WG5
Social vulnerability and adaptive capacity

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

Bologna meeting, June 8-10
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
Evolution of population in Catalonia (people/km²) and Languedoc-Roussillon

Motivation: Increasing human exposure

Vinet, 2010

Llasat et al., 2008
Motivation: High social and economical impacts of extreme weather

175 flood events between 1990 and 2006

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

Llasat et al., 2010
• 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?
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
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 (I): Build a comprehensive database of flood impacts
LOP: Loss of life circumstances during the September 2002 flash floods in the Gard

- 11 deaths inside homes
  - 5 catchments > 1000 km$^2$
  - Mean age: 76 years
  - Mainly males

- 11 deaths outside
  - 9 catchments < 20 km$^2$
  - Mean age: 43 years
  - Mainly males


Post-event investigation (Gard, 2002)
- investigation on circumstances of the accidents
- georeferencing
- calculate watersheds surface area
- Hydro-meteorological simulation (Liquid)
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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
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

<table>
<thead>
<tr>
<th>Dry-spell</th>
<th>Drought</th>
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<tbody>
<tr>
<td><strong>Occurrence:</strong> 2/3 years Two out of three years</td>
<td><strong>Occurrence:</strong> 1/10 years One year out of ten</td>
</tr>
<tr>
<td><strong>Impact:</strong> Yield reduction</td>
<td><strong>Impact:</strong> Complete crop failure</td>
</tr>
<tr>
<td><strong>Cause:</strong> Rainfall deficit of 25 week periods during crop growth</td>
<td><strong>Cause:</strong> Seasonal rainfall below minimum seasonal plant water requirement</td>
</tr>
</tbody>
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Table 3.1. Differences between droughts and dryspells according to Falkenmark et al. (2009)
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
Relation between peak flow and roads cut in the Vidourle catchment during the 2005 event
LOP: Monitor dynamic exposure through traffic flow

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

Monthly roads traffic in the Gard department
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)
**EOP: Post event data collection strategy**

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**Anticipation time**

- Time lag between human response and the time of the peak discharge
**EOP: Post event data collection strategy**

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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
EOP: Compare social anticipation time across events

The coupling of social and physical response scales

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

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