

Finokalia Aerosol Measurement Experiment, FAME-11

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- Introduction / Motivation / Scientific objectives

The purpose of the project is to better characterize organic aerosols (OA) and gas precursors (sources and properties) in the Eastern Mediterranean during a period of the year (falls) when photochemistry offers the best conditions to investigate OA having different oxidation states.

This project is part of ACTRIS TNA activity on “In-situ chemical properties of aerosols & Trace gases networking: Volatile organic carbon”. It is headed by LSCE (France, François Dulac) and hosted by FORTH for the Finokalia infrastructure.

This field experiment was a follow-up of the FAME-2008 field experiment which has shown that OA aerosol at Finokalia was highly oxygenated during summer (Lee et al., ACP, 2010) while its primary fraction (hydrogen-like OA) was not detected (Hildebrandt et al., ACP, 2010). High OH exposure may have partly explained this unusual pattern providing the need to perform a new field experiment (FAME-2011) under lower oxidative conditions (September-October 2011).

Based on a multi-tracer approach of organic material in gases/aerosols, LSCE contribute to this study by providing a time-resolved source apportionment of OA and VOCs (PMF & AETHALOMETER models). Such information is particularly valuable regarding the time-limited (but intense) OA-containing plumes which are passing over Crete Isl. Real-time information of water-(in)soluble OA (LSCE) will complete the OA oxidation/volatility measurements performed by FORTH.

The 2 LSCE Ph-D students – new users José Nicolas and Cerise Kalogridis work on the characterization of aerosols and reactive gases in the Mediterranean, respectively. These 2 students had here a unique opportunity to participate to an international field experiment (12 participants from Greek, French and US research teams) and get trained on many state-of-the-art field instruments.

- Reason for choosing station

The Finokalia measurement station is ideally placed to examine the air masses advected from continental Europe. Local pollution is restricted to a few cars maximum per day passing on a minor coastal road ca. 50 m west of and some 20 m below the station. Coastal orography shifts the local wind direction from north/north-west to almost due west in summer, and only a slight sea-breeze oscillation in wind direction between day and night is generally observed. Air passing a substantial distance over Crete before arrival at the site is therefore rare at Finokalia under these conditions (Mihalopoulos et al., 1997), so that local effects on the atmospheric chemistry are minimal for long periods (Salisbury et al, 2003).

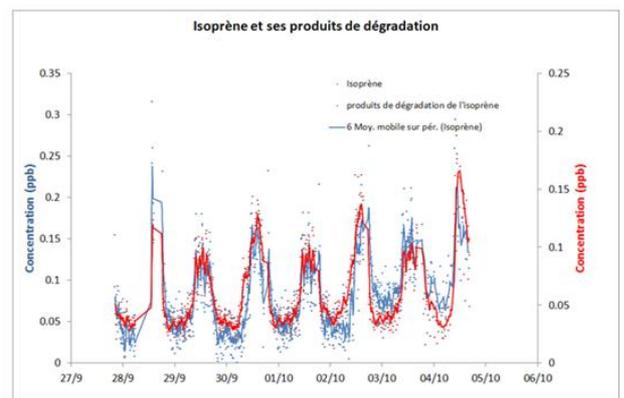
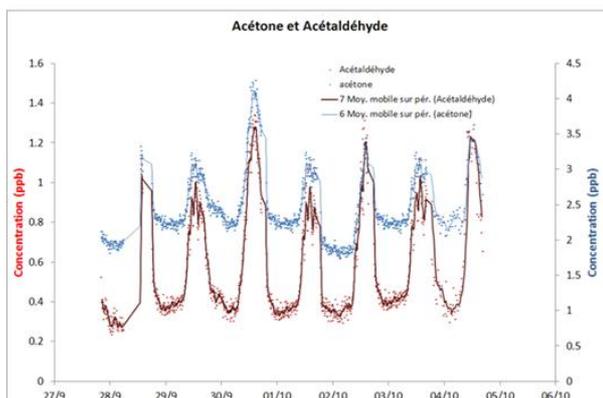
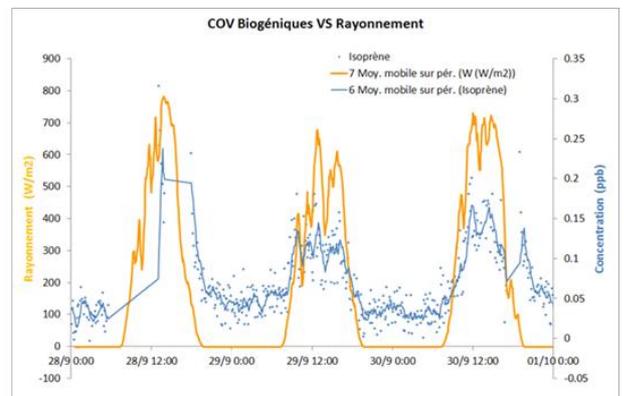
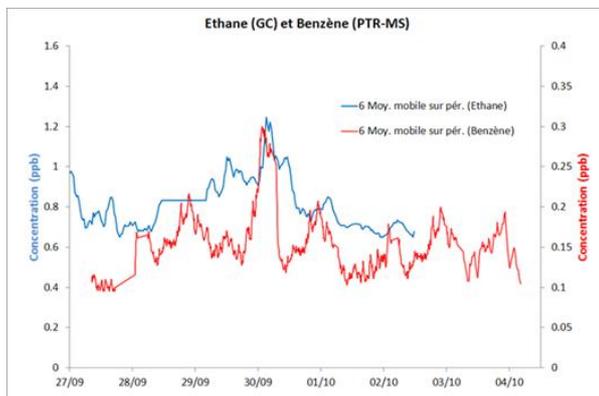
- Method and experimental set-up

Complementary to the instruments deployed by FORTH (thermo-denuded HR-ToF AMS, dry/wet SMPS, DAASS, APS ...) and those available at Finokalia station, LSCE provided real-time information on water-(in)soluble OA (PILS-TOC & EC-OC Sunset field instruments), real-time measurement of specific organic tracers (oxalate, MSA by PILS-IC; levoglucosan, pinic/pinonic acids by PILS + LC-MS/MS), and real-time measurements of gas precursors (light NMHC by GC-FID, OVOCs by PTR-MS, NH₃ by AiRRmonia). Filter samples were collected every 6 h as back-up of the on-line instruments and provided complementary information (sample library available for future exploratory organic speciation).

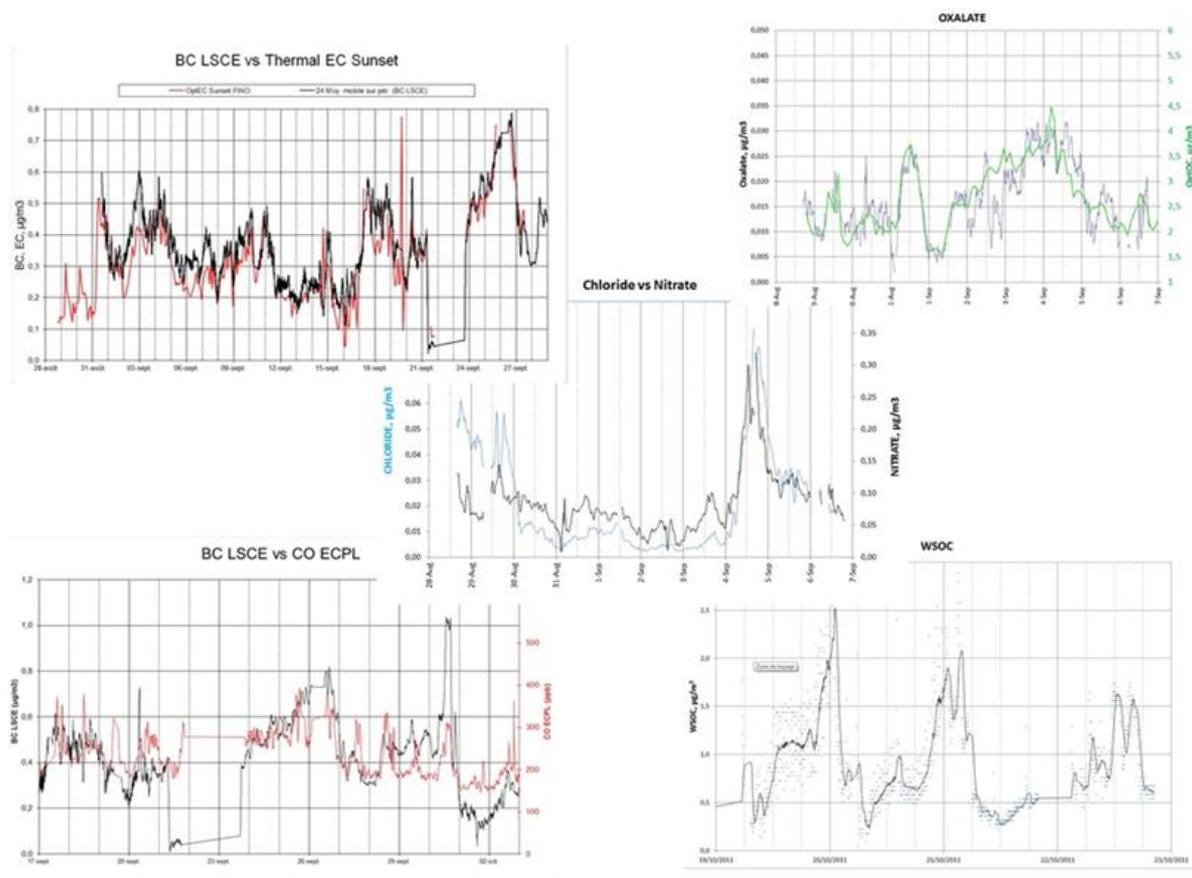
These measurements have been developed and qualified by LSCE (Sciare et al., AGU, 2011) and used successfully in the field to explore the water-(in)soluble fraction(s) of SOA (Sciare et al., JGR in revision, 2011). Most of these instruments have been deployed during the EU-FP7 MEGAPOLI experiments providing unique information on carbonaceous aerosols (Healy et al., 2011, submitted to ACP).

- Preliminary results and conclusions

Preliminary results are presented on the graphs below.



VOC's measurements with a PTR-MS & GC-FID



Aerosols' measurements with an PM2.5 aethalometer, PILS-IC & PILS-TOC

During FAME-11, many breaks in power supply occurred causing a lot of data loss. After a first data processing and post-calibrations of the instruments, we will have a better view of our dataset. Complementary post-campaign analyses of organic tracers could then be scheduled on 120 6-hour filters (PM2.5 Partisol), and on 710 30-minute vials (PM2.5 PILS/BMI).

- Outcome and future studies

After this data processing period, data exchange and discussions will occur with the FAME-11 partners.

Results of the FAME experiments (2008 and 2011) will be compared with similar field studies which are planned in 2012 & 2013 in the western Mediterranean (Corsica Isl. in particular) as part of the CHARMEX project (<http://charmex.lsce.ipsl.fr/>; PI = François Dulac).

- References

+ Lee, B.H., Kostenidou, E., Hildebrandt, L., Riipinen, I., Engelhart, G.J., Mohr, C., DeCarlo, P.F., Mihalopoulos, N., Prévôt, A.S.H., Baltensperger, U., and Pandis, S.N.: Measurement of the ambient organic aerosol volatility distribution: application during the Finokalia Aerosol Measurement Experiment (FAME-2008), *Atmos. Chem. Phys.*, 10, 12149-12160, doi:10.5194/acp-10-12149-2010, 2010.

+ Hildebrandt, L., Engelhart, G.J., Mohr, C., Kostenidou, E., Lanz, V.A., Bougiatioti, A., DeCarlo, P.F., Prévôt, A.S.H., Baltensperger, U., Mihalopoulos, N., Donahue, N.M., and Pandis, S.N.: Aged organic aerosol in the Eastern Mediterranean: the Finokalia aerosol measurement experiment-2008, *Atmos. Chem. Phys. Discuss.*, 10, 1847-1900, doi:10.5194/acpd-10-1847-2010, 2010.

+ Salisbury, G., et al.: Ground-based PTR-MS measurements of reactive organic compounds during the MINOS campaign in Crete, July-August 2001. *Atmos. Chem. Phys.*, 3, 925-940, 2003.