CRUE FLOODING ERA-NET

3rd ISSUE Dec. 2010

CRUE Snapshot

Flood Resilient Communities

TOPICS IN THIS ISSUE

- Editors Preface
- 2nd ERA-Net CRUE Funding Initiative: Flood Resilient Communities
- Snapshots on flood-related research in 2009/10
- Latest news on national FRM policy/administrative developments

Published in December 2010

EDITOR'S PREFACE

The self-sustainability of a network

It has been over one year since CRUE was one of the first ERA-Nets whose contract under the 6th Framework Programme ended in October 2009. This was not the end of the CRUE network, mainly due to the fact that the projects of the 2nd common funding initiative are ongoing.

The management of the seven projects plus a scientific coordination project of the 2nd funding initiative was our main activity in the last year. But, as a CRUE Ambassador, I had the opportunity to represent the network as well. A CRUE presentation was given at the Thematic Workshop on "Flash Floods and Pluvial Flooding" of Working Group F in Cagliari, organised by the Italian CRUE partner ISPRA. At this workshop there were also posters and presentations from CRUE funded projects and the piles of brochures and fact sheets almost ran out. The EU Commission (DG Research) and UN-ISDR organised an international workshop at the beginning of July about Climate Change Impacts and Adaptation: "Reducing Water-Related Risks in Europe". CRUE as well as some projects from its funding initiatives were mentioned in the topics "Extreme Floods" and "Water, security and resources, incl. Drought".

We are still on the radar! We receive questionnaires to indicate in detail all output of the network and CRUE is mentioned with a fact sheet and a link to the website on the mini-website about ERA-Nets (European Commission's website about FP7).

Personally, but I think I can speak for many of us, it feels a pity the WatERAnet wasn't successfully approved. The concept of 'an umbrella'- network with thematic action groups could fulfil the needs of funders, managers and researchers. This is not the end of our contacts with already a new idea born: a Joint Programming Initiative (JPI) Water. From the side of the EU Commission, an initiative to bring the project leaders of these previous funded networks together was welcomed in November. Preparations were made together with the members of IWRM-Net, SNOWMAN and CIRCLE-2. What are our strengths and weaknesses? Where are the opportunities?

There is a future for CRUE! Collaboration is and will be the way of doing research in the future. Therefore I am happy with the results of our CRUE mid-term meeting of the nowadays funded projects (see further in this snapshot). We bring partners from different countries together to do produce common results and there is collaboration in between the projects to gain as much as valuable results with the limited resources there are.
How our future will evolve is still unclear at the moment but the end of the contract was not the end of the network. And therefore we have to thank the voluntary efforts of all CRUE partners!
Wouter Vanneuville
CRUE Ambassador

CRUE snapshot is published by the CRUE ERA-Net. It features the key policy-relevant developments in European research on Flood Risk Management (FRM) and coversupdates on European FRM Policy, Country reports including research highlights, and flood research-related news.

While the aim is to give an update along a representative range of topics, the coverage makes no claim to completeness.

Contributions presented in this Issue may be covered by intellectual property rights.

CRUE Contact Details

Scientific coord. Proj.
alpS GmbH
Grabenweg 68
A-2020 Innsbruck

Wouter Vanneuville,
CRUE Ambassador
Waterbouwkundig Laboratorium
Berchemlei 115
B-2140 Borgerhout

info@crue-eranet.net
http://www.crue-eranet.net/

ERA-Net CRUE was funded by the ERA-Net Scheme under the 6th Framework Programme
General Directorate for Research in the European Commission
Contract number: ERAC-CT-2004-515742

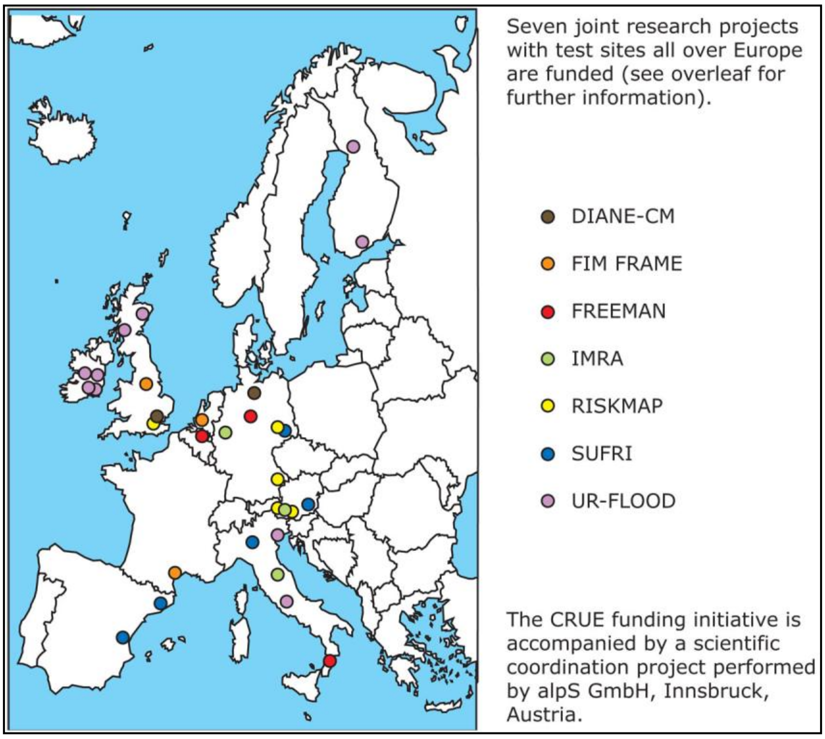
Contents

Integrate,Consolidate
and Disseminate

European Flood Risk Management Research

2nd ERA-Net CRUE Research Funding Initiative

CRUE ERA-NET aims to introduce structure within the area of European Flood Research by improving coordination between national programmes. The vision for the CRUE ERA-Net action on flooding is to develop strategic integration of research at the national funding and policy development levels within Europe to provide knowledge and understanding for the sustainable management of flood risks. The 1st call for proposals focussed on research related to "Risk assessment and risk management: Effectiveness and efficiency of non-structural flood risk management measures". The results from the CRUE ERA-Net Funding Initiative can be downloaded from http://www.crue-eranet.net/publications.asp.



With its 2nd Research Funding Initiative "Flood Resilient Communities – Managing the Consequences of Flooding", CRUE aims to

- further integrate the European Research area to support the implementation of national and European policies on Flood Risk Management (FRM),
- develop evidence and innovation required to underpin sustainable flood risk management across Europe, reducing the potential for duplication of research effort, improve the integration of knowledge and to develop further the systematic exchange of information and good practice on flood management and research effort,
- improve the integration of knowledge and to develop further the systematic exchange of information and good practice on flood management and research.

Contact: http://www.crue-eranet.net/contact.asp
Project website: www.crue-eranet.net

Seven joint Research Projects were funded within the framework of ERA-NET-CRUE
(for more information see http://www.crue-eranet.net/project_list.asp?Call_ID=3):

DIANE-CM:

Decentralised Integrated Analysis and Enhancement of Awareness through Collaborative Modelling and Management of Flood Risk

Main objectives:
- Introduce innovative methods of risk quantification and participation in a public dialogue
- Improve flood hazard and risk maps and near real time flood forecast
- Increase preparedness of local communities in flood risk management due to collaborative modeling
- Test the developments in two selected case studies for a feature of 'good governance'

Webpage: http://www.leuphana.de/en/mariele-evers/forschung-projekte/diane-cm.html
Funding: BMBF, EA, MinVenW

FIM FRAME:

Flood Incident Management – A FRAMEwork for improvement

Main objectives:
- Assess the effectiveness of flood incidence management plans in the UK, the Netherlands and France
- Evaluate tools that are used for flood incidence management planning
- Establish how these tools can be used to improve emergency management plans

Webpage: http://www.fimframe.net/index.html
Funding: Joint Defra/EA FCERM Programme, MEEDDM

FREEMAN:

Flood REsilience Enhancement and MANagement: a pilot study in Flanders, Germany and Italy

Main objectives:
- Identify factors, strategies and measures that increase flood resilience
- Provide guidance on the operational use of flood resilience into flood risk management (FRM)
- Provide practical policy recommendations to aid the implementation of the EU Floods Directive

Webpage: http://www.feem-project.net/FREEMAN/index.php
Funding: Flanders Hydraulics Research, ISPRA, BMBF

IMRA:

Integrative flood risk governance approach for improvement of risk awareness and increased public participation

Main objectives:
- Development of a methodology for an integrative concept for participatory flood risk management
- Validate the concept by application to three case studies
- Discuss the results with scientific experts and disseminate to policy and decision-makers, as well as to a wider public

Webpage: http://www.imra.cnr.it/
Funding: BMLFUW, BMBF, ISPRA

RISK MAP:

Improving Flood Risk Maps as a Means to Foster Public Participation and Raising Flood Risk Awareness: Towards Flood Resilient Communities

Main objectives:

- Develop appropriate stakeholder participation processes
- Improve the content of risk maps by considering social, economic and environmental risks
- Improve the visualisation of flood risks in order to produce user-friendly risk maps
- Provide quantitative information related to the content of risk maps

Webpage: http://www.risk-map.org/
Funding: BMBF, Defra, BMLFUW, MEEDDAT

SUFRI:

Sustainable Strategies of Urban Flood Risk management with non-structural measures to cope with the residual risk

Main objectives:

- Evaluate the recent situation with projected structural measures to detect weak spots in the technical system, infrastructure as well as in the crisis coordination
- Provide a tool to characterize residual flood risk in urban areas to reduce flood risk
- Evaluate current national practice with regard to flood communications and flood understanding by application of five case studies to establish potential improvements

Webpage: http://www.sufri.tugraz.at/
Funding: BMLFUW, Gov. of Styria, WLV, MICIN

UR-FLOOD:

Understanding Uncertainty and Risk in communicating about FLOODs

Main objectives:

- Investigate and communicate how flood risk communications are incorporated into the knowledge systems of different actors
- Evaluate current practice with regard to flood communications and uncertainty against existing good practice criteria to establish potential improvements

Webpage: http://www.macaulay.ac.uk/urflood/index.php
Funding: Scottish Gov., ISPRA, MMM, OPW, EA, Defra

SCP:

The CRUE funding initiative is accompanied by a scientific coordination project performed by the alpS GmbH, Innsbruck, Austria, and supported by the Climate Service Center, Hamburg, Germany.

Main objectives:

- facilitate cooperation and networking among the seven joint research projects
- collect, analyse, disseminate up-to-date research activities and results, with the ultimate aim to support – at national and European level – policy choices and to find best practices for the EU Floods Directive implementation

Funding: all CRUE partners

Events

Kick-Off Meeting 2009 in Rome

The Kick-Off Meeting took place in Rome from 20th-21st October, 2009. The project members of the various projects convened to present their plans for the 2nd Era-Net CRUE funding initiative and to discuss possible synergies. Furthermore dissemination and communication strategies were discussed and input given pertaining to the choice of case studies and the measuring of project success. Researchers were divided into seven thematic groups to discuss the issues of methods applied, stakeholder groups involved and the location of where research is to be performed. Finally the concept of resilience in each project was discussed.

Midterm Seminar 2010 in Madrid

The Midterm Seminar took place from 19th – 20th October 2010 at Fundación Goméz Pardo in Madrid, Spain. Around 80 participants including scientists from all projects, as well as CRUE partners and project evaluators from throughout Europe assembled to present and debate the current status of the projects and to discuss further steps and measures in the ERA-Net CRUE initiative. In four discussion groups on the topics of *resilience, communication* & *participation, transferability* & *applicability* and *synthesis*, scientists from different projects and backgrounds joined together to share their experiences, knowledge and questions and to find answers to the greater overarching questions. Additional project meetings were arranged to support communication within the various projects and to accelerate project progress. Alongside the Midterm Seminar two meetings of the Steering Committee were also held in which the overall progress of the 2nd funding initiative as well as organizational issues and future developments were discussed and directional decisions made.

Final Symposium 2011 in Graz

The Final Symposium will be held in Graz in conjunction with the International UFRIM Conference (21st-23rd Sept., 2011). A plenary session on the Era-Net CRUE at UFRIM is planned for 21st Sept.

Review on Resilience-Summary

1. Introduction

Recent flood events, e.g. in 2000 and 2007 in the UK, in 2002, 2005 and 2010 in Germany, in 2010 in France or in 2010 in Pakistan point out that natural disasters are phenomena which can cause a large number of fatalities as well as high economic losses in developed as well as developing countries. In order to avoid that natural hazards become disasters, the implementation of adequate mitigation measures and risk management strategies is necessary. Based on data of the Centre for Research and Epidemiology of Disasters (CRED) at the University of Louvain (Belgium), Strömberg (2007) determined an average yearly increase in the number of natural disasters of about 5% since 1960. This development can be traced back to a) climate variability, b) environmental degradation, c) rapid growth of the world population and d) urbanization (Abramovitz 2001). However, although the dataset of CRED is the most comprehensive, one has to keep in mind that the increase in the number of natural disasters is also determined by an improvement of disaster reporting (Strömberg 2007). The observable increase in the number and intensity of natural disasters suggests that these events might take unexpected dimensions (e.g. magnitudes never experienced before, new locations). Against this background, one has to accept that absolute safety and perfect prevention are often not possible. Rather, it is important to increase resilience by providing measures which raise the ability of a society to withstand and recover from disasters (Zhou et al. 2010).

However, as will be shown in the following, even after 30 years of research, the concept of resilience is still diverse. Since the term resilience is used by very different fields of research, each applying different methodologies, one can observe a wide range of definitions. The implementation of correct mitigation strategies requires a better understanding of the concept of resilience. Along with the diversity of definitions comes a lack of a framework on the assessment of resilience.

The following part of this article first gives an overview of the existing concepts of resilience, in particular disaster resilience and then presents two ways to measure resilience.

2 The concept of resilience

The term resilience originates from the Latin word resiliere which means "to jump back" (Klein et al. 2003) and was first conceptualized by Holling (1973) in the field of ecology. According to Holling (1973) resilience is a "measure of the ability of an ecosystem to absorb changes and still persist" and as such has to be distinguished from stability which Holling (1973) defines as the "ability of a system to return to its equilibrium after a temporarily disturbance".1 Both resilience and stability are important features of an ecosystem, whereby a resilient system might be unstable, i.e. show great fluctuations (Handmer & Dovers 1996). As shown in the following, the concept of resilience developed to an important approach across disciplines.

Timmerman (1981) was among the first to move from the concept of ecological resilience towards social resilience and was followed by Adger (1997) who defined resilience as "the ability of human communities to withstand external shocks or perturbations to their infrastructure such as environmental variability or social, economic, or political upheaval, and to recover from such perturbations". The recognition of resilience in the social sciences went hand in hand with the adaptation of the concept to natural hazards in that the connection of resilience and adaptation to natural hazards was made. Timmerman (1981) defined resilience as a "measure of a system's or part of the system's capacity to absorb and recover from hazardous event". According to Tobin (1999) resilient communities must be characterised by a) a reduction of the exposure to natural hazards, which can be achieved by structural and non-structural measures, b) a lower level of vulnerability, that needs especial care of those politically and economically weak, c) long-term investments in sustainable and adaptable measures, d) the willingness of policy-makers to promote resilience, e) the cooperation of different

[1] For an overview of ecological definitions, see Mayunga (2007).

organizations, f) strong social ties and g) the adequate scale of planning. In recent years, many other approaches occurred, which relate resilience to natural hazards. Thywissen (2006) and Mayunga (2007) give an overview of these definitions (see Table 1). A closer look at the definitions reveals that these differ in some respects.

According to Dovers & Handmer (1992) resilience can be reactive, but also proactive. Thereby, the reactive approach aims to strengthen the status quo in order to be able to withstand changes. In comparison, a proactive understanding of resilience accepts upcoming changes in the system and aims to develop a regime which is able to adjust to new conditions. As such, proactive resilience has an adaptive character including the willingness and the ability of a society to learn and adjust to changes (Klein et al. 2003).

Table 1: Selected definitions of disaster resilience[2]

Author	**Definition**
Timmerman (1981)	Resilience is the measure of a system's or part of the system's capacity to absorb and recover from occurrence of a hazardous event.
Correira et al. (1987)	Resilience is a measure of the recovery time of a system.
Wildavsky (1988)	Resilience is the capacity to cope with unanticipated dangers after they have become manifest, learning to bounce back.
Buckle (1998)	The capacity that people or groups may possess to withstand or recover from emergencies and which can stand as a counterbalance to vulnerability.
EMA (1998)	Resilience is a measure of how quickly a system recovers from failures.
Mileti (1999)	Local resiliency with regard to disasters means that a locale is able to withstand an extreme natural event without suffering devastating losses, damage, diminished productivity, or quality of life without a large amount of assistance from outside the community.
Adger (2000)	Social resilience is the ability of groups or communities to cope with external stresses and disturbances as a result of social political and environmental change.
Buckle et al. (2000)	Qualities of people, communities, agencies, infrastructure that reduce vulnerability. Not just the absence of vulnerability rather the capacity to 1) prevent, mitigate losses and then if damage occurs 2) to maintain normal living conditions and to 3) manage recovery from the impact.
Buckle et al. (2000)	Not just the absence of vulnerability. Rather it is the capacity, in the first place, to prevent or mitigate losses and then, secondly, if damage does occur to maintain normal living conditions as far as possible, and thirdly, to manage recovery from the impact.
Department of Human Services (2000)	The capacity of a group or organization to withstand loss or damage or to recover from the impact of an emergency or disaster. The higher the resilience, the less likely damage may be, and the faster and more effective recovery is likely to be.
Alwang et al. (2001)	From the sociology literature, resilience is the ability to exploit opportunities and resist and recover from negative shocks.
IPCC (2001)	Resilience is the flip side of vulnerability – a resilient system or population is not sensitive to climate variability and change and has the capacity to adapt.
Handmer (2002)	Details of Resilience might be inherently unknowable – especially in the case of complex communities undergoing constant change.
Pelling (2003)	The ability of an actor to cope with or adapt to hazard stress.
Turner et al. (2003)	The concept [of resilience] has been used to characterize a system's ability to bounce back to a reference state after a disturbance and the capacity of a system to maintain certain structures and functions despite disturbance.[…] resilience of the system is often evaluated in terms of the amount of change a given system can undergo (e.g., how much disturbance or stress it can handle) and still remain within the set of natural or desirable states (i.e., remain within the same 'configuration' of states, rather than maintain a single state).

[2] The definitions are adapted from Thywissen (2006) and Mayunga (2007).

Disaster Recov. Journal (2005)	The ability of an organization to absorb the impact of a business interruption, and continue to provide a minimum acceptable level of service.
IRIN/OCHA (2005)	The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters and improving risk-reduction measures.
Foster (2006)	Regional resilience is the ability of a region to anticipate, prepare for, respond to and recover from disturbance.
Paton & Johnston (2006)	Resilience is a measure of how well people and societies can adapt to a changed reality and capitalize on the new possibilities offered.
Pendall et al. (2007)	A person, society, ecosystem, or a city is resilient in the face of shock or stress when it returns to normal (i.e. equilibrium) rapidly afterward or at least does not easily get pushed into a new alternative equilibrium.

For some researchers, resilience is a long-term process which they measure by the time a system needs in order to return to its original state (Klein et al. 2003, Pimm 1984). The quicker the pre-disaster growth-path is achieved, the more resilient a community is considered to be. However, as Klein et al. (2003) note, this approach is criticized by many ecologists, as ecosystems are dynamic and able to adjust to external changes. In this respect, a return to the original equilibrium is not an improvement, since the system did not advance in its capacity to cope with a shock.

The relationship between resilience and vulnerability is widely discussed. While some researchers see resilience as the opposite of vulnerability, others would understand resilience, next to exposure and resistance, as one of three elements of vulnerability (Blaikie et al. 1994). Thereby the term vulnerability has as many different definitions as the term resilience (e.g. "The insecurity of the well-being of individuals, households or communities in the face of a changing environment" (Moser & Holland (1997) as quoted in Alwang et al., 2001). According to Zhou et al. (2010) resilience refers to the potential of resisting and recovering from a potential loss. Thereby the focus of the process is mainly on the time during the disaster and after the disaster. In comparison, vulnerability is the exposure and sensitivity of a system towards (potential) hazards. As such, its main focus is on the situation before a disaster and ways to increase preparedness.

Some researchers regard sustainability[3] and resilience as positive features of a community (Tobin, 1999). However, as Carpenter et al. (2001), note, in contrast to sustainability, resilience can be a characteristic which is not always desirable (e.g. a resilient dictatorship). In other words, in comparison to resilience, sustainability does account for desired preferences and as such has to be seen as an overarching concept.

3 Measuring Community Disaster Resilience

There have been many attempts in the past to measure the concept of community resilience (see among others, Tobin 1999). However, as the assessment has to account for the different interactions on community level (e.g. human, environment), this proved to be a very difficult task. As a result, most frameworks consider a limited number of factors. Due to the lack of appropriate methods to quantify resilience, scientists are still not able to analyze how countries' levels of resilience vary in time and space. The following part of this paper seeks to introduce two approaches aiming to measure resilience in a holistic manner, in that they, according to the authors, account for the majority of necessary variables and the interaction between those. In contrast to the existing literature these approaches aim for a comparison of resilience across countries and time.

[3] According to the World Bank, sustainable development is "a process of managing a portfolio of assets to preserve and enhance the opportunities people face".

The PEOPLES Resilience Framework

Renschler et al. (2010) use the acronym PEOPLES to highlight the seven dimensions of community resilience, whereby the interaction between these dimensions is crucial for the assessment of community resilience.

a) Population and Demographics

The authors suggest using the social vulnerability index (SoVI) of Cutter (1996) as an indicator for the functionality of population and demographics, since social vulnerability affects a communities' capacity to prevent against disasters through different channels. In this respect the quality of institutions, cultural values but also the structure of the population is expected to be relevant. Cutter (1996), who defines vulnerability as the opposite of resilience, uses 11 indicators for his index, among those, socioeconomic status, elderly and children, development density, rural agriculture, race, gender, ethnicity, infrastructure employment and country debt/ revenue. However, it should be noted that many institutions (e.g. World Bank) offer alternative databases on population and demographics.

b) Environment

The PEOPLES Resilience Framework uses the Normalized Difference Vegetation Index (NDVI) as a proxy for ecosystem productivity and measures if the ecological system is able to cope with a disaster in returning to its original status. The NDVI can be applied in order to measure differences in the capacity of an ecosystem to cope with natural hazards in time and space. However, as suggested by the authors, it should only be used for shocks which alter the NDVI (e.g. floods).

c) Organized Governmental Services

The majority of prevention measures (e.g. police, fire departments) is in the realm of governments and has a public good character. Possible proxies for this dimension are the per capita expenses for prevention measures or the proportion of people working in related sectors.

d) Physical Infrastructure

For the dimension of physical infrastructure the authors use two indicators, facilities and lifelines. Facilities incorporates housing (i.e. the share of houses not classified as hazardous), commercial facilities and cultural facilities, while lifelines includes food supply, healthcare, utilities, transportation and communication networks.

e) Lifestyle and Community Competence

This dimension of the PEOPLES Resilience Framework aims to account for the ability of people within the community to apply changes which contribute to their resilience. The focus is on participation and involvement of individuals in the process of prevention and catastrophe management rather than in assuming that people are passive actors.

f) Economic Development

According to Kahn (2005) least developed countries do not experience more natural disasters than developed countries. However, the death toll in least developed countries is on average higher. Since economic development is a key indicator of resilience, the authors account for the level of economic activity (for example measured by GDP per capita or employment rate) as well as for economic development (measured by growth). Other indicators could be life expectancy, literacy rate etc.

g) Social-cultural Capital

By social-cultural capital the Authors point out the importance of networks within a community and the willingness of people to participate within the community. Thereby indicators, like education services and child services could be important indicators. In a disaster context, the existence of risk-management plans, rescue plans etc. which require the help of volunteers, usually indicate a high level of social-cultural capital.

The Capital-Based Approach
Mayunga (2007) developed a capital-based approach which accounts for five different forms of capital, which are social, economic, physical, human and natural capital. The framework is built upon the assumption that communities which are economically developed have better access to risk-management strategies and therefore are likely to be more resilient.

a) Social capital
Throughout the years researchers have found different ways to define social capital. In relation to community resilience, social capital refers to the ability of individuals to cooperate and the extent of that. Mayunga (2007) suggests to measure social capital by the extent of individual involvement in public activities. Thus, possible indicators could be the number of non-profit organizations, voluntary associations, voter participation, newspaper readership etc.

b) Economic capital
The higher the endowment of a community with economic capital, the larger the possibilities of that community to invest in prevention measures which allow absorbing the impact of natural hazards. According to Buckle (2001) a growing economy has better capacities to deal with the aftermath of a natural disaster than an economy in recession.

c) Physical capital
According to Mayunga (2007) physical capital refers to residential housing and infrastructure. Especially in the post-disaster situation, communities which are endowed with more physical capital are more capable to respond to natural disasters. The author suggests to access physical capital by "the number, quality, and location of housing units, business/industry, shelters, lifelines, and critical infrastructures".

d) Human capital
The World Bank defines human capital as "people's innate abilities and talents plus their knowledge, skills, and experience that make them economically productive". Investments in education and health care can increase a country's human capital. As such, human capital contributes to the ability of people to adapt knowledge and skills which are necessary to be able to adapt to natural disasters. In this respect, possible indicators for human capital are education (e.g. years of schooling), population density and growth, the quality of infrastructure, household characteristics etc.

e) Natural capital
Natural capital incorporates natural resources (e.g. water, oil) and the ecosystem required for those. However, the quality and extent of natural capital is often adversely affected by human action. Mayunga (2007) suggests measuring the endowment with natural capital by the quality of, air, soil and water as well as by the existence of parks.

Integrating the Dimensions of Resilience
In order to allow for a comparison of resilience within communities and time, the different dimensions of resilience need to be integrated. In this case the design of an index is common. However, the construction of an index is a challenge at different stages.
The first problem arises from the use of different measures, e.g. number of people, miles, Euros, making simple addition within a resilience index impossible. Therefore, all indicators of a domain need to normalized, i.e. by transforming the observations to a scale from 0 to 1 or 0 to 100.
A second problem which is crucial for the construction of indexes is the weighting of the determinants of each dimension as well as the dimensions themselves. These can be weighted in different ways: a) Weights can be based on theoretical evidence (e.g. provided by a theoretical model on the concept of community disaster resilience). b) Moreover, weights can be determined on basis of empirical

approaches, whereby Mayunga (2007) suggests two alternatives, the disposition of surveys and the application of factor analysis. Research questions with high practical relevance which require the expertise of many stakeholders can be addressed by c) weighting the indicators based on the political relevance of those and by d) accounting for the opinion of stakeholders, policy-makers etc. e) Finally, weights can be distributed equally.

The last challenge of the construction of a resilience index refers to the summation of the determinants of resilience. Simple addition of the indicators could result in cancellation of determinants, i.e. if a good score of one determinant cancels out a bad result of another determinate. One common way of circumventing this problem is the application of exponential transformation (Mayunga, 2007).

4 Conclusions

As we have seen, the existent definitions for resilience vary in many respects. One can observe differences in the conceptualization of resilience across the disciplines but also within the disciplines. Moreover, resulting from the lack of a unified definition, literature did not agree on how to measure resilience. Most of the frameworks on the assessment of resilience focus on selected factors, thereby neglecting relevant determinants. This overview has presented two possible concepts for a holistic approach. According to Thywissen (2006) the differences in the interpretation of resilience lead to misunderstandings in discussions on disaster reduction. From her point of view an agreement on the key features of resilience would contribute to an increase of the efficiency of initiatives aiming to reduce disaster risk.

Within the framework of the 2nd Funding Initiative of ERA-Net CRUE – Flood resilient communities – managing the consequences of flooding – resilience is understood as a term which integrates a variety of dimensions. Therefore, all results are discussed with respect to the restrictions they underlie, i.e. all projects reveal whether and to what extent their results can be generalised, thereby referring to a) social, socio-cultural-historical, legal-institutional, political and economic characteristics, b) the flood type and the degree of awareness and c) uncertainties and the way they are dealt with.

Contact Details of Authors

Project partner #1 (Co-ordinator)	alpS - Centre for Natural Hazard and Risk Management Manijeh Schwindt Grabenweg 3, A-6020 Innsbruck schwindt@alps-gmbh.com
Project partner #2 (Associated)	CSC – Climate Service Centre Helmholtz-Zentrum Geesthacht Prof. Dr. Annegret Thieken Bundesstrasse 45a annegret.thieken@hzg

References

Abramobitz, J. (2001). Unnatural disasters, Worldwatch Institute Paper No. 158.

Adger, W.N. (1997). Sustainability and social resilience in coastal resource use. CSERGE Working Paper Series, Centre for Social and Economic Research on the Global Environment, University of East Anglia, Norwich and University College London, UK.

Adger, W.C. (2000). "Social and ecological resilience are they related?" Progress in Human Geography, 24(3), 347-364.

Alwang, J., Siegel, P.S. & Jorgensen, S.L. (2001). Vulnerability: A view from different disciplines. Social protection discussion paper # 115, The World Bank, Social protection Unit, Human Department, http://www1.worldbank.org.

Blaikie, P. Cannon, T., Davis, I. & Wisner, B. (1994). At Risk: Natural Hazards, People's Vulnerability and Disasters. Routledge, London, UK.

Buckle, P. (1998). "Re-defining community and vulnerability in the context of emergency management". Australian Journal of Emergency and Management, 1998/199, 21- 29.

Buckle, P., Marsh, G. & Smale, S. (2000). "New approach to assessing vulnerability and resilience". Australian Journal of Emergency Management, 2000, 8-15.

Buckle, P., Marsh, G. & Smale, S. (2001). Assessing resilience and vulnerability: Principles, strategies and actions. Victorian Government publishing services.

Carpenter, S., Walker, B., Anderies, J.M. & Abel, N. (2001). "From Metaphor to Measurement: Resilience of What to What?" Ecosystems, 4(8), 765-781.

Comfort, L. et al. (1999). "Reframing disaster policy: The global evolution of vulnerable communities". Environmental Hazards, 1, 39–44.

Correira; S.R. (1987). Engineering Risk in Regional Drought Studies. pp. 61-86. In: Duckstein; Plate (Eds.): Engineering Reliability and Risk in Water Resources. Martinus Nijhoff Publishers, Dordrecht, Boston, Lancaster.

Cutter, S.L. (1996). "Vulnerability to Environmental Hazards". Progress in Human Geography 20(4), 529-539.

Department of Human Services (2000). Assessing Resilience and Vulnerability in the Context of Emergencies: Guidelines. Victorian Government Publishing Service.

Disaster Recovery Journal (2005). Business Continuity Glossary.<http://www.drj.com/glossary/ glossleft. htm>.

Dovers, S.R. & Handmer, J.W. (1992). "Uncertainty, sustainability and change". Global Environmental Change, 2(4),262-276.

Emergency Management Australia (EMA) (1998). The Australian Emergency Management Glossary, http://www.ema.org, accessed August 2006.

Foster, K. A. (2006). A case study approach to understanding regional resilience. A working paper for building resilience network. Institute of urban regional development. University of California.

Handmer, J.W. (2002). We Are All Vulnerable. <http://online.northumbria.ac.uk/geography_research/ radix/resources/vulmeeting-pbmelbourne11.doc

Handmer, J.W. & Dovers, S.R. (1996). "A typology of resilience: rethinking institutions for sustainable development". Industrial and Environmental Crisis Quarterly 9(4), 482-511.

Holling, C.S. (1973). Resilience and stability of ecological systems. Annual Review of Ecology and Systematics, 4, 2-23.

IPCC (International Pannel on Climate Change) (2001). Climate Change 2001. Synthesis Report. A Contribution of Working Groups I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Watson, R.T. et al. (Eds.). Cambridge University Press, Cambridge, New York.

Integrated Regional Information Networks (IRIN) (2006). Disaster Reduction and the Human Cost of Disaster - IRIN Web Special. <http://www.irinnews.org/webspecials/DR/Definitions.asp>.

Kahn M.E. (2005). The death toll from natural disasters: The role of income, geography and institutions. The Review of Economics and Statistics, 87, 271-284.

Klein, R.J.T., Nicholls, R.J. & Thomalla F.T. (2003). "Resilience to natural hazards: how useful is the concept?" Environmental Hazards, 5, 35-45.

Mayunga, J.S. (2007). Understanding and Applying the Concept of Community Disaster Resilience: A capital-based approach. Working Paper prepared for the summer academy for social vulnerability and resilience building. Munich, Germany.

Mileti, D.S. (1999). Disaster by design: A reassessment of natural hazards in the United States. Washington DC, Joseph Henry.

Moser, C.; Holland, J. (1997). Household responses to poverty and vulnerability. In: Confronting Crisis in Cawama. Lusaka, Zambia. Urban Management Programme. Vol. 4, Report No. 24, The World Bank, Washington, D.C.

Paton, D. & Johnston, D. (2006). Disaster resilience: An integrated approach. Springfield, IL, Charles C. Thomas.

Pelling, M. (2003). The Vulnerability of cities: Natural disasters and social resilience. London, UK: Earthscan.

Pendall, R., Foster, K.A. & Cowell, M. (2007).Resilience and regions: Building understanding of the metaphor. A working paper for building resilience network. Institute of urban regional development, Univ. of California.

Pimm, S.L. (1984). “The complexity and stability of ecosystems”. Nature, 307, 321-326.

Renschler, C.S., Frazier, A.E., Arendt, L.A., Cimellaro, G.P., Reinhorn, A.M. & Bruneau, M. (2010). Developing the ‘PEOPLES’ Resilience Framework for Defining and Measuring Disaster Resilience at Community Scale. Presentation held at the Climate Service Center Germany.

Strömberg, D. (2007). “Natural Disasters, Economic Development, and Humanitarian Aid”. Journal of Economic Perspectives, 21(3), 199-222.

Thywissen, K. (2006). Components of Risk. A Comparative Glossary. United Nation University, Publication Series of UNU_EHS, No. 2/2006.

Tierney, K. (2009). Disaster response: Research findings and their implications for resilience measures. CARRI Research Report 6. Oak Ridge. www.resilientUS.org.

Timmerman, P. (1981). Vulnerability, Resilience and the Collapse of Society: A Review of Models and Possible Climatic Applications. Institute for Environmental Studies, University of Toronto, Canada.

Tobin, G.A. (1999). “Sustainability and community resilience: The holy grail of hazards planning”. Environmental Hazards, 1, 13-25.

Turner, B.L. et al. (2003): A Framework for Vulnerability Analysis in Sustainability Science. Proceedings of the National Academy of Sciences of the United States of America (PNAS). Vol. 100, No. 14. pp. 8074-8079. <http://www.pnas.org/cgi/reprint/100/14/8074.pdf>.

Wildavsky, A. B. (1988). Searching for Safety. New Brunswick, NJ, Transaction.

World Bank (2010). DEP web. http://www.worldbank.org/depweb/english/beyond/global/ glossary.html.

Zhou, H., Wang, J., Wan, J. & Jia, H. (2010). “Resilience to natural hazards: a geographic perspective. Natural Hazards”, 53, 21-41.

Snapshots on flood-related research in 2009/10

In the last two years a large amount of flood related research has been carried out throughout the various CRUE partner countries. A short overview of studies conducted and research results obtained is given in the following chapter.

Austria

Introduction to ORTIS Risk Management for Tyrolean Municipalities prone to Flood Risks

Background

According to the Tyrolean Catastrophe Management Act, dealing with risks in a municipality is mandatory and thus forms one of the primary challenges to its leadership. Hence, alpS-Centre for Natural Hazards and Risk Management has developed the clearly structured and transparent risk management system ORTIS to support the complex risk management process for alpine municipalities in the Austrian Federal State of Tyrol. ORTIS places its emphasis especially on flood risks and is composed of ORTIS consulting services supported by a pragmatic, user-friendly risk management software tool.

Risk Management – a participatory approach

ORTIS deals with risks strategically, systematically and comprehensively and is based on the three core processes of risk analysis, risk control and risk monitoring. Risk analysis serves as a first step in the investigation and requires active participation of community representatives. Under the supervision and guidance of ORTIS risk experts a municipal risk committee is formed for whom special workshops are organized. This committee includes the political leadership and decision-makers (e.g. mayor and municipal council) as well as representatives on operational levels such as the fire chief and other essential members involved in rescue and crisis operations. In these workshops strong emphases are placed on participatory methods allowing for all experts to express his or her voice in the process and for all participants to actively contribute to identifying relevant risks.

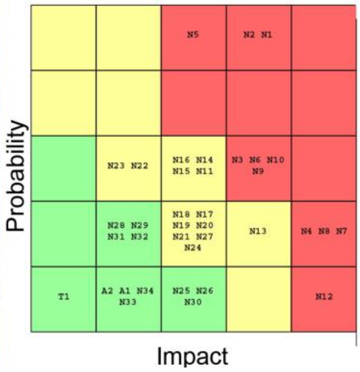
In addition to various objective assessments, the risk committee assesses their risks subjectively based on local knowledge and experience. All risks associated to flooding are illustrated in a risk matrix (Figure below). This participatory approach contributes to the aggregation of risk knowledge as well as to the valuable increase in risk awareness and the sense of risk ownership among those in positions of responsibility.

In the course of the risk analysis two further procedures are considered. Firstly, acquiring the necessary risk information corresponding to the identified risks and secondly, depicting the risk information in risk maps among others (Figure below). Thereby different forms of information are coupled such as scientifically derived data (e.g. flood model results) and personal information based on expert knowledge and experience.

Risk control and risk monitoring

Without the identification and (also socioeconomic) assessment of the essential risks in a community it is impossible to develop appropriate and sustainable measures to consequently reduce flood risks as part of the risk control process. Risk monitoring as the third and final step of the risk management process supervises the developed measures according to their practicability and observes possible changes in risks.

This risk management approach provides instruments for dealing with risks in a municipality on a daily basis. For this purpose specialized methods of participation, communication and software aimed at the specific needs required for conducting the risk management process were developed.



Flood risk map and risk matrix

Contact:
e-mail: ortner@alps-gmbh.com, lammel@alps-gmbh.com

More information available via:
http://www.ortis-info.at

Belgium

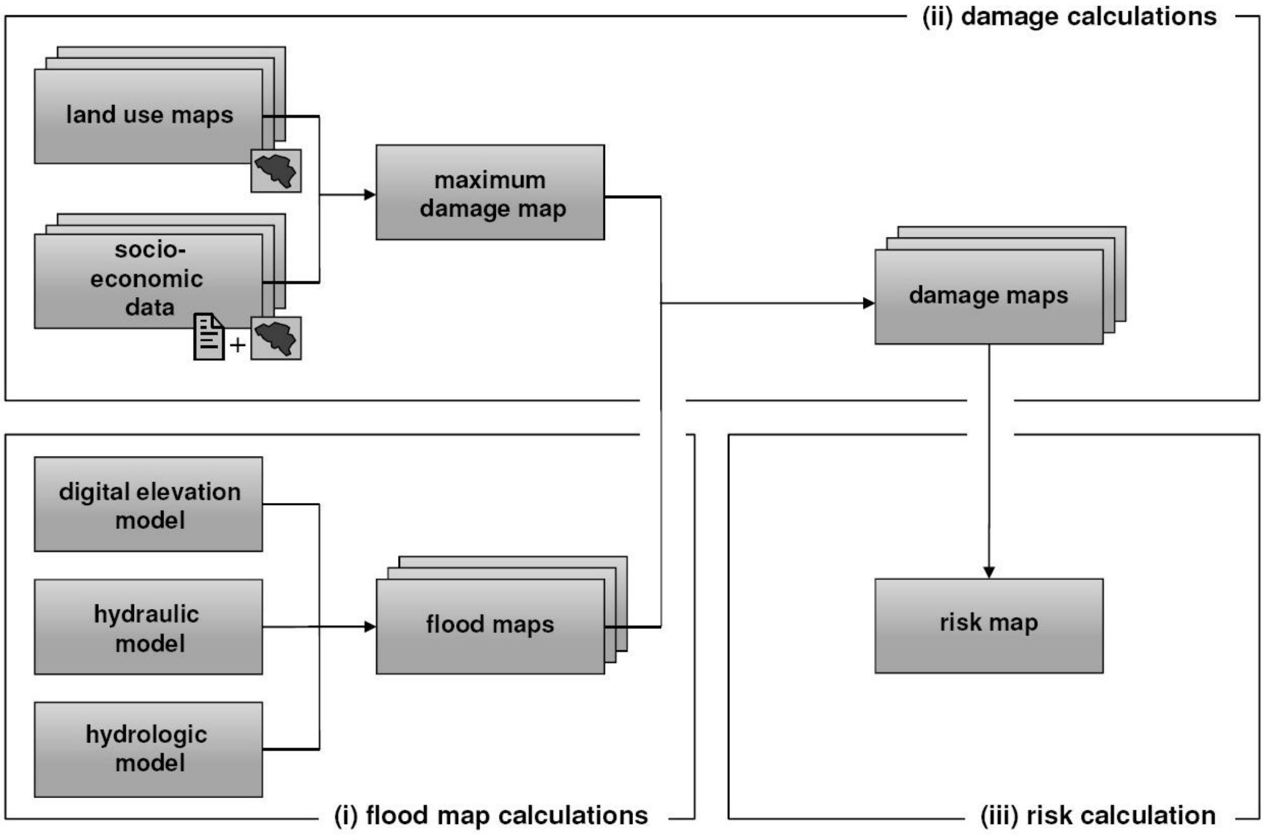
Research about the valuation and appraisal of flood consequences
One instrument, several users

Over more than 10 years, the interest shifted from the physical parameters of flooding (e.g. extent, water depth, velocity), also called hazard into hazard and vulnerability. A tool called LATIS was created by Flanders Hydraulics Research to compare the different alternatives for riverine and coastal management plans. The idea is to use this tool for the flood risk management plans of the EU Floods Directive as well. To do so, also other water management agencies must have access to it and the tool has to be adapted to their needs. Moving from the coast and the navigable rivers to the non navigable rivers, creeks and brooks is mainly a matter of geographic positioning, scale and thematic attributes. In the autumn of 2009, Flanders Hydraulics Research developed a new version of its damage and risk tool for floods. Compared with the previous version, the new one implements some methodological improvements of the damage and risk calculation.

Firstly, the damage calculation of residential buildings has been improved. Therefore, vector-based cadastral data is added to the original land use map. This makes it possible to allocate the maximal damage value of houses only to the shapes of the buildings and not anymore to the wider class 'built-up area' that was based on Corine Land Cover. Due to the evolution of house prices over the last years the relative value of household furniture is re-evaluated. Secondly, in a similar way as the residential buildings the damage to industry is improved. Furthermore, the industrial buildings are now divided in 16 classes (chemical industry, food industry…) to which different maximal damage values are given. Each of these classes is also linked with one of 3 depth-damage functions.

The third major improvement has been done to the agricultural classes. Earlier, damage of croplands and pastures was only dependent on water depths. In fact the damage of those classes is conditioned more by the moment of flood occurrence (a flood in the summer will cause more damage than one in the winter) and less by the water depth. To ameliorate this, users of the new LATIS tool can choose a month or a season for which they want to calculate the damage and risk.

These entire improvements allow LATIS to be used widely for flood damage and risk calculations. A copy of the software and database is installed at the Flemish Environmental Agency (VMM). The instrument is already usable for the 1st generation of flood risk management plans, but is not perfect. New improvements will be made by Flanders Hydraulics Research but based on needs and remarks of the VMM as well. The most important improvement for the autumn of 2010 will be a whole new land use map. Further linking these economic damage tools (where several classes of cultural heritage are in) to social (now only the calculation of deadly victims) and ecological risk calculations are the next major steps.



Contact:
e-mail: Pieter.Deckers@mow.vlaanderen.be

More information available via:
http://geoweb.ugent.be/en

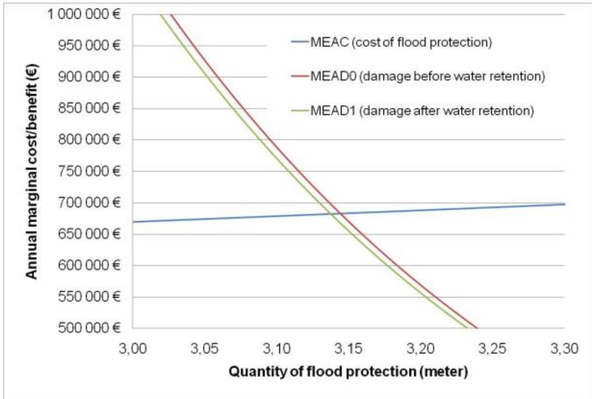
Finland

Flood risk reduction benefit of water retention basins (the Pori project)

The Floods Directive obligates member states to develop higher quality risk and hazard maps. The maps and data derived can be used to calculate economic damage more accurately. Also in the preliminary flood risk assessment, which should be carried out by the end of 2011, the effectiveness of existing man-made flood defense infrastructure should be evaluated. Thus, by 2011 we should know more on the optimal type and quantity of flood protection. Once good maps are available and we become aware of appropriate protection levels we can calculate flood reduction benefits.

Runoff simulations from the project in the 1st CRUE Funding Initiative were used to estimate benefits of different water retention scenarios. Later in a RIMAX-project retention capacity was evaluated, based only on the usage of existing digital information. The design of water retention basins using runoff modeling is known to be expensive. In the Pori project a method to evaluate flood reduction benefits without rainfall runoff models was developed. The idea was to calculate benefits of water retention (euros per cubimeter) prior to design or implementation of these areas.

The developed method implies that water retention benefits could increase 20% by 2070-2099. However, it turned out, we need to increase the extent of flood protection so much that benefits are in fact reduced. Design costs (no construction) of water retention basins are often more than 0.1 euros per cubimeter (see IRMA-project available at: http://www.irma-programme.org). Simulation results show that flood risk reduction benefits are smaller than design costs. Thus, it is obvious that costs need to be lower and/or we need to include more benefits to make water retention more feasible.



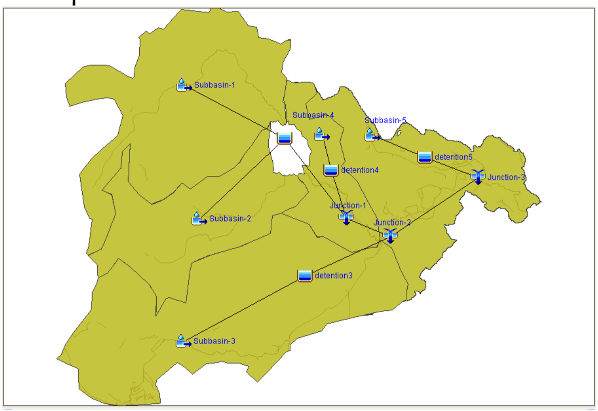
The pilot area was the city of Pori in the Kokemäenjoki catchment (27 000 km²), protected by a dyke, population 80 000 people and flood damage HQ 1/250 less than 200 million Euros (direct flood damage). The figure shows the change in marginal damages when 1 mm/m² of water is retained in the catchment.

Contact:
e-mail: Jari.Silander@ymparisto.fi

More informatrion available via:
http://www.ymparisto.fi/
.

TUVE – A Finnish Research Project on Integrated flood Management

In Finland floods occur due to rapid snow melt, intense rainfall and high sea level. The future flood regime in Finland is expected to change with changing climate. This will have an impact on flood management and also on water quality. Integrated flood management requires that multiple objectives are met in future flood mitigation. This includes objectives besides preventing flooding also objectives such as better water quality and biodiversity as set by the water framework directive (WFD). The WFD requires the implementation of measures in river basin management to improve water quality by 2015. It is important that measures taken to protect for floods (EC flood directive) are in agreement with objectives set to improve water quality (WFD) and that the impacts of foreseen measures are evaluated simultaneously. Different small scale flood protection measures can potentially improve water quality as well as reduce floods. Better conditions can be obtained by 1) decreasing erosion and nutrient transport, 2) increasing self-purification potentials in catchments, and by 3) providing better environmental flow conditions by e.g. increasing low flows. The TUVE project focuses on measures that combine flood mitigation measured with benefits for water quality. We will look into different methods and mathematical modeling that can be used to assess floods and water quality side by side. Also we will look into methods to assess past and future flood peaks and flash flood events. The project will look into these issues by working at different case sites in different regions of Finland. The project is funded by Ministry of Agriculture and Forestry and is carried out at University of Oulu in collaboration with water protection authorities such as Centres for Economic Development, Transport and the Environment and SYKE.



Map of the Kivijärvi foreseen experimental basins in central Finland where the impacts of dams and lake restoration on downstream flood and water quality is measured and simulated with HEC-HMS.

Contact:
e-mail: bjorn.klove@oulu.fi

More information available via:
http://www.oulu.fi/poves/pages/leftlink/currentprojects.html#integrwater

Germany

BMBF-National Research Programme "Risk Management of Extreme Flood Events" (RIMAX)

The RIMAX research programme (2005-2010) has been completed. While integrating different disciplines and stakeholders in 38 projects it had the goal of developing and implementing new and improved flood risk management tools and methods. The RIMAX research programme has since been considered to have achieved a "quantum leap" in German flood risk research.
In the scope of this programme an interactive network of all projects was developed, joint workshops and conferences were held and the RIMAX metadatabase (http://www.rimax-hochwasser.de/metadb.html) compiled containing all documentations, publications and results within the research initiative. Furthermore a number of technological solutions, new or improved flood forecasting systems, models, concepts and decision support aids were elaborated. Thereby, the programme encompassed four postdoctoral studies, 43 PhDs, 80 Diploma, Master and Bachelor theses and led to 458 publications in national and international journals. As a majority of the projects cooperated closely with corporates and public offices a significant knowledge transfer could take place, and hence important contributions to the European flood risk management guidelines were made.

A sample of scientific outputs includes:

- A special issue in the international scientific journal NHESS-Natural Hazards and Earth Science Systems was published containing 15 contributions and can be read online at: http://www.nathazards-earth-syst-sci.net/special_-issue82.html
- In IHP/HWRP-Report – Issue 9, 2009, the methods and strategies developed in central Europe are conveyed to other regions of the world with similar challenges. An English version can be ordered for free at: http://ihp.bafg.de/servlet/is/15627
- The book 'Management von Hochwasser-Risiken' edited by Merz, Grunewald, Piroth and Bittner published in 2010 by Schweizerbart contains the most important results and contributions obtained during the research programme, and targets the German-speaking public with an emphasis on the technical community, e.g. consulting engineers, public institutions, decision-makers and the scientific community.
- Two special editions in the journal 'Hydrologie und Wasserbewirtschaftung', a German scientific journal for the dissemination of current scientific developments and operational implementations, were published in August 2008 and June 2009. More information can be found at: http://www.hywa-on-line.de
- The brochure 'Ergebnisse aus der Hochwasserforschung' containing the results and written in a more understandable way, was prepared for the interested public to reach a broader target group and to promote Germany as a strong location for research. This brochure is available for free at: http://www.rimax-hochwasser.de/419.html. The brochure 'RIMAX-Risikomanagement extremer Hochwasserereignisse' informs about the various research projects and aims at strengthening networks and building synergies. It can be downloaded for free at http://www.rimax-hochwasser.de/419.html

Contact:
e-mail: bittner@gfz-potsdam.de

More information available via:
http://www.rimax-hochwasser.de

Europe

CapHaz-Net – Coordination activity (FP7)

CapHaz-Net stands for 'Social Capacity Building for Natural Hazards: Toward More Resilient Societies'. We understand it both as an open and growing network of researchers, practitioners and stakeholders from across Europe sharing an interest in the social dimensions of natural hazards as well as a research project. However, CapHaz-Net does not conduct 'first hand' empirical research. It rather builds upon existing knowledge. We review and synthesise previous and ongoing research and aim at stimulating discussion and exchange. Thus, sharing experiences between researchers and practitioners is at the heart of Net's activities!

Which topics is CapHaz-Net dealing with?

CapHaz-Net looks back on meanwhile some 70 years of social science research on natural hazards. In that time a rich field of theoretical perspectives, empirical findings and policy-relevant insights developed upon which CapHaz-Net builds. We have identified specific, well established topics we concentrate on during the first project phase (until mid-2010). Here CapHaz-Net will meet regularly in an open workshop atmosphere where existing knowledge is reviewed and synthesised. Our geographical focus is on Europe.

There are two overarching themes which CapHaz-Net will deal with during the entire project duration:

- social capacity building describes a process (rather than a simple managerial task) which requires different actors and takes place on various levels. It is understood as an umbrella term including efforts to build individual, organisational, local, technical, as well as institutional capacities
- risk governance covers the entire process of risk assessment and management by integrating formal institutions and informal regimes, diverse and possibly conflicting assumptions and world views as well as a multiplicity of actors.

More specifically, CapHaz-Net concentrates on the following topics:

- risk perception stands for a variety of socio-psychological factors defining people's interpretations and evaluations of risks,
- social vulnerability relates to the behaviour and responses to natural risks as well as the resources and capacities to deal with them,
- risk communication describes all kinds of information exchange between institutions responsible for risk production, forecasting and warning and the public at risk,
- risk education is a more targeted effort focusing on specific socio-demographic groups (such as children or teenagers). These topics are permanently reflected in light of the overall aim of:
- social resilience is a concept underlining the need to live with change and uncertainty, to permanently learn and to create opportunities for self-organisation of local communities, institutions and other social entities.

From mid-2010 onwards, we will contextualise the theoretical knowledge gained in the first project phase by confronting it more thoroughly with actual experiences and regional practices related to the core themes of the project. Therefore we will focus on the regional level and conduct three regional hazard workshops (rhw) where we will meet with local and regional decision-makers, practitioners and representatives of civil society. This shall allow us to downscale and enrich our previous findings from reviewing literature and practice examples.

Alpine hazards, such as flash floods, avalanches and debris flows, are amongst the most threatening hazards in the entire Alpine space. These phenomena occur suddenly, are localised, fast moving, generally violent, and difficult to predict. Thus, risk communication, education and social capacity building are key issues for effective short and long term responses. riverine floods in central Europe causing substantial damages have been regularly occurring since the early 1990s at the Rhine, Oder and Elbe rivers. But flooding is a key risk threatening most European societies. Consequently, transnational flood policy is currently striving toward the new approach of flood risk management which is particularly visible in the European Floods Directive from 2007.

What does CapHaz-Net aim to achieve?
The overall goal of CapHaz-Net is to develop deeper insights and recommendations on how to enhance the capacities of European societies to prepare for, cope with and recover from the impact of a ›natural‹ hazard. Therefore the following outcomes are foreseen:

- A state-of-the-art overview of natural hazards research in the social sciences
- Recommendations for and prioritisation of future research needs by identifying gaps of knowledge and open questions
- A network of scholars and stakeholders from across Europe committed to this subject
- Recommendations and praxis examples on how to enhance social capacities for natural hazards and increase social resilience.

Contact:
e-mail: caphaz-net@ufz.de

More information available via:
http://www.caphaz-net.org

WG F Thematic Workshop on "Flash Floods and Pluvial Flooding"

The Working Group F (WG F) on Floods of the EC Common Implementation Strategy for the Water Framework Directive 2000/60/EC (WFD) is promoting a series of thematic workshops looking at the implementation of the Directive 2007/60/EC on the assessment and management of flood risks (Floods Directive). In such a framework, ISPRA (Italy), in co-operation with the EC WG F, the Italian Ministry of Environment and the Region of Sardinia, organized on 26–28 May 2010 in Cagliari, Italy, a Thematic Workshop on "Flash Floods and Pluvial Flooding".

In elaborating flood risk management plans and maps as foreseen in FD, Member States (MSs) shall indeed consider the entire spectrum of types of flood events, some of which can have disastrous consequences on their territories. In the last 10 years, high intensity, often localized, phenomena gave rise to flash floods (FFs) which caused severe damage and loss of life. Noticeable examples include the events that occurred in Spain in 2000 (Montserrat, Catalonia region), Southern France in 2002 (Cévennes), Germany in 2003 (Dresden), Central Romania in 2005, and Italy in 2008 (Cagliari, Sardinia region) and in 2009 (Messina, Sicily region), and more recently on 21 February 2010 in Portugal (Madeira), which claimed over 40 lives. High intensity rainfall can also give rise to pluvial flooding (PF) events where overland flows and ponding can occur in areas which were never expected to be at risk of flooding and which can give rise to major damage particularly in urban areas. This was the case in the summer 2007, where a PF event in England caused over 3 billion Euros of damage. Instances of major damage due to PF also appear to be increasing in other parts of Europe. Climate change is likely to increase the likelihood of extreme rainfall events and hence the risk of both FF and PF. Storm events leading to FF and PF are often characterised by short duration, high intensity and small spatial scales: this poses specific challenges to flood risk management. The need to identify these challenges and examine such particular flood events called for the Cagliari thematic workshop.

Almost 120 delegates from MSs and invited speakers across Europe attended the workshop. An introductory plenary session, which provided a characterization of FF and PF events across Europe, was then followed by four thematic sessions on:

- Events characterization, analysis and approaches to hazard assessment;
- High intensity storms and flood: monitoring, nowcasting and forecasting;

- Structural and non structural measures: planning and prioritization;
- Socio-economic aspects.

Each session ended with parallel discussion groups, and their outcomes reported in plenary session.

During the discussion it was recognized that:

- the timing and durations of FF and PF reduce possibilities of intervention for risk reducing/mitigating and ask for new approaches in hazard assessment techniques;
- FF and PF are not a local problem but spread among the entire EU, exacerbated by climate change; it needs to be studied in detail to be better addressed in planning policies.

Therefore, there is a need to:

1. develop a common language among the different science, technical and policy communities dealing with FF and PF;
2. improve knowledge and structure existing information in shared standardized databases (the significant parameters to be monitored and common monitoring methodologies should be defined);
3. enhance the available monitoring systems by implementing also forecasting/warning systems and by including information on representative past events;
4. widen the range of possible structural and non-structural measures (also through a better understanding of such phenomena): communication and participation are the main measures to invest on in order to choose the best other measures to be implemented;
5. emphasize the research in atmospheric processes leading to FF and in building capacities in order to monitor and provide better warnings on suck kind of events.

All workshop presentations and papers (abstracts/full papers) from the plenary session and the four thematic sessions are downloadable from the Cagliari workshop webpage.

Contact:
e-mail: floods_cagliari2010@isprambiente.it

More information available via:
http://www.isprambiente.it/site/en-GB/Archive/Events/Documents/flash_floods.html

Ireland

Irish National Pluvial Flood Screening Project

A requirement of Directive 2007/60/EC on the assessment and management of flood risks (the ‘Floods’ Directive) is that Member States undertake a Preliminary Flood Risk Assessment to identify Areas of Potentially Significant flood Risk (APSRs), from fluvial, tidal, coastal and other sources of flooding. One such other source of flooding is pluvial, or surface-water flooding, defined as flooding that results from rainfall-generated overland flow and / or ponding, that may occur during or immediately after intense rainfall events, before the runoff enters any watercourse or sewer.

The Irish National Pluvial Flood Screening Project utilises new datasets that are available in Ireland to produce pluvial flood maps with national coverage for the purposes of identifying APSRs. The project uses the new national digital terrain model (DTM) coupled with the rainfall depth-duration-frequency (DDF) mapping, as well as the new Physical Catchment Descriptor dataset for Ireland. The rainfall generated from the DDF model is spread across the terrain using HR Wallingford’s Rapid Flood Spreading Model (RFSM).

There are three principal deliverables:

- *Flood depth maps* – ponded and transient flood depths.
- *Flood velocity maps* – averaged flood velocities.
- *Flood risk maps* – a quantitative assessment of economic damage to property (expressed as the Expected Annual Damage - EAD).

The principal stages in the project were:

- Create ‘Basin’ catchments for the whole of Ireland using the National DTM

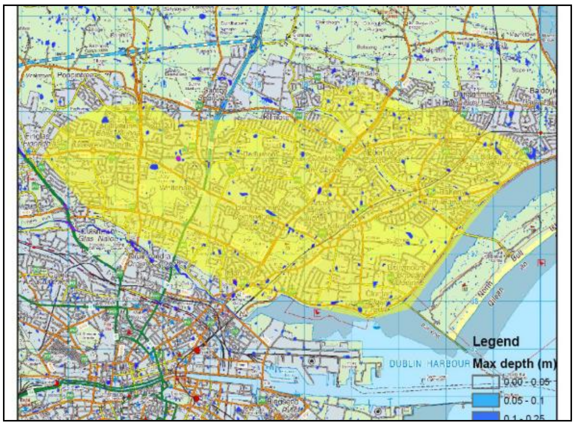
- Process the rainfall to produce hyetographs from the DDF model
- Estimate the effective rainfall (after losses) based on soil type or urban surface
- Simulate the 2D propagation of pluvial flood waters across the topography using the Rapid Flood Spreading Model
- Process for maximum flood depth and velocity
- Evaluate the associated damages and calculate EAD
- Produce all outputs into a database suitable for showing the results on the web.

As with all modelling of complex processes a large number of assumptions were made in carrying out this work. These are summarised in outline below:

- Depression / interception storage has been universally applied as 5mm for all rainfall events.
- The proportion of runoff is based on deducting a loss rate from rainfall.
  For rural areas this is based on soil type using the runoff formula from Institute of Hydrology Report No. 124 for the 100 year 6 hour event. Typical values range from 3 to 8mm/hr.
  For urban areas the loss model is based on an assessment of the pipe system to cater for the runoff from an assessment of the performance of three network models. This has been assumed to be 15mm/hr. This figure is based on a body of research that used InfoWorks CS models of surface water sewers, to estimate the rainfall intensities that would be expected to cause surcharge from sewers.

Ireland was divided into nearly 100 basins of up to 1,000 km^2 for analysis. The use of the RFSM software ensured that the number of basins for analysis could be kept to a minimum.

The outputs provide the starting point for more detailed investigation of locations that might suffer from excessive flooding from extreme rainfall.



Flooded test area (Dublin Docklands) for urban infiltration based on 15mm/hr – part of Basin 9 – DRAFT.

The project was commissioned by the Office of Public Works (OPW) which is the Government's lead agency in coordinating flood risk management policy and the flood relief capital programme in Ireland, and is the Competent Authority under the 'Floods' Directive.

Contact:
e-mail: oliver.nicholson@opw.ie

More information available via:
http://www.opw.ie/

Italy

Toward more resilient communities. Inputs from sociological research in an Italian Alpine Region.

Which are the key drivers of social resilience? What really makes individuals and communities more resilient? The results of a research undertaken within the EC funded FLOODsite project show quite clearly that individuals and communities develop different strategies and behave in different manners to adapt and cope with the impacts of disastrous events. Some persons and groups are more able than others to adapt to change, to learn lessons from the past, to adjust to adverse contingencies, to increase their capacity for foresight, and to adopt effective recovery strategies.

In the following some results are summarized from sociological research which, among others, was aimed at gaining a better understanding of social resilience in four communities in an Italian Alpine region (Trentino Alto Adige). These communities had been seriously affected by flash floods or debris flows between the years 2000 and 2002. All the events caused severe material damages and the partial or total evacuation of the population.

The research work used a triangulation of methods to explore the perspectives of different social actors, with the purpose of providing an integrated picture of the situation with respect to vulnerability and resilience, including factual elements as well as socio-psychological and organizational factors. More specifically, the following methods were used: collection of existing data from secondary sources (Census, historical archives, newspapers, etc.); participant observation in the communities under study; semi-structured interviews, in-depth interviews and focus groups with risk managers, policy officers, and other key informants; and a survey with questionnaires administered face-to-face to 400 subjects (100 residents in each of the four communities). The research process was designed as a recursive one, where each passage provided an input to the next one and subsequently received a feedback from it.

The survey results revealed that a crucial role with respect to social resilience is played by the residents' knowledge of local conditions (including topological and social characteristics of the space they inhabit) as well as their capacity to mobilize existing social networks.

First, the residents with a consistent body of knowledge regarding the local territory appeared to be more aware of impending hazards and risks and tended to behave in a more adaptive manner during flash floods. Such knowledge includes, among other, the morphology of the territory and its use (e.g. neglect vs. over-exploitation), the location of dangerous areas, the presence and efficiency of monitoring and management strategies (e.g. dedicated devices, institutional procedures, etc.). Second, the residents with stronger social networks and bonds in their communities attested that they had received more help during past flood events and were better able to cope with adversities in comparison with those with no or poor local connections. Also, the former expressed more positive evaluations about both personal and community preparedness in the face of flood hazard. Personal and community resilience thus feed on one another, the former deriving from knowledge of and access to existing collective support mechanisms, the latter profiting from increased knowledge of and participation to networks on mutual support.

When transferred at the community level, our analysis (supported by data derived from interviews, focus groups, and participant observation) showed that the more isolated the communities, the more autonomous and active their inhabitants appear with regard to hazard prevention and mitigation activities. Overall, they tend to be more aware that the environment can be a source of danger. Also they are inclined to adopt measures of self protection based on personal and local resources, rather than confiding primarily on external support. In many families there is (at least) one member participating in voluntary organizations of civil protection or fire fighters. These are actively involved in risk mitigation and emergency management and, thanks to their being both professionally trained and locally embedded, act as "resilience catalysts" for the all population.

When the latter element (i.e. local rooting) is lacking, professional efficiency alone seems to generate some perverse effects, potentially decreasing the overall social resilience of the communities exposed to flood hazards. Somewhat paradoxically, the existence of and reliance upon professional agencies and services tends to discourage people's personal engagement, favouring loss of historical memory about past events and lack of risk awareness.

It is therefore mandatory that any communication activity promoted by administrators or emergency managers be based on an accurate exploration of the local situation and the role played by the relevant stakeholders. As confirmed also by the parallel studies of partners in task 11 of the FLOODsite project, no recipe is available (nor possibly desirable) for every situation and circumstance, due to different organizational and institutional arrangements, local habits, cultures, and traditions. Yet a fundamental principle holds, which should guide any intervention: all the available resources of knowledge and commitment should be explored and elicited, favouring the creation of positive synergies between all interested actors.

Contact:
e-mail: bruna.de-marchi@fastwebnet.it

scolobig@isig.it

More information available via:
http://www.floodsite.net

The Netherlands

Flood Risk Management Policy developments in the Netherlands (2010)

Present situation

Protection is the cornerstone of the present Flood Risk Management (FRM) policies in the Netherlands. The length of primary flood defences in the Netherlands is about 3500 km, supplemented with some 14000 km of secondary (less critical) flood defences. The required height and strength of the primary water defences is based on safety standards developed in the 1960's, by the first Dutch Delta Committee. The safety standards are expressed as a maximum allowable exceedance probability of the hydraulic conditions (water levels, wave run-up, etc.) that a dike must safely withstand. Protected economic values and protected population size then were taken into account to some extent. This led to relatively high protection levels with allowable design water level exceedance probabilities of 1/1250 per year along most of the rivers (1/250 for some less vulnerable parts along the upper Meuse) down to 1/10000 per year for Central Holland. The Dutch Water Law prescribes that the height and strength of Dutch water defences is to be tested every 6 years.

FRM-related policy developments

Policy evaluations, experiences abroad (such as hurricane Katrina in New Orleans) and the 2008 advice of the 2nd Delta Committee led to a number of FRM-policy adjustments. This update of FRM and water management policies has been published in the Dutch National Water Plan (NWP; http://www.verkeerenwaterstaat.nl/english/topics/water/water_and_the_future/national_water_plan/), which also contains an extensive research agenda.

The FRM-measures in the NWP focuses on timely implementation of the EU Floods Directive and a three-layered FRM-approach focussing on protection, prevention through for example, spatial planning (risk zoning, risk maps) and disaster management. See the illustration below, where protection is the basic layer (the cornerstone of FRM-policy), supplemented with spatial planning and disaster management.

With respect to protection, the NWP plans a definition of new safety standards in 2011 and an implementation decision in 2017, after a pilot-evaluation of a series of dike rings. Both personal risk, group risk and cost-benefit considerations (based on the present protected values rather than those of 1960) will be included in the new standards. Recent insights in failure mechanisms of water defences will also be taken into account, when water defences are to be evaluated with the new standards.

It must be emphasised that due to the potential impact, implementing the new standards must be a careful process, where it is crucial to know the consequences of implementing new standards, and to verify whether the new standards are suitable and acceptable for key stakeholders.

Protection remains the cornerstone in Dutch FRM policy. Yet it has become clear that designing for low-probability floods implies that the few extreme floods that may occur (despite all prevention) could have disastrous impact. Therefore, the NWP also focuses on the *consequences* of flooding. Not only in the context of spatial planning, but also in the context of disaster management. Organisational issues, vital infrastructure (both physical and ICT) and improving self-reliance of citizens in such large-scale disasters are considered to be crucial aspects for successful disaster management.

Contact:
E-mail:
cruenl (at) rws.nl, frank.alberts (at) rws.nl

More information available via:
http://www.rijkswaterstaat.nl/

FRM research highlights in the Netherlands (2010)

Flood-related climate research highlights in The Netherlands

In previous CRUE Snapshots, some of the 'mainstream' Flood Risk Management (FRM) research projects in the Netherlands were presented, focussing on flood prevention and event management. However, a significant amount of FRM research takes place within climate programmes.

One of the main climate research programmes is the five-year programme Knowledge for Climate (KfC; www.knowledgeforclimate.nl), which started in 2008. Its organisation is founded by the Universities of Wageningen and Utrecht, and now also includes the Free University of Amsterdam, the Dutch Meteorological Service (KNMI) and the research institutes TNO and Deltares. The programme is supported by a 50 million Euro subsidy from the Dutch government

Knowledge for Climate (KfC) focuses around 8 geographical hotspots considered to be vulnerable to climate change, considering issues like water (in all respects), transport, agriculture, nature, recreation urban development, energy supply, financial services and health. Within these hotspots, scientific knowledge is translated into practical solution strategies. A wide range of public and private stakeholders is involved in programming the research for these hotspots, and is active in translating its outcomes into practice. The hotspots for Rotterdam, the rivers and Wadden seem the most relevant in FRM context, together with some international hotspots related to www.delta-alliance.com.

The KfC-publication 'Climate Research Netherlands' highlights some projects that are of particular interest from FRM viewpoint. For the Netherlands, some key facts and lessons from the project 'Financial arrangements for disaster losses under climate change' are:

- Flood probability may increase by a factor 10 for each 50-80 cm sea level rise
- Flood risk will increase due to climate change but also due to economic development (increasing vulnerability). Required adaptation costs due to economic development are of the same order as those of 60cm/century sea level rise; both of these together are expected to be no more than 0.1-0.2% of the Gross Domestic Product.

The project 'National adaptation strategies' suggest that hydrological uncertainties may have a (far) smaller influence on flood risk than uncertainties related to the impact of floods. The latter especially applies to the formulas describing the relation between inundation depth and actual damage.
Similarly, the project 'Adaptive capacity to extreme events in the Rhine basin' suggests that although on a basin (as opposed to local) scale, large scale dike reinforcement is the measure that yields the strongest flood probability reduction, flood risk is even more reduced through vulnerability reduction.

Last but not least, the above KfC publication contains useful lessons on stakeholder participation. Depending on the degree of uncertainty/consensus about the outcome on one hand, and about the beliefs and causes on the other hand, four decision strategies seem appropriate. These strategies can be characterised as: computational, compromise, judgemental and inspirational. The first strategy applies for high consensus and high certainty. The last strategy, whether or not supported by social learning, is suitable for so-called 'wicked' (environmental) problems where both certainty and consensus levels are low. KfC proposes Constructive Conflixt Methodology as a tool, using the four successive steps of stakeholder identification, articulation of perspectives, their confrontation and their synthesis.

Besides this, experiences from two hotspots indicate that research not always needs to be integrated within a spatial planning process; parallel research may be preferred to give more opportunities for innovative thinking, for example through back-casting from a desired future. However, good timing and good involvement of the 'real-world' planners in the hotspot research team then proved to be essential to guarantee the uptake of the findings of such a independent parallel research track.

Contact:
E-mail: cruenl (at) rws.nl, frank.alberts (at) rws.nl

More information available via:
www.knowledgeforclimate.nl
(http://www.climateresearchnetherlands.nl/templates/dispatcher.asp?page_id=25222946

Scotland

Long term deteriation of Flood Embankments

Long term deterioration is recognised to be an important factor affecting the integrity and reliability of flood embankments. Changes in material properties (e.g. desiccation or softening of clays) or in the structural form of embankments caused by erosion and/or burrowing can affect their integrity. The process of desiccation fissuring is known to contribute to embankment failure during overflow conditions that can lead to excessive ingress of water into the crest and on the outward slope ending into breaching and slope failure. However, very little information is known about the rate of desiccation within newly constructed flood embankments. Likewise no robust methods have been developed to monitor the presence of fissures except than excavating trial pits for inspection.
This project was funded by the Scottish Government, East Ayrshire Council and the Institution of Civil Engineers Innovation Fund to investigate the rate of desiccation and structural integrity (cracking) monitoring of a newly constructed flood embankment in Galston (Ayrshire). It was a unique opportunity to monitor the onset of desiccation fissuring at a newly constructed flood embankment that has been constructed from medium plastic Glacial Till. Three different but complementary techniques were used to monitor desiccation and hence changes in moisture content. The first technique involved the installation of soil suction probes beneath the crest and along the side slopes of the embankment. The second technique was geophysical with the use of resistivity arrays to scan the subsurface of the embankment down to 3 metres. The third technique was electro magnetic in order to measure the conductivity of the soil along the whole length of the flood embankment down to 1 metre depth.

From the results obtained, it seemed that the main weather condition affecting the water content within the embankment was the rainfall, and, secondarily, the temperature (which however appears to be strictly related to the rainfall). Other weather variables (wind speed and direction, relative air humidity, sun exposition) do not appear to influence the monitored embankment.
The embankment is mainly characterised by an average water content very close to the saturated one (about 20%), and variations could be observed only at very low depth below the ground surface after a relatively dry period. For

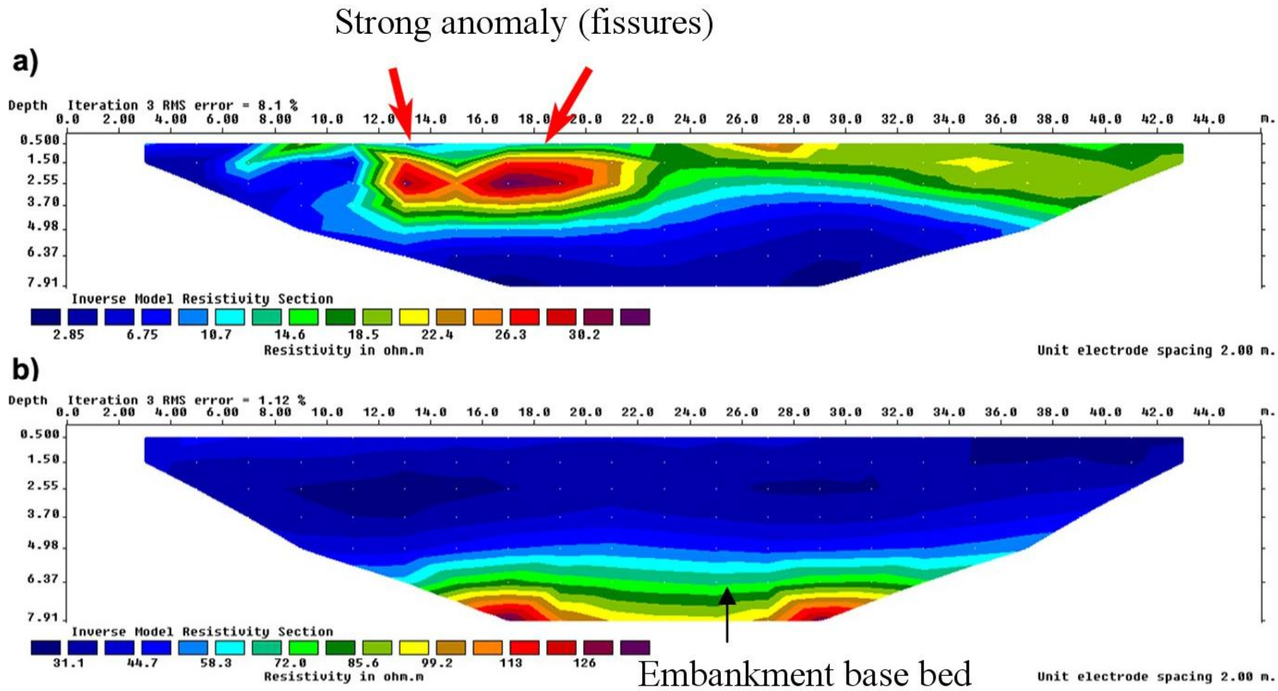
depths larger than 40 cm, no significant variation from the saturated condition could be appreciated. Moreover, for this reason, no conclusions concerning the interaction between the embankment and the water table in the foundation soil could be drawn.

It is worth noting that no significant cracks were observed on site, during the whole monitoring period. This conclusion, in fact, can be derived by the following considerations:

The top soil protects the core of the embankment both on a hydraulic point of view (larger variation in the water content mainly affect the top soil, rather than the core), and on a mechanical point of view (the roots of the grass layer increase the strength of the soil, both with respect to shear and tensile stresses), thus preventing its fissuring. As already observed, the core of the embankment is characterised by a quite constant water content very close to the saturation; in these conditions, no fissuring is expected. This conclusion is also supported by the resistivity tomographic scans of the subsurface using Geophysics. The resistivity measurements haven't shown any strong anomalies along the structure of the embankment in Galston as a comparison to the one scanned recently in Kingston upon Hull. The conductivity scans haven't shown any strong peaks revealing anomalies.

Contact:
e-mail: stan.irvine@scotland.gsi.gov.uk

More information available via:
http://www.scotland.gov.uk/Topics/Environment/Water/Flooding



Resistivity Scans of the subsurface of Hull desiccated embankment (a) and Galston (b)

Technical Exhibition

A Technical Exhibition will take place along with the Symposium. For more information please visit the website www.ufrim.tugraz.at

Venue

The symposium will be held in the city of Graz, in the second largest city of Austria. Graz is situated in the South of the Alps on both sides of the river Mur. Its famous mountain in the middle of the city with the clock tower, called "Schlossberg", provides a perfect view over the old town, which is on the UNESCO 's list of World Cultural Heritage. Moreover, the European Capital of Culture of the year 2003 impresses by modern and spectacular architecture as the Island in the Mur or the "Friendly Alien". Six universities with over 40,000 students are in addition responsible for the young and dynamic charm of the city. Since 200 years Graz University of Technology is one of them.
The UFRIM symposium will be held in the historical building of Graz University of Technology, which dates back to 1811.

For more details related to Graz please contact:
www.graztourismus.at

Supported by

lebensministerium.at · Das Land Steiermark · die.wildbach

Organizer

GRAZ UNIVERSITY OF TECHNOLOGY
Institute of Hydraulic Engineering and
Water Resources Management
Stremayrgasse 10/II, 8010 Graz, Austria
www.hydro.tugraz.at

Head:
Prof. Gerald Zenz

Core organizing team:
Breinhälter H., Jöbstl C., Knoblauch H., Ortner S., Vitas C.

In cooperation with:
Government of Styria, Water Protective Economy and Groundwater Resources

Int. Advisory Committee

Bateman A.	Spain	Meghella M.	Italy
Berga L.	Spain	Nachtnebel H.-P.	Austria
Boes M.	Switzerland	Natale L.	Italy
De Hemptinne F.	Belgium	Patek M.	Austria
Escuder I.	Spain	Pohl R.	Germany
Falconer R.	Great Britain	Riha J.	Czech Republic
Frei R.	Austria	Sumi T.	Japan
Grossmann G.	Austria	Schüttrumpf H.	Germany
Hornich R.	Austria	Stiefelmayer H.	Austria
Koutsoyiannis D.	Greece	Ten Veldhuis M.C.	Netherlands
Loipersberger A.	Germany		

Information

Website www.ufrim.tugraz.at
E-mail ufrim@tugraz.at
Phone +43/316/873/8861

INTERNATIONAL SYMPOSIUM
21st - 23rd September 2011 - Graz, Austria

UFRIM

URBAN FLOOD RISK MANAGEMENT

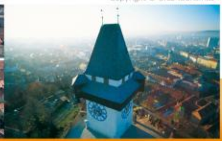
Approaches to enhance resilience of communities

Preliminary Bulletin
>> Call for Papers

TU Graz · 200 JAHRE TU GRAZ 2011

www.ufrim.tugraz.at



General

In the recent past, flood events occurred ever more frequently, and with snowballing effects for the landscape and its habitants. As a result of the current situations in many cities that relate to flooding the demand of the population for safety becomes top priority.

According to the European flood directive management plans have to be developed in the next few years. In this process non-structural measures, as risk communication, participation or warning systems come to the fore.

The aim of the symposium is to provide a forum for scientists and engineers to exchange ideas and sample applications in order to gain new knowledge as well as to identify research needs. Thereby the whole spectrum of urban flood risk management and its related measures and experiences will be discussed. Additionally a study tour will provide an insight into the flood situation in Graz and its vicinity.

Due to the 200 year jubilee of Graz University of Technology in 2011, we are looking forward to celebrate this special occasion with you.
What could be better than a conference, where one of the basic purposes of universities – research – shows its importance in regard to an improvement of people's life and the society.

200 JAHRE TU GRAZ 2011

Topics

A STRUCTURAL FLOOD PROTECTION MEASURES
- Warning Systems
- Small Dams, Retention Basins
- River Training
- Mobile Flood Protection
- Flood-proofed Buildings and Infrastructure
- Canal Systems

B FLOOD FORECASTING, WARNING SYSTEMS AND OTHER NON-STRUCTURAL MEASURES
- Weather Forecast
- Measurement Methods
- Precipitation-Runoff Simulation
- Warning Systems

C FLOOD SAFETY ASSESSMENT
- Risk Analysis
- Risk Maps
- Spatial Planning
- Vulnerability Analysis
- Physical Model Tests
- Numerical Simulations
- Dam Break
- Pollution

D FLOOD MANAGEMENT AND ENHANCEMENT OF RESILIENCE
- Risk Communication
- Action Plans
- Disaster Control Management
- Responsibilities
- Information Platform
- Flood Damage Assessment
- Responsibilities of Dam Owners in regard to Flood Protection
- Insurance
- National and International Guidelines and Regulations

E FLOOD HISTORY AND RESPONSE
- Flood Resilient Communities
- Recent Flood Events
- New Concepts of Flood Protection
- Urban Floods in Developing Countries
- International Cooperation
- Current Projects

F SOCIAL ASPECTS AND PARTICIPATION
- Risk Awareness
- Risk Perception
- Sensitization
- Risk Communication

Program

21st Sept. 2011	Symposium, Evening Event
22nd Sept. 2011	Symposium, Laboratory Tour
23rd Sept. 2011	Study Tour

Call for Abstracts

Participants intending to present a paper are invited to submit abstracts with about 300 words. The abstracts should clearly state the purpose and the conclusion of the potential paper. Abstracts including the complete title of the paper, the corresponding topic, authors, mailing adress, e-mail, phone and fax number should be submitted by the symposium website www.ufrim.tugraz.at.

Important Dates

31st Jan. 2011	Deadline for Abstracts
21st Feb. 2011	Notification of Acceptance
21st April 2011	Full Paper Submission

Study Tour

Two different study tours will be offered on Friday 23rd of September 2011 including urban flood management of small streams in Graz and in small cities in Styria.