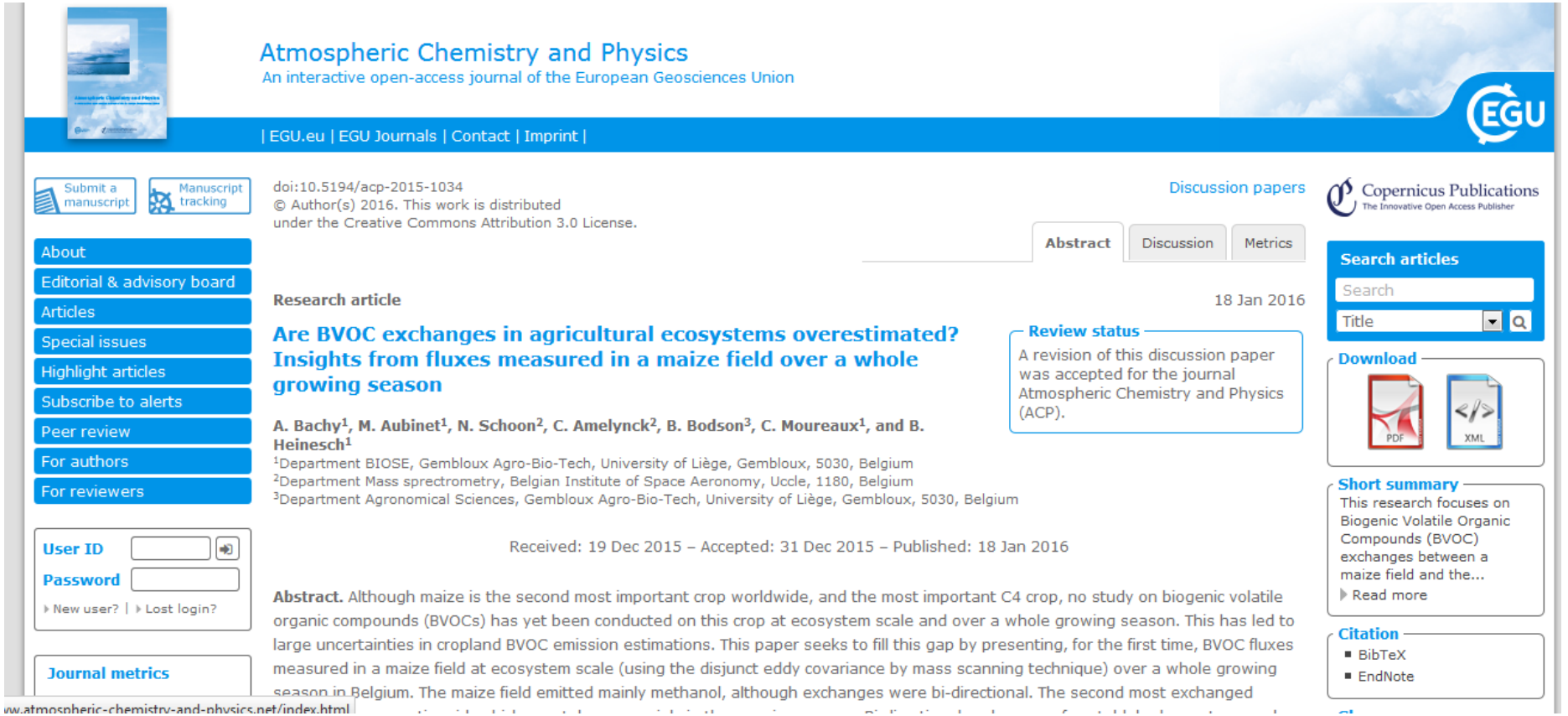
Take home messages

Source: LTO site

- Qualitatively, BVOC exchange similar to other crop and grasses
- Soil was a major actor in BVOC exchanges
- Quantitatively:
  - Much lower than other maize studies
  - Lower than other European crops
- Methanol and isoprene SEF much lower than those currently used by models

Interested ?

Source: LTO site



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Discussion papers

Abstract | Discussion | Metrics

Research article

18 Jan 2016

Are BVOC exchanges in agricultural ecosystems overestimated? Insights from fluxes measured in a maize field over a whole growing season

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Review status
A revision of this discussion paper was accepted for the journal Atmospheric Chemistry and Physics (ACP).

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Abstract. Although maize is the second most important crop worldwide, and the most important C4 crop, no study on biogenic volatile organic compounds (BVOCs) has yet been conducted on this crop at ecosystem scale and over a whole growing season. This has led to large uncertainties in cropland BVOC emission estimations. This paper seeks to fill this gap by presenting, for the first time, BVOC fluxes measured in a maize field at ecosystem scale (using the disjunct eddy covariance by mass scanning technique) over a whole growing season in Belgium. The maize field emitted mainly methanol, although exchanges were bi-directional. The second most exchanged

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Short summary
This research focuses on Biogenic Volatile Organic Compounds (BVOC) exchanges between a maize field and the...
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Bachy et al., 2016 - DOI 10.5194/acp-2015-1034

On the road…

Source: LTO site