EUROPEAN COMMISSION
Community research

Thematic Presentation
Climate Change Impacts on Extreme Floods

Marco Borga
University of Padova
Italy

SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION
Community research

Climate Change Impacts on Extreme Floods

Focus on:

- **flash floods**
- **urban floods**
- **coastal floods**
- **emerging technology and costs of natural hazards**
- **national projects**

- **Social impacts/Economics**
- **Embankments**
- **Uncertainty**
- **Stakeholders/case studies**
- **Communication issues/User engagement**

SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION
Community research

Scientific outputs
C- Extreme floods

FLASH:
Thunderstorms and Flash Floods

- Focus on improved thunderstorm modelling and observation techniques have been developed

- New real time lightning product for the Mediterranean online (http://flashproject.org)

- New thunderstorm "nowcasting" product online for 1-3 hour forecasts of heavy rainfall

- New thunderstorm "forecasting" product online for 6-72 hour forecasts of heavy rainfall

- New synoptic indicators of flash floods

- New educational outreach website on flash floods and thunderstorms

F L A S H

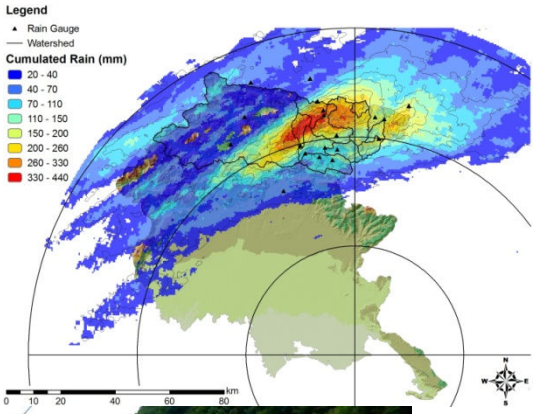
6 partners from 5 European countries, EC contribution of 1.2 M€, ends August 2010

EUROPEAN COMMISSION
Community research

Scientific outputs

C- Extreme floods

HYDRATE:
Hydro-meteorological data resources and technologies for effective flash flood forecasting



- Focus on development of a European observational strategy on flash floods, coupling: weather radar observations, post-flood surveys, hydrological modelling.

- Hydro-meteorological analysis of flash flood regimes / extreme events: space-time scale and resolution, interactions between hydrology/geomorphology/hydraulics

- Development of hydro-meteorological models for precipitation now-casting and flash flood guidance/forecasting/warning

HYDRATE PROJECT

14 partners from Europe, EC contribution of 2.35 M€, end May 2010
– International partners: China, USA, Africa

EUROPEAN COMMISSION
Community research

Scientific outputs

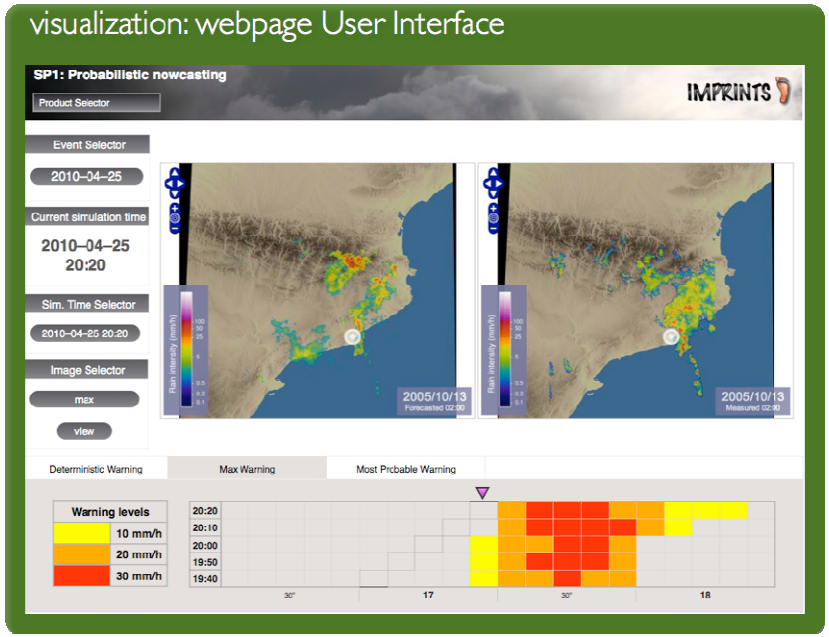
C- Extreme floods

IMPRINTS:
Preparedness and risk management for flash floods and debris flow events

- Focus on improvement on anticipation (rainfall forecast), preparedness and operational risk management for Flash Flood and Debris Flow generating events, thus reducing casualties and damages to the environment.

- Methods and tools to be used by emergency agencies and utility companies responsible for the management of FF/DF risks and associated effects

- Develop prototype tested on six selected flash flood/debris flow prone areas (Alpine and Mediterranean catchments)



Practitioner's Tool
(Beta version)

17 partners from Europe, EC contribution of 3.3 M€, end February 2012
– International partners: South Africa

IMPRINTS

SEVENTH FRAMEWORK PROGRAMME

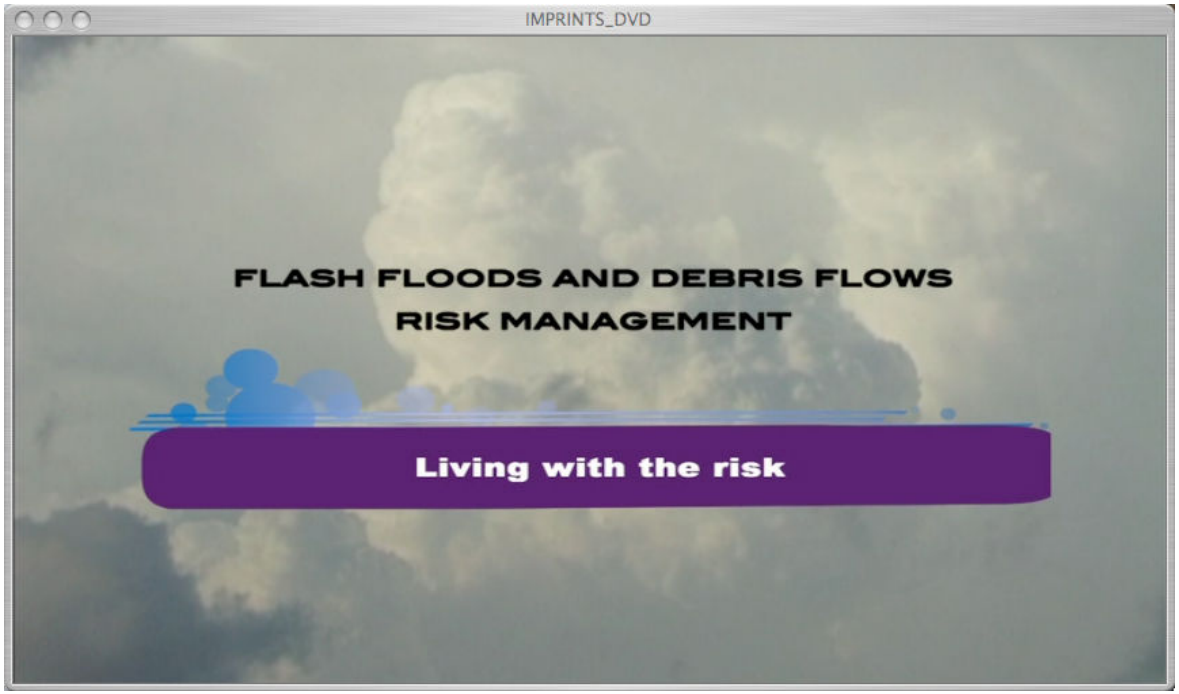
EUROPEAN COMMISSION
Community research

Scientific outputs

C- Extreme floods

IMPRINTS:
Preparedness and risk management for flash floods and debris flow events

Available VIDEO



Flash Floods and Debris Flows Risk Management. Part 1 - Living with the Risk

http://www.crahi.upc.edu/

IMPRINTS

SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION
Community research

Scientific outputs

C- Extreme floods

SMARTEST:
Smart resilient technology, system and tools

- Focus on cost-effective solutions for the flood resilient systems in the urban environment.
- Development of model of FRe systems
- A damage model for the simulation of FRe construction, technology and system; A decision support tool for professional stakeholders in flood resilience technology
- A guideline for the implementation of flood resilience construction, technology and system by stakeholders
- Workshops at local level in case study areas to define requirements for FRe systems; National workshops for local contact and language dissemination
- Policy brief on environmental impact of the research

Photo: Floodplan

SEVENTH FRAMEWORK PROGRAMME

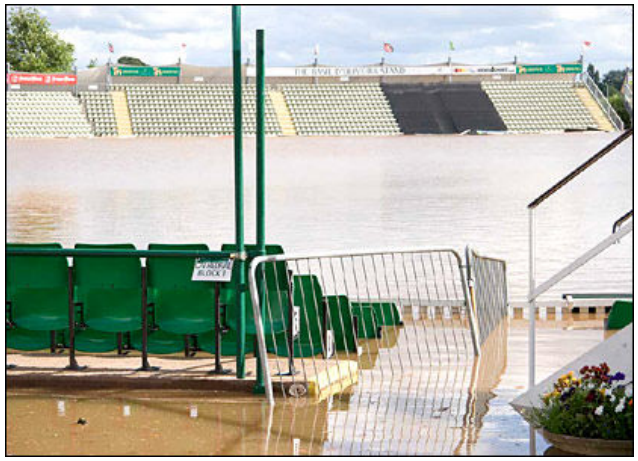
EUROPEAN COMMISSION
Community research

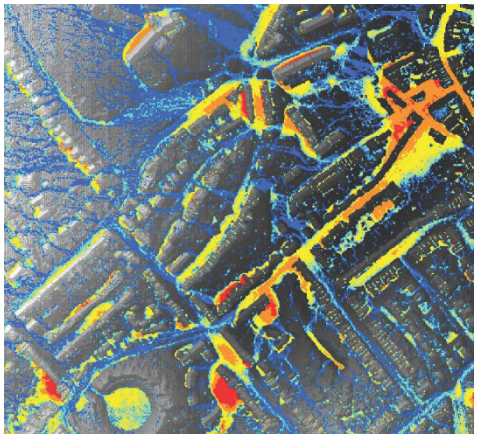
Scientific outputs

C- Extreme floods

CORFU:
Collaborative research on flood resilience in urban areas

- Focus on differences in urban flooding in Asia and Europe
- Methodology for assessment of impacts and possible responses by envisaging different scenarios of relevant drivers (climate change, socio-economic trends, land use/planning etc.)
- Quantification of cost-effectiveness of resilience measures and integrative and adaptable flood management plans for these scenarios
- Advances in modelling drivers and pressures, flood forecasting, flood risk analysis and mapping, flood impact assessment and flood risk management





SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION
Community research

Scientific outputs

C- Extreme floods

FLOODPROBE:
Technologies for improved safety of the built environment in relation to flood events

- Focus on cost-effective means for flood risk management in urban areas.
- Knowledge on vulnerability critical infrastructure and improving flood defences: getting the balance in holistic flood risk management strategies
- Biotechnical methods for improving flood defences
- Concepts for multifunctional flood defences and shelters

FloodProBE

14 partners from Europe, EC contribution of 3.5 M€, end October 2013

SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION
Community research

Scientific outputs

C- Extreme floods

THESEUS:
Innovative coastal technologies for safer European coasts in a changing climate

- Consolidated methodologies for risk assessment with analysis of drivers and impacts of changing flood risk and uncertainties in coastal process.
- Risk based design of innovative or optimised defence structures: wave energy converters, reefs, floating breakwaters, dikes, nourishment.
- Maintenance and construction of habitat for mitigation purposes: biological reefs, dunes, saltmarshes, managed realignment.
- Coastal risk governance: insurance schemes, land use planning, private sector strategies, post crisis management, knowledge mobilization and crisis planning protocols.

THESEUS

SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION
Community research

Scientific outputs
C- Extreme floods

UrbanFlood

- Focus on developing innovative technologies to help emergency management on flood conditions (as well as support for routine asset management)

- Developing a working flood risk early warning system that uses sensor technology embedded in flood embankments (and flood defences), linked via Internet technology with online user interfaces and a mutli-touch table system for emergency services access and control.

- Application to 3 pilot sites in Amsterdam, London and St Petersburg

ICT for Environmental Services and Climate Change Adaptation Programme

6 Partners; €4.1M programme of work; Grant agreement No. 248767

December 2009 → November 2012

SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION
Community research

Scientific outputs
C- Extreme floods

ConHaz:
Costs of natural hazards

- Compilation of state-of-the-art methods for cost assessment of natural hazards: droughts, floods, storms and coastal hazards, and alpine hazards;

- Analysis and assessment of these methods in order to identify best practice methods and identify theoretical and practical knowledge gaps;

- Synthesis of the resulting knowledge into recommendations for assessments of the costs of natural hazards and identify further research needs.

CONHAZ
Costs of Natural Hazards

SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION
Community research

Scientific outputs
C- Extreme floods

FRMRC and EQUIP:
National (UK) projects

- UK national academic collaborative projects
  - flood risk and uncertainty in climate impact assessment
- Achievements
  - Research addresses "users" problems
  - Policy-relevant research
  - FRMRC1 research now in use in UK for inspection of flood defence infrastructure
- Aspiration to contribute to IPCC AR5

SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION
Community research

Perspectives
C- Extreme floods

FLASH FLOODS:
research perspectives

- Science integration:
- Monitoring/observations: total lightning data in real-time monitoring of intense storms; rainfall at flash flood scales; programs for post-flood survey;
- Modelling: rainfall data assimilation for precipitation forecasting in NWP; flash flood prediction/forecasting in ungauged basins; Probabilistic forecasts-Uncertainty assessment.

- Operational/Policy integration - Interaction:
- Increase of anticipation as a key point for preparedness: Uncertainty must be estimated and provided to the end-user in a proper way; Development of Tools and Software adapted to Practitioner's needs for the real-time risk management;
- Need to facilitate scientist – end user/stakeholder interactions.

- Sustainability:
- Improve analysis of influence of environmental changes (LU/CC) on flash flood regimes;
- Improve analysis of social changes on flash flood risks.

F L A S H

EUROPEAN COMMISSION
Community research

Perspectives
C- Extreme floods

URBAN FLOODS: research perspectives

- Science integration: development of draft harmonised standards (European), development of system approaches to the use of technology and appropriate tools to quantify application and performance. Specific focus on:
  - the vulnerability of critical infrastructure and high-density value assets,
  - the reliability of urban flood defences and
  - construction technologies and concepts for flood-proofing buildings and infrastructure networks.

- Interaction: Enhancing the dialogue between engineers and scientists, industry (manufacturers and builders), local and national government and agencies and standards bodies. Cataloguing and sharing best practice on mitigation and resilience measures.
- Significant increase in the cost-effectiveness (i.e. performance) of investments in newly developed and existing flood protection and flood resilience measures increasing the flood-resilience of the urban system.

- Sustainability: Development of a flood resilience approach in key stakeholders.

SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION
Community research

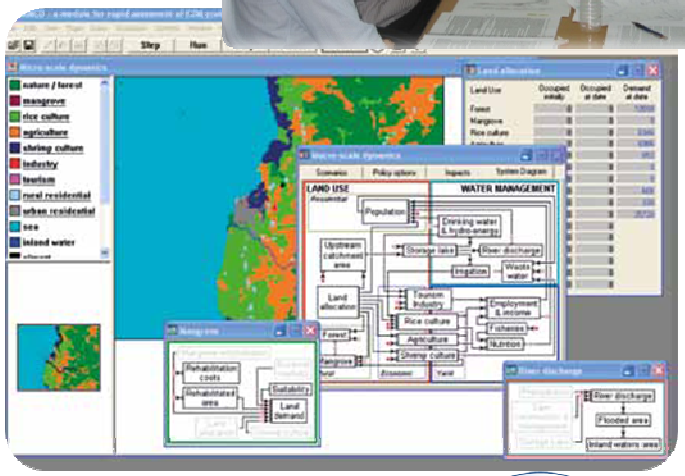
Perspectives
C- Extreme floods

COASTAL FLOODS:
Research perspectives

- Integration. Integration of scientific outcomes into design guidelines and software tool for defence planning.

- Interaction. Dialogue between engineers and scientists, land use planners, politicians and the affected public to achieve an effective coastal planning strategy.

- Sustainability. Development of standard integrated practices for the selection of sustainable mitigation measures.



THESEUS

SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION
Community research

Perspectives
C- Extreme floods

EMERGENING TECHNOLOGY:
Research perspectives

- Sensor data uncertainty and resolution in relation to different end user needs
- Verifying/ensuring system reliability and security, particularly during extreme events
- Implementation at larger (catchment) scale offers added potential for risk / event management but we then need to address the wider challenges of:
- Integrated operation and maintenance across numerous defence structure owners, flood risk management and emergency service organisations
- Management and processing of very large data volumes in real time
- Standards for design, installation and operation

SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION
Community research

Perspectives
C- Extreme floods

COSTS OF NATURAL HAZARDS:
research perspectives

- Compile, analyse and assess existing knowledge for costing of different natural hazard types

- Recommendations on methods, knowledge transfer

- Networking within and between natural hazard communities (research, practitioners, policymakers)

CONHAZ
Costs of Natural Hazards

SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION
Community research

Perspectives
C- Extreme floods

FRMRC and EQUIP: research perspectives

- Quantifying the scenarios and uncertainty for short-term precipitation extremes and flood impacts
- Contribution of land use and management to flood risk management
- The effects of ageing of flood defence infrastructure on failure probability
- Quantifying uncertainty in assessments of flood risk and better communication of uncertainty

SEVENTH FRAMEWORK PROGRAMME