Background

- Few BVOC measurement studies about crop ecosystems at ecosystem scale, leading to uncertainties for crop BVOC modeling
- Poor understanding of OVOC driving mechanisms and phenology influence on those mechanisms at ecosystem scale

Objectives

- Qualify and quantify BVOC fluxes from a maize field
- Identify fluxes driving mechanisms and evaluate the impact of phenology on those mechanisms

Methods

- Site characteristics:
  Site location: Lonzée, 50°33'06" N, 4°44'42" E, 165 m elevation, Belgium.
  Species: Zea mays, varieties: Prosl and Rocket.
- Measurement campaign:
  May to October 2012 (whole maize growing season).
- Instrumentation:
  BVOC, CO2 and H2O fluxes per eddy covariance (sampling frequency 1/2h).
  BVOC concentration was measured with a 3s sampling interval using a proton-transfer-reaction mass spectrometer (PTR-MS).
- Meteorological (sampling frequency 1/2h) and phenological measurements.
- Investigated BVOC:
  Methanol (M33), acetaldehyde (M45), acetone (M59), isoprene (M69), MKV+MACR (M71), MEK (73), benzene(M79), leaf alcohols or GLV* (M83), toluene (M93) and monoterpenes (M137).

Results and discussion

Temporal dynamics by phenological stage

- Climatic conditions over the growing season:
  Heat and drought waves at the end of stage G and at the beginning of stage R.
  Cold but dry period during stage G. Warm and dry period during stage S. No significant difference in temperature for stages L and R, but stage L was wetter than other periods.
- Temporal dynamics of methanol fluxes
  Clear diel dynamics with higher emissions during daytime and small uptake during nighttime.
  Variation of emission rate across phenological stages, with more emissions during dryer periods. Disentangling between phenological and environmental influence on fluxes is being investigated.

Conclusion and prospects

We are the first study measuring VOC fluxes at ecosystem scale on maize during a whole growing season. Results show significant methanol emissions varying across phenological stages, as well as significant acetic acid uptake. We are furthermore investigating exchange mechanisms for methanol fluxes and other OVOC. Such kind of study can provide to modelers more accurate OVOC exchanges rates from croplands and deeper comprehension of their exchange mechanisms for up-scaling efforts, knowing that croplands are important OVOC sources and that maize is the 2nd most cultivated crop in the world (FAOSTAT).