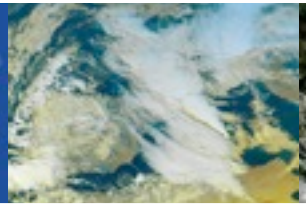
WG5
Social vulnerability and adaptive capacity

I. Ruin, C. Lutoff & C. Llassat

With contributions from H. Hoff, D. Saurí, F. Vinet, O. Petrucci, M. Llasat-Botija, A. Chanzy, M. Grimalt

Bologna meeting, June 8-10

HyMeX





Hydrological continental cycle

Heavy Precipitation
Flash-flooding

1- Monitor and analyze the evolution of social and ecological vulnerability to deficit and exceedance of water

2- Observe social ability to cope with short-fuse and slow rise weather-related events

Water budget
of the
Mediterranean

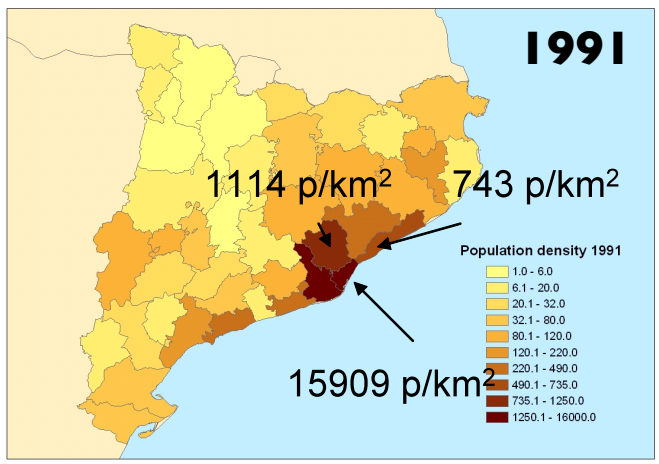

Flash floods

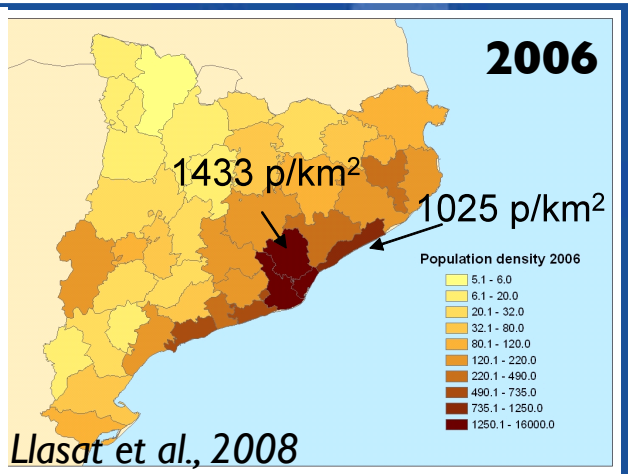

Drought

Event | Seasonal | Annual | Century

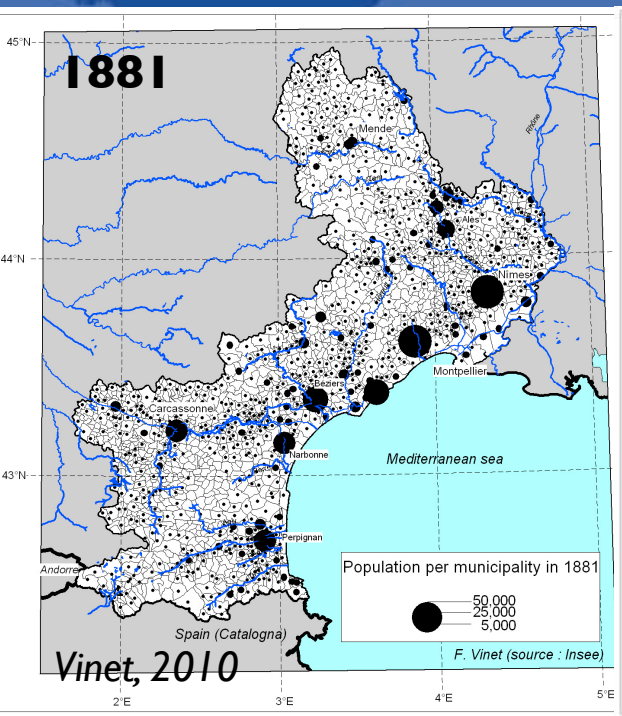
Motivation : Increasing human exposure

Evolution of population in Catalonia (people/km²) and Languedoc-Roussillon

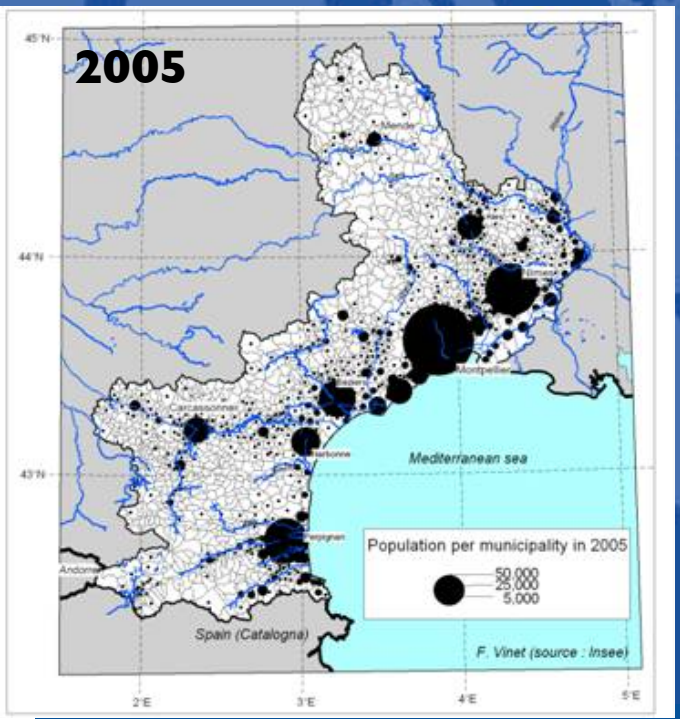




Llasat et al., 2008



Vinet, 2010



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Motivation : High social and economical impacts of extreme weather

175 flood events between 1990 and 2006

Llasat et al., 2010

Main economical damages in northern countries:

➡ about 30,000 millions euros mainly in Italy, France, Romania, Turkey and Spain

Human losses mainly in southern mediterranean countries

➡ 4,500 casualties mainly in Algeria, Morocco, Egypt and Italy

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HyMeX

Key questions

- What methods, indicators and sensors may be used to monitor short-term and long-term adaptation strategies at various space scales and for different cultural contexts?

- What lessons can be learnt from the experience of different societies and individuals to better cope with climate change and hydrometeorological extreme events around the Mediterranean Sea?

- How can we make these lessons beneficial and relevant for all Mediterranean communities?

- How can we define plausible scenarios (land use, economy,...) to quantify the impact of global change on the Mediterranean hydrological cycle and extremes?

- How is vulnerability of humans and ecosystems going to change under future global change?

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Program strategy

Monitoring vulnerability factors and adaptive capacity

- **Long-term Observation Period: LOP 2011-20**
  - Monitor vulnerability factors in space and time
- **Enhanced Observation Period: EOP 2011-14**
  - Learn from interdisciplinary post-event investigation
  - Observe social ability to cope with intense weather events at various scales

LOP (1): Build a comprehensive database of flood impacts

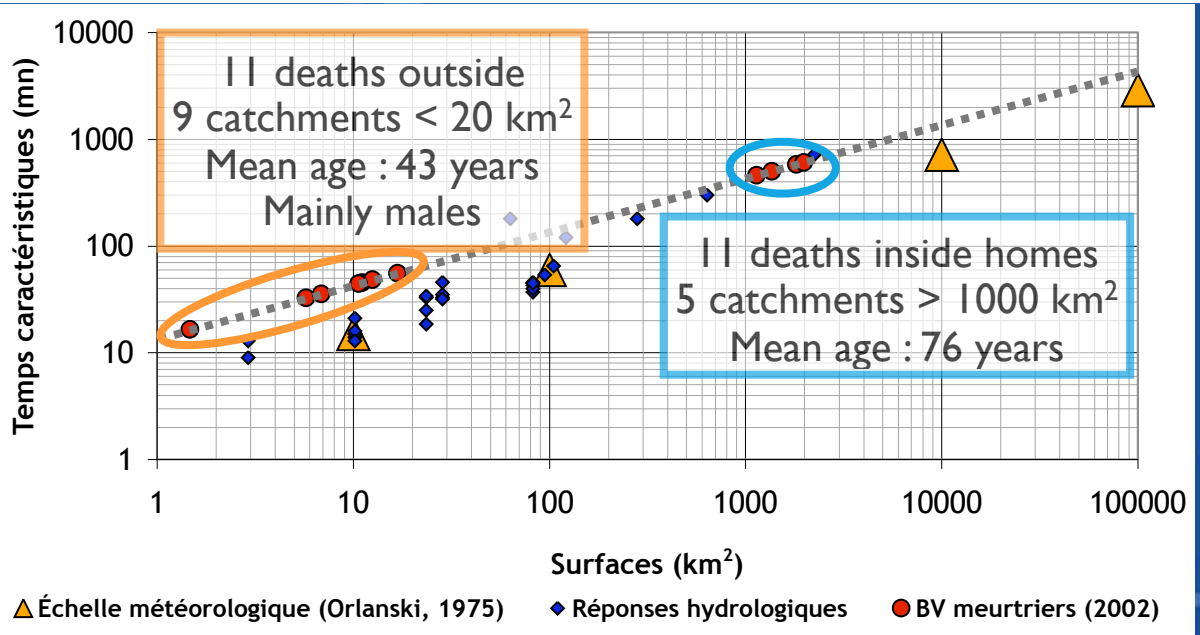
Objectives

- Study the relationship between socio-economic and ecological impacts and the hydro-meteorological event's characteristics
- Create a loss of life model in extreme events

Observation and data collection

- Time and location of fatalities and injuries VS # of people exposed
- Circumstances of the accidents : activity of the victims, timing of the warnings, hydro-meteorological parameters
- Socio-demographic characteristics of the victim : age, gender, place of residence, marital status, professional activity…
- Quantify economic losses and impacts on ecosystem services
- Document social system's perturbations at various scales

LOP: Loss of life circumstances during the september 2002 flash floods in the Gard



Ruin et al., 2008. Journal of Hydrology, vol. 361, 199-213.

Post-event investigation *(Gard, 2002)*

- investigation on circumstances of the accidents
- georeferencing
- calculate watersheds surface area
- Hydro-meteorological simulation (Liquid)

8

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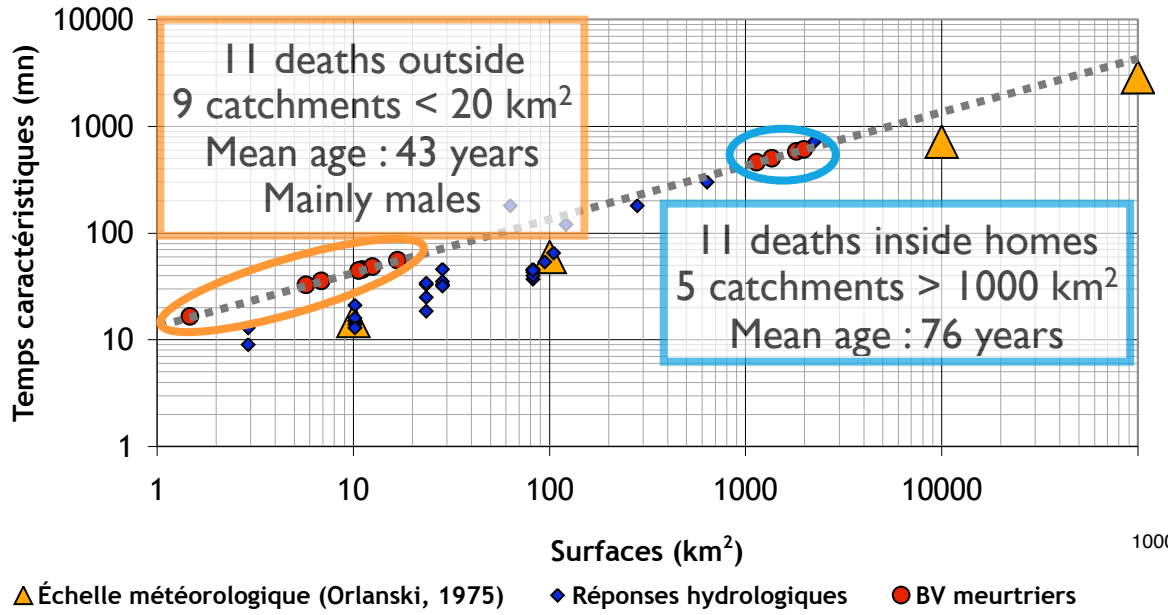

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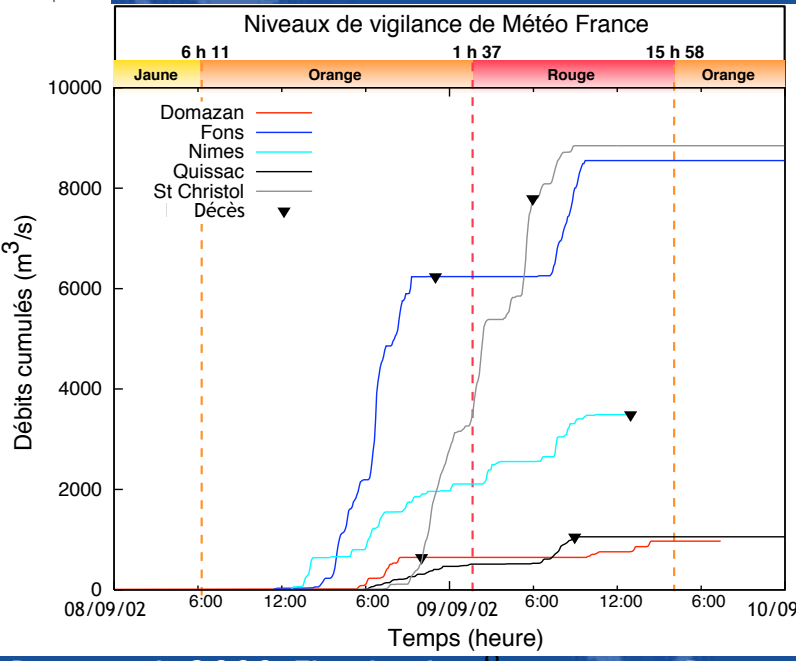
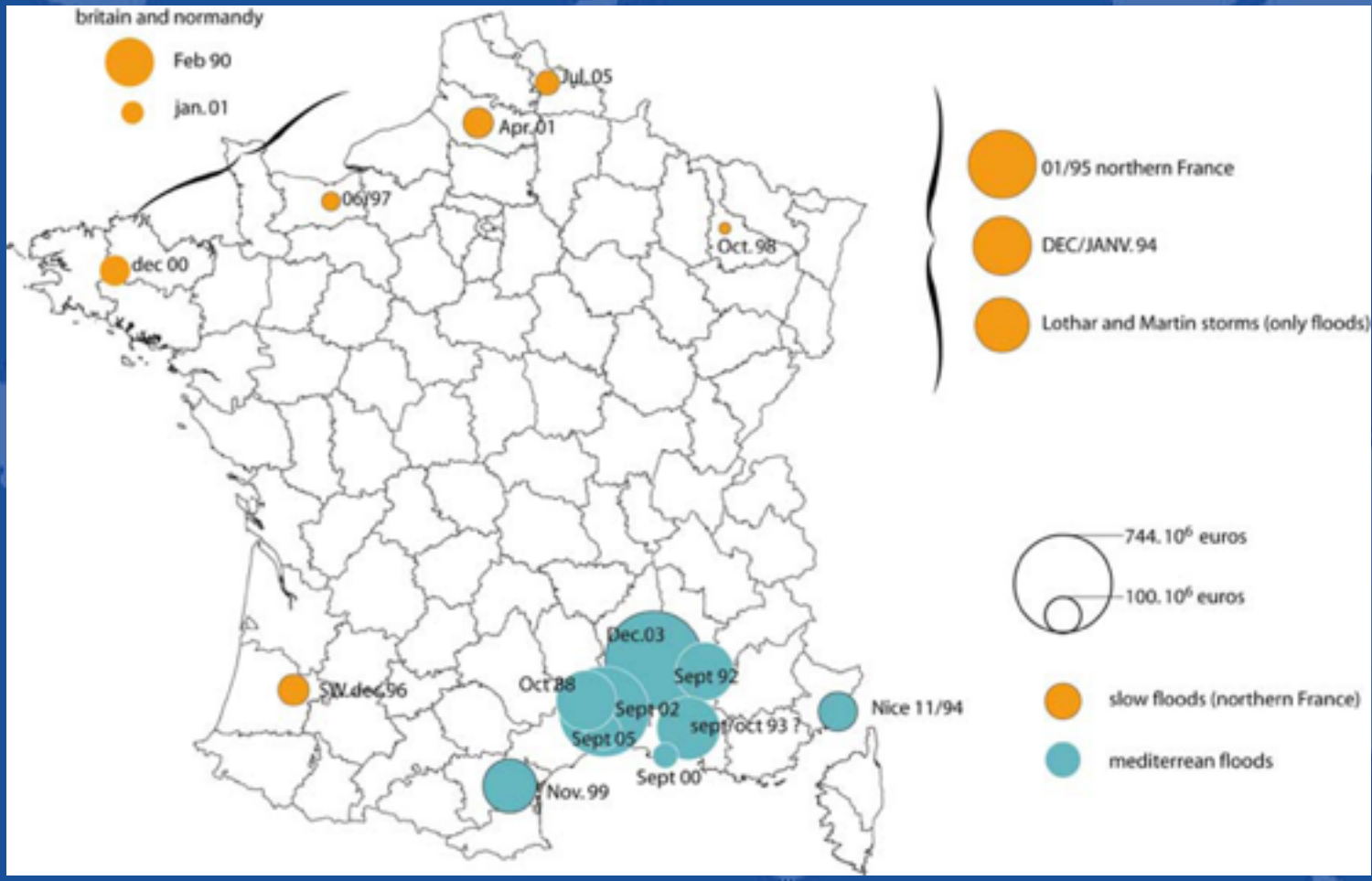


Ruin et al., 2009. Flood risk management: Research and Practice, 1005-1012.

LOP: Monitor economic losses and impacts on ecosystem services

Flood damages on private properties (1983-2005)



Source: CCR - from Vinet, 2007

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LOP: Analysis of the drought impact and ecosystem services

Ecosystem Services (ES): the conditions and processes through which ecosystems sustain and fulfill human life provides a link between humans and the environment :

- food, wood and biofuel production
- carbon sequestration
- climate protection
- protection from floods and other hazards
- water provisioning or purification
- erosion reduction (maintaining soil productivity and preventing siltation of reservoirs e.g.)
- biodiversity

Dry-spell	**Drought**
Occurrence: [2/3 years] Two out of three years	***Occurrence:*** [1/10 years] One year out of ten
Impact: Yield reduction	***Impact:*** Complete crop failure
Cause: Rainfall deficit of 2-5 week periods during crop growth	***Cause:*** Seasonal rainfall below minimum seasonal plant water requirement

Table 3.1. Differences between droughts and dryspells according to Falkenmark *et al.* (2009)

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LOP (2)
Monitor vulnerability factors

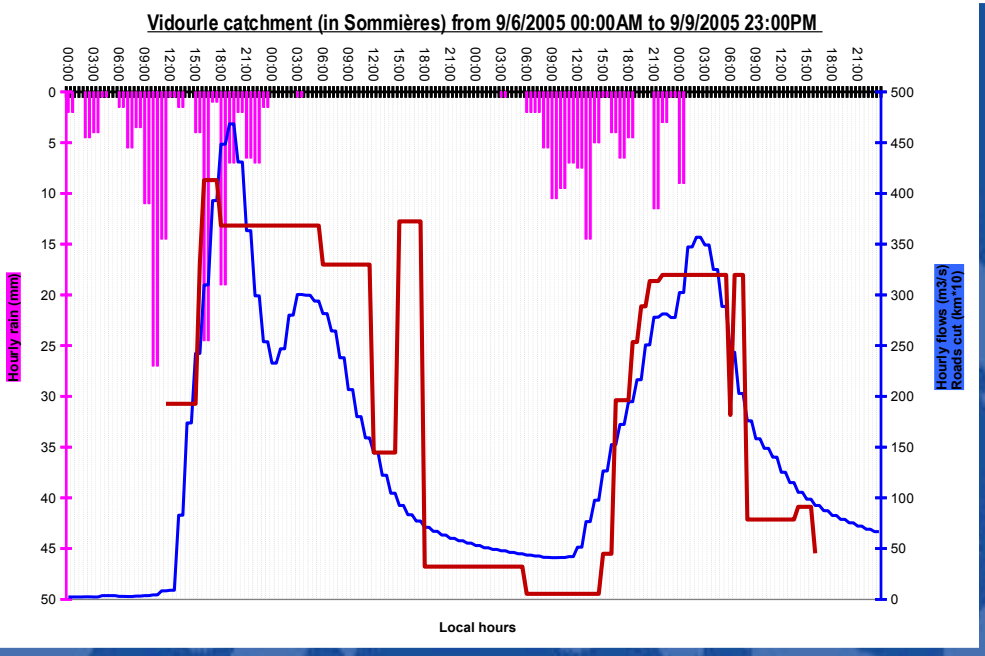
Objective :

- Identify relevant vulnerability factors for water-related issues (water exceedance and deficit) at various scales (local to global)
- Map their evolution at various spatial and temporal scales

Observation and data collection

- Quantify exposure in space and time :
  - Static : infrastructures and people at work or at home
  - Dynamic : people in transit (motorists, pedestrians, transient, outdoorsmen)
- Socio-demographic and economic attributes : age, gender, livelihoods…
- Psycho-socio-cultural factors : Hazard knowledge, risk perception, event history, social norms, values and belief…
- Public policy and risk management : prevention and crisis management measures and practices

LOP: Monitor dynamic exposure through traffic flow



Relation between peak flow and roads cut in the Vidourle catchment during the 2005 event

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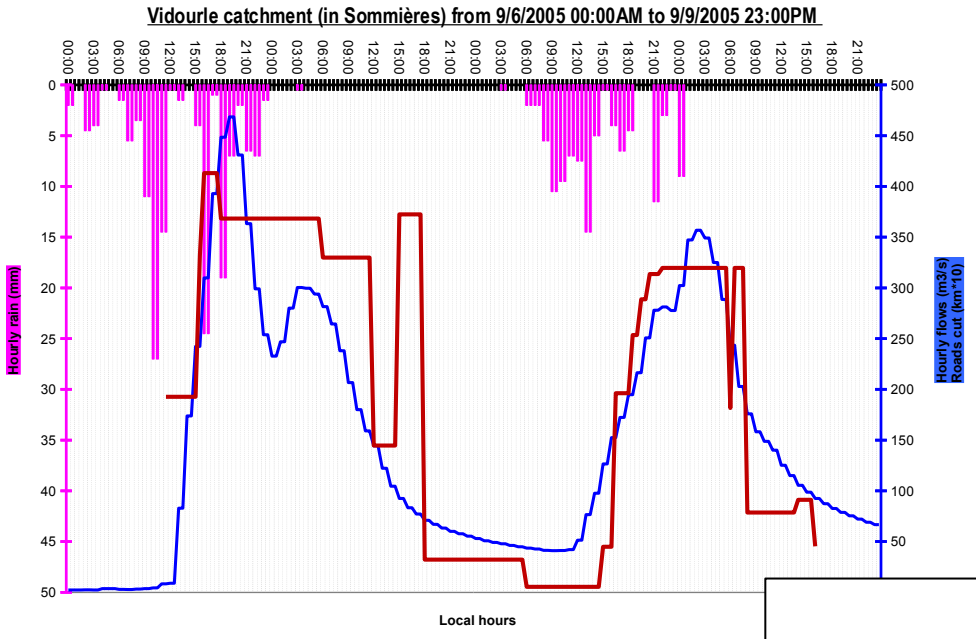

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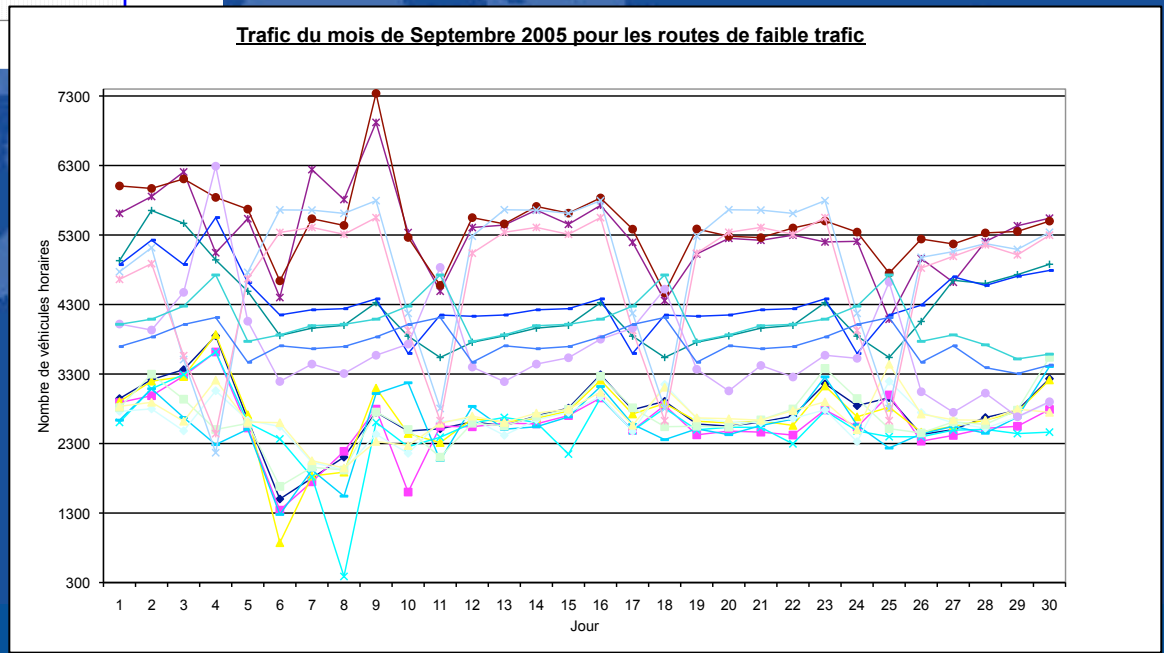
Monthly roads traffic in the Gard department



EOP: Learn from interdisciplinary post-event investigation

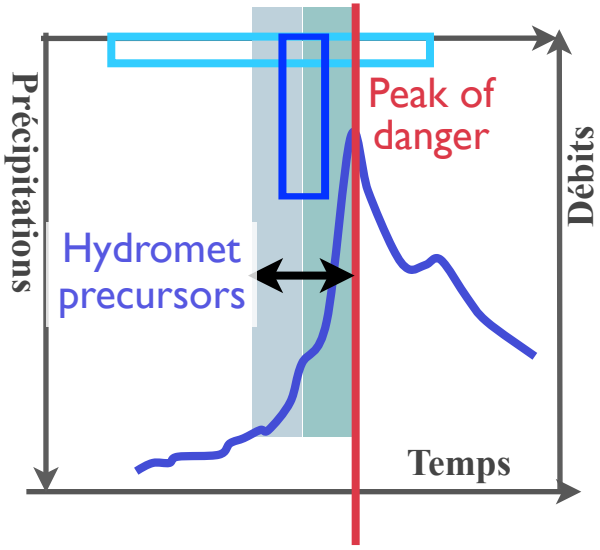
Objective:

- Observe social ability to cope with intense weather events

Methods and data collection

- Identify quantitative and qualitative indices of social perturbation / adaptation within informal social networks and official systems
- Identify the social entities who are able to organize themselves to cope with the event
- Document the location, nature and timing of their reaction and compare them to the local dynamic of the event
- **Data**: media reports, crisis logbooks, Web 2.0, internal emails, web server logs, post-event interviews…

EOP: Post event data collection strategy



Time of the Hydro-meteorological precursors

= Time lag between the beginning of heavy rainfall and the peak discharge

= physical time maximum available for reaction

= vary with the surface of the catchment (BV)

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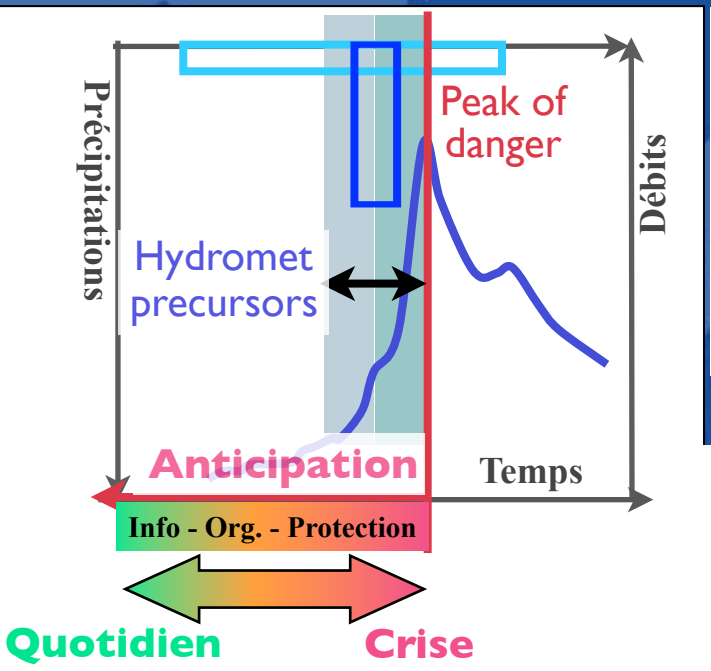
EOP: Post event data collection strategy



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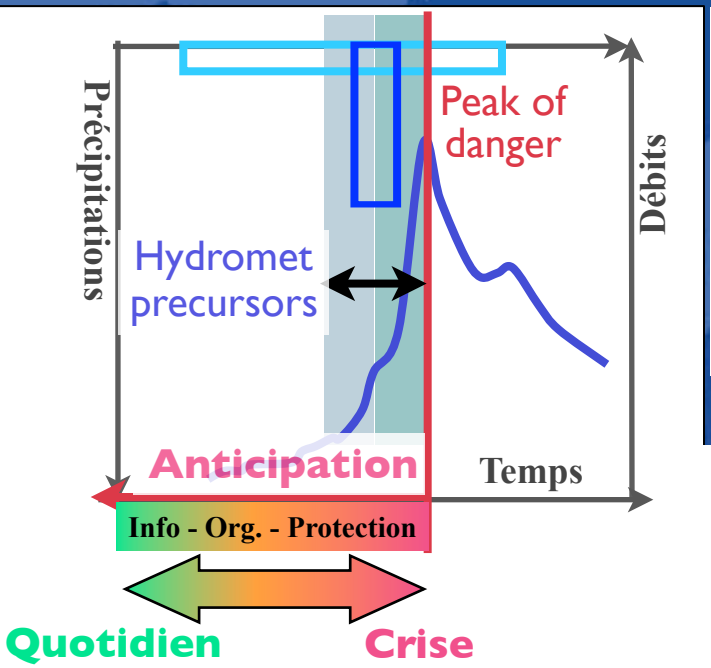

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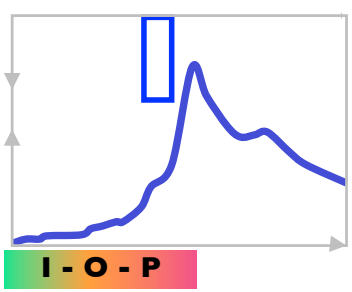

Observation unit = 1 transition event between daily routine and crisis

- a group of individuals who organize themselves to cope with the crisis
- a unit of IOP activities

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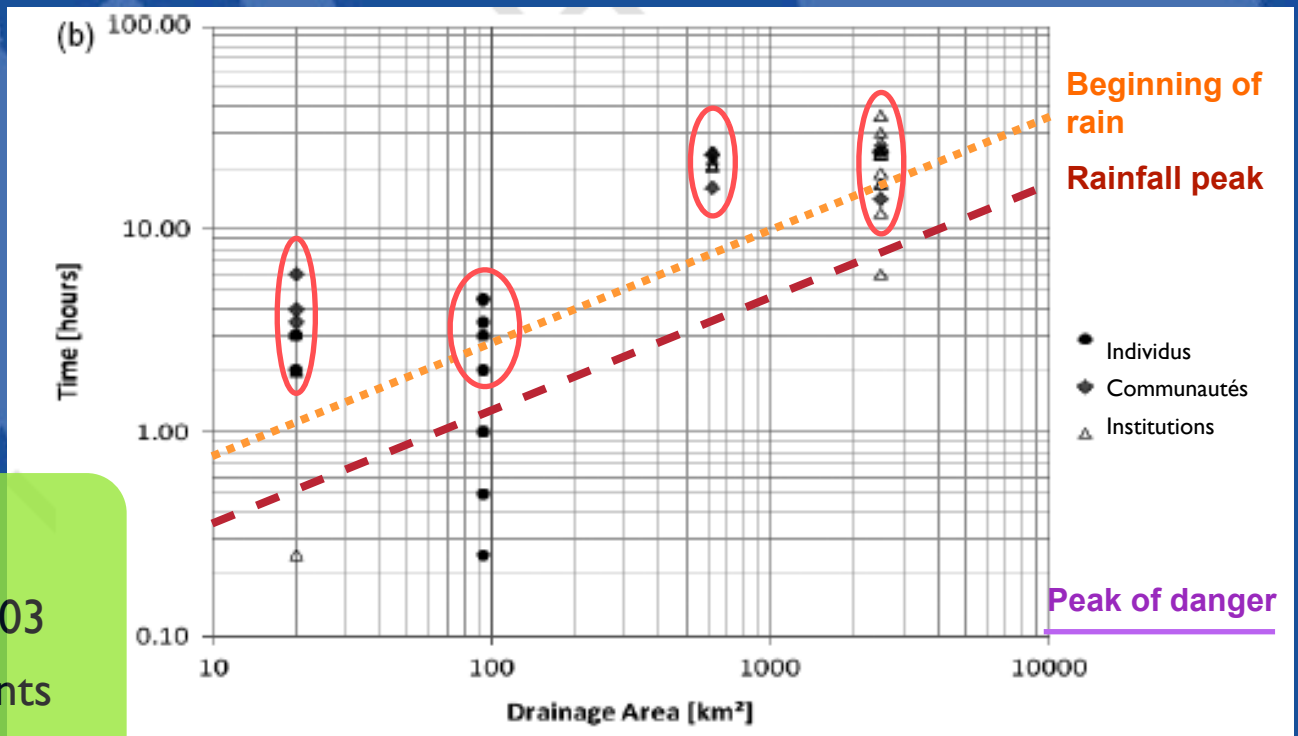
EOP: Compare social anticipation time across events

The coupling of social and physical response scales



Creutin et al., 2009 - Meteorological Applications, vol. 16, 115-125

Re-analyze

- Gard 2002 ; Fella (Italie) 2003
- 4 municipalities in catchments of various surfaces
- 43 actions at individual, community and institutional scales

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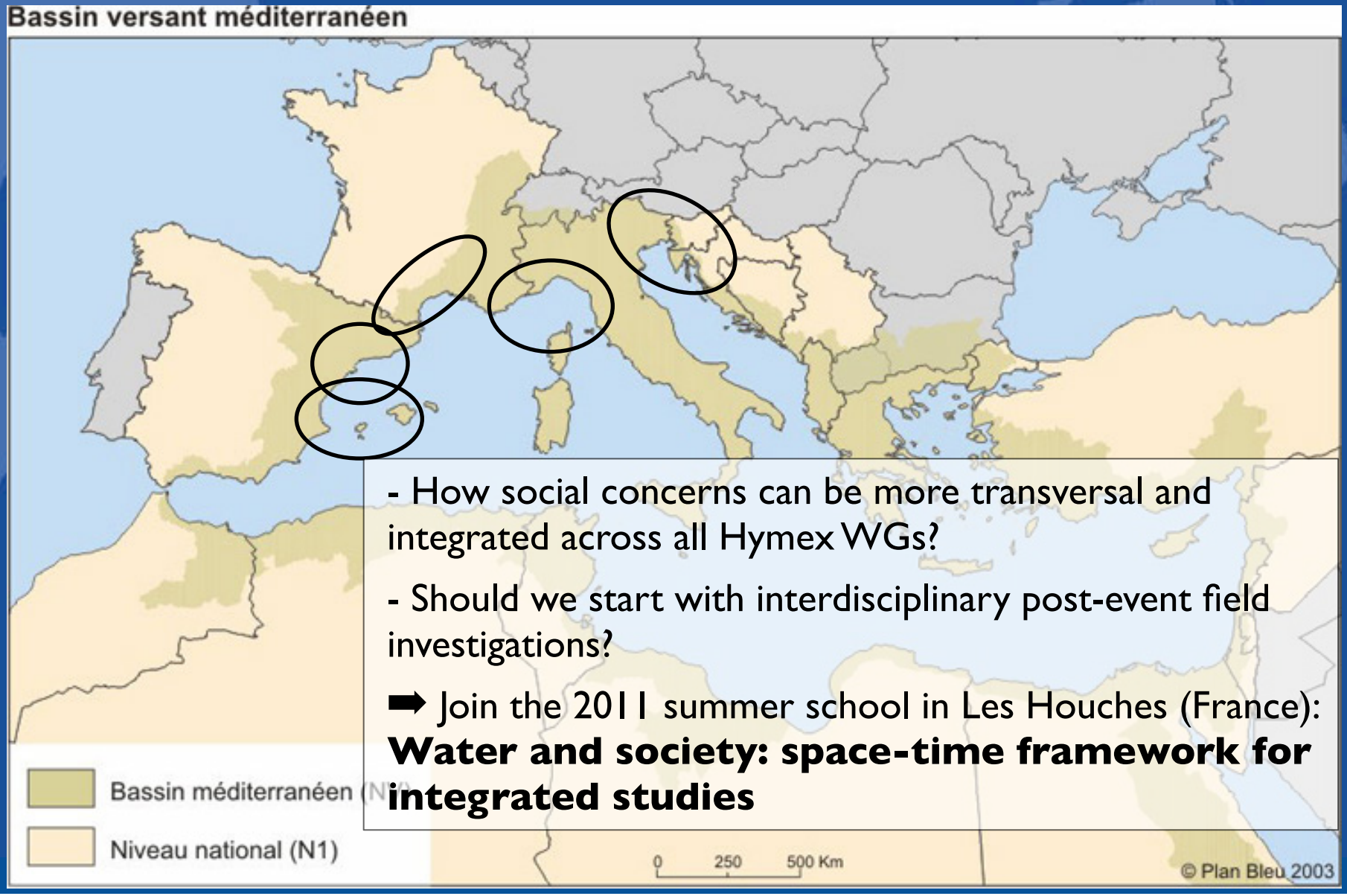
Enhance the synergy with hydro-meteorological pilot sites



- How social concerns can be more transversal and integrated across all Hymex WGs?

- Should we start with interdisciplinary post-event field investigations?

➡ Join the 2011 summer school in Les Houches (France): **Water and society: space-time framework for integrated studies**