



IFSTTAR



# The FluxSAP hydroclimatological experimental campaigns over an heterogeneous urban area

F Rodriguez et al...

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**INSU EC2CO**, FluxSAP - BIOEFFECT and LEFE

# The FluxSAP team

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2010

2012

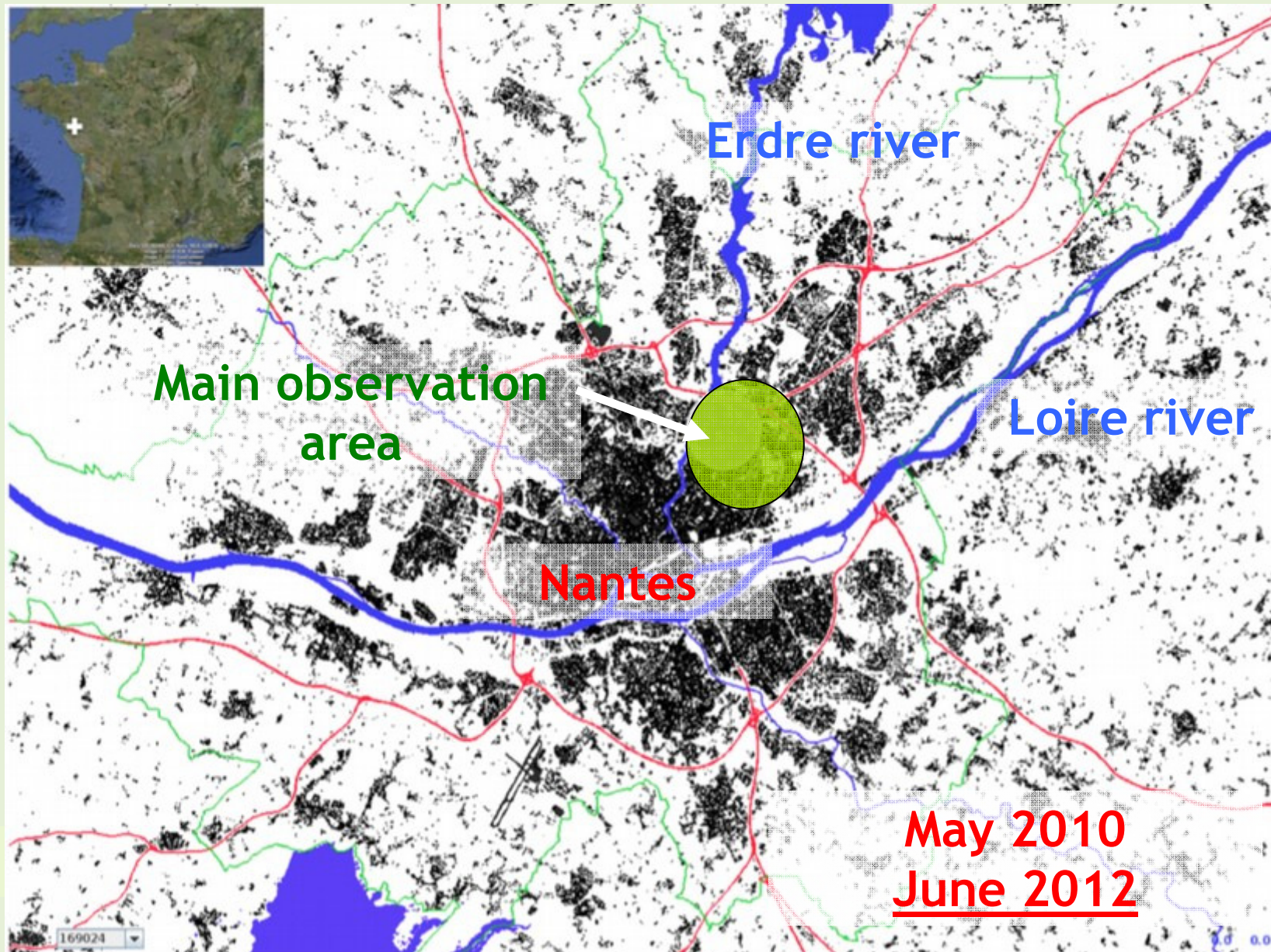
- (1) CESBIO
- (2) CSTB
- (3) IFSTTAR/GER
- (4) INRA EPHYSE
- (5) IRSN
- (6) IRSTV
- (7) LHEEA / ECN
- (8) LSIIT
- (9) LTHE
- (10) LPGN
- (11) Centre Météo France 44
- (12) University of Oklahoma
- (13) CEREMA DTer EST
- (14) CEREMA DTer IDF
- (15) CNRM GAME
- (16) LNE
- (17) EDF



# The objectives

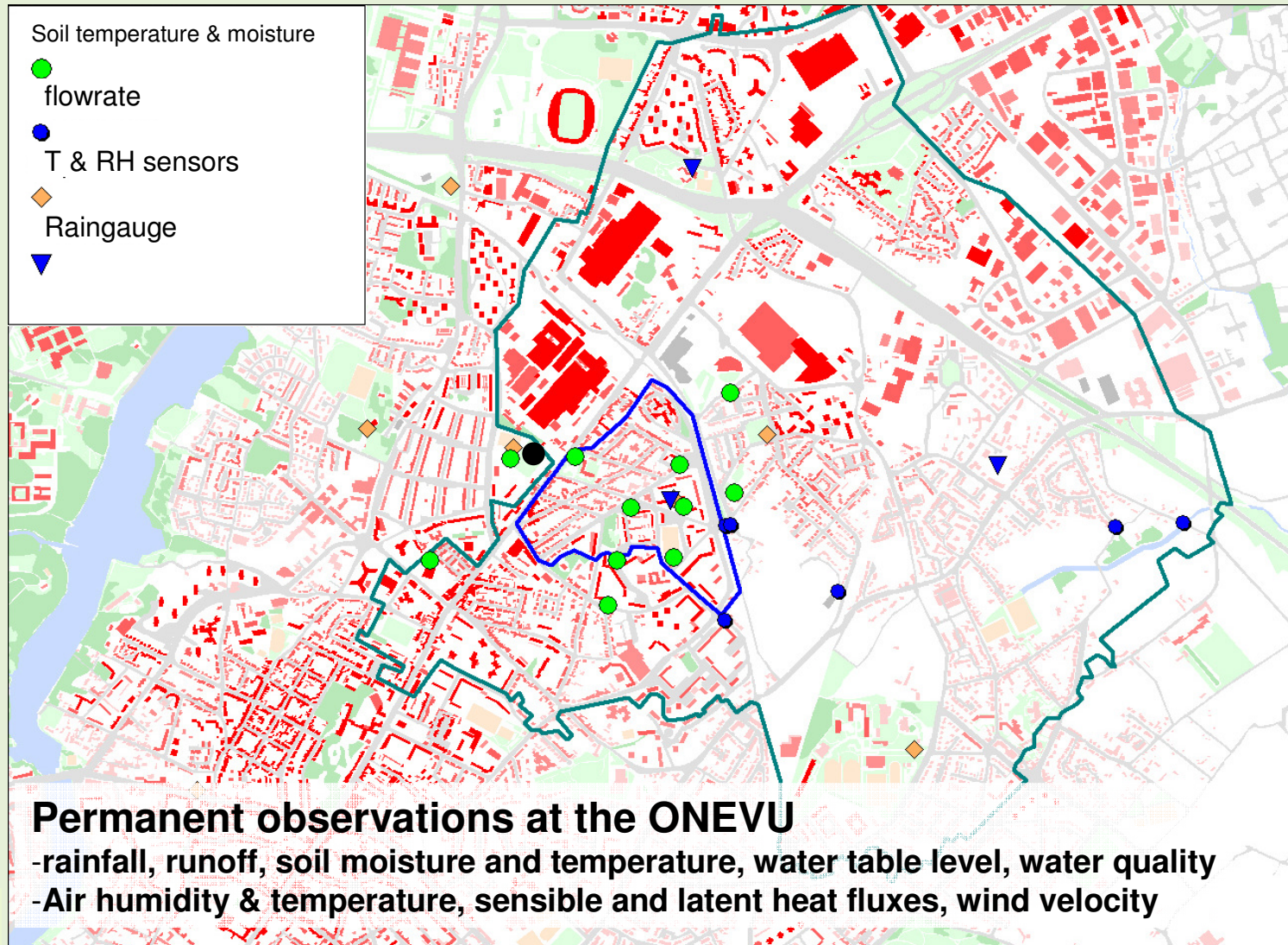
- FluxSAP : to obtain reference data
  - for evaluating urban hydrology and microclimate models
  - for assessing quantitatively the role of vegetation on urban climate
- FluxSAP 2010 : to test the methods allowing
  - to measure sensible heat and water vapour fluxes over an heterogeneous urban district
  - to spatialise the measurements, taking into account land use heterogeneity
  - to test footprint models over an urban area
- FluxSAP 2012 : to focus on observations
  - to increase the reliability of observations (sensors inter-comparison )
  - to compare heat fluxes from sealed vs vegetated areas
  - to refine latent heat flux observations (at local and larger scales)

# Location and campaign periods



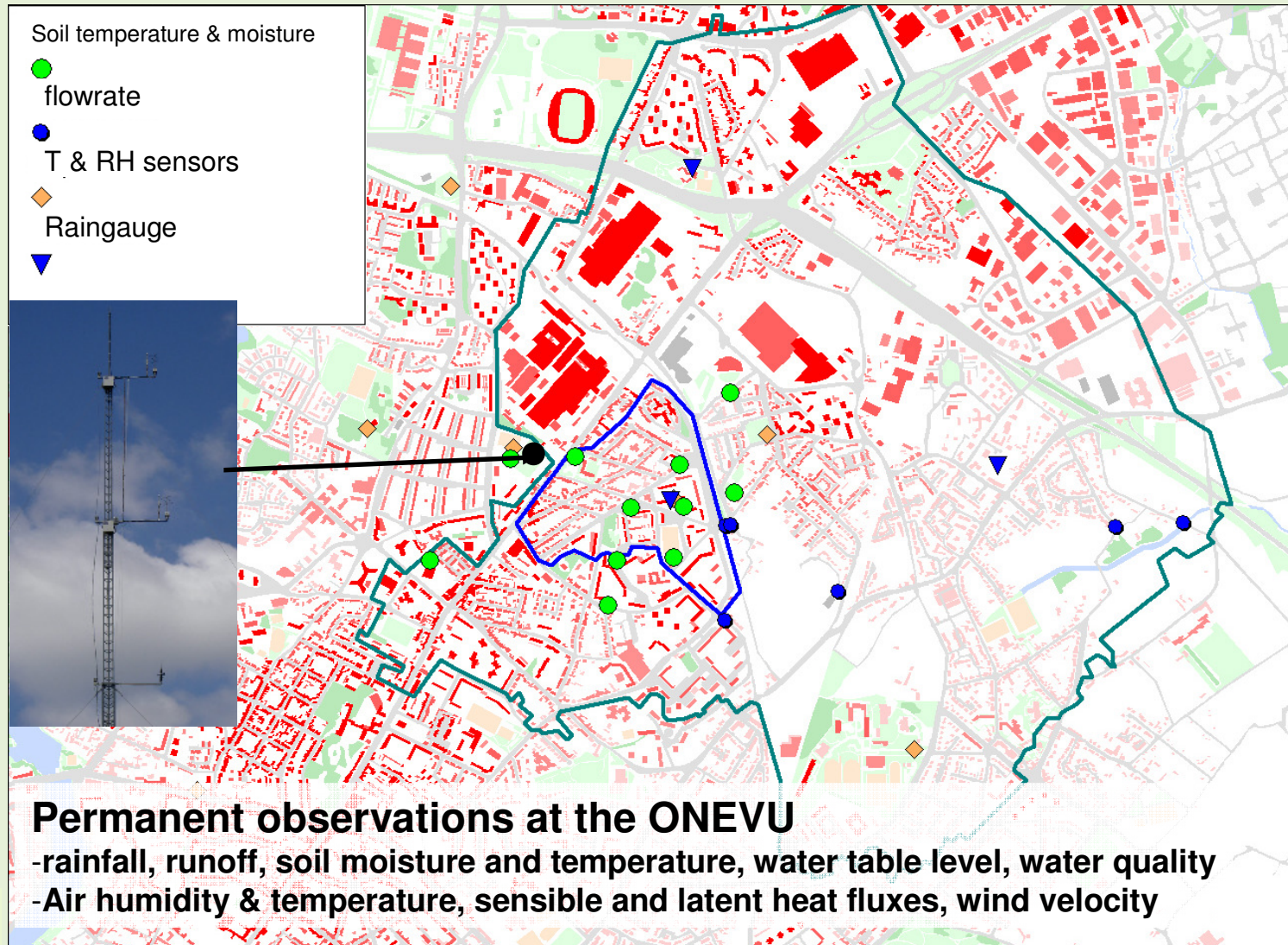


## 2012 set of observations



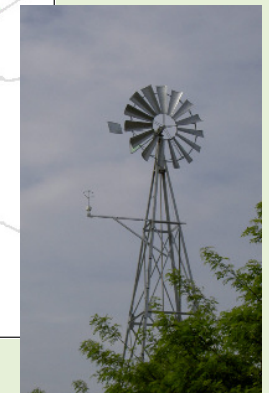
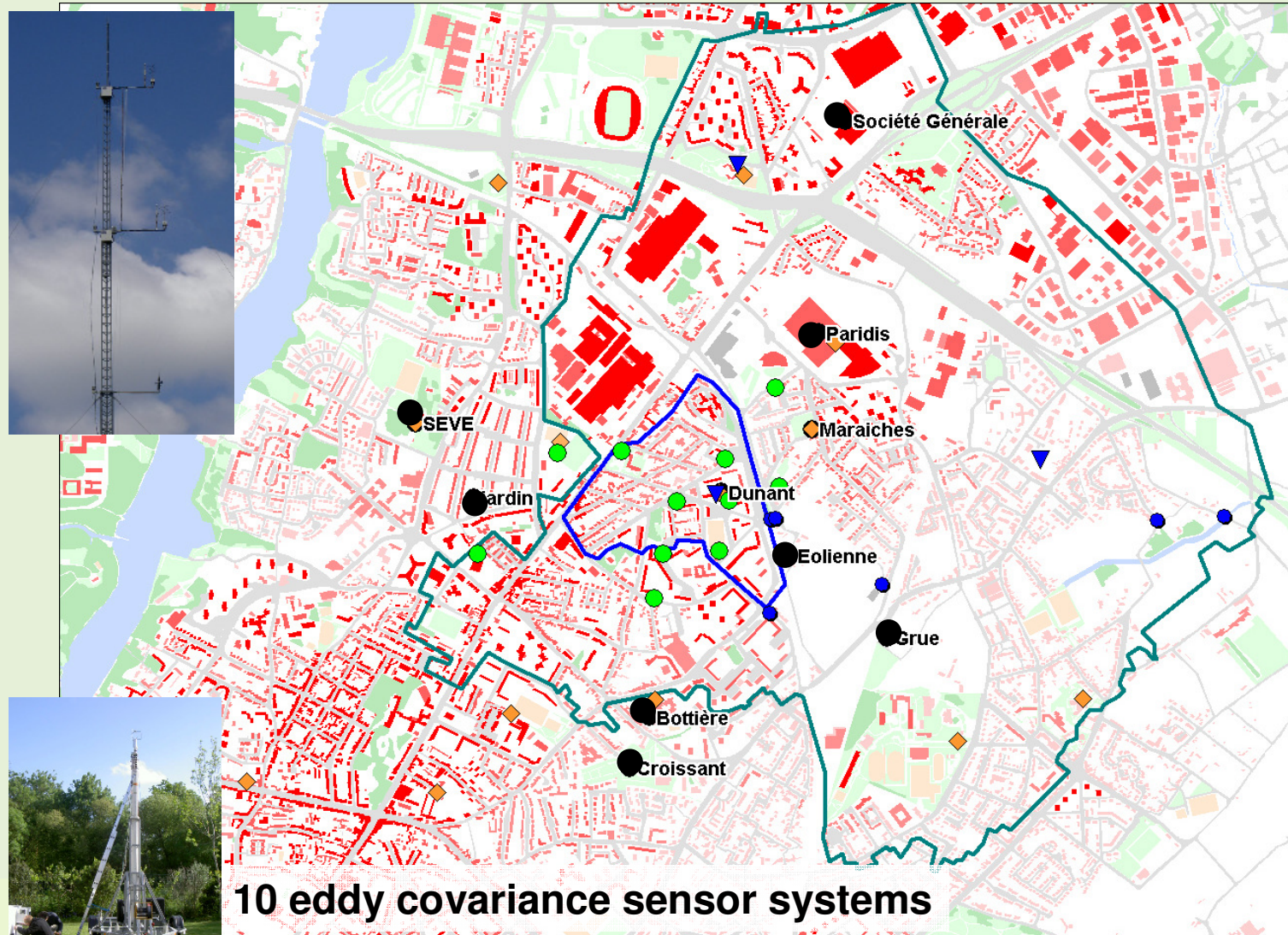


## 2012 set of observations

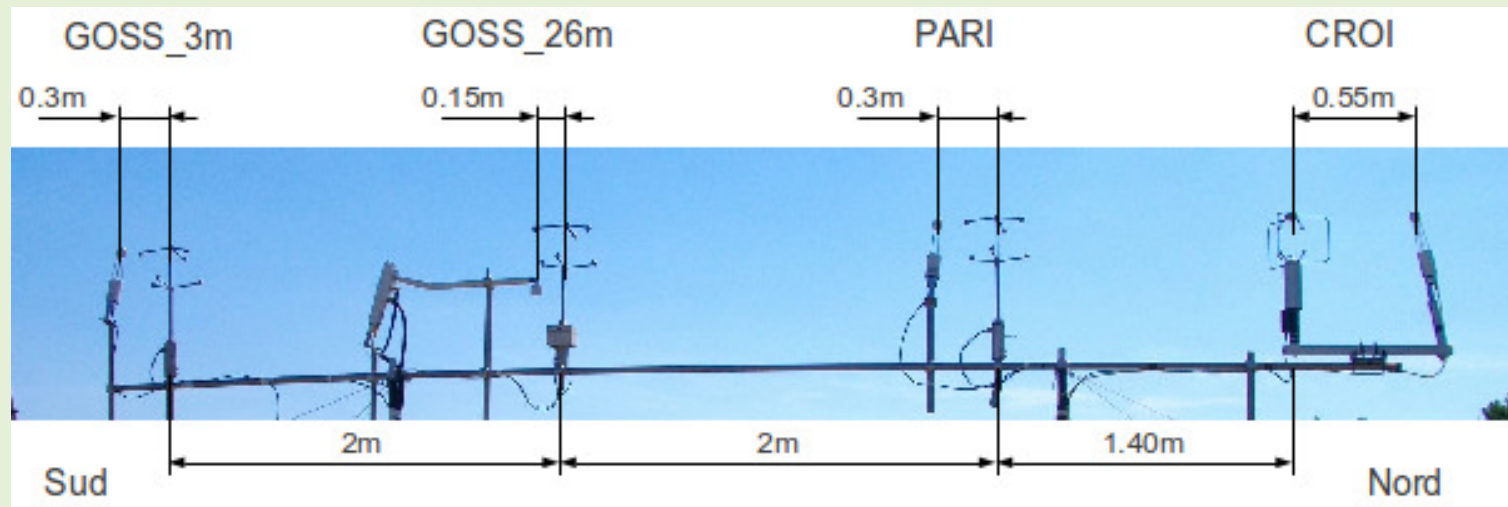




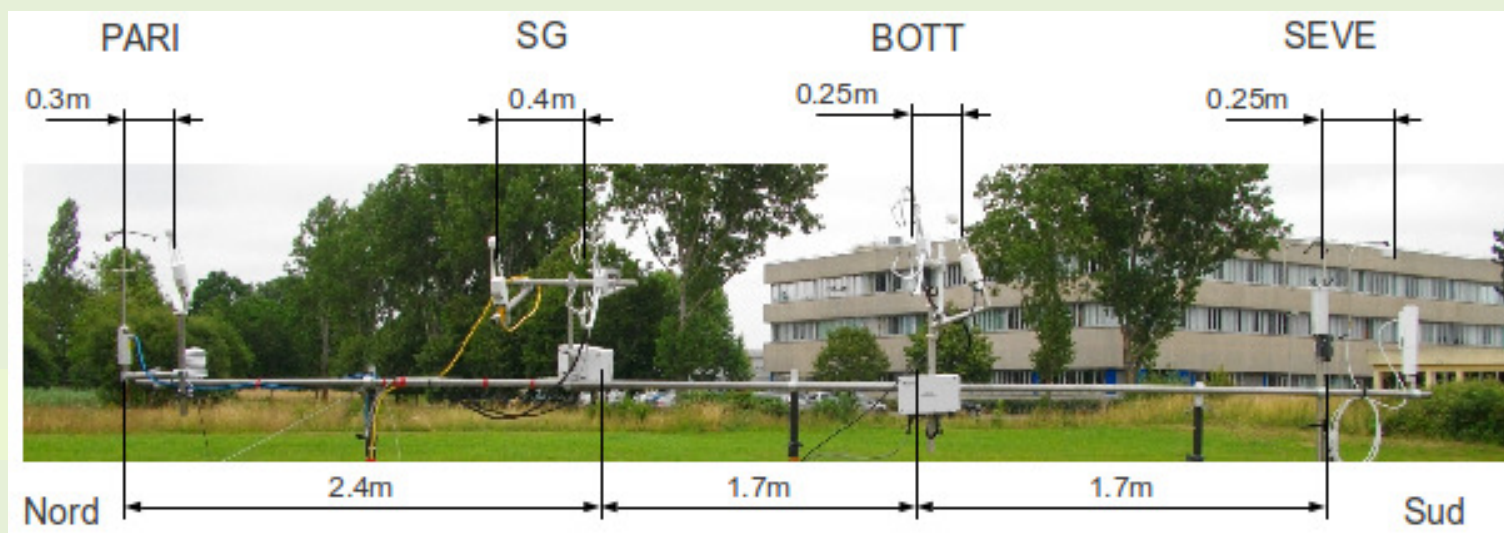
# 2012 set of observations



**Before-campaign sensor intercomparison :**  
**Eddy covariance sensor systems**  
**Implementation of SAT & IRGA over an homogenous grassland**  
**at IFSTTAR Bouguenais**



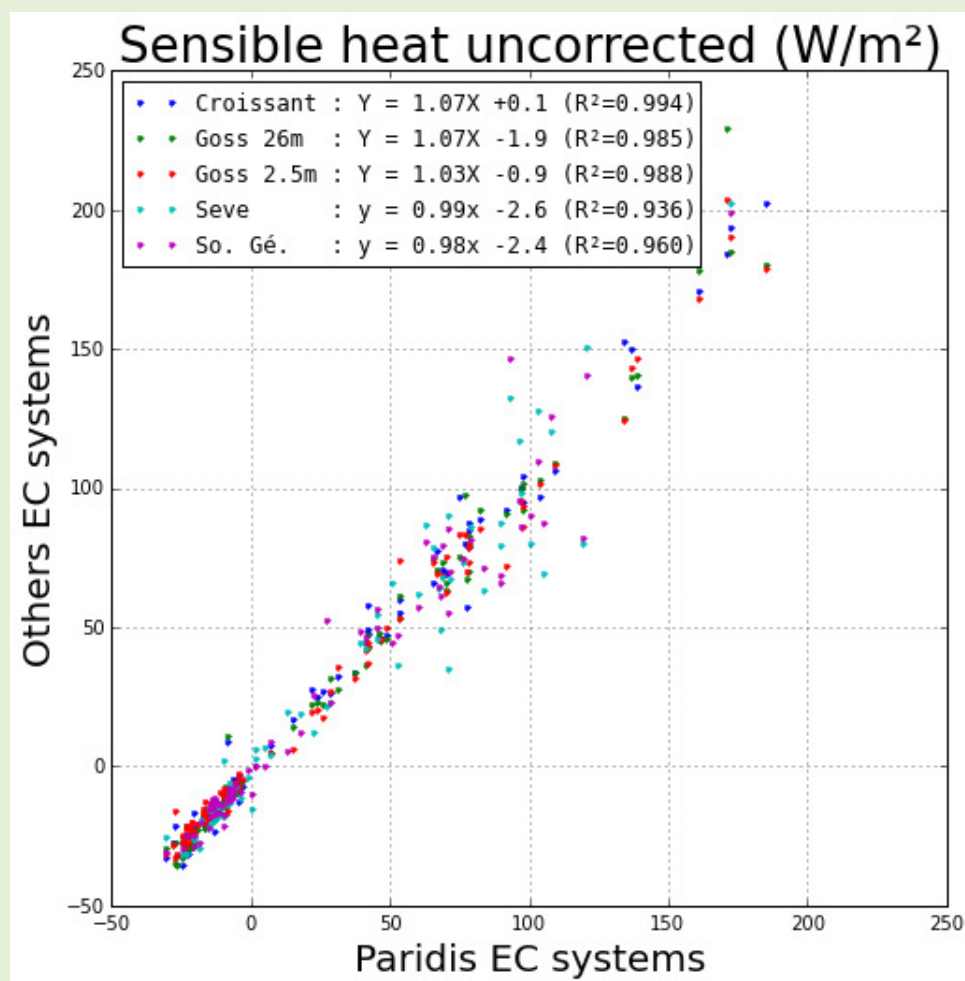
H=2,15m



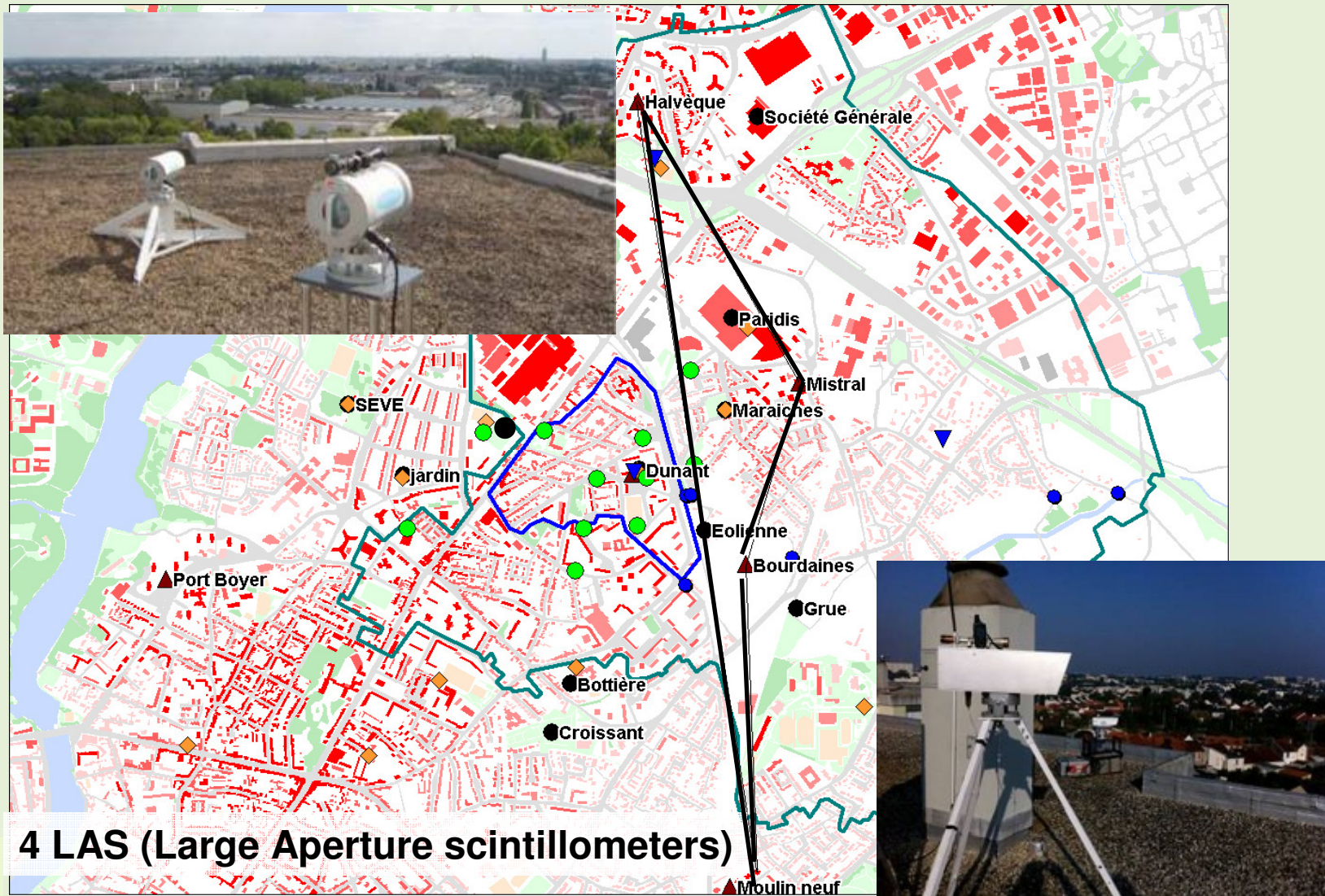
H=2,35m



**Before-campaign sensor intercomparison :  
Eddy covariance sensor systems  
Implementation of SAT & IRGA over an homogenous grassland**

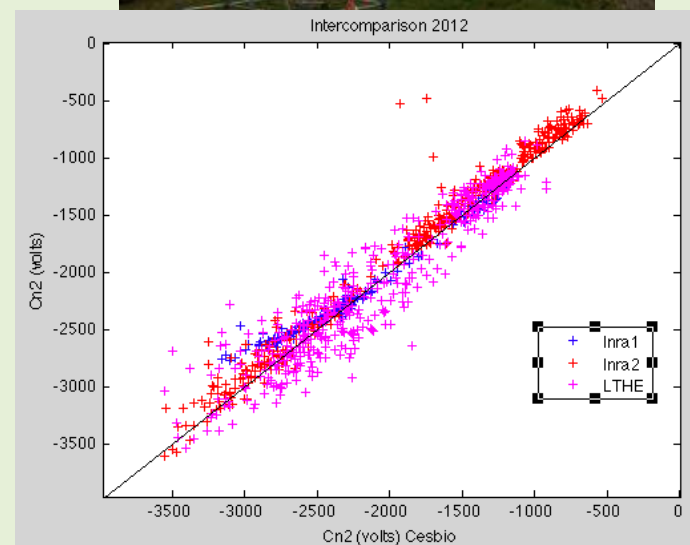


## 2012 set of observations





# Before-campaign sensor intercomparison : scintillometers Implementation of LAS over an homogenous grassland at INRA Bordeaux



**Comparison of Cn2**

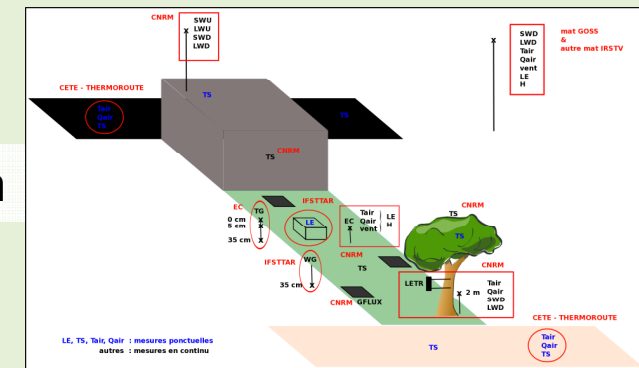
# 2012 set of (other) observations

## 7 one-day Evapotranspiration Chamber sites



## Mobile observations with car (T,RH) + TIR / urban transects

## Energy budget at a local scale / urban garden



## Passive tracer dispersion experiments + PTUV profiles



# Land use : geographical database

## Vectorial geographical database

Streets, houses

## Raster images (Quickbird)

4 bands multispectral image



# Land use : geographical database

## Vectorial geographical database

Streets, houses

## Raster images (Quickbird)

4 bands multispectral image

Extraction of vegetation  
(from NDVI/SAVI estimation  
methodology)

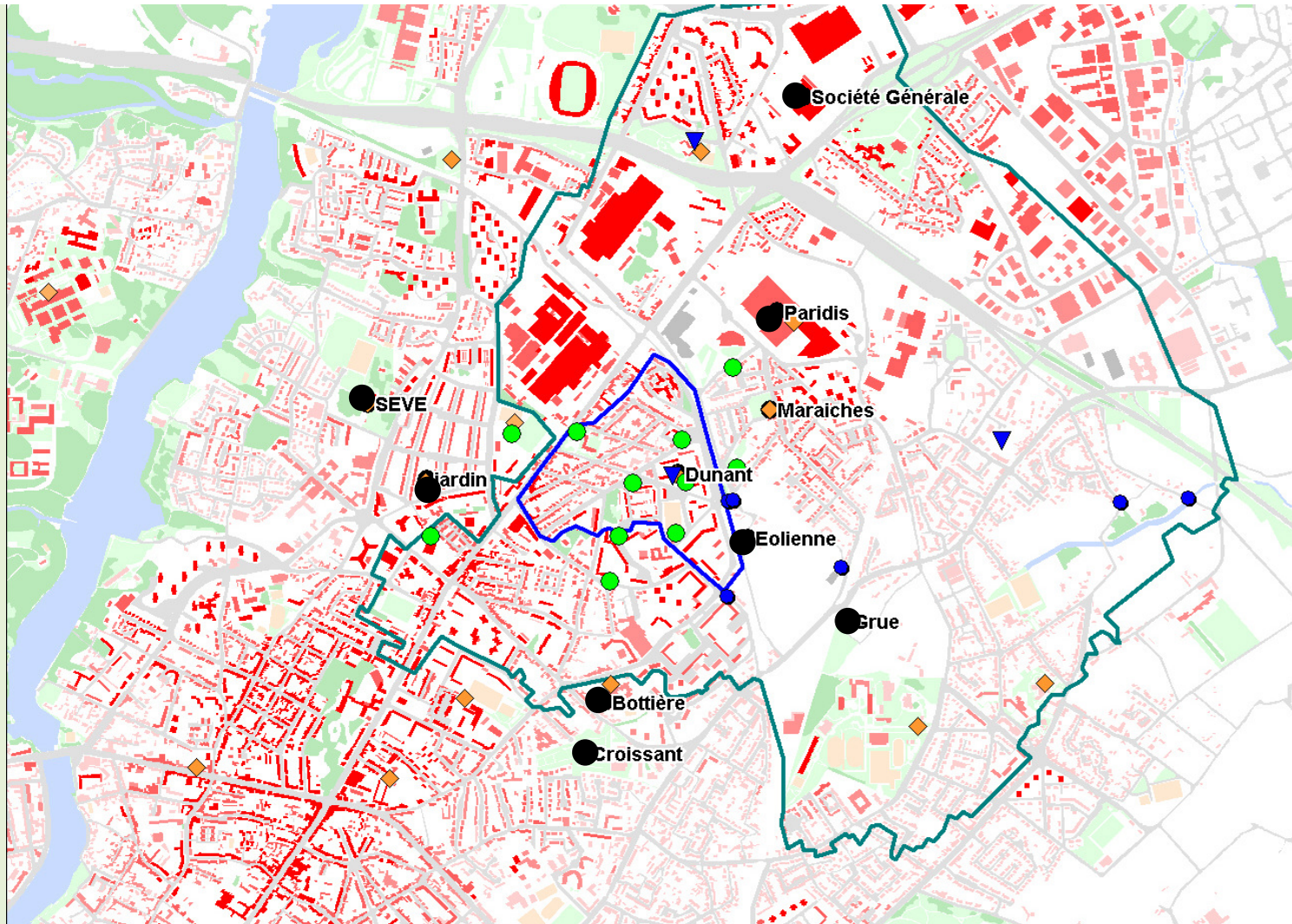
FluxSAP campaign area





# Results - Heat fluxes during the campaign / Eddy Covariance observations

Relation between EC heat flux and vegetation fraction ?



# Heat fluxes observations during the campaign

## Methodology :

Determination of the daily average flux

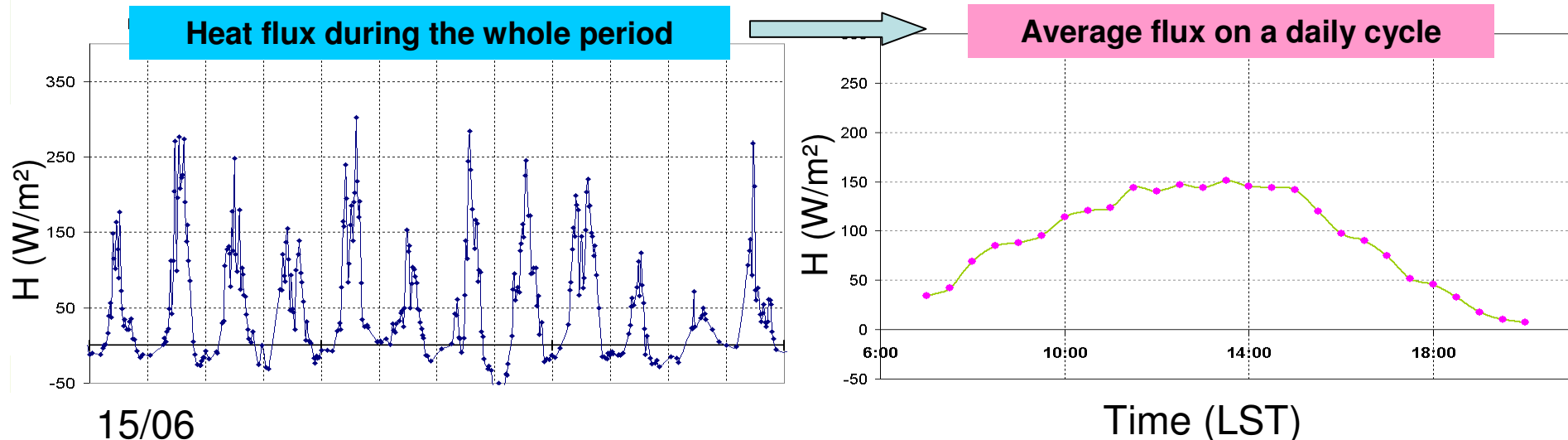
1/2 h time step from 7 am to 8 pm

Analysis time interval : 01/06 to 27/06/2012

## Variables :

- Sensible heat flux  $H$
- Latent heat flux  $LE$
- Evaporative fraction :  $LE/(LE+H)$

Site	Period
PARI	31/05 - 27/06
SOGE	01/06 - 26/06
MARA	27/05 - 27/06
SEVE	24/05 - 27/06
GOSS26	29/05 - 27/06
CROI	24/05 - 27/06
GRUE	01/06 - 12/06
GOSS3	29/05 - 27/06



27/06

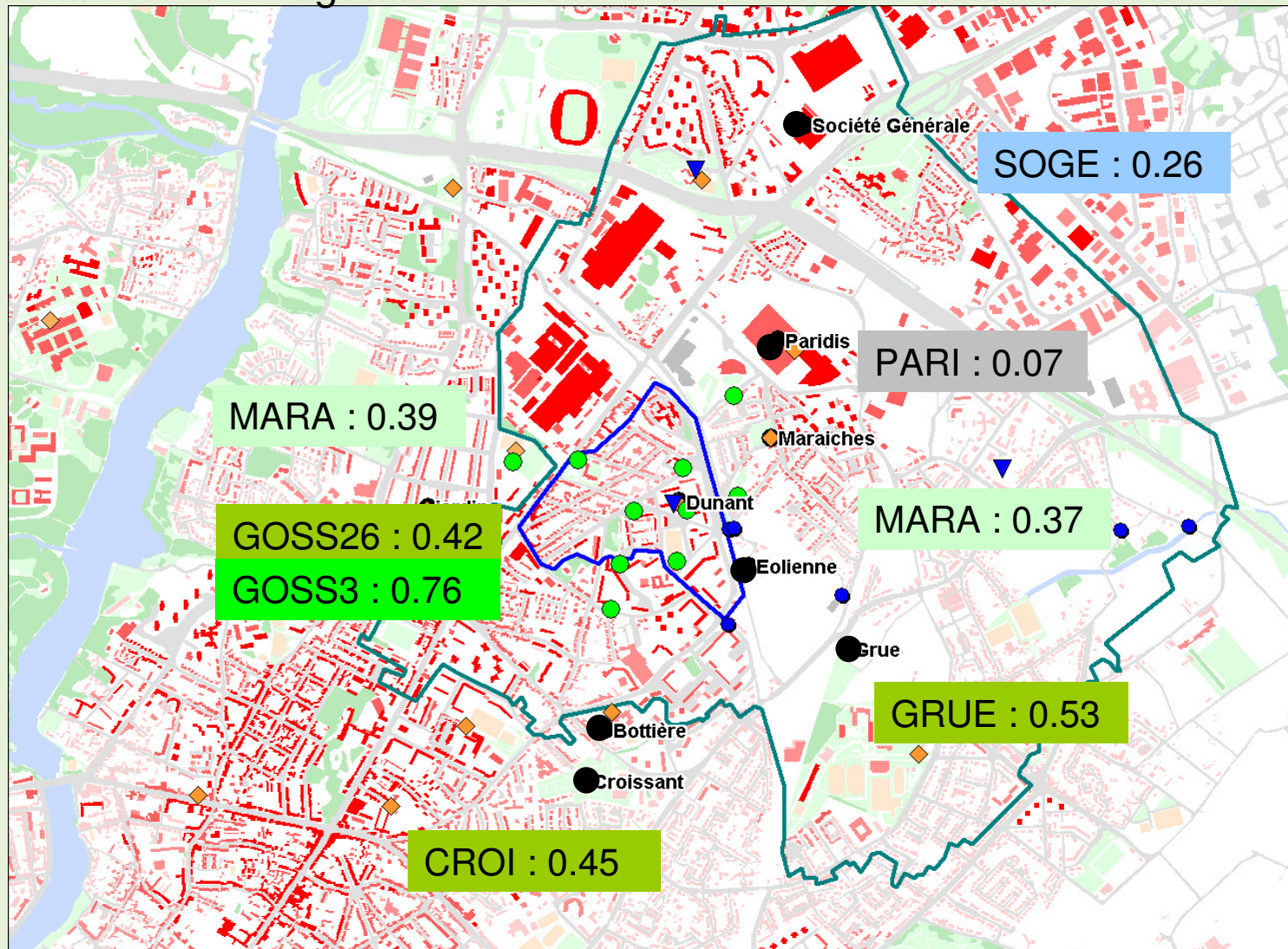
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# Heat fluxes observations during the campaign

Relation between EC heat flux and vegetation fraction ?

Estimation of the vegetation fraction in a 200m circle around the flux tower





## Heat fluxes observations during the campaign

## Comparison of two sites with very contrasting land use



PARI

# Goss26



# Heat fluxes observations during the campaign

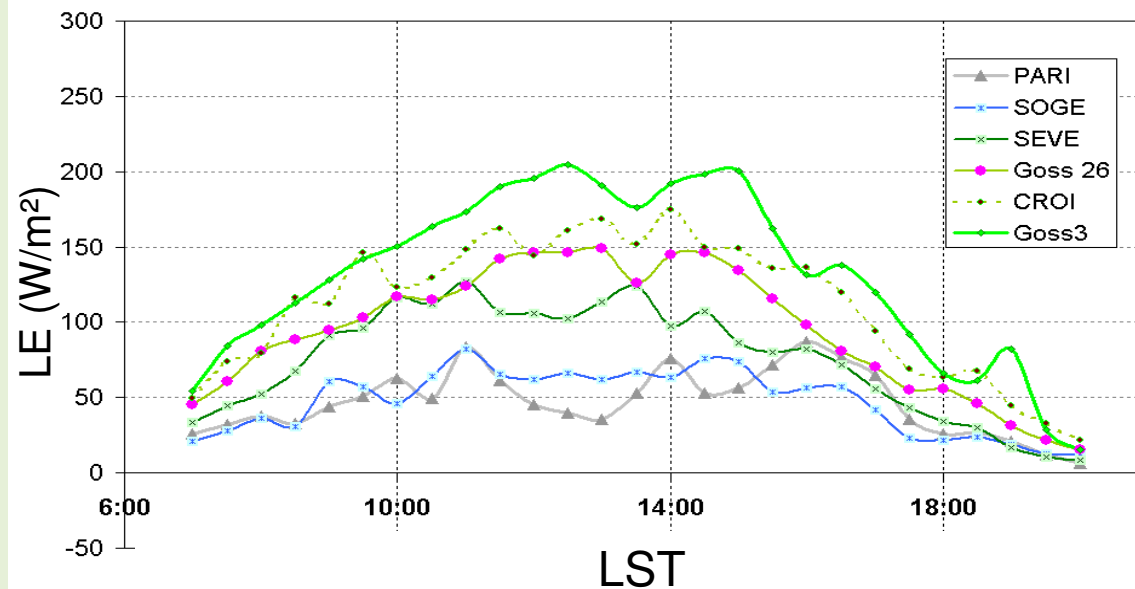
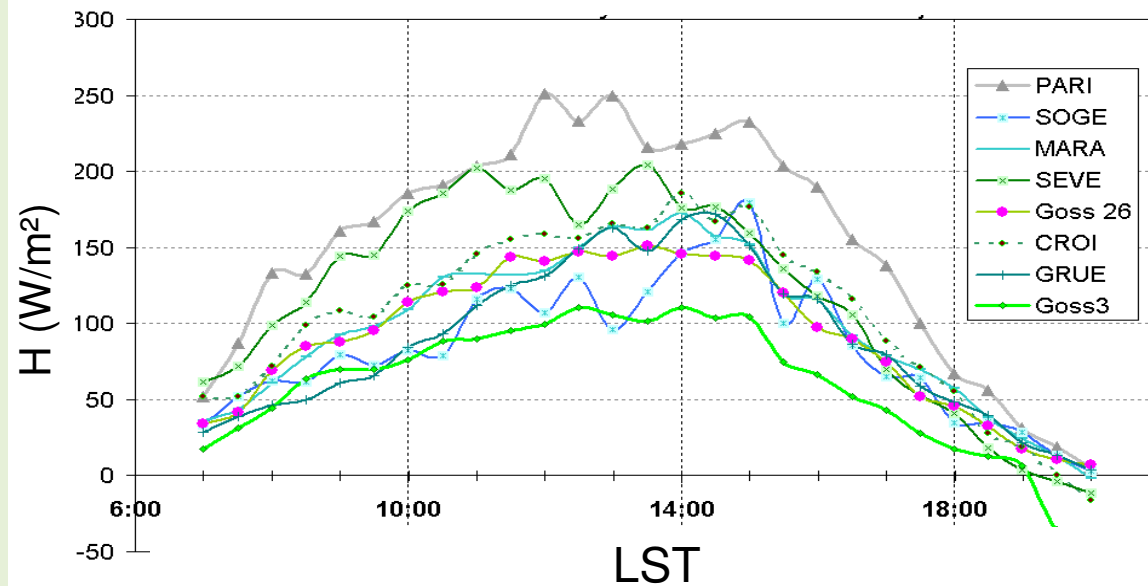
Sensible heat flux  $H$

$H \searrow$  with Vegetation

Site	Fraction
PARI	0.07
SOGE	0.26
MARA	0.37
SEVE	0.39
GOSS26	0.42
CROI	0.45
GRUE	0.53
GOSS3	0.76

Latent heat flux  $LE$

$LE \nearrow$  with Vegetation

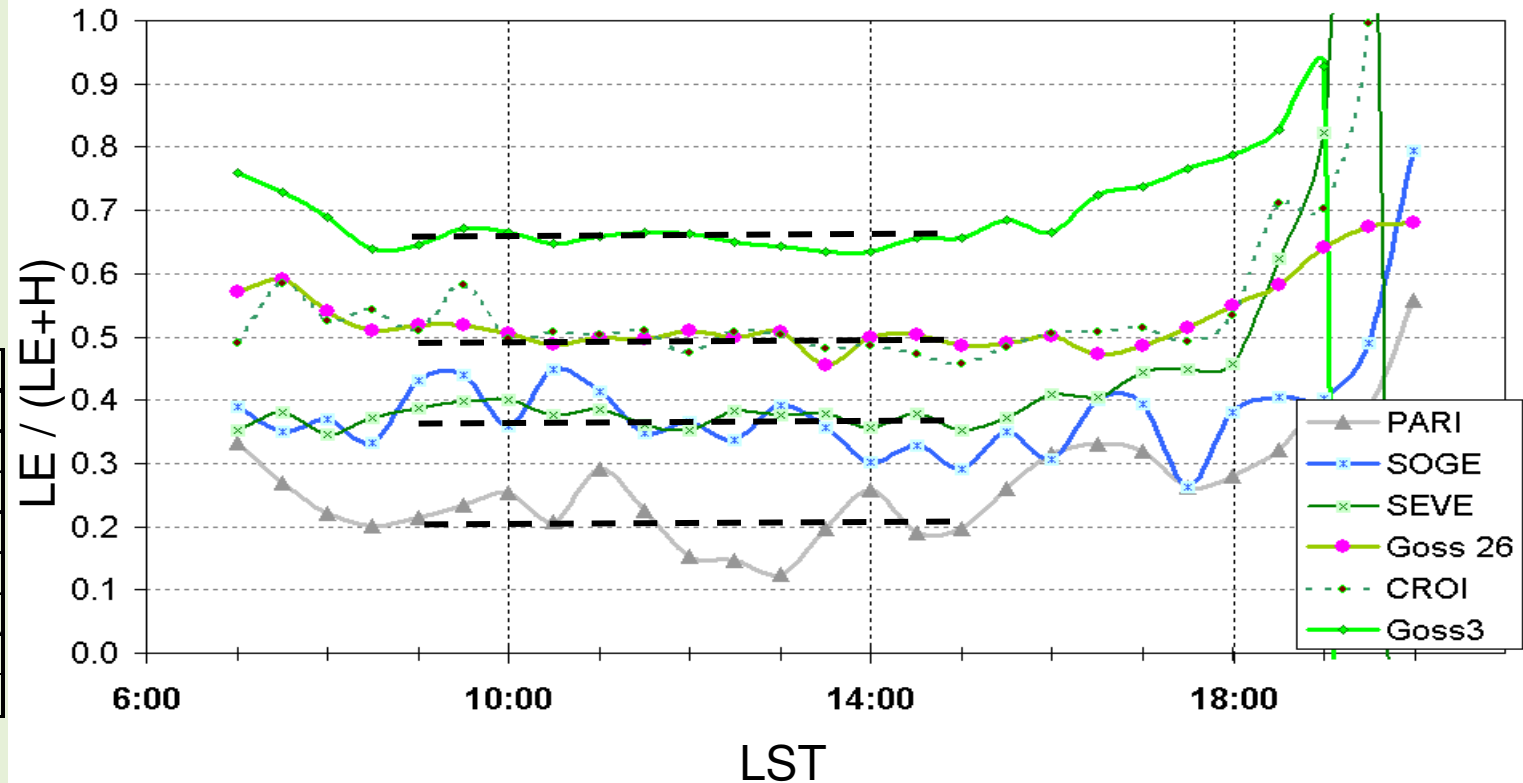


# Heat fluxes observations during the campaign

## Evaporative fraction

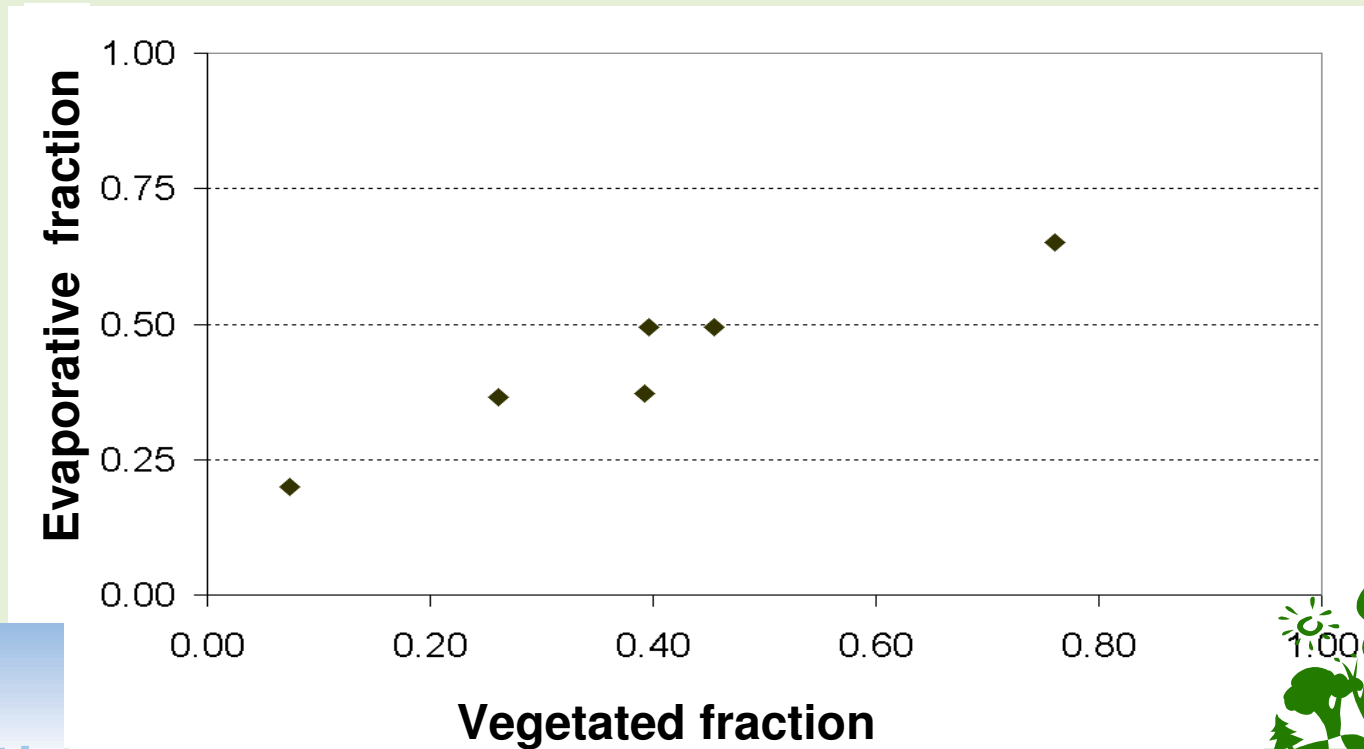
- net radiation energy ratio consumed by Evapotranspiration
- quite stable from 10 am to 3 pm

Site	Fraction
PARI	0.07
SOGE	0.26
MARA	0.37
SEVE	0.39
GOSS26	0.42
CROI	0.45
GRUE	0.53
GOSS3	0.76





# Heat fluxes observations during the campaign



Modification of the energy budget with vegetation during a spring/summer period in Nantes

# Conclusion and perspectives

**Observations in urban areas are very useful!**

**Impact of vegetation on heat fluxes**

**Further analyses of data are necessary / Heat Fluxes**

Estimation of real footprint

Comparison of heat fluxes (EC method / scintillometry)

**Further analyses (other observations) are still in progress**

Thank you...