FluxSAP 2010 experimental campaign over an heterogeneous urban zone, part 1: heat and vapour flux assessment

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The participants and co-authors


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The context

- VegDUD, The role of vegetation in the sustainable urban development; an approach by the stakes linked to climatology, hydrology, energy control, and environment,

- a cooperative program based on a systemic approach, with some 15 partners aiming at understanding and quantitatively assessing the vegetation impact in the present and future urban development projects

- funded by the French National Research Agency (ANR) during 4 years (2010-2013).

- within this framework two campaigns of at-ground and airborne measurements are organized, the first one in 2010 and the second one in 2012

- around the permanent observation site of IRSTV (Pin Sec district)
The objectives

- **FluxSAP’s objective**: to obtain reference data for assessing quantitatively the role of vegetation in urban climate,
- and for evaluating urban hydrology and climatology models
- **FluxSAP2010’s objective**: to test the methods allowing
  - to measure the sensible heat and water vapour fluxes over a heterogeneous urban district,
  - to spatialize the measurements taking into account the heterogeneous land surface cover modes,
  - and to test the footprint models for a urban area.
In the soil (permanent) : 10 piezometers 
8 temperature profiles and water content
In the air: 14 T-RH sensors at z = 2-3 m agl
10 Eddy Covariance sensor systems
5 Large Aperture Scintillometers (LAS)
5 LAS and 1 SAS
Set-up summary

- T-RH (2 m)
- EC mast
- Scintillo
- Sodar
- GIS limits
Airborne (13 flights) and handheld (140 refs) thermal infrared measurements
Hyperspectral (Hyspex) airborne measurements

Flight scheme: 20 flight lines

VNIR (400-1000 nm): 160 bands (4nm), 0.6 m resolution

SWIR (1000-2500 nm): 256 bands (6nm), 1.2 m resolution

95 measurements at ground with portable spectrometer
30 passive tracer dispersion exercises
see Part 2 (Maro et al.)
The meteorology (26 April – 7 June)
First results: temperature and humidity gradients from T-RH and surface sensors.
First results: heat flux measurements with EC turbulent sensors

HARMO14 – Kos – 2-6 Oct. 2011
First results: heat flux measurements with LAS scintillometers

Sensible Heat Flux during FluxSAP 2010

300 Wm$^{-2}$
Preliminary conclusions

- Good coherency between sites but differences between measurement methods (sensors + algorithms).
- Differences between sites linked with different distributions of land cover modes (buildings, pavement, bare grounds, high and low vegetation).

Mestayer et al. (2011), *Urban Climate News*, 40, 22-30 (www.urban-climate.org)

” ” ” (in French) *La Météorologie*, 73 (mai 2011), 33-43 (www.smf.asso.fr)

- Footprint analysis should allow to separate the various contributions to fluxes and to quantify the influence of vegetation.
Further analysis: The footprint issue

turbulent flux sensor

Source area or footprint

Wind U
The footprint issue

\[ \text{footprint length distance} = f(z_0, U, z/L) \]
Preparation for second campaign, May-June 2012

- Look for more differences between footprint land cover modes.
- Look for more differentiated LAS paths (mineral, vegetal, mixed).
- Look for more EC masts over vegetated eco-districts.
- Look for more H₂O turbulent sensors (Li-Cor).
- Look for building influence on vegetation.
- Monitor water table in the ground (soil moisture profile)
- Measure PTUV profile (0-150 m) with tethered balloon.
- Hope to have 1 or 2 water vapour scintillometers.

Thank you for your attention