

FLUXPYR

Global Change in the Pyrenees

2009-2012

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CONTENTS

- 1) Project & Context
- 2) Main Objectives and Questions
- 3) FLUXPYR Organization
- 4) Methodology & Instrumentation
- 5) Products
- 6) Conclusions



COOPERACIÓN TERRITORIAL
COOPÉRATION TERRITORIALE
2007-2013

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THE PROJECT

FLUXPYR is a trans-border network (instruments & experts) for the assessment and management of water, carbon and energy fluxes under climate change in agricultural and grassland ecosystems in the Pyrenees.

INTERREG IV-A Project, Poctefa Programme; Duration: 2009 - 2012

Consortium: 11 partners from Spain, France, Andorra; Coordinator: CTFC

Linked with other networks (e.g. CARBOMONT, CARBOEUROPE, FLUXNET)

Budget: 2.2 M euros

Co-financed by: European Regional Development Fund (ERDF), Departament de Medi Ambient i Habitatge (Oficina Catalana del Canvi Climàtic), Departament d'Innovació, Universitats i Empreses, and Conseil Régional de Midi-Pyrénées.



CONTEXT: CLIMATE CHANGE (CC)

Changes in precipitation/drought, storm frequency/intensity, sea level, ice cover, etc.

→ Ecological impacts: fauna-flora, ecosystem productivity, goods & services.

→ Socio-economic impacts: changes in agrosilvopastoral practices, tourism, etc.

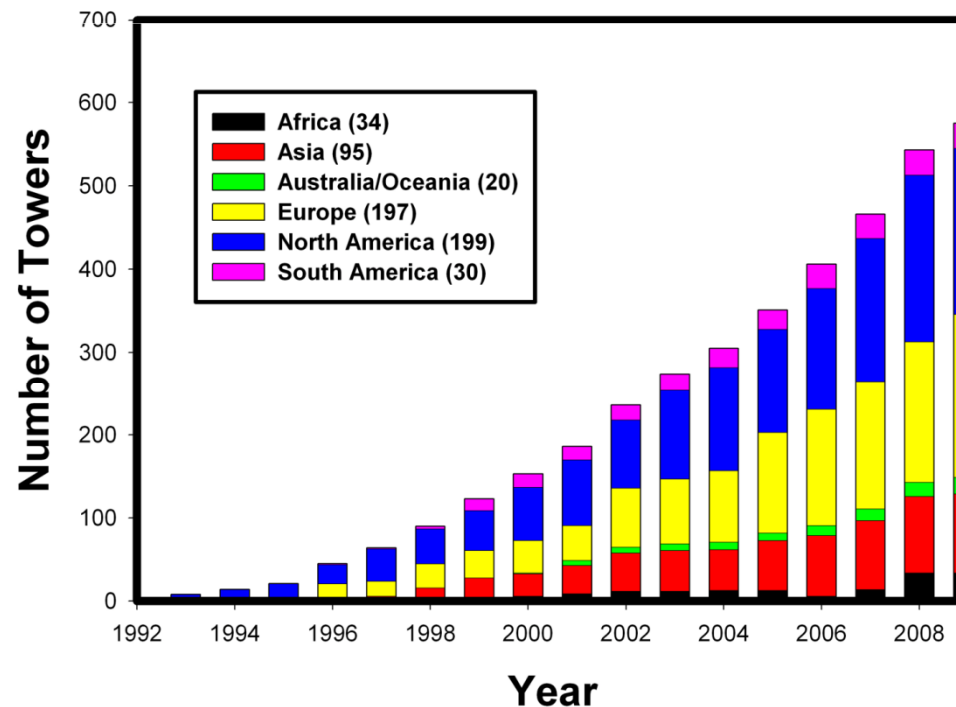
"Mountainous areas will face glacier retreat, reduced snow cover and winter tourism, and extensive species losses... In southern Europe, climate change is projected to worsen conditions (high temperatures and drought) in a region already vulnerable to climate variability, and to reduce water availability, hydropower potential, summer tourism and, in general, crop productivity" (IPCC 2007).

→ Need to characterize & quantify H₂O, C, N, energy fluxes & stocks; identify C sinks & sources and the influence of environmental factors, climate & management.

→ Need to design & implement appropriate mitigation + adaptation measures.

Many existing networks: FLUXNET, EUROFLUX, CARBOEUROPE-IP, CARBOMONT, CARBOITALY, ASIAFLUX, AMERIFLUX, CHINAFLUX, KOFLUX, etc.

Growth of FLUXNET 576 Towers as of March 31, 2009





MAIN OBJECTIVES

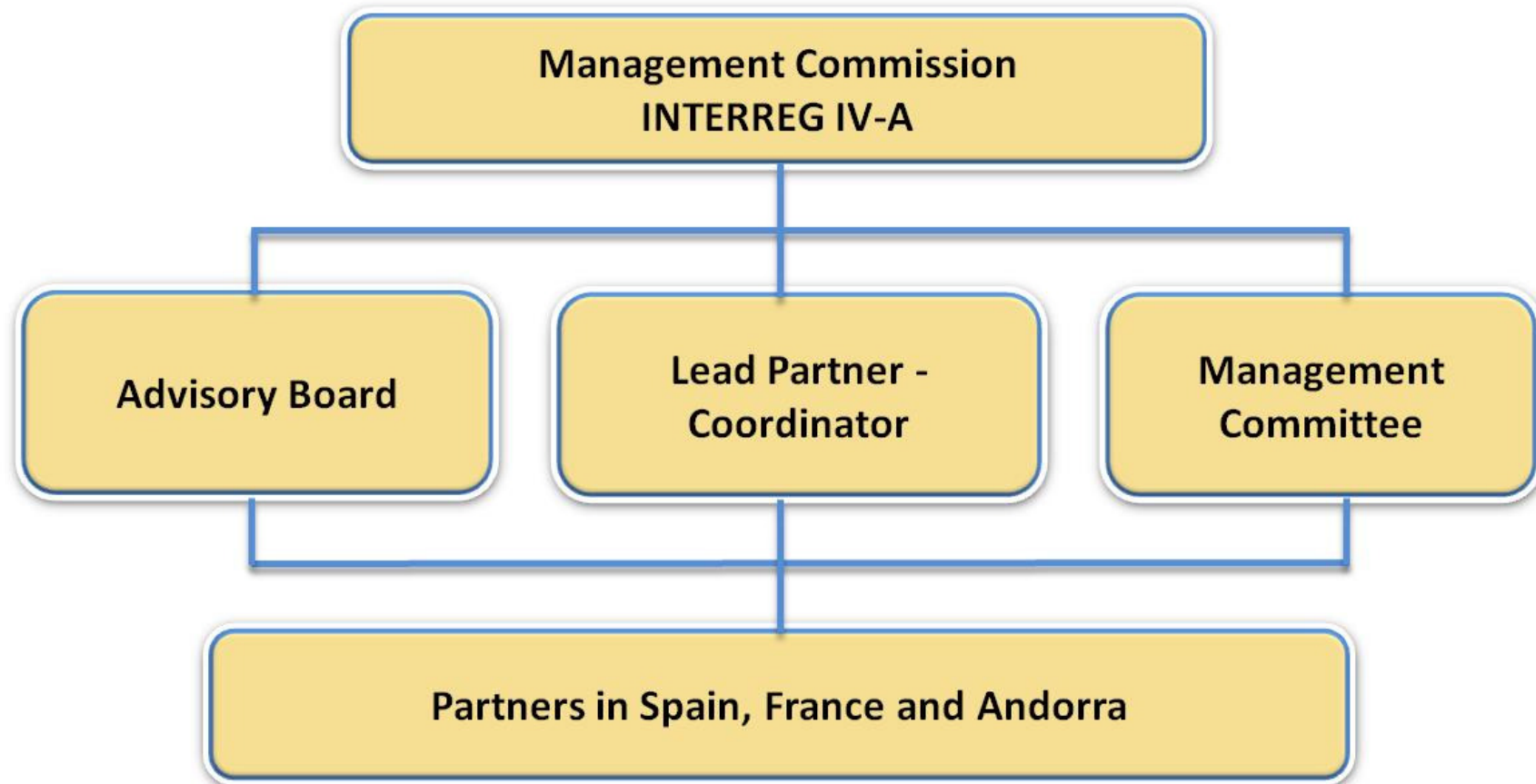
1. To develop a cross-border network for the assessment & management of H₂O, C and energy fluxes and stocks in agricultural and pastoral ecosystems in the Pyrenees.
2. To combine flux measurements, meteorological data, remote sensing & modelling to produce predictive maps (land use, productivity, C distribution, snow cover), and to assess the impacts of climate and land use change on Pyrenean ecosystems.
3. To ensure the creation & exchange of data, knowledge and expertise and facilitate the training of students, technicians and researchers.
4. To guide policies & local actors for sustainable land & natural resources management in the Pyrenees (mitigation & adaptation strategies).
5. Raise awareness among citizens: cut down GHG emissions & energy consumption, manage natural resources sustainably.
6. Strengthen the scientific cooperation in the field of climate change.



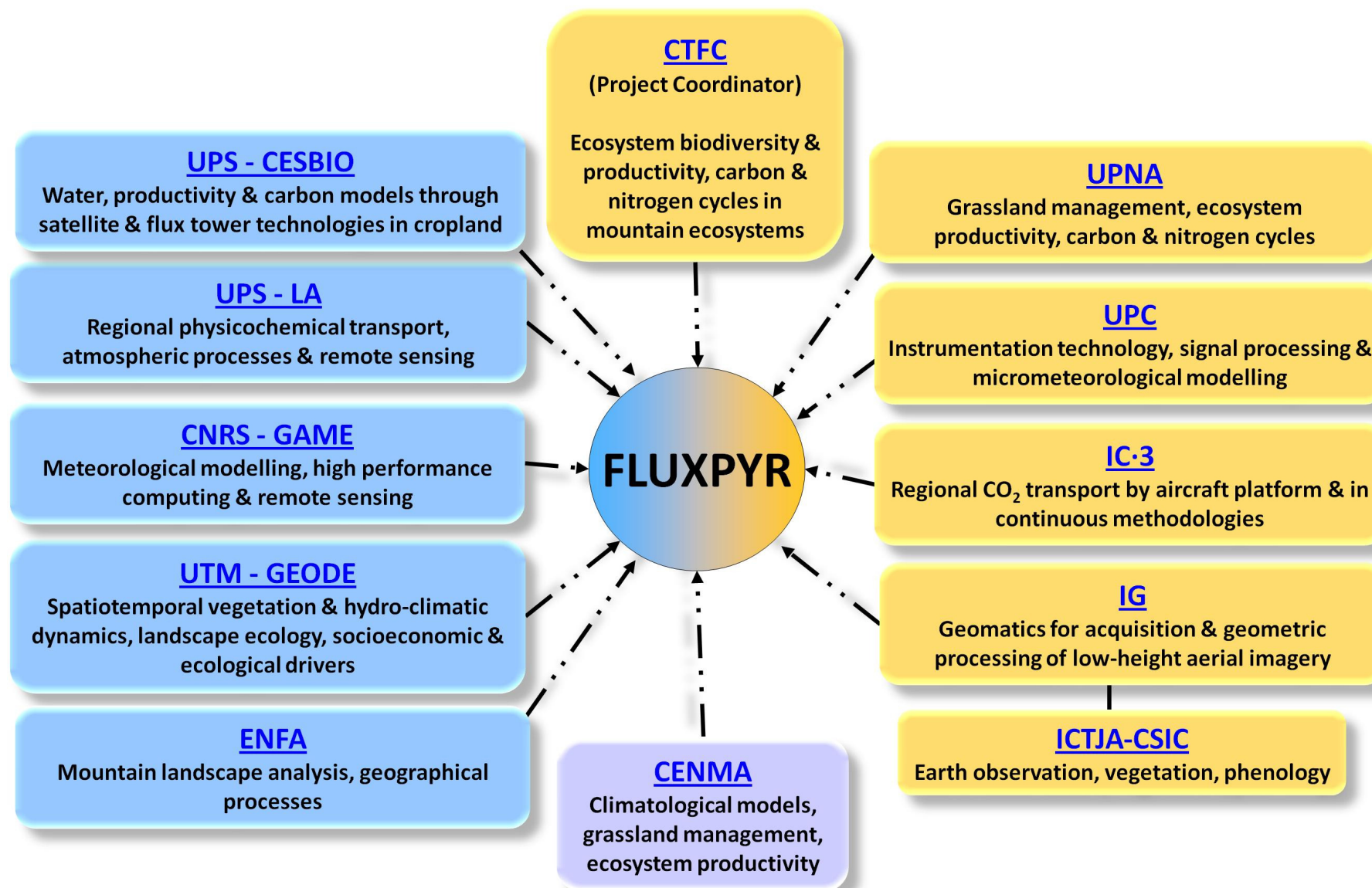
QUESTIONS

- 1) How to best characterize & quantify spatio-temporal dynamics in H₂O, C and energy fluxes and stocks in mountain ecosystems?
- 2) What are the drivers for those dynamics: vegetation type, phenology, land use, soil type, management, topography, climate, etc.; which are the feedback mechanisms involved between the biosphere & the atmosphere?
- 3) What are the impacts of CC on ecosystems (e.g. biodiversity), resource availability (e.g. water, fodder) and human activities (e.g. agriculture, forestry, tourism) in the Pyrenees, and which indicators can be used to describe those impacts?
- 4) Which mitigation & adaptation strategies and policies are suitable to cope with CC, at local and regional scales, and how should they be coordinated?
- 5) Which role can networks such as FLUXPYR play in the study of CC and how should they be managed to optimise their benefits?

ORGANIGRAM

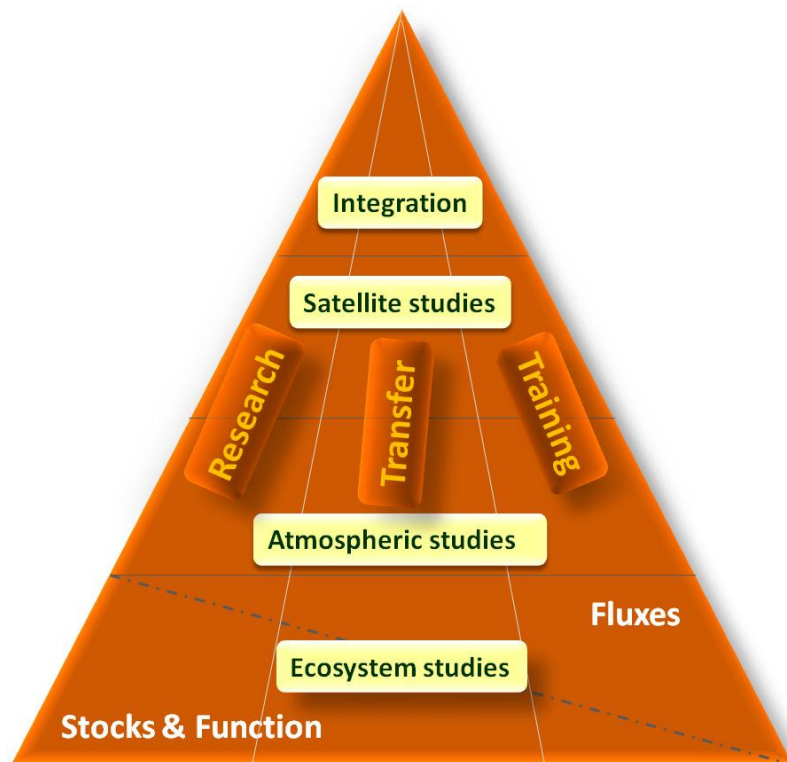


THE PARTNERS & THEIR ROLES

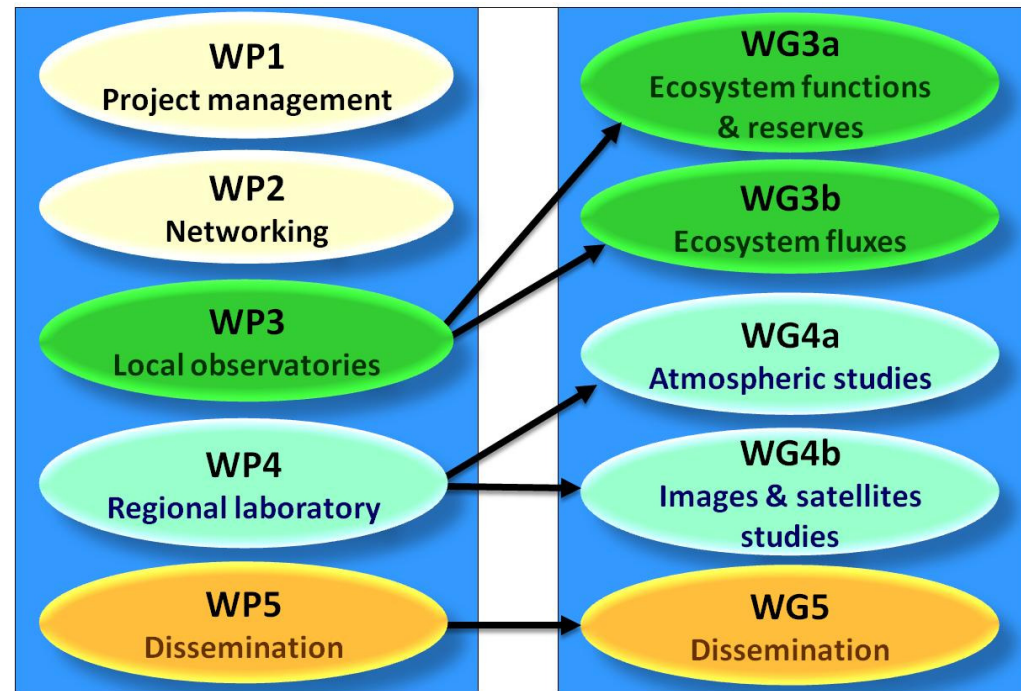


WORK ORGANIZATION

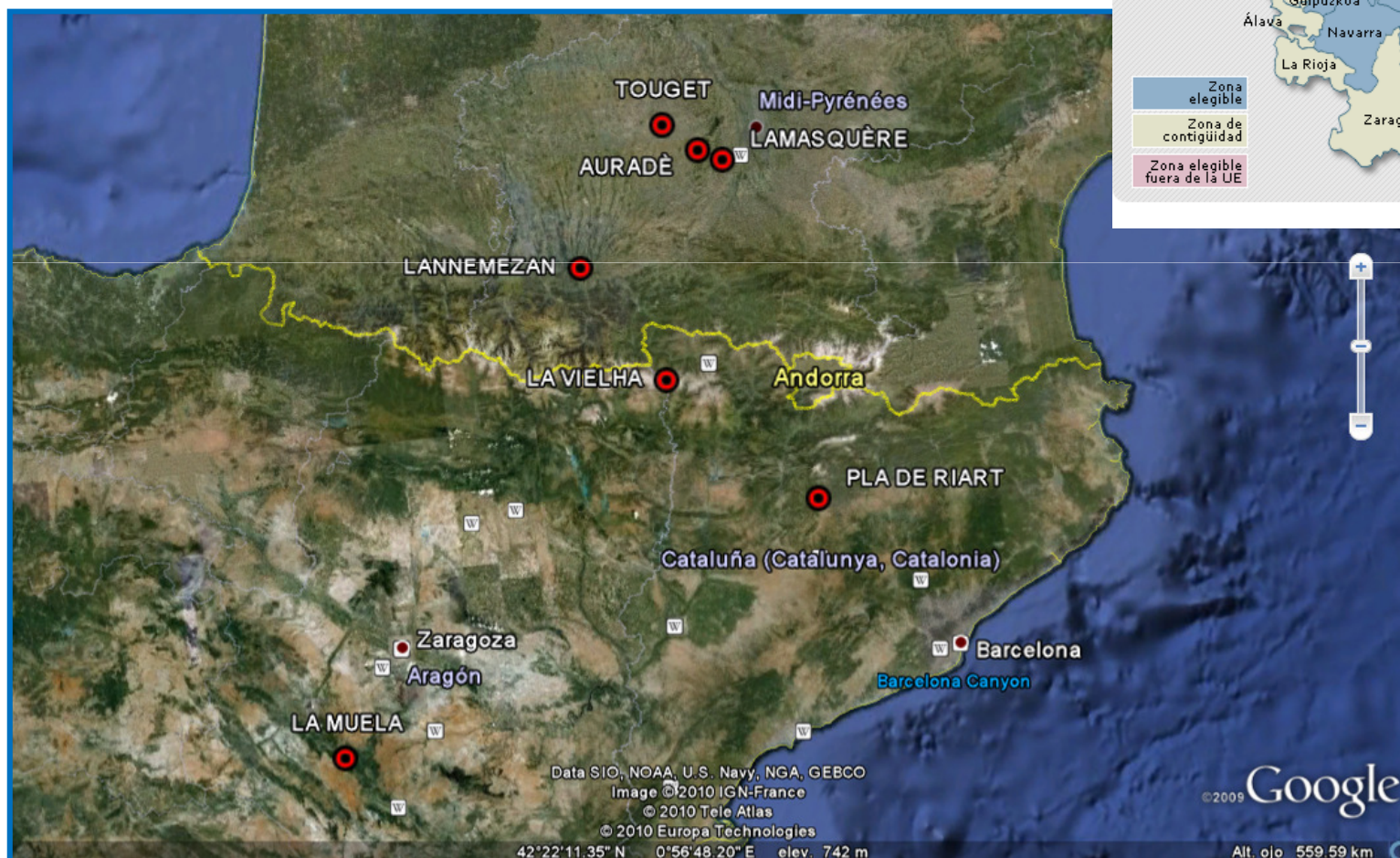
Conceptual Framework



5 Working Groups (WG)



STUDY AREA





SITE NAME	COORDINATES ALTITUDE	ELEVATION	EQUIPMENT & MEASUREMENTS	START	INSTITUTIONS IN CHARGE	PROJECTS
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FLUXPYR stations already operational

AURADÉ (France)	43° 54' 97" N 01° 06' 22" E	243 m asl.	EC mast + meteo	2005	CESBIO	FLUXPYR, CarboEurope IP
LAMASQUÈRE (France)	43° 29' 48" N 1° 14' 15" E	181 m asl.	EC mast + meteo	2005	CESBIO	FLUXPYR, CarboEurope IP
TOUGET (France)	43° 40' 13" N 0° 55' 29" E	155 m asl.	EC mast + meteo	2010	CESBIO	FLUXPYR
LA MUELA (Spain)	41°13'50" N 1°15'00" E	611 m asl.	Tall EC tower + meteo.	2004	IC3	FLUXPYR
VIELHA (Spain)	42° 37' 17" N 0° 45' 57" E	1630 m asl.	CO ₂ sensor + meteo.	2010	CRAM	FLUXPYR

FLUXPYR stations to be installed in 2010

PLA DE RIART (Spain)	42° 03' 8" N 1°30'48" E	1003 m asl.	EC mast + meteo	May 2010	CTFC – UPC	FLUXPYR
LANNEMEZAN (France)	43°07'40" N 0°21'55" E	590 m asl.	EC mast + meteo + Tall Tower	2010	LA, CESBIO	FLUXPYR
Location to be determined		1300 m ?	EC mast + meteo	2010	CTFC, UPC	FLUXPYR
CASTELLAR DE N' HUG (Spain)		2000 m asl.	EC mast + meteo	2010	CTFC, UPC	FLUXPYR

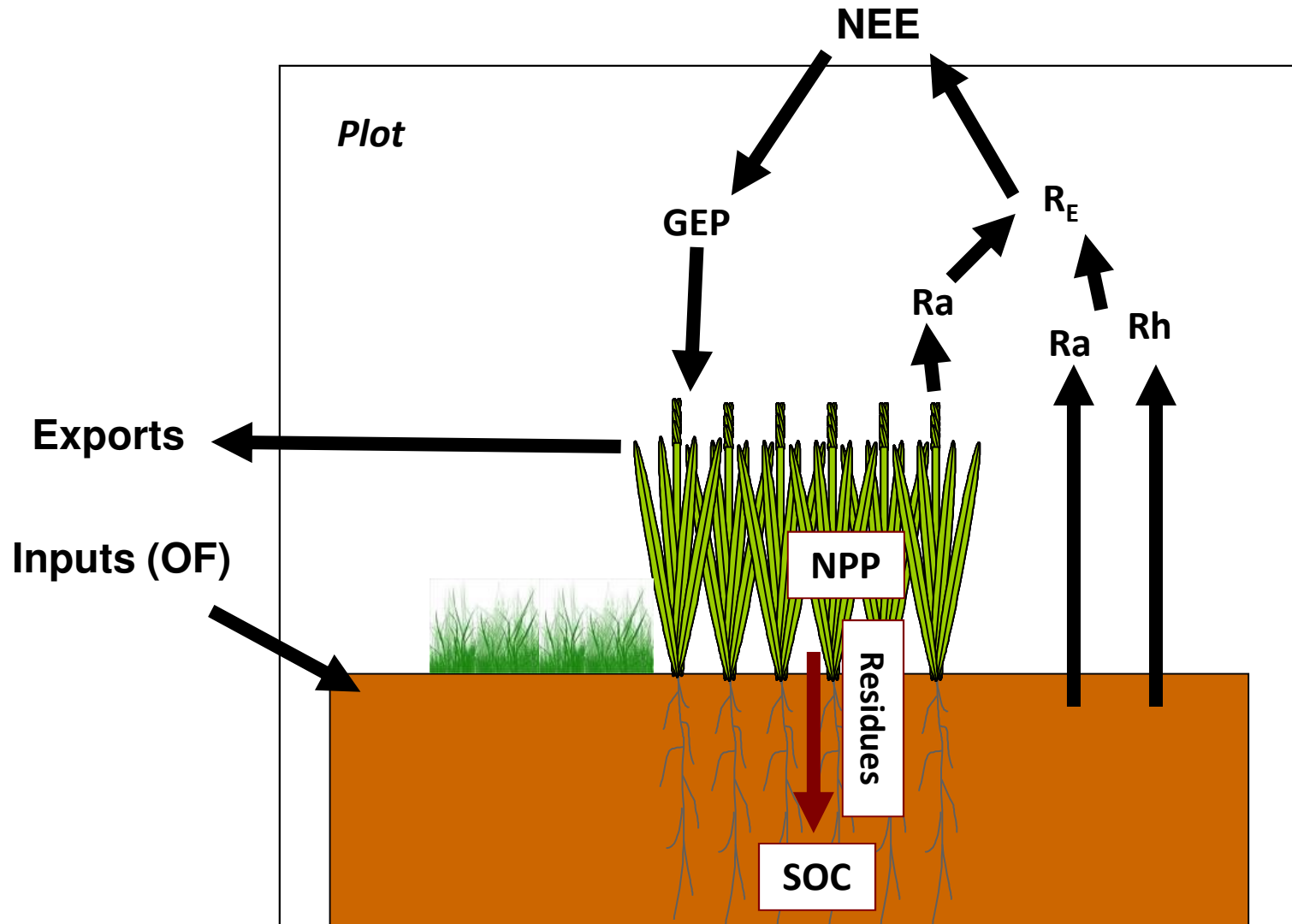
Associated Sites

CASTELLNOU D'OSSO (SPAIN)	41°45'53" N 1°08'35" E	355 m asl.	Ecological surveys, Lysimeters, GHGs	2009	CTFC	OPS
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Carbon budget

NEP = annual Σ of NEE



$$dSWC = P(+I) - ETR - R - D$$

ETR : Evapotranspiration

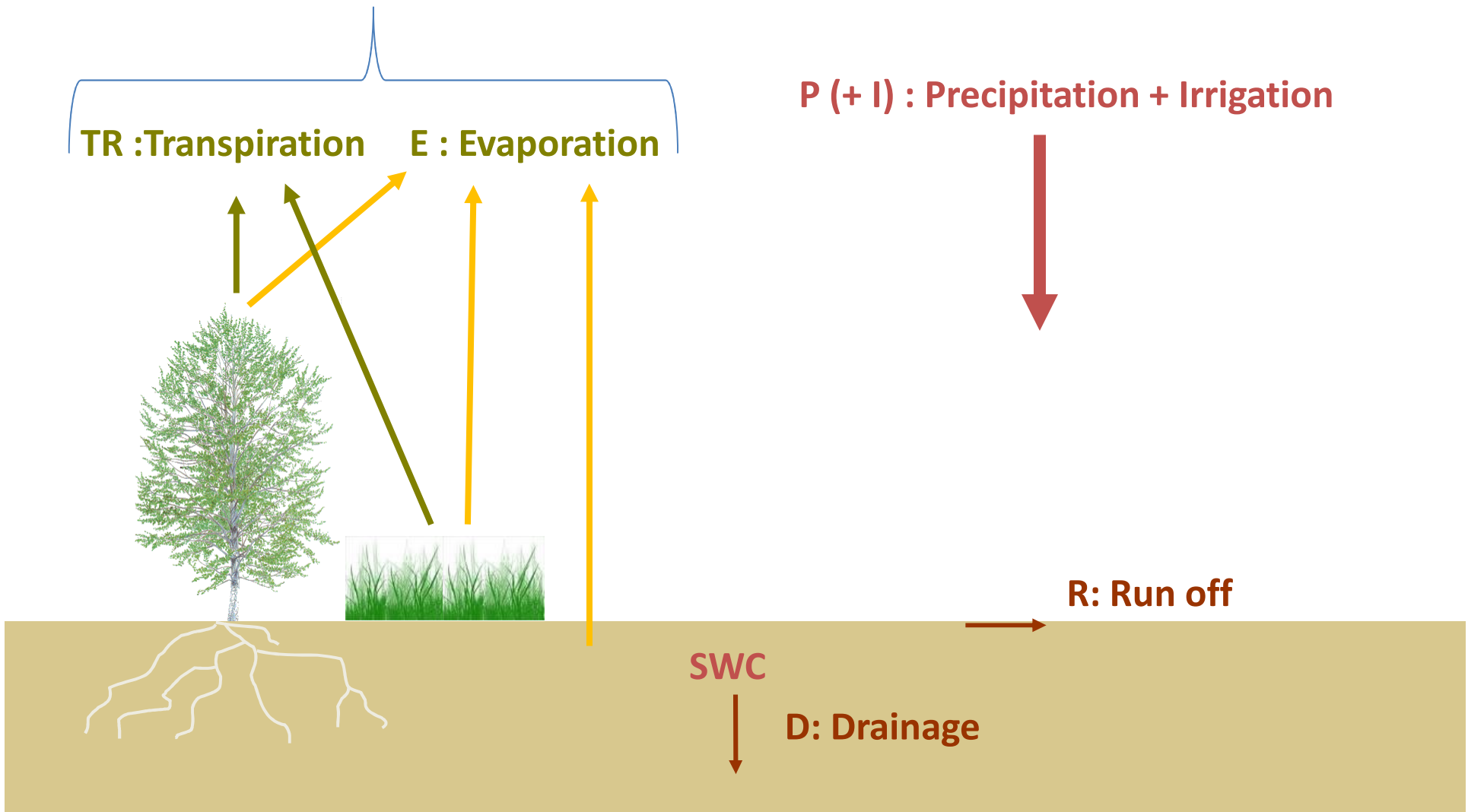
TR : Transpiration E : Evaporation

P (+ I) : Precipitation + Irrigation

R: Run off

SWC

D: Drainage



METHODS AND INSTRUMENTATION

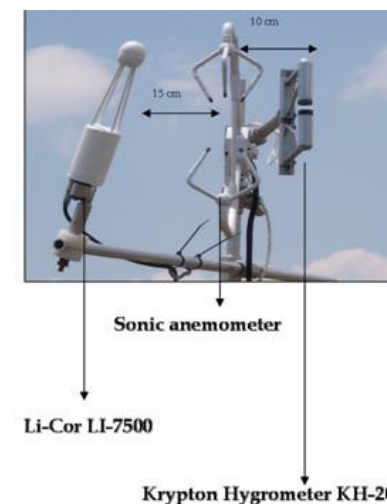
Flux studies....



Lamasquère, France
(micro-meteorological mast)



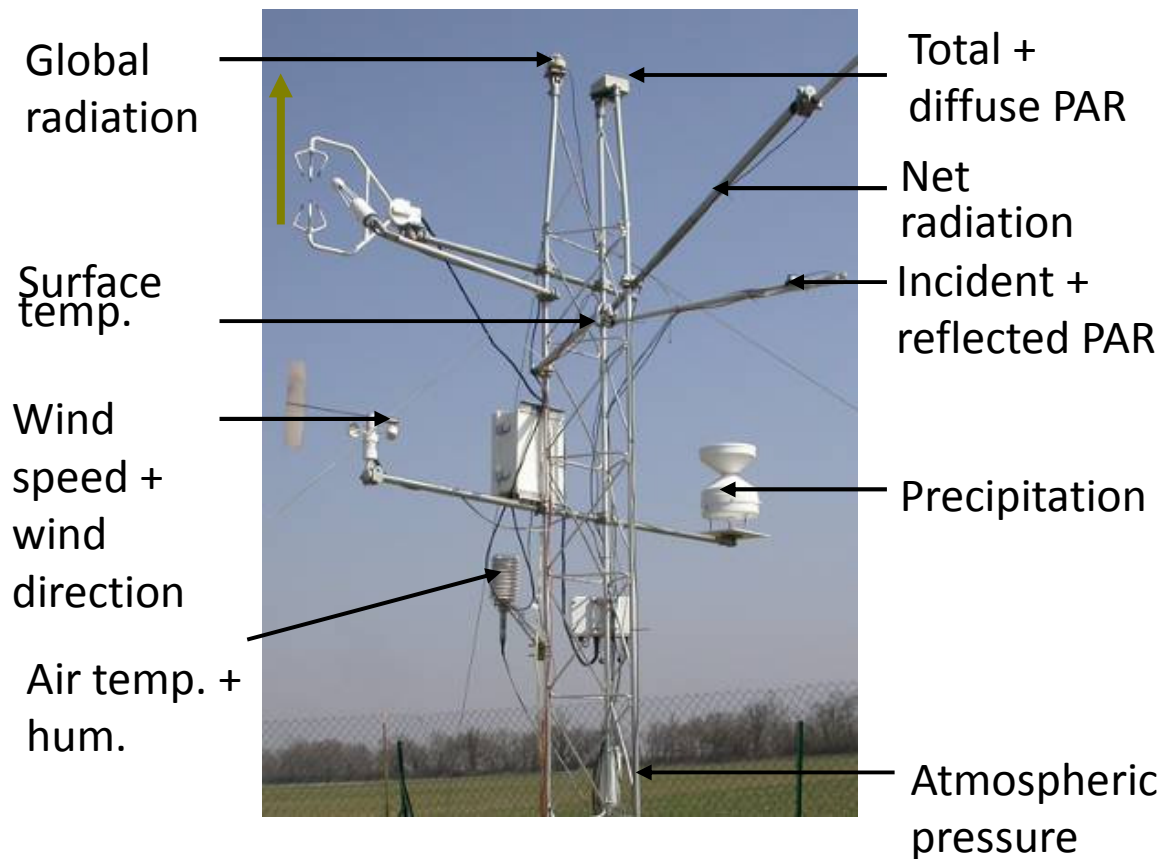
Lannemezan, France



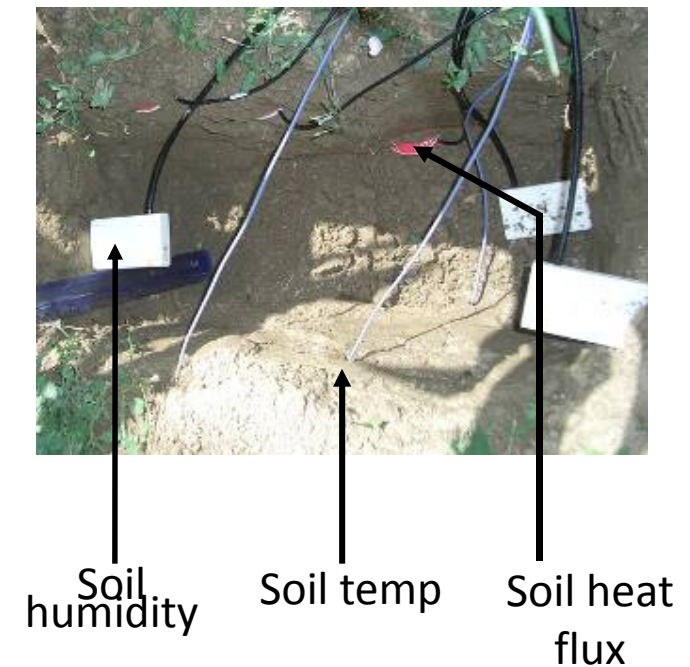
Eddy Covariance Equipment: Datalogger (CRx), 3D sonic anemometer, temperature & relative humidity sensors, finewire thermocouple, CO₂-H₂O analyser (IRGA), batteries, solar panels (others: raingauge, PAR, soil temperature/water content/resp., etc.)

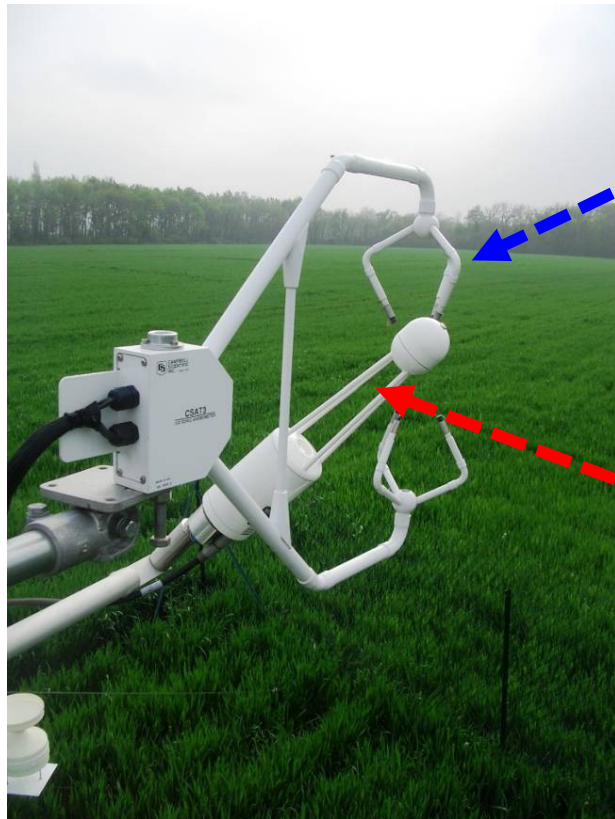
Meteorological measurements

Aboveground



Belowground





Sonic anemometer (u, v, w, Ta)

Infra red gaz analyser (CO₂, H₂O)

(Li7500 ; measurements at 20 Hz)

Correct positionning of the Li7500 is essentiel to reduce the
« Burba » effect and spectral corrections

Soil Water Content (SWC)

EC fluxes analyses : stomata closure & soil resp. depend on SWC



Time Domain Reflectometer

Theta Probe



Respiration & photosynthesis...



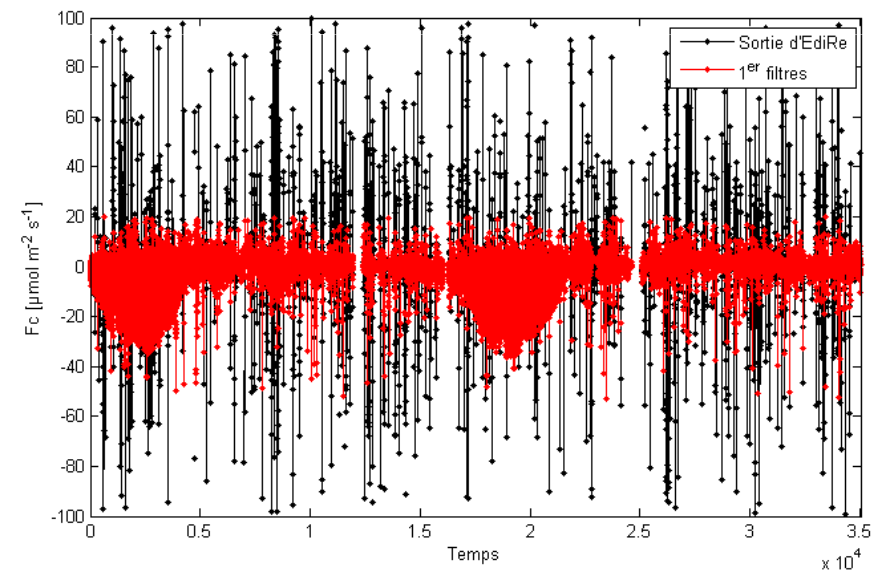
Overview of the data processing chain

1. Calculation of the flux

Rotations; Calculation of the lag; Calculation of the covariances; Spectral corrections (Moore); Density corrections (Webb) (*Aubinet et al., 2000, Baldocchi, 2003, Moore, 1986, Webb et al., 1980*)

2. Filtering and quality check

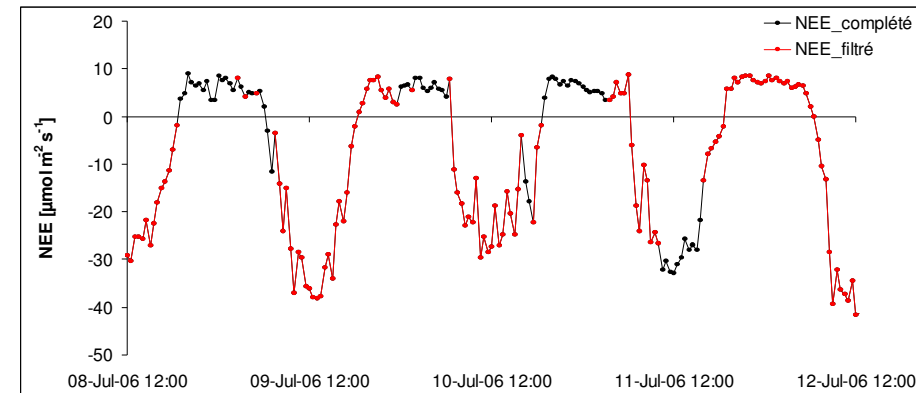
Comparison with meteo data; Statistical filtering ; Spatial representativity (footprint); Stability; Stationnarity



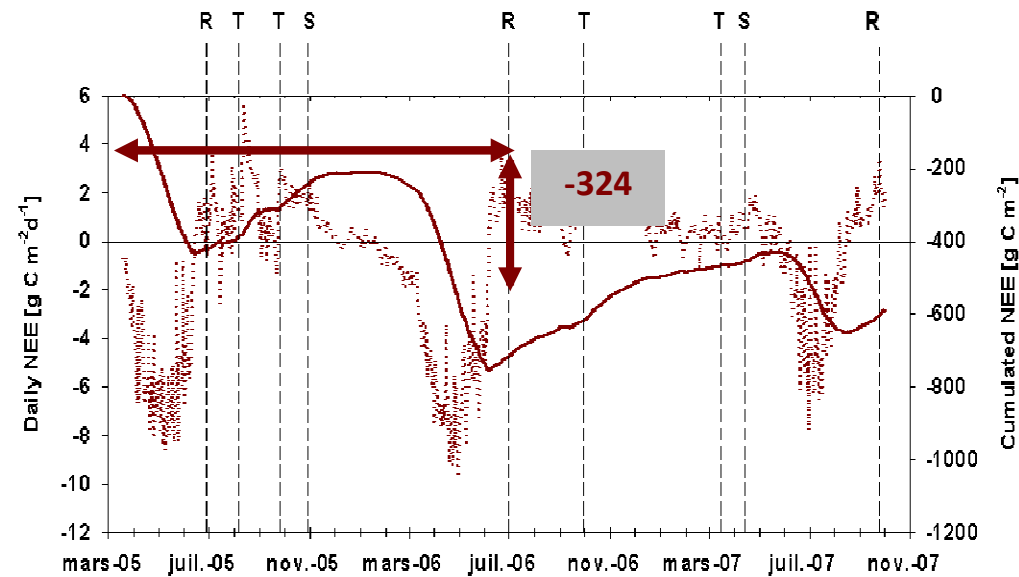
(*Aubinet et al., 2000, Foken and Wichura, 1996, Papale et al., 2006*)

3. Gapfilling

Linear interpolation; regressions;
look up table; mean diurnal
variations

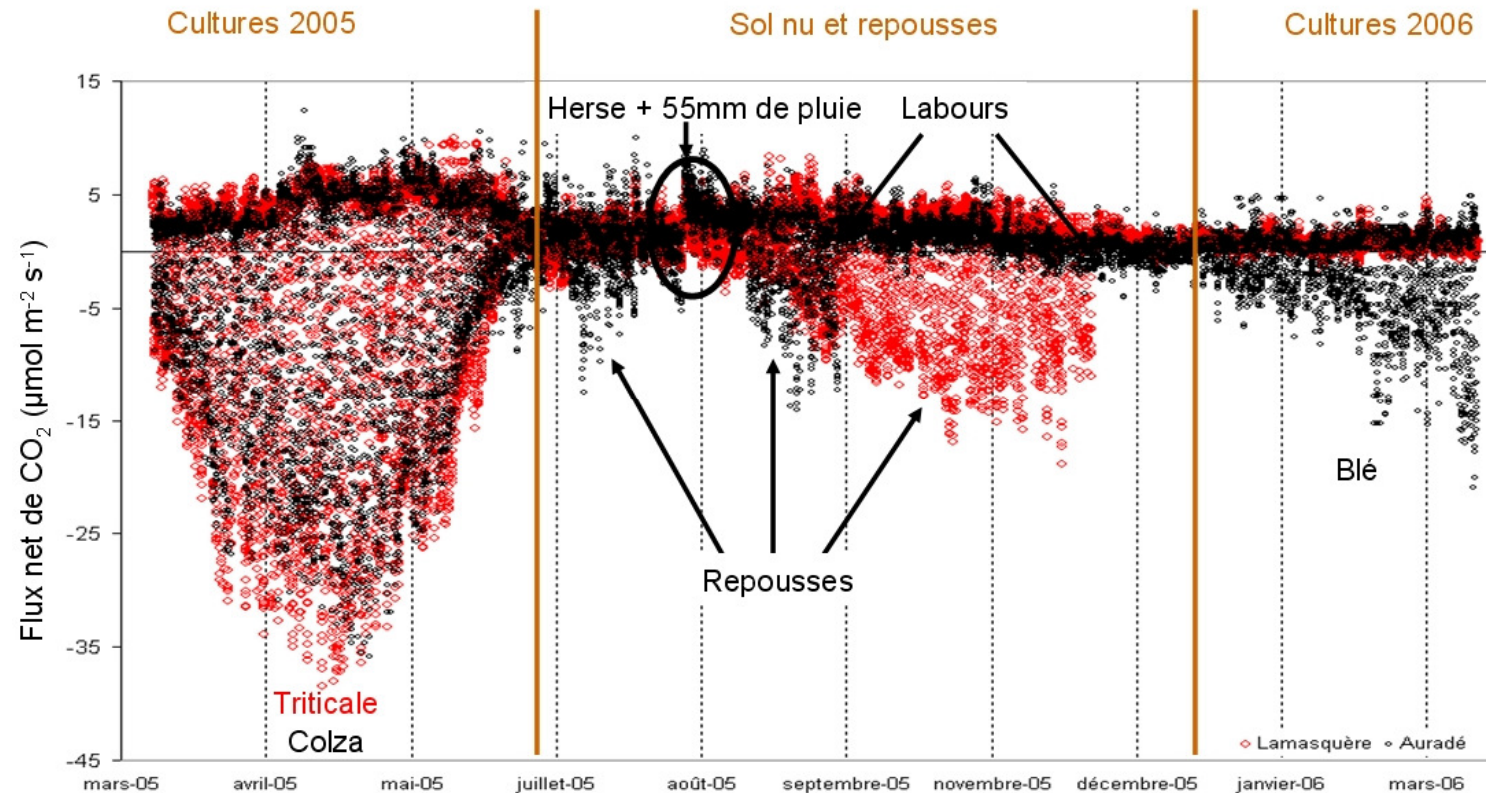


(Aubinet et al., 2000, Foken and Wichura, 1996,
Papale et al., 2006)



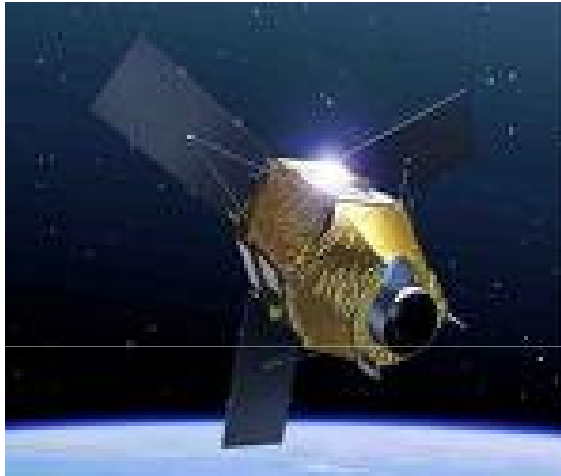
(Falge et al., 2001, Reichstein et al., 2005)

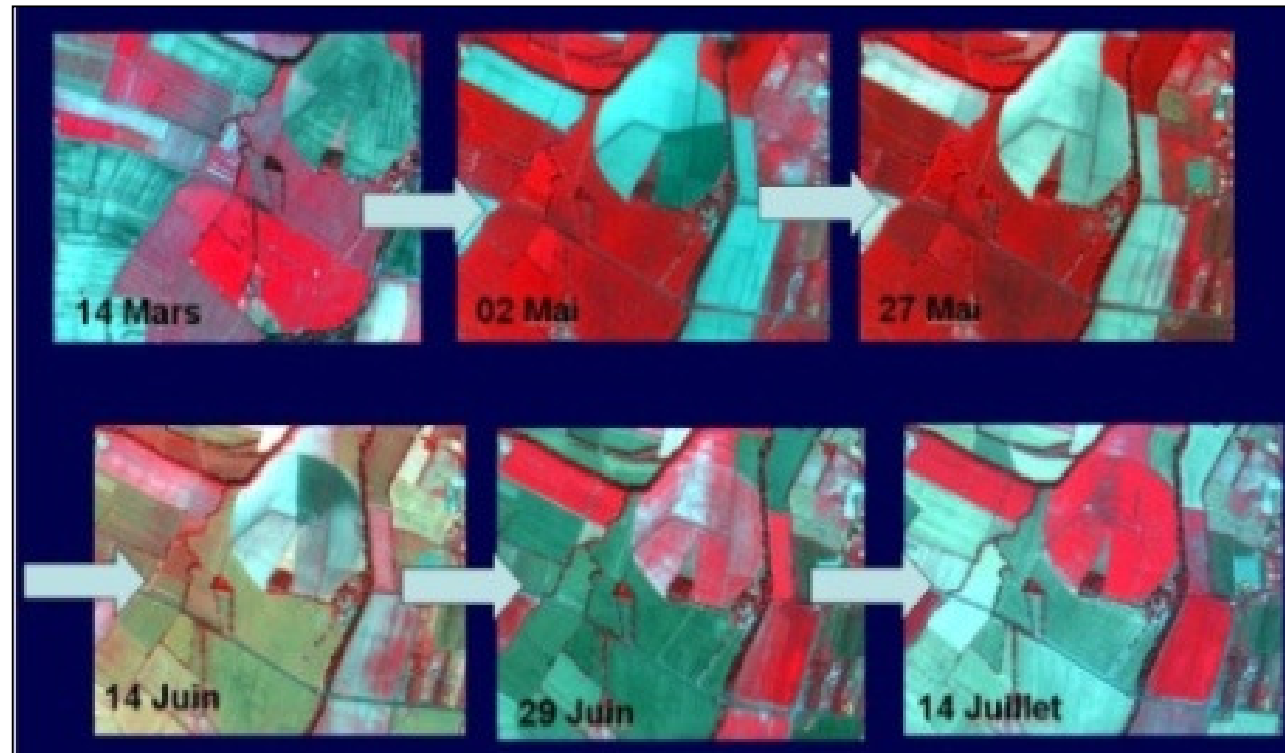
RESULTS - PRODUCTS



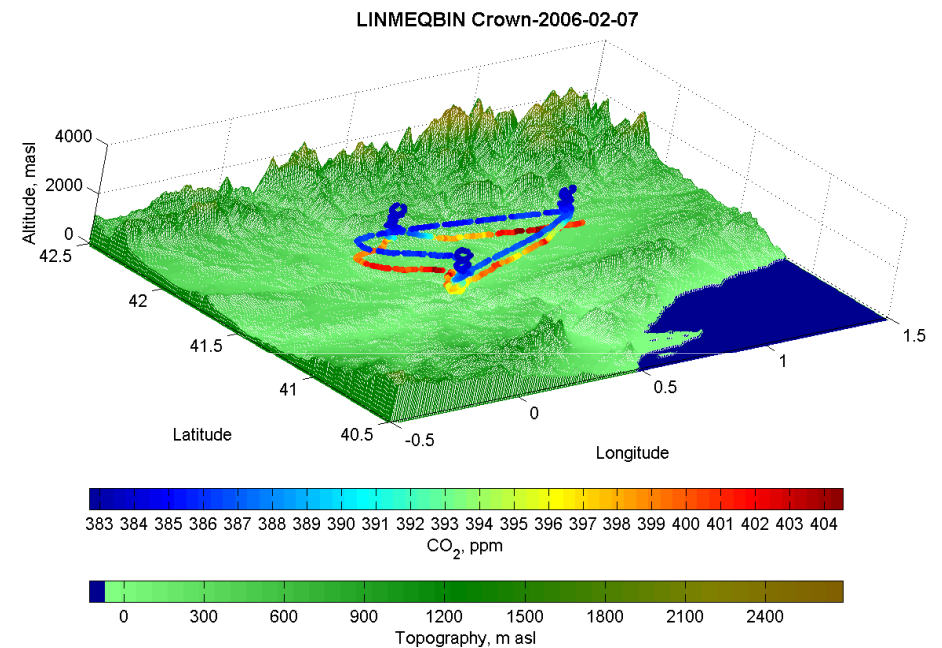
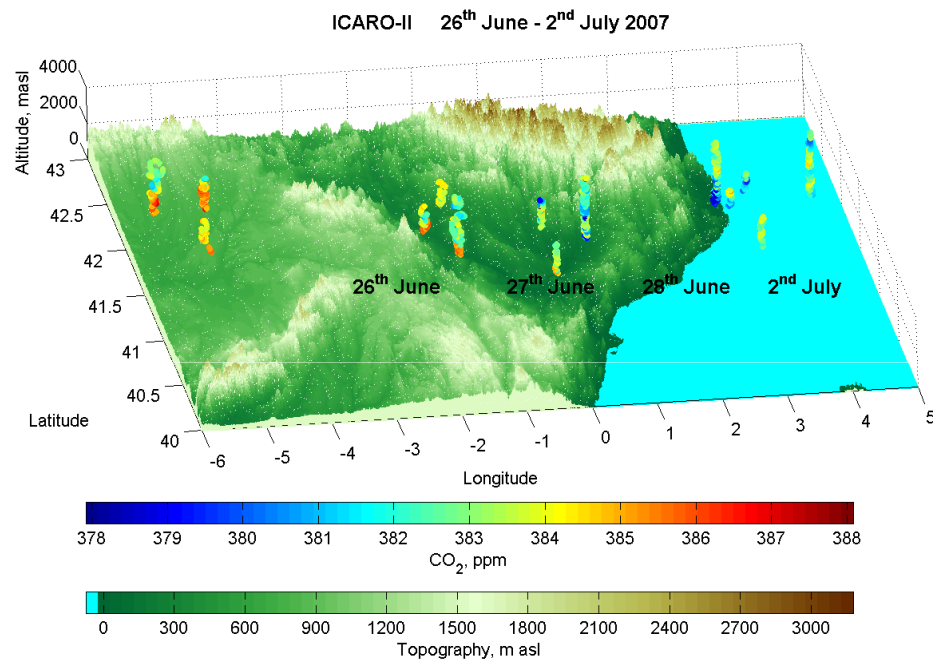
Fluctuations in net CO₂ fluxes at 2 agricultural sites near Toulouse (Auradé=black, Lamasquère=red). Values <0 = CO₂ absorption (day, full cover); Values >0 = net CO₂ emission (no cover or respiration>photosynthesis). The effects of farming practices (e.g. ploughing) are visible.

Earth Observation / Remote Sensing

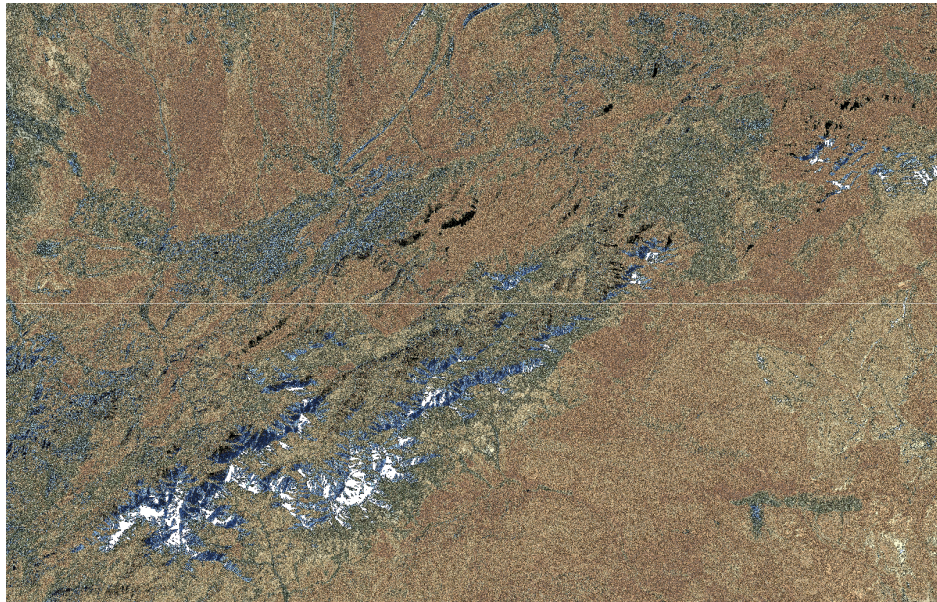




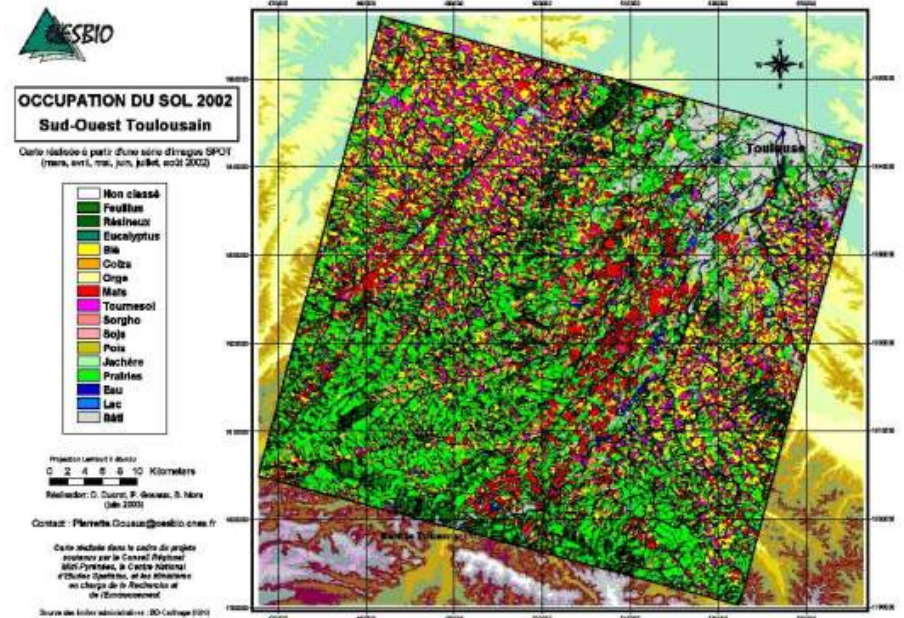
Series of satellite images (Formosat – near IR, red green false-colour images) illustrating the evolution of the photosynthetic activity of the vegetation (red) in an agricultural area near Toulouse in 2006



Vertical profiles (left) and transects (right) of atmospheric CO₂ obtained from tropospheric flights (high frequency measurements at 0.5-1 Hz) (Valle del Duero, Valle del Ebro and coast of Girona)



Snow cover map



Land cover map



Several difficulties....

- 1) Short-scale Project (time for installation, data collection, analysis, etc.).
- 2) Budget has been cut down → initial objectives & HRs had to be reduced.
- 3) Many partners with different objectives and priorities → Need to stimulate the collaboration, work in the same direction, share data and knowledge, and ensure CONTINUITY.



FLUXPYR provides...

- ❖ **A trans-border macro-infrastructure of excellence covering a larger area of the Pyrenees.**
- ❖ **A solid network of experts in climate change, ecology and remote sensing based on innovative networking and cooperation techniques.**
- ❖ **Innovative technologies, protocols, databases and models.**
- ❖ **Predictive maps: land use, productivity, carbon distribution, snow cover, avalanche hazard + Scenarios.**
- ❖ **Transfer of tools, methods, models, experience and training of technicians, young researchers & students.**
- ❖ **Practical implications for agro-ecosystem management and guidance for environmental policies (mitigation & adaptation strategies).**



THANKS FOR YOUR
ATTENTION !

QUESTIONS ?

CONTACTS

The FLUXPYR webpage will open very soon !
(www.fluxpyr.eu)



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FLUXPYR (2009-2012): New cross -border network for the assessment and management of water, carbon and energy fluxes under climate and land-use change conditions in agricultural and grassland ecosystems in the Pyrenees .

(Interreg IV-A Project; Acronym: EFA 34/08 - FLUXPYR)





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