OZONE UPTAKE AND DEPOSITION ON SOIL SURFACES

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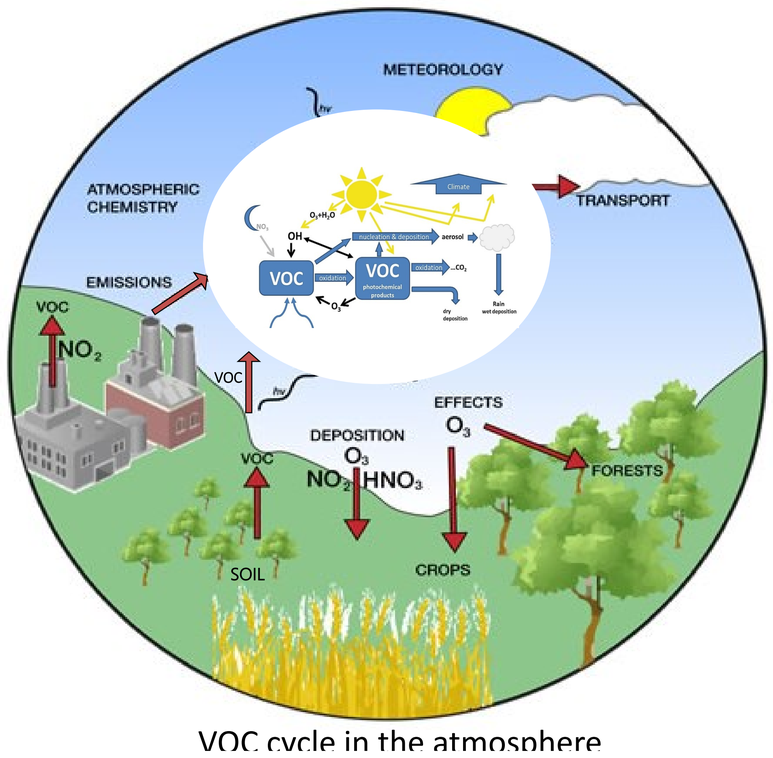
INTRODUCTION

Organic molecules are signature compounds of the biosphere and include many volatile organic compounds (VOC) that can escape into the atmosphere. VOCs are released by soil organic matter content, soil microorganisms, fauna and plant roots[1].

Ozone is of major importance in tropospheric chemistry, at high concentrations near the surface being harmful to humans and vegetation[2].

In this work, we investigated the **interactions of ozone at soil surfaces** with particular attention to **VOC emissions** and **ozone uptake and deposition processes**. Our goal is to characterize the mechanisms and parameters affecting these processes using a high sensitivity proton transfer reaction mass spectrometer.



VOC cycle in the atmosphere

EXPERIMENTAL S

Soil containing reactor coupled with high sensitivity proton transfer

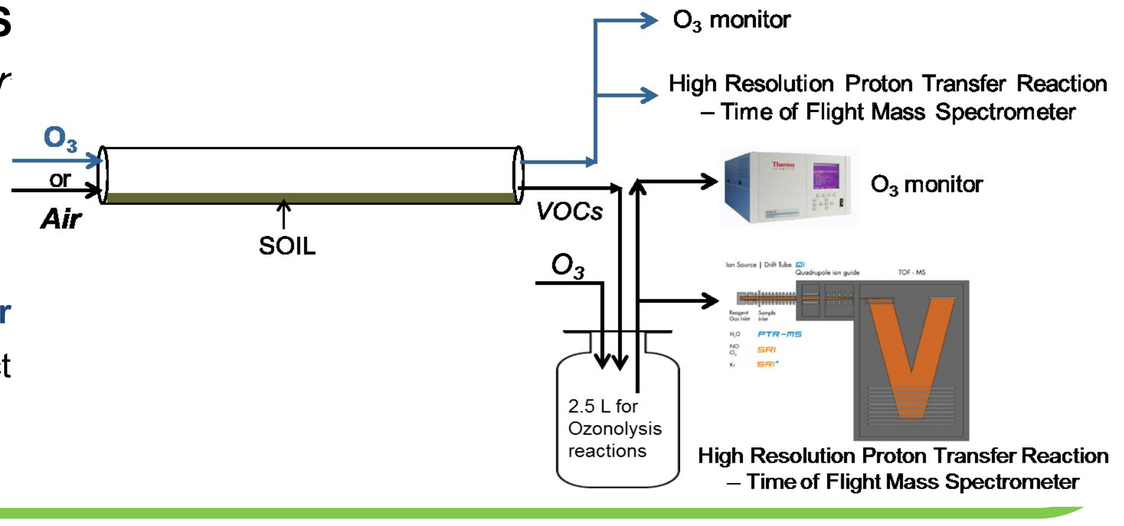
- samples collected in Grignon, ICOS site, France
- O_3 = 80 ppb

The experiments were designed to observe both:

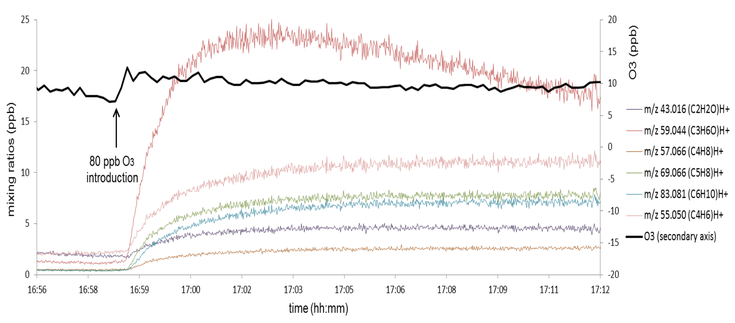
a) the ozone deposition on soil system : heterogeneous + gas phase reactions (**blue cir**

b) the ozonolysis of the gas phase products emitted by the soil : ozone in contact released by the soil (**black circuit**)

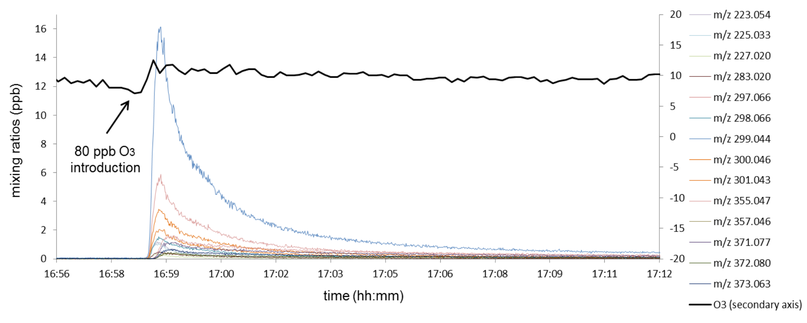
Reactor dimensions : length : 68 cm, diameter : 0.36 cm, residence time ~ 1.5 min



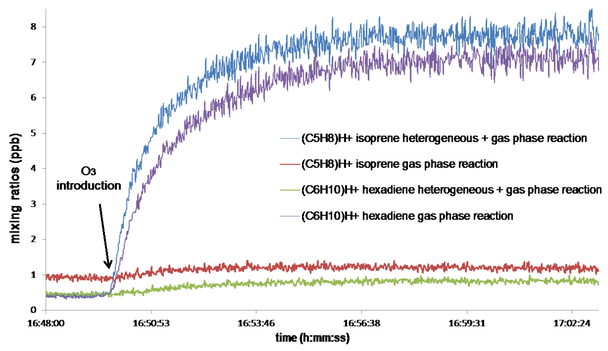
RESULTS AND DISCUSSION



Typical deposition experiment showing the formation of low mass VOCs



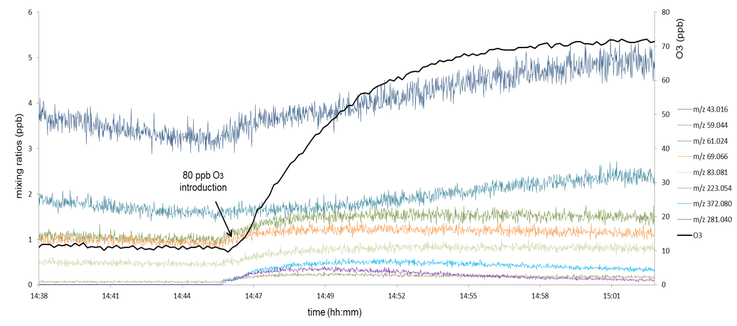
Typical deposition experiment showing the formation of high mass VOCs



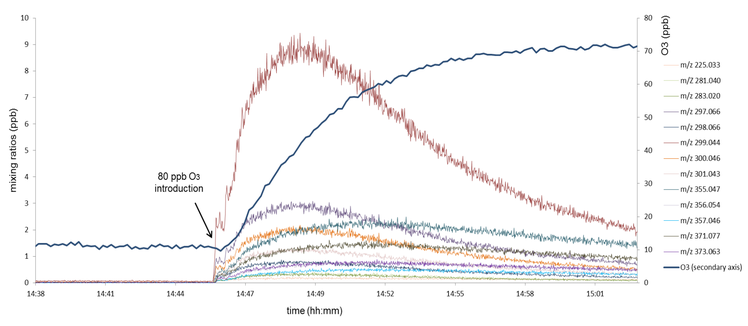
Isoprene and hexadiene signals as a function of experiment type

✓ 2 different responses : continuous VOC formation and rapid formation followed by deposition or subsequent oxidation

✓ 2 different rates of ozone loss

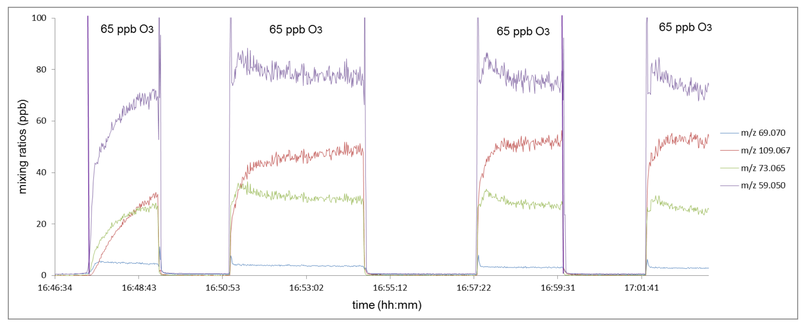


Typical gas phase ozonolysis experiment showing the formation of low mass VOCs



Typical gas phase ozonolysis experiment showing the formation of high mass VOCs

First results on cattle slurry + ozone



VOCs signals of manure slurry exposed to ozone in gas phase **(more info see poster F. Lafouge)**

CONCLUSION AND FUTURE WORK

Preliminary results showed that :

- **Bare soil** is releasing **high amounts** of **low and high masses VOCs**
- **Reactions of ozone** at the **soil interface** occur via **two simultaneous mechanisms**:
  - **heterogeneous reactions** strictly on the surface with **high deposition rate of ozone** on bare soil: **96% O_3 loss**
  - **homogeneous reactions** occurring in the gas phase with a **lower impact** of gas phase **ozonolysis** : **14% O_3 loss**
- **Higher VOCs concentrations in cattle slurry**

In the future : identification of emitted VOCs

tests variating the humidity of air and soil

REFERENCES

1. J. Peñuelas et al., Plant, Cell and Environment, 37, 1866–1891, 2014
2. G. M. Wolfe et al, Atmos. Chem. Phys., 11, 7875–7891, 2011

ACKNOWLEDGEMENTS

The authors thank ANAEE France for funding the PTR-TOF-MS