PROJECT FINAL REPORT

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Participant no.*	Participant organisation name	Participant short name	Country
1 (Coordinator)	UNESCO-IHE Institute for Water Education	IHE	The Netherlands *(International Institute)*
2	University of Brescia	UniBs	Italy
3	European Centre for Medium-Range Weather Forecasts	ECMWF	United Kingdom *(International Centre)*
4	University of Ljubljana	UniLj	Slovenia
5	Swiss Federal Institute - WSL	WSL	Switzerland
6	Consorzio Ricerche Laguna	CORILA	Italy
7	King's College London	KCL	United Kingdom
8	EC - Joint Research Centre	JRC	Belgium *(European Centre)*
9	Alto Adriatico Water Authority	AAWA	Italy
10	University of Bristol	UniBris	United Kingdom
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FINAL PUBLISHABLE SUMMARY REPORT

Executive summary

The extreme consequences of recent water-related disasters have highlighted that risk prevention still needs to be improved to reduce human losses and economic damages. The KULTURisk project provided a comprehensive demonstration of the benefits of prevention measures to support the development of a culture of risk prevention. At first, the project reviewed static and dynamic measures to prevent water-related hazards and risk communication techniques. Then, the KULTURisk project has developed a methodology (Figure 1) to demonstrate the benefits of risk prevention techniques, which are being applied to a variety of case studies characterised by different socio-economic contexts and types of water-related hazards. The method can evaluate the benefits of prevention actions and help stakeholders to better consider the benefits of risk prevention. Two transboundary catchments (the Soca-Isonzo and the Danube) enable the investigation of cross border aspects. The case studies (6 in total), are used to demonstrate not only the benefits of risk prevention, but also the need for a European approach to disaster risk reduction. The KULTURisk research is based on up-to-date techniques and the methodology includes driving factors such as land-use changes, spatial planning and climate change impacts. Lastly, the methodology was used to demonstrate that prevention measures are very effective from a social and economic point of view for different types of water-related risks (e.g. floods, landslides). To promote a culture of risk prevention, KULTURisk pointed the need to: a) increase the risk awareness of the public via improved communication; b) shape risk perception of inhabitants in an appropriate and responsible way; and c) train professionals to better evaluate the socio-economic benefit of risk prevention techniques for water-related risks (more details at www.KULTURisk.eu).

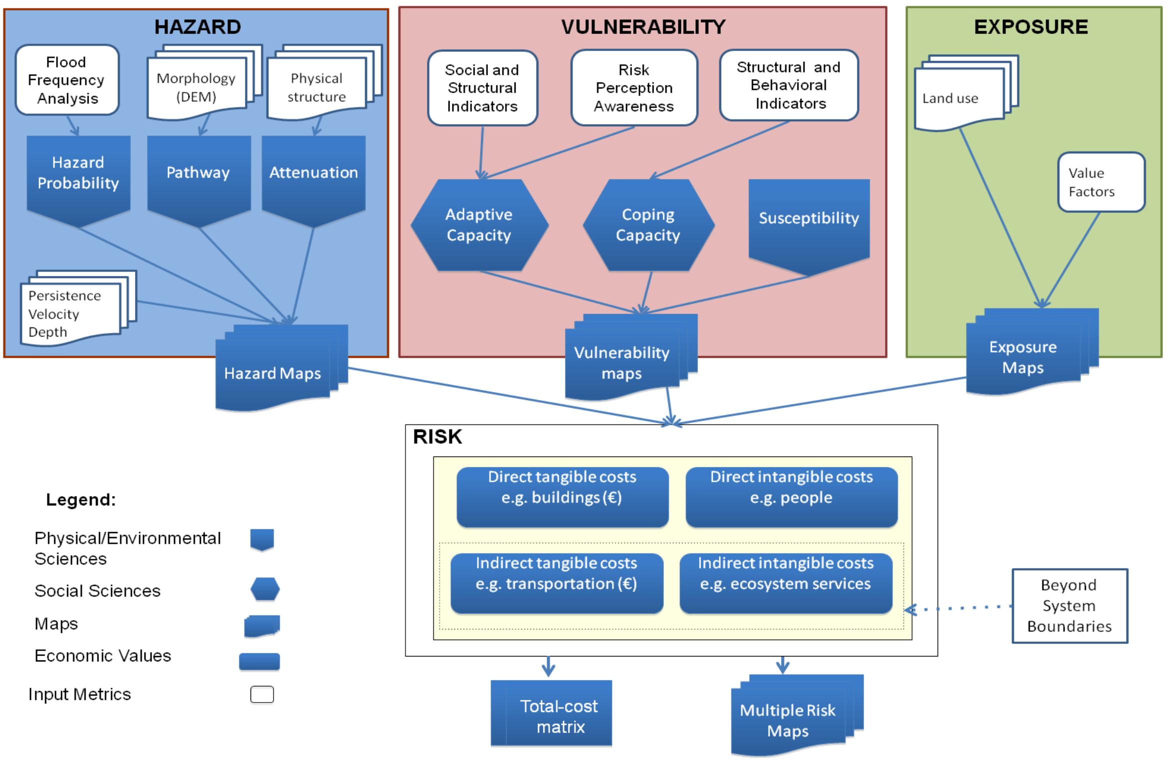

Figure 1. The KULTURisk methodology

Summary description of project context and objectives

Aim of the Project

The KULTURisk project aims to promote a culture of risk prevention by evaluating the benefits of different prevention measures. This evaluation is being carried out by developing a novel methodology and referring to different types of water-related catastrophes, such as river inundations, urban floods, storm surges, rainfall triggered debris flows and landslides.

To demonstrate the advantages of prevention options, an original methodology was developed and applied to a variety of European case studies, characterized by diverse socio-economic contexts, different types of water-related hazards (floods, debris flows and landslides, storm surges) and space-time scales: Danube (Many countries, trans-boundary large river basin), Somerset (UK, coastal area), Barcelonnette (France, urban high-land), Carlisle (UK, urban low-land), Zurich (Switzerland, Alpine catchment), and Soča-Isonzo (Slovenia and Italy, trans-boundary small catchment).

The KULTURisk project has initially focussed on water-related hazards, as the likelihood and adverse impacts of water-related disasters are expected to increase in the near future because of changes in land-use and/or climate. In the last phase of the project, the applicability of the KULTURisk approach to different types of natural hazards (e.g. earthquakes, forest fires) was also be analysed.

Objectives

The main objectives of the KULTURisk project are:

- A critical and comprehensive review of static (structural measures and non-structural initiatives, such as risk mapping, land planning, and insurance policies) and dynamic (forecasting, early warning systems and real time control) measures to prevent water-related hazards with special focus on the importance of risk communication techniques.
- The development of a risk-based methodology for the evaluation and accounting of risk prevention measures, able to consider alternative options (based on static and/or dynamic measures), that is tested with a number of case studies.
- The demonstration that prevention measures are very effective from a social and economic point of view for different types of water-related risks (landslides, flash floods, storm surges, large scale inundations), characterized by different temporal and spatial scales (from small to large catchments, including trans-boundary basins), and diverse socio-economic contexts within Europe.
- The promotion of a culture of risk prevention by using the KULTURisk outcomes as examples to: (a) increase the risk awareness of the public via improved communication; (b) shape risk perception of inhabitants in an appropriate and responsible way; and (c) train professionals, such as engineers and technicians working for government, regional authorities, officers of municipalities, consultants, academics conducting relevant research and students, to better evaluate the socio-economic benefit of risk prevention techniques for water-related risks.

All the activities planned for the achievement of these goals were regularly performed, and all objectives were met.

The concept of risk prevention

In KULTURisk, risk prevention here is meant as the policy objective to reduce risk to an acceptable level. This is achieved by reducing one or more components of risk, defined as a combination of hazard, exposure and vulnerability (see Figure 1).

Structural measures (such as levees and other flood defence structures) can be used to reduce hazard, while non-structural measures can decrease exposure or vulnerability. For example, a conscious land use planning can largely reduce the exposure of houses (and of their inhabitants) to flooding. People awareness, starting from children education, promotes a better behaviour during dangerous events and therefore reduces vulnerability. More examples are published in the KULTURisk project reports (available at www.kulturisk.eu), including the proposed methodology, able to provide an accountability scheme for these actions and demonstrate the benefits of risk prevention.

Key messages

Prevention strategies can be accountable and key to secure a smart, sustainable and inclusive growth of well being.

The EU2020 strategy for a smart, sustainable and inclusive growth could be jeopardized by the impacts of natural hazards, if they become disruptive disasters. As too often experienced, a disaster not only affects assets and economy, but also human lives, environment and cultural heritages. In addition, social differences are often enlarged by disasters because their consequences are suffered more by the weaker parts of societies.

Increasing the resilience of a society, by means of a proper prevention strategy, is a basic condition for a secure path towards a durable and enduring growth.

The costs of taking measures before the occurrence of a hazardous event to reduce its probability and/or mitigate its potential consequences are often less than the restoration and recovery costs. However, in practice, prevention initiatives attract less attention and are only seldom rewarded.

The KULTURisk project outcomes demonstrate that prevention is accountable. As a matter of fact, an adaptable practical methodology was developed and validated in different cases, related to various water-related hazards. The approach is both rigorous and flexible and allows considering different spatial-temporal scales. On this base, investments on prevention by Public Administrations can be better evaluated and shared with citizens, also in order to support the rising of a culture of prevention in the whole society.

We have found out how the lack of “political rewards”, added to the cost of some measures, is one of the main causes for not implementing prevention measures. Some examples of local administration involvement and rewarding are present (e.g. in the UNISDR campaign “Making cities resilient”), but a real cultural shift is necessary, underpinning and promoting a new Social Pact for a Secure Growth, at European, national and local level.

In order to promote Public Administration (financial) investments in prevention actions, the quality of “growth-enabler” of these in-vestments should be recognised, when discussing possible revisions of Stability and Growth Pact (SGP, both at EU and national levels). An investment for safeguarding the territory should have a priority lane (or exception from SGP) to when compared to others, e.g. involving soil consumption.

This could be one concrete answer to the recent OECD conclusion that “The key policy question is what type of rewards and incentives can be created in the near term for governments to invest on risk prevention and mitigation”. In addition, public investments and framework rules (starting from an effective implementation of EU legislation and including land use planning) are also triggering factors for innovation in risk management and therefore can carry a direct contribution to the economy growth.

Intangible and indirect damages matter, while social capacities can change prevention actions if accounted for.

The actual costs of natural hazards are difficult to quantify. For this reason, tangible costs such as the number of destroyed houses, loss of production and the costs of evacuation are traditionally used to get a picture of the magnitude of the impact of natural hazards.

The KULTURisk project developed a methodology that accounts for intangible costs, such as lives of people, psychological trauma, loss of working time, quality of environment and cultural heritage, as well as indirect damages such as loss of services (i.e. hospitals and other critical hot spots) that are often neglected, mainly due to the difficulty of their quantitative estimation.

One of the main outcomes of the KULTURisk project is the methodology to assess the vulnerability of societies and relate it to the economic benefits of risk prevention and mitigation by either cost-benefit analysis (CBA), or cost-effectiveness analysis (CEA) that helps accounting also for intangible/indirect damages.

The methodology considers economic, social, cultural, and environmental receptors as indicated by the Flood Directive and allows the evaluation of benefits of risk prevention measures through a participatory process involving all actors, being policymakers or people.

The methodology was tested and validated for a variety of case studies across Europe and also for several types of water related hazards. Furthermore, it proved to be adoptable to different needs of stakeholder and end-users, scales, and data availability. Lastly, the flexibility of the methodology and potential applicability to other natural hazards was demonstrated.

Recognizing and estimating uncertainty lead to more robust risk assessment

Risk prevention is about acting before events happen. This implies that most decisions must be taken based on modelling of future scenarios. In particular, when dealing with floods, many factors are uncertain, such as weather forecasts, hydrological and hydraulic modelling, climate projections, geotechnical parameters, but also the exposed people and assets as well as their vulnerability.

Uncertainty must be acknowledged given that methods and models used to support risk studies are always affected by uncertainty. Ignoring uncertainty may lead to potentially negative situations. Thus, any scientifically-sound advice should provide a transparent overview of the assumptions, their impact on the results and the associated uncertainty.

KULTURisk findings show that considering and estimating uncertainty, and explicitly communicating it, is not only a more scientific approach, but also very useful from a practical viewpoint as the estimation of the uncertainty increases the value of information and often leads to more robust decisions in the field of risk management.

Since decision makers have to deal with uncertainty, an explicit accounting of it is necessary to generate more robust and conscious decisions. Although uncertainty has been discussed in the scientific arena for some years, translation of the knowledge to practical applications has been difficult. While many decision-makers have become more and more confident in dealing with uncertainty, a legal framework that explicitly accounts for the presence of uncertainty is still missing.

The KULTURisk project has made significant contributions to the understanding and estimation of uncertainty, especially for flood hazard and risk mapping and for flood forecasting, with the purpose of considering it in practical applications. The KULTURisk Framework proved to be capable to integrate several of the above mentioned sources of uncertainty into the risk assessment methodology.

Moreover, evaluating the impact of climate and socio-economic changes on the occurrence and impact of natural hazards, such as floods, ap-pears a mandatory component of long term risk assessments, but it adds a new dimension to the management of uncertainty, going beyond consolidated approaches.

Two-way risk communication increases consensus about prevention measures and trust in authorities.

Knowledge about natural hazards makes com-munities more resilient and better prepared to respond. Facilitating such knowledge is one of the purposes of risk communication, which is fundamental when turning from hazard control to risk management.

Risk communication helps building not only awareness, but also participation and responsibility in the communities. However, risk communication is challenging because it must take place among all relevant actors, who have specific risk-related understandings and interests.

The KULTURisk project systematically evaluated a wide range of communication activities to understand the factors affecting risk communication and reveal the elements that make it more effective. Different target groups were analysed with different risk situations and communication goals, using qualitative interviews, standardized surveys, experimental evaluation and media analysis.

It was found that the compressibility, readability, completeness and usefulness of the information material, as well as the trust on its source, are key factors that affect risk communication. This is important because stakeholders generally adopt the messages they consider relevant to their needs.

One-way communication is the most widely used method, but is the least cost effective. It has a moderate positive effect on risk awareness and on the motivation to implement individual prevention measures. Although target-group tailored information can have a substantial impact on both risk awareness and prevention, it must be presented in a way that addresses their concerns and way of thinking. This requires more efforts in practice and research.

On the contrary, two-way communication increases consensus about prevention measures and trust in the authorities, although it is costly and only reaches a limited circle of stakeholders directly.

Risk communication is about communicating constantly and is needed to achieve awareness for any risk-related topic among heterogeneous end-user groups. It must be included in any long-term communication strategy. Risk communication can be improved through education, being primary and secondary schools the ideal target.

Although mass media are important for risk communication, they tend to highlight measures of traditional hazard control (levees or dikes for flood defence) rather than the wide set of risk prevention measures (structural and non-structural). Proactive media information by risk managers or responsible offices would therefore be a relevant tool to establish a comprehensive culture of risk prevention.

The benefits of risk prevention

The KULTURisk methodology was applied to diverse European case studies to evaluate the social and economic benefits of risk prevention, i.e. reduction of potential flood losses due to the implementation of prevention measures. Among many outcomes, it was demonstrated that the implementation of early warning systems can significantly (between 30 and 40%, depending on various factors) reduce the potential flood damage in the Danube river basin countries indicating that investments in preparedness and early warning systems can be highly beneficial. In the Ubaye Valley (France), it was found out that a combination of structural and non-structural prevention measures can remarkably reduce the potential impact of flooding in Barcelonnette for different receptors (70% less for people, 84% for buildings, 77% for infrastructures, 91% for agriculture). In Zurich (Switzerland), prevention measures reduce the potential damage caused by extreme flood events in the Sihl River by 50%, while additional prevention options in Zurich (e.g. discharge tunnel) were found to potentially reduce flood losses near zero with benefits more than 10 times higher than the costs of prevention measures.

More details about case studies are published in the KULTURisk available at www.kulturisk.eu.

Description of the main results/foregrounds

The following sections provide a concise overview of the main results of the KULTURisk project for each work package in the KULTURisk case studies (Figure 2), in line with the structure of Annex I to the Grant Agreement. More details can be found in the corresponding deliverables.

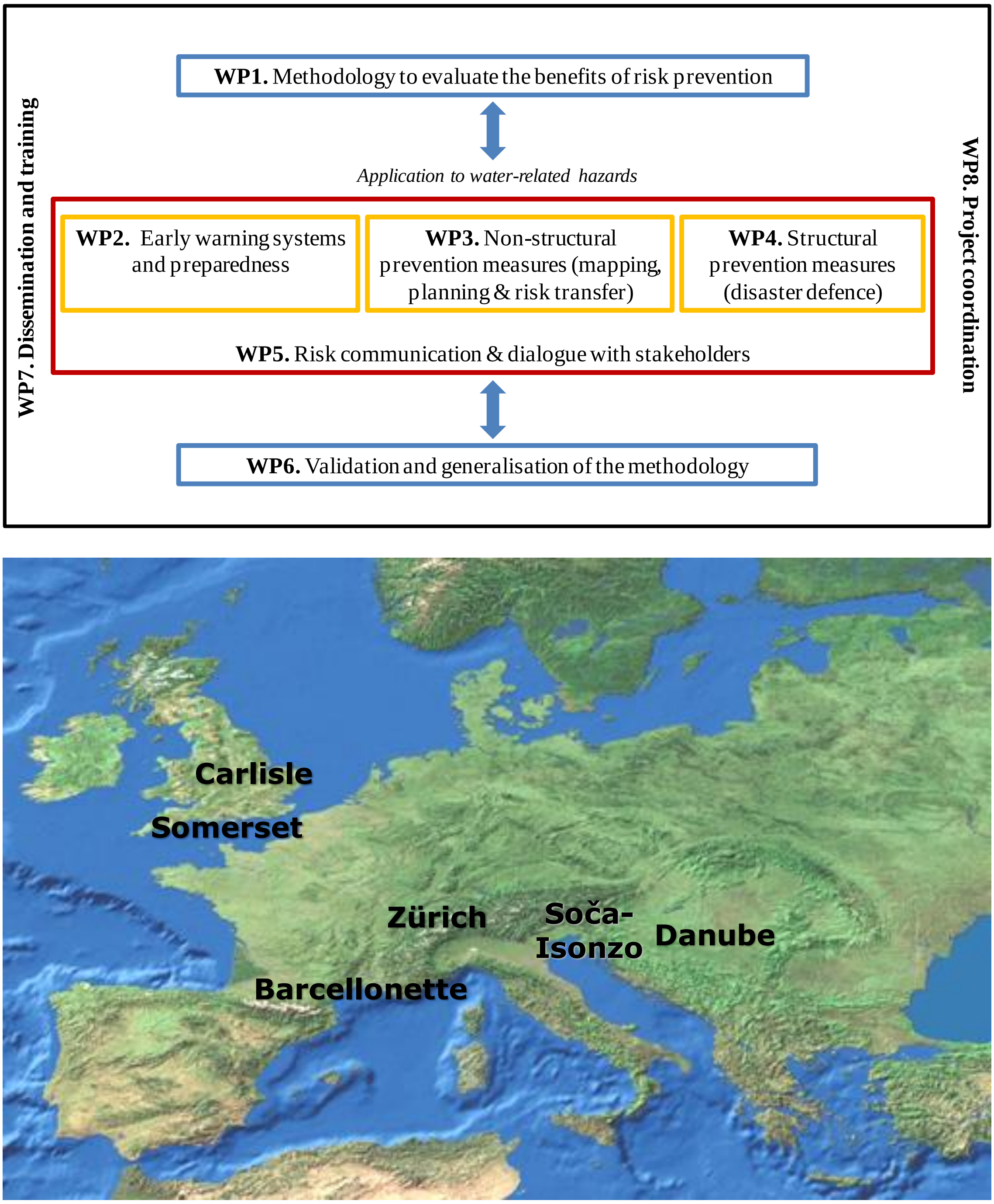

Figure 2. KULTURisk work packages and their interdependencies (above)

Map of KULTURisk case studies (below)

Methodology to evaluate the benefits of risk prevention

(WP1, led by CORILA)

Development of a methodology for evaluating the benefits of risk prevention

Over the past 18 months of the project, many activities have been related to the development of the KULTURisk methodology for evaluating the benefits of risk prevention and to further refine it according to specific case study needs. Starting from the KULTURisk framework presented in Deliverable 1.6 (month 18), a risk-based methodology for evaluating the benefits of risk prevention for water-related natural hazards was developed. The KULTURisk methodology was described in the publicly available Deliverable 1.7 "Development of a risk assessment methodology to estimate risk levels" and additional details were added in the Deliverable 1.7b for supporting case study leaders in applying it to the KULTUrisk case studies.

The methodology is in principle applicable to different types of water-related hazards (e.g. landslides and debris flow, storm surges) however, D1.7 presents how the methodology can be specifically applied for floods.

The KULTURisk methodology starts from the analysis of information produced by hydraulic engineering (e.g. flood hazard assessment and mapping) and can integrate probabilistic flood forecast information, addressing the notion of uncertainty in the risk assessment process. It is a general and flexible methodology for the integrated assessment of risks levels associated to floods on multiple receptors/elements at risk (i.e. people, economic activities, cultural heritages, natural and semi-natural systems) according to the Floods Directive (EC, 2007). The method was mainly developed for analysis at the meso-scale level, adopting the land use/land cover classes proposed by the CORINE Land Cover dataset, as major spatial units of reference (Büttner et al., 2006). However, it is sufficiently flexible to be applied at different spatial levels (i.e. the macro or the micro scales) based on the purposes of the assessment, the geographical extent of the case study and the level of detail of input dataset.

Its main objective is to identify and prioritize areas and targets at risk in the considered region, allowing evaluating the benefits of different risk prevention scenarios (i.e. baseline versus alternative scenarios).

In order to consider all the environmental, social and economic aspects depicted in the KULTURisk framework, the risk-based methodology was structured according to three tiers of analysis (Figure 3): Regional Risk Assessment (RRA), Social assessment (S) and Economic assessment (E). The first tier (i.e. Regional Risk Assessment), developed by the Department of Environmental Sciences, Informatics and Statistics (DAIS), considers the flood hazard and the physical/environmental dimension of vulnerability (i.e. susceptibility) in order to identify and classify physical/environmental risks associated to floods for different receptors located in the analysed region. The method is spatially resolved and produces an integrated risk index that evaluates the potential implications of floods in non-monetary terms. The results of the RRA are basically GIS-based maps allowing the identification and prioritization of areas, receptors and hotspots at risk at the regional scale, and representing a basis for flood hazard and flood risk management plans according to the Floods Directive (EC, 2007).

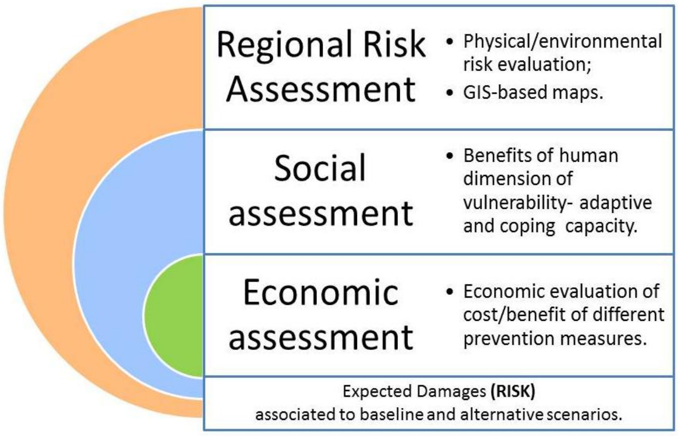

Figure 3. Implementation of the KULTURisk methodology to estimate risk levels.

This RRA tier is a fundamental step for the KULTURisk methodology, as it provides an estimation of the physical/environmental risks that can be used as input for the social and economic tiers of analysis. These tiers can be used separately (i.e. considering only the social or the economic dimension) or sequentially (i.e. estimating the effects of the social and value indicators, together with the physical/environmental ones, on the expected costs). Specifically, the social assessment aims at considering the benefits of the human dimension of vulnerability (i.e. adaptive and coping capacity).

Department of Economics (DE) developed the Socio-Economic Regional Risk Assessment shortly known by KR-SERRA. SERRA methodology complements the well-known Regional Risk Assessment (Landis et al, 2005) in two respects. First, it considers the social capacities of the societies by including the adaptive and coping capacities that will reduce the negative impacts of catastrophes on the society. Constructing the Vulnerability index is done through a participatory process that also takes into account the preferences and knowledge of experts. Secondly, KR-SERRA attempts to provide solutions for monetization of intangible or indirect costs.
In particular, the SERRA methodology provides innovative solutions to evaluate the costs and benefits of the specific alternative scenarios such as the benefits of alternative transportation system or the costs and benefits of the early warning system, which are subject to uncertainty and are stochastic in nature. Finally, the KULTURisk framework was finalized and modified to incorporate the uncertainty dimension of risk assessment.

The proposed KULTURisk methodology was applied in different (6) case studies (Deliverables 2.4, 3.4 and 4.4) and then validated (WT 6.1 and 6.3). Moreover, the possibility to generalize/adapt it in order to address other types of natural hazards was explored (WT 6.2 and 6.3).

Evolution of risk perception

Deliverable 1.8 “Evolution of risk perception in each case study” (due by month 30) was finalised. Specifically, as agreed in Deliverable 1.3 (month 6), different strategies to assess flood risk perception have been tested in both Sihl River and Vipacco/Vipava case studies. Moreover, other two specific activities: a workshop organized by JRC on expert preferences and perceptions of best practice in uncertainty communication, and a comparative analysis of risk perception in UK, Netherlands, Switzerland and Italy promoted by KCL, were carried out. The case study work allowed to highlight the following issues.

Focusing on the Sihl study, three different methods have been applied to reveal the interrelation between risk communication and risk perception: an experimental evaluation based on a repeated standardised measurement of a participatory planning process, an evaluation of an information campaign based on a cross-sectional standardised survey and an ex-post assessment of the risk management of a flood event based on qualitative interviews. A cross comparison of these three methods in an evaluation study of participatory revitalisation projects in Switzerland (Buchecker et al., 2013) revealed that each method has its strengths and limitations, and that a combination of these methods would yield the most reliable results.

An experimental evaluation allows the researchers to reveal causal relationship, e.g. between risk communication and risk perception. The main limitation, however, are normally self-selection effects of the sample. In a repeated measurement of real (not experimental) social processes, the mortality within the panel is often quite high, and this self-selection process necessarily influences the results. A cross sectional survey allows the researchers to include a larger random sample and thus to achieve statistically reliable results. The main limitation of this method lies in the uncertainty of the direction of revealed interactions. So, even if risk communication appears to be a significant predictor of risk awareness, it remains uncertain whether risk communication promotes risk awareness or risk awareness has a positive influence on risk communication. Finally, qualitative interviews allow the researchers to achieve a better and more comprehensive understanding about change processes. Limited in this methodological approach is on the one hand the sample size and thus the information about the representativeness of the finding for the investigated population, and on the other hand the size of revealed changes or differences.

Due to the methodological differences of the three studies in the Sihl case study, the measured changes in risk perception of different target groups could not be directly compared. But the findings allowed us to draw some clear conclusions.

Risk perception of property owners is considerably low even in areas prone to flood. Putting effort in awareness rising in such area is worthwhile to prevent future flood damages. The results show that the information campaign on the hazard map of the city of Zürich appeared to be a successful instrument to increase the social capacities of a large target group. As relevant was the insight hypothesised in an earlier study (Höppner et al. 2012) that regular and piecemeal information increases citizens' motivation to receive further information. This is a long-term process and requires awareness of the importance of risk communication among persons in charge in municipalities.

The baseline survey conducted at the workshop in Gorizia revealed that due to lacking flood experience the participants' risk awareness was low. Nevertheless, they consider the implementation of prevention measures and are particularly open towards risk communication as a means of increasing self-responsibility among residents. The results of this study stress the importance of risk acceptance as a pre-condition for the intention to adopt mitigation measures.

The ex-post interview analysis of stakeholders' perception of the management of a recent flood event in the Kander and Lötschen valley clearly confirmed that a flood event increases not just stakeholders' risk awareness but also their acceptance for risk prevention measures. The flood event opened in both valleys a window of opportunities to implement risk prevention measures that had been postponed in the last years. Flood events with limited damage seem to promote learning effects in terms of non-structural prevention measures, if local as well as regional experts are involved in the negotiation of the post event measures.

The participatory assessment process on the long-term flood prevention project of the Sihl revealed that risk awareness of these experts was quite high at the onset. Since they were already fully aware of flood risks, no effect on their risk awareness could be measured. However, two way communication could transform participants awareness of a flood risk into a higher support of a risk based management.

Finally, findings also suggest the challenging complexity that collaborative, participatory processes will involve. As an example, in Vipacco/Vipava case study, it is clear that there are important lay persons-experts divisions that transcend national boundaries. Experts on either side of the board share more in common in terms of their perception of risk with each other than with general citizens. Among the citizens there were some aspects of lay risk perceptions in Vipacco/Vipava which were similar but it was possible to identify also some national-specific differences. In the same direction goes the comparative analysis of risk perception in UK, Netherlands, Switzerland and Italy by suggesting the importance of national differences in risk perception and in particular in expectations about the levels of protection provided by and responsibilities of the state.

Early warning systems and preparedness

(WP2, led by JRC)

Alternative scenarios for the application of the risk-based methodology

Danube Case Study

One of the principal requirements of the risk assessment methodology is the flood extent and water depth of the area to be evaluated. We derived a Danube wide flood hazard map by expanding the cascading models approach. Figure 4 illustrates the flood hazard map for a 100 year return period event in the Danube river basin.

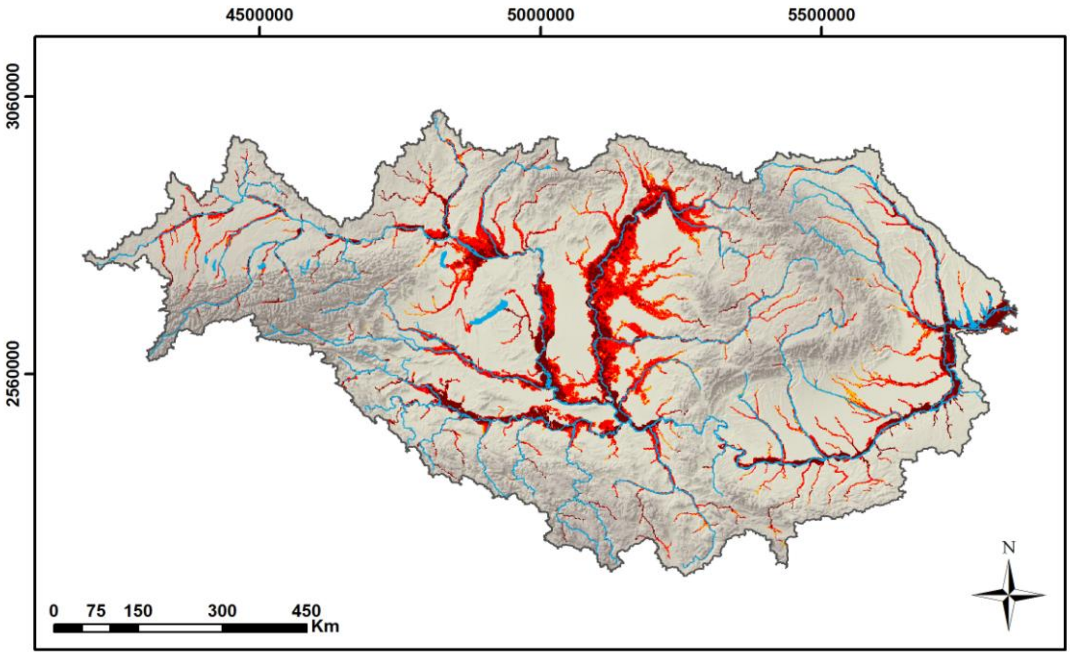

Figure 4. Flood hazard map of the Danube river basin for a 100 year return period event. Color coding indicates areas with a certain flood water depth: orange up to 0.5m; red 0.5m to 2m; dark red greater than 2m.

In order to evaluate the effect of the flood early warning system on the vulnerability and the risk, the methodology described in Deliverable 1.7 requires the quantification of lead time and reliability of the early warning system. Whereas the lead time is an intrinsic variable to any early warning system, measuring the performance of the system is a complex task. A number of different metrics were selected to assess the performance of the European Flood Alert System in the long run. The real-time verification metrics are used as a guide to decision making since they can give some answer as to the immediate performance of the system, whereas more sophisticated metrics are used in long-term experiments.

For evaluating the damage mitigating effects of a flood early warning system various different scenarios will be generated. We will focus in those scenarios on assessing the benefits of different lead times ranging from a short term warning (e.g., a few hours only) to a medium range warning (e.g., various days) and on estimating the benefit of probabilistic versus deterministic forecasting. Thus, we will apply the risk assessment methodology to four cases:

1. No warning;
2. Perfect forecasts,
3. Deterministic forecasts;
4. Probabilistic forecasts.

Soča-Isonzo Case Study

The transnational Vipacco basin was selected as tested within the Soca-Isonzo case study, as shown in Deliverable 2.2. Surface data will be used to validate the distributed hydrological model named DIMOSHONG and developed by Brescia University which can be used in the operational forecasting chain. The availability of surface meteorological and hydrometric data in the last decades has been checked in order to select some flood events for the calibration and validation of the hydrological model. A study of the local correlation among precipitation, discharge and water table elevation is also being performed, in order to support the development of a karst module for the hydrological model. Quantitative precipitation forecast provided by ECMWF in both the high resolution deterministic mode and the coarser resolution ensemble EPS system will be used in the forecasting operational chain to provide flood forecasts for the Vipacco River. Both deterministic and probabilistic meteorological predictions will be considered.

An early warning system can support stakeholders and people to reduce both direct and indirect effects of a flood, especially considering small-scale catchments like the Vipacco/Vipava watershed, where the decision-makers can meet fewer difficulties in coordination and communication to people. A deterministic forecast is probably the clearest way to alert the end users, but it can also bring to false alarms, as well as to underestimate a flood event. It has to be underlined that a single forecast-failing can reduce substantially the confidence in the whole forecasting system. A probabilistic approach is therefore necessary. But it is also essential for the stakeholders to understand the concept of this approach. The only way to do this is by making the output of a probabilistic forecasting as clear and simple as possible, so that the decision maker can more easily understand it and provide adequate guidelines to the population. So our aim will be not only to provide the forecast outputs, but above all to make them understandable for a large amount of people.

Sihl Case Study

Since September 2008, a regional flood warning system (IFKIS-Hydro Sihl) has been operating in the basin of the Sihl river in order to support the flood prevention in the city of Zürich. To increase our understanding of users' perception of flood warning systems we will address this issue within a study in which we analyse the knowledge transfer through an education program for the (recently introduced) local natural hazard consultants. This education program included an introduction in and a training of the use of the National Natural Hazard Platform GIN. GIN is an internet platform for warning and intervention that accommodates forecasts, warning systems, models and actualized data of the Federal Office for Environment FOEN, the Federal Office for Climatology (Meteo Switzerland, national weather service), the WSL Institute for Snow and Avalanche Research SLF and the National Earthquake Service.

The main goal of the just started study is to understand the benefit of an education program for local natural hazard consultants in terms of the knowledge transfer. More precisely, we want to understand to which degree the original messages on hazard management that have been develop and meditated by the cantonal experts has been received by the local natural hazard consult-ants. Of interest is not only the consultants' acquired knowledge, but also their understanding of their role in the hazard management as well as their first experiences of using their knowledge. In this context, we are also interested in their knowledge of and their experiences with the GIN plat-form.

Evaluation of the benefits of risk prevention techniques and demonstration of how an acceptable level of risk can be reached in case studies

Danube Case Study

In this research we have assessed the applicability of the KULTURisk methodology to the large scale transnational Danube river basin and we have evaluated the benefits of a river basin wide flood early warning system. The main conclusions of the Danube case study are:

- Using the regional risk assessment (RRA) it could be shown that the total flood risk as well as the flood risk of different receptors varies significantly between the different countries of the Danube river basin.
- The highest damages were found to be related to people. This appeared to be explained by high number of people with injuries and thus also deaths as both are linked within the KULTURisk methodology. Relating death and injuries to flood characteristics requires further investigations.
- The application of the social vulnerability reduced significantly the risk highlighting the importance of accounting for adaptive and coping capacities despite its associated uncertainties.
- Adding an early warning system into the risk assessment provided an overall quantification of the expected benefits for such a transnational flood forecasting system.
- The differences in loss reduction between the deterministic and probabilistic forecasting scenario were relatively low as the equitable threat score, used to calculate the reliability of the early warning system, does not penalize false alarms and misses.

- The most important issues in the application of the KULTURisk methodology for this case study were the large amounts of data required by the methodology.
- Weighting of large amounts of data may introduce uncertainties which would make comparisons of different case studies less accurate as subjectivity in weighting affects the coping and adaptive capacities of receptors.

Soča-Isonzo Case Study

The KULTURisk methodology (Regional Risk Assessment) for the Soča/Isonzo case study was applied to the Vipava/Vipacco sub basin, and an early warning system was developed and described in D.2.4. In the RRA methodology, an early warning system influences only the vulnerability/susceptibility component of the algorithm implementation. The value of its "weight" is set by stakeholders or decision makers. In order to verify the applicability of the RRA methodology to this case study different experts and stakeholders were consulted and a questionnaire was prepared and sent to some of them. Received comments are mainly positive up to this stage of the project development. One of the most noticeable benefits in the application of the flood forecasting system is its potential interconnection with the spatial application of the KR methodology, as seen in D.3.3. Indeed a forecasted hydrograph can be directly used as input for either a one-dimensional or a bi-dimensional flood model, instead of a synthetic hydrograph built on the basis of a pre-assigned return period peak discharge.

When the early warning system is run in operational mode, forecasted hydrographs could be compared to synthetic ones referring to different return periods within a reasonable range and for which corresponding flood hazard maps were previously produced. As a preliminary risk estimate, the forecasted hydrograph can then be expected to lead to a risk map not very different from the one produced by the closest synthetic hydrograph in the catalogue. In any case, the early warning system including the flood forecasting tool can reduce the vulnerability/susceptibility component of the risk. On a realistic point of view, a correct flood warning given with 1 to 5 days of time ahead makes some important actions feasible:

- Evacuating people away from the potential flooded areas.
- Protecting economic activities (moving equipments, machineries, etc)
- Minimize the potential damages of cultural heritages and if possible of natural and semi-natural systems.

Another benefit of the KR methodology was the definition of both deterministic and probabilistic scenarios. Even if it is not yet possible to quantify neither the costs of failure and false alarms nor the value of the forecast system skill scores the combined approach was found to improve the confidence in the flood forecasting by the AAWA end user. The probabilistic (or ensemble) flood forecast framework was considered a step forward to the multi-model deterministic hydro-meteorological forecasting chain which is actually in operation for the investigated region.

Sihl Case Study

The application of the KULTURisk methodology revealed that a flood event of the Sihl river with a return period of 300 years (status before 2008) would bring about considerable damages in particular in the city centre of Zurich (see Figure). Unfortunately, there are no spatial data available defining the flood risk under the condition of alternative prevention measures. The envisioned long-term prevention measures, in particular the prioritized alternative of a discharge tunnel bypassing extreme floods to the Zurich lake would widely eliminate the flood risk of the Sihl in Zurich. Of more relevance would be the calculation of the current status of flood prevention.

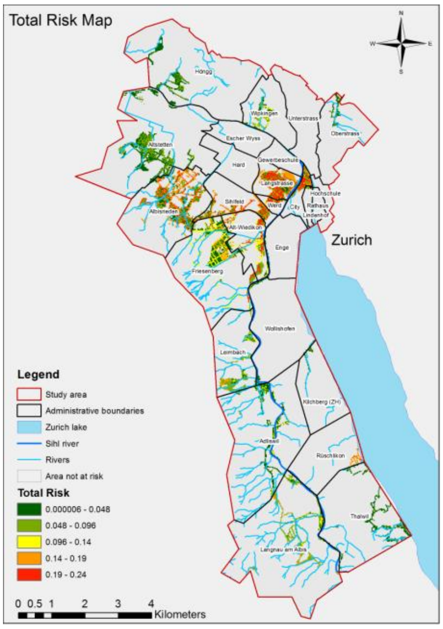

Figure 5: Total Risk Map for Sihl study area (Bullo, 2013).

Since September 2008, a regional flood warning system (IFKIS-Hydro Sihl) has been operating in the basin of the Sihl river in order to support the flood prevention in the city of Zürich. This early warning system has mainly the function to allow for an early extension of the retention capacity of the Sihl lake, which has been constructed for energy production in the upper Sihl basin in 1934. Based on this prevention approach, a substantial reduction of flood risk can be expected. But for building a sufficient retention capacity to mitigate extreme flood events, a lead time of three days is necessary. The effectiveness of this prevention measure mainly depends on the reliability of (mid-term) meteorological forecasts. An evaluation based on discharge thresholds of 75 to 90% of daily maximum distribution of the period from 1974 and 2007 in Zürich revealed that forecast with a lead time >2 days show a poor model performance in terms of hit and false alarms and in particular a over-forecasting tendency (50-70% false alarms for Q 0.9). This performance is expected to be considerably worse for extreme events; according to the analysis of historical floods, the most extreme flood events of the Sihl are expected to be high intensity precipitations less than 16 hours and extreme thunderstorms of less than 8 hours that normally cannot be predicted precisely. This high quota of false alarms is all the more critical as unnecessary preventive draw drops lead to significant money losses. An assessment of the probability of successfully predicting extreme events in the Sihl was estimated to be 80% for LT1, 60% for LT2 and 40% for LT3. This means that the flood risk of the Sihl can be substantially reduced by an early extension of the retention capacity of the Sihl lake, but that flood risk in Zürich remains critical.

Barcelonnette Case Study

The KULTURisk methodology was applied in Barcelonnette with reference to a set of possible flood hazard mitigation measures (and strategies). The alternative flood mitigation measures were divided into two main categories i.e. structural and non-structural.

The Ubaye River is in a quick responding catchment characterised by tributaries originating from steep alpine slopes. At the time of the application of the methodology, there was no formal operational early warning system (EWS). Specific details of the proposed type and setup of the EWS were not considered, however, the benefits of the virtual EWS were simulated by calculating the reduction in the vulnerability (in the social assessment) of the receptors in the floodplain; i.e. people, agriculture, building content, and infrastructure.

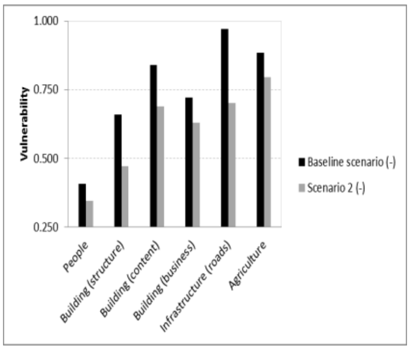

Figure 6. KULTURisk output showing the decrease in vulnerability of different receptors

Figure 6 shows the reduction in the vulnerability of the receptors in the floodplain, thus documenting the benefits of an EWS in flood risk mitigation, for the chosen study area. One of the main findings from the analysis was that the effect of implementation of the EWS had a relatively low effect (lower than practically expected) in reducing the susceptibility of the people to the flood risk. This was attributed to the compensatory effect of the weights during aggregation.

Non-structural prevention measures

(WP3, led by UniBs)

Non-structural prevention measures in KULTURisk case studies

Vipava/Vipacco case study

To evaluate the benefit of non structural measures as the coupled used of early warning systems and flood risk mapping can be a useful prevention measure to mitigate effects of floods the flood risk map for the Italian side of the Vipava/Vipacco basin was computed by the Alto Adriatico Water Authority partner applying the KULTURisk methodology, and assuming that the information of the a flood warning system as that implemented in WP 2 is available to the population. Results are shown in Figure 7, which can be considered as a summary of the KULTURisk project for a part of the Vipava-Vipacco basin in the Soca-Isonzo case study.

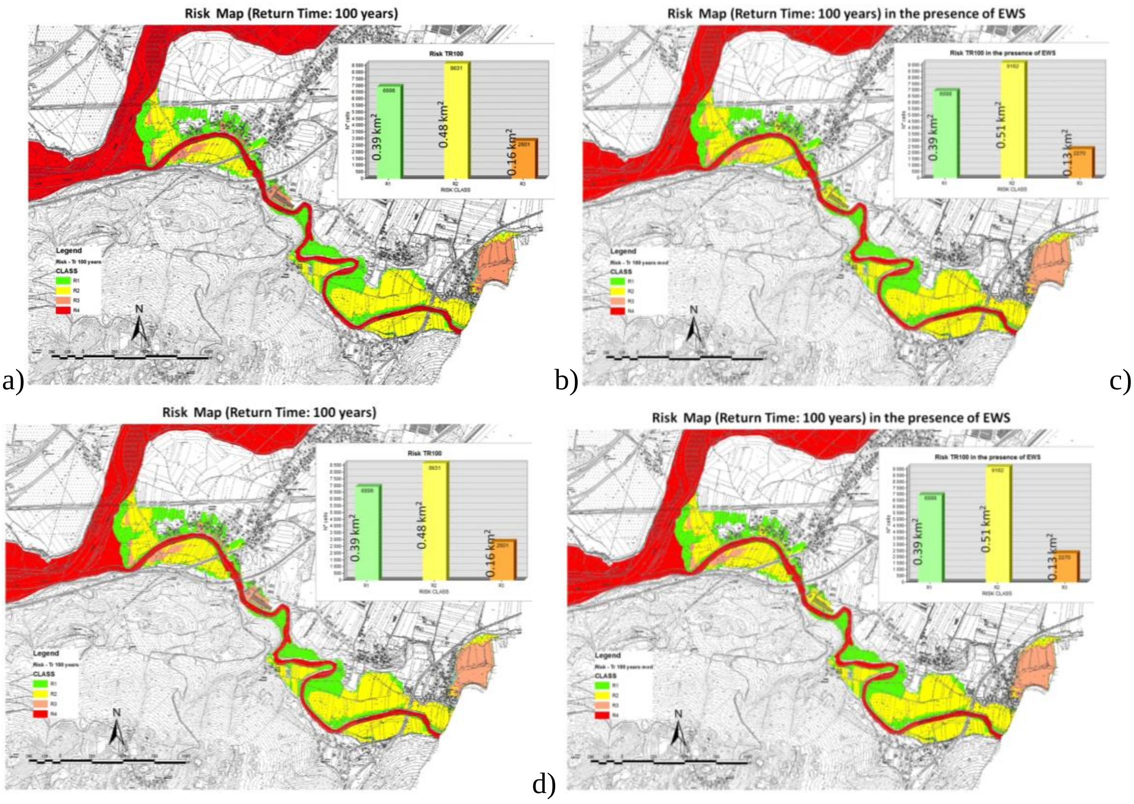

Figure 7. Flood risk map computed by the Alto Adriatico Water Authority partner for the 100-year flood event for the Italian side of the Vipava-Vipacco river applying the Kulturisk methodology: a) with and b) without flood warning systems. In the pink rectangles are marked some areas where the 3rd risk level decreases to the 2nd because of the enhanced coping capacity of the population using the information provided by the flood warning system. Overall the 3rd risk level areas decrease from 16 to 13 hectares. In panel c) the same risk map computed with the current land use and in d) with a poor management of land use planning that does not take into account the information obtained from hazard mapping. The comparison between the two maps shows that in some areas the 1st and 2nd risk levels increase to the 3rd due to the construction of new residential and industrial settlements in flood prone areas.

<u>Carlisle case study</u>

Two scenarios were set up in Carlisle, a baseline scenario and an alternative scenario. The baseline scenario is analogous to the deterministic mapping that the Environment Agency would carry out as part of a flood risk assessment as mandated by the floods directive. The alternative scenario was different (Figure 8). Here the uncertainty in the flow return periods due to the short gauging station records available at the site was taken into account, while considering the joint probability of flooding from all three rivers that converge in the city. The hazard layers from the two scenarios were converted to risk estimates using the Kulturisk SERRA methodology. An overview of the estimated economic risks to people and buildings associated with the selected scenarios is presented in Table 1.

Table 1: Summary statistics for SERRA		
Receptor	**Baseline**	**Alternative**
SERRA		
People		
Number of injuries (SERRA)	**11 people**	**67 people**
Number of deaths (SERRA)	**0.35 people**	**2 people**
Total cost to people	**£13.6M**	**£92.5M**
Buildings		
Damage to Structures	**£9.05M**	**£75.0M**
Damage to Contents	**£5.85M**	**£44.2M**
Total Damage to Structures	**£14.9M**	**£119.2M**
Total Cost	**£28.5M**	**£211.7M**

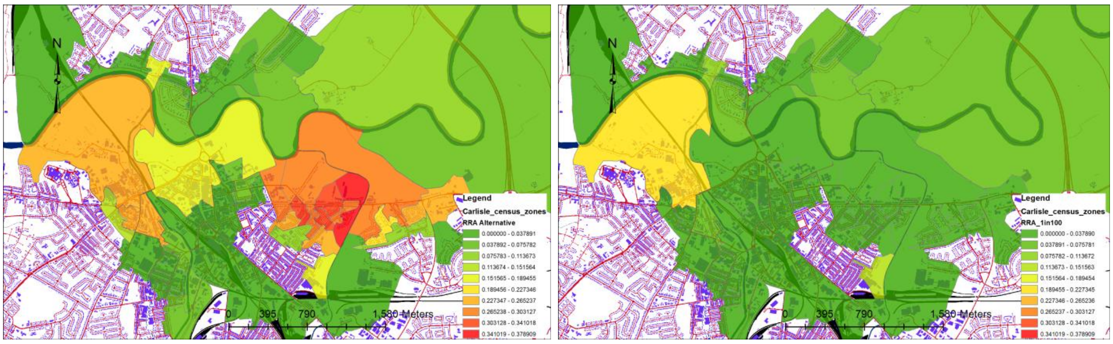

Figure 8. RRA combined risk for baseline (LEFT) and alternative (RIGHT) scenarios.

Somerset case study

This research focussed on extreme sea level rise and its effect on the risk to coastal inundation in the Somerset Levels region in the year 2100. A large degree of uncertainty surrounds the rate at which the sea level is expected to rise, due, in part, to the contribution from ice sheet mass loss; a process that is poorly understood at present. This is likely to influence the most efficient mitigation options for the region. This research investigated the importance of how one defines the boundary water level conditions when providing a future flood risk assessment, considering uncertainties arising in deterministic and probabilistic methodologies. A comparison was made between the flood risk given a deterministic approach where the sea level was specified by the 95th percentile relative to the H++ max value of the distributions described by Lowe et al. [2009] for the Severn Estuary. A subsequent assessment examined the change in risk due to the inclusion of the H++ high end tails within a probabilistic approach by calculating the risk when considering only the 5th to 95th percentile portion of the distribution [after Purvis et al., 2008] and comparing it to the risk when considering the full distribution.

The LISFLOOD-FP hydrodynamic model, which has been validated in the Somerset Levels region, was used to define the flood depths, velocities and extents in this research [Bates et al., 2005; Smith et al., 2012]. The KULTURisk methodology was utilised to provide the corresponding estimates of flood risk.

The two deterministic scenarios resulted in vastly differing estimates of risk by 2100 to the Somerset Levels. Using the 95th percentile value the risk was estimated to be £3.3 m per year (given a 1:200 year probability), while the risk given the H++ max sea level rise was £26 m per year, due to the significant increase in flood extent (Figure 9) and the corresponding depth and flow velocity in the hazard estimated in the latter scenario which drastically increased the population estimated to be hurt or killed. Furthermore, analysis of the results indicated that the pathways by which flood waters were able to inundate urban areas also varied between the scenarios; a finding that is of importance when defining effective mitigation measures for the region.

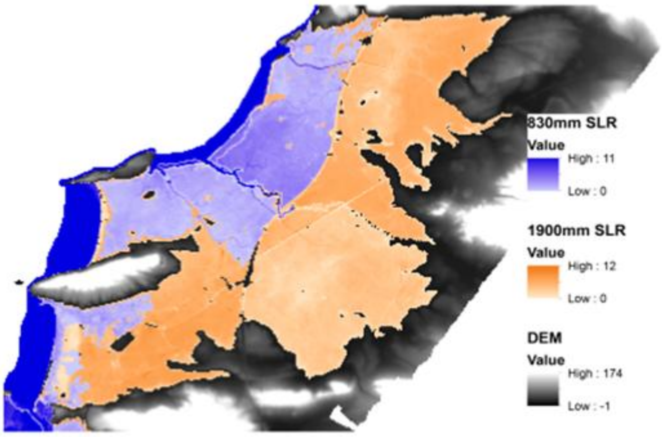

Figure 11. Flood hazard: 830 mm and 1900 mm MSLR

The examination of the probabilistic risk assessment further highlighted the importance in quantifying the uncertainty in the boundary conditions. Given the distribution used (Fig. 10) the estimated risk to the region (by 2100) contained in the 5th to 95th percentile portion of the distribution was approximately £1.17 m per year (accounting for a 1 in 200 event probability as well as the likelihood of each sea level rise scenario occurring). Relative to the risk estimated when including the low probability tails of the distribution (£1.66 m per year) there was a decrease of 29.7%. Furthermore, the contribution to the overall risk, from 10 % bins of the distribution, was calculated, revealing that more than 41 % of the risk was from scenarios in the top 10 % of the distribution. These findings clearly indicate that despite the low likelihood of extreme events occurring, they are capable of contributing a disproportionally high level of risk. The way in which one defines the boundary conditions to the region can significantly alter the predicted risk. A probabilistic approach should be considered best practice in order to account for the uncertainty in the future state of the system. Furthermore, it is recommended that very extreme, low probability tails be included in the assessment due to their relatively high hazard, and consequently, significant contribution to the predicted risk. Failure to do so may lead to significant error in the perceived risk to a region, and therefore, inacurate information with which to direct policy.

<u>Ubaye valley, Barcelonette case study</u>

In the Ubaye valley, the application of the methodology was done based on flood hazard in the town area. A similar magnitude flood, as the June 1957 flood (Weber, 1994), was chosen for the analysis; this flood corresponds to a centennial flood.

In the following the scenarios that were chosen for analysis are first reported. Then, the receptors; People, Buildings, Roads and Agricultural land were chosen to analyse the effect of the flood hazard. Results of the KULTURisk methodology on spatial receptor in the flood plain are shown in Table 3.

Table 2: Alternative scenarios

Scenario	Description
Baseline Scenario	Current state of the river geometry and structures.
Scenario 1	River channel conveyance enhancement by bridge reconstruction
Scenario 2	Inclusion of the benefits of a formal reliable EWS system to the baseline
Scenario 3	Combined measures of a formal reliable EWS system and improving the channel conveyance.

Table 3: Percentage of receptor physical damage (RRA) based on the defined receptor susceptibility

Receptor	Damage level	Baseline and Scenario 2	Scenario 1 and Scenario 3
Buildings	Inundation	25 %	6 %
Roads	Inundated	16 %	6 %
Agriculture	Inundation	9 %	1 %
	Destruction	5 %	1 %

From Table 3 there is a systematic decrease in spatial damage to the receptors in the flood plain, thus the proposed measures would be beneficial if they were to be applied.

Sihl/Zurich case study

The Sihl is a pre-alpine river with a catchment area of 336 km^2 that flows in Zurich in the Limmat river. Since 1938 the discharge of the Sihl has been influenced through the power production by the Sihl barrier lake that captures the upper half of the catchment area. The last disastrous flood event of the Sihl dates back to the time before this hydrological intervention, in 1908. Non-the-less the Sihl has remained to be a dangerous river because large parts of the city of Zurich are located on the alluvial cone of the Sihl river. During a flood event in 2005 the city of Zurich just escaped being badly damaged by inundations. Recent studies revealed that already flood events of the Sihl slightly less seldom than a HQ 100 can trigger inundations that bring about damages amounting to 5 billion Swiss francs. So the Sihl river represents one of the main flood risk in Switzerland. The high need for action in terms of improving flood prevention was recognized and an action planning was launched. Three measures were taken to mitigate this critical flood risk: 1) an early warning system was installed combined with a strategy to extend the retention capacity of the Sihl lake and an improved emergency planning; 2) a long-term flood prevention project was launched envisioning diverse alternatives of structural prevention measures (e.g. a discharge tunnel or a more efficient strategy to extend the retention capacity in the Sihl lake); 3) A pro-active implementation of the hazard map of the city of Zurich. This included the definition of mandatory prevention measures in particular for objects in the red and blue zones and a respective reservation or limitation of the insurance benefits (AWEL und GVZ, 2003), as well as an information campaign involving all affected property owners of the city (approx. 10’000 persons). In this campaign, the property owners received brochures and newsletter on the flood risk in the city, possible individual prevention measures and the legal implications of the flood hazard maps.

In the canton of Zürich, the building insurance is mandatory and the cantonal building insurance has the monopole for the insurance of buildings. The insurance of movables against hazard risks is optional, but the large majority (>90%) of the property owners provide of an insurance of household effects that covers damages through natural hazards. Since the hazard map of the city of Zürich has been implemented, the building insurance covers building damages in the red and blue hazard zone only if the property owners have implemented individual prevention measures.

A study that applied the KULTURisk methodology to the Sihl/Zurich case study (Bullo, 2013) revealed that in a flood event of a 300 years return period (HQ300), more than 3200 buildings in the case study area (Zurich and 6 municipalities of the lower Sihl basin) would be inundated. The buildings related risks were, however, found to be only relevant for the contents of these buildings, but not for their structure, because most of the buildings present a massive structure (see Fig. 15).

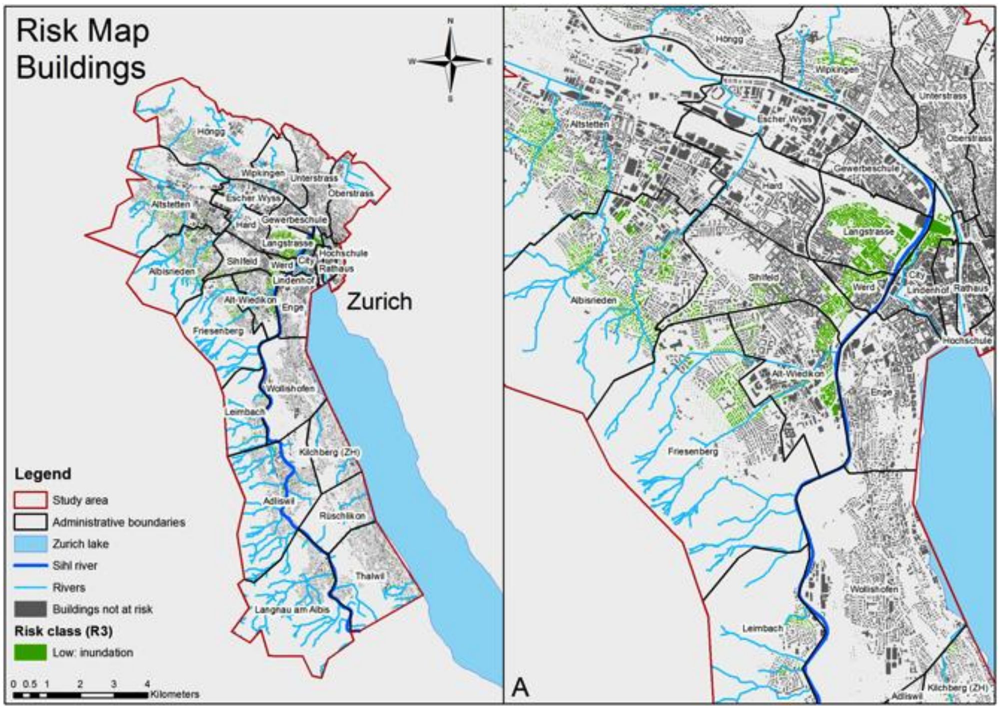

Figure 12. Inundated buildings by a flood event considering the 300 years return period scenario

The limitation of building insurance benefits will thus have only marginal financial consequences for the property owners. All the same, the information campaign on the legal implications of the flood hazard map (that is the announced reservation of the insurance benefits) might have consequences on property owners’ motivations to take their responsibility in the hazard management and to implement individual prevention measures.

The evaluation of the information campaign in Zurich that we conducted based on a cross-sectional survey (Maidl und Buchecker, 2012; Maidl und Buchecker, 2013; Maidl and Buchecker, subm.) revealed that property owners who assumed that their property was assigned to the red or blue zone showed a significantly increased preparedness to implement individual prevention measures. As most of the property owners did not know and mainly underestimated the actual risk level of their property, this effect could, however, not be observed in terms of the actual hazard zone status of the properties (see Fig. 13).

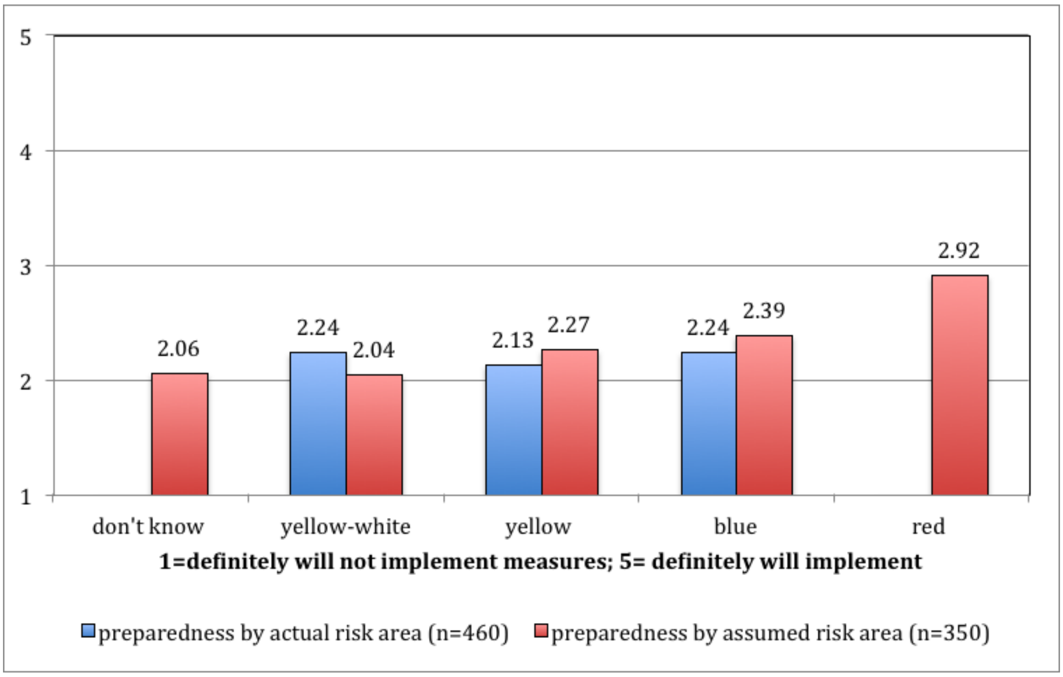

Figure 13 - Level of preparedness according to actual and perceived risk area

This means that well-designed information of the affected property owners on the legal implications of the flood hazard map will have positive consequences on their preparedness to implement individual prevention measures, if they will at the same time also be explicitly informed of the hazard zone status of their property. Accordingly, a well communicated limitation of insurance benefits (including explicit information about the hazard zone status of the individual owners' property) will lead to a moderately reduced flood risk level.

Structural prevention measures

(WP4, led by UniLj)

Structural prevention measures in KULTURisk case studies

The Danube case study of the KULTURisk project focuses specifically on the socio-economic effects of large-scale inundations in a transnational river by applying the risk-based methodologies developed in this project (see above). Besides, a critical analysis of flood protection measures taken to cope with flooding along the Danube (specifically in Vienna, Bratislava, and Belgrade) was carried out.
The city of Vienna, the capital of Austria, has been exposed to severe flooding of the Danube since its foundation, i.e. since 500 BC. Only the oldest part of the city, where the Roman fort was once established, is not prone to floods. The Danube flowed through a wide belt of marshy meadows, severely hampering the trade routes towards Bohemia and Moravia and limiting the expansion of the city in the 19th century. The establishment of a secure port close to the city and the construction of permanent crossings were considered important issues. In 1869, the decision was made to regulate the course of the Danube in the vicinity of Vienna with structural measures (Starosolszky, 1994). This first regulation project entailed a cut-off through the meandering arms, thereby unifying and straightening the river bed. The controlled Danube bed was 280m wide and was adjoined by a 450m floodplain on the left bank and a dike to protect the flat, low-lying surrounding areas. Work on the cut-off lasted from 1870 to 1875. However, shortly after the first Danube regulation had been finished, the

catastrophic floods in 1897 and 1899 gave rise to doubts concerning the estimates used to design the height of the embankments, especially concerning the right bank of the Danube at Handelskai ("Trade pier"). Furthermore, the largest flood on the Danube in the last century, in July 1954, clearly illustrated that the protection provided by the embankments was not sufficient. Extensive scientific studies were performed to determine the design flood upon which Vienna's flood protection system should be based. The flood of 1501 can be considered the highest flood ever observed in the upper Danube reach (and also in Bratislava) according to reliable historical records of the Austrian Hydrographic Service. The peak discharge at Vienna was estimated up to 14 000m^3 s^{-1}. There is also some evidence of floods in the 16th–17th centuries (1594, 1598, 1670, and 1682). Thus, the result was a generally accepted figure of 14 000m^3 s^{-1}. A number of flood protection studies focused on increasing the conveyance (i.e. the capacity to convey a higher river discharge). The different proposals called for raising and reinforcing the existing dikes, removing parts of the floodplain, widening the river bed and constructing bypass canals within and in addition to the existing protection facilities. In 1969 the city council supported, against strong political opposition, a project proposing the construction of a new flood bypass canal (the "New Danube") and the use of the excavated material to build a flood-free island (the "Danube Island"). Hence, the excess water would be directed through the New Danube during high-water periods; while, for most of the year, the water in the New Danube is kept constant by two weirs, resulting in a calm, lake-like surface. This project was supported by a political decision which was also confirmed by a referendum. Works for this project started in March 1972. It took 17 yr to complete the New Danube and the Danube Island. The overall project was completed in 1998 with the commissioning of the Freudenau power plant. It is estimated that the Vienna flood protection system can manage flows with a return period of around 10 000 yr, which is one of the highest safety levels in Europe.

Digging the bed for the New Danube involved excavation of 28.2 million m^3 of earth, most of which was used to create the 390 ha-large Danube Island. The New Danube is about 21 km long and has an average width of 210 m. The discharge in the flood relief canal is regulated by means of weirs; three sets of sluice gates control the water level of the New Danube. The inlet structure at the upstream end is used to regulate the flow into the New Danube and, further downstream, two weirs are used to maintain the water level during non-flood periods. When the Danube carries high water, the three gates are opened according to strictly defined operating procedures, and the excess water flows into the bypass canal.

The discharge capacity of the New Danube amounts to about 5200m^3 s^{-1}. As the works proceeded, sections of the island were opened to the public, and comments made then were integrated into the plans for the final design and landscaping of the Danube Island. As a result, while the original layout had foreseen a strictly trapeze-shaped cross section for the New Danube, the design was modified to create banks with a more natural shape. Also, the City of Vienna eventually decided that the Danube Island would be kept free from civil constructions and would be developed as a recreational area that would also bring ecological benefits. Nowadays, the Danube Island is used mostly as a leisure park.

Bratislava is the capital city of Slovakia. It is situated in Central Europe, approximately 62 km east of Vienna. The Danube river distance from Bratislava to Vienna is only 65 km. That is why the flood regimes for both cities are very similar. As a result, some parts of Bratislava, particularly Devín and Devínska Nová Ves, are vulnerable to the Danube floods. These regions have been prone to flooding for many years due to storm rainfall events, especially during the snowmelt period. Historically, the Danube floods at Bratislava (and also at Vienna) most often occur in May and June. The first flood records in the Slovak portion of the Danube date back to 1526 and are documented in the municipal archives of the City of Bratislava. However, the morphology of the watercourse was different at that time. In the Middle Ages, there were either none or only very low flood-preventing dikes alongside the river. The stream channel had a low capacity and the water often flooded the lower parts of the city (including a part of the city's downtown – Main Square). The entire 130 yr data set of mean daily discharge of the Danube at Bratislava (1876–2005) reveals a total of four flood events with peak discharge exceeding 10 000m^3 s^{-1}. Since 1920, there have been two such floods, i.e. in July 1954 and in August 2002.

The main protection measures taken between 2007 and 2010 to cope with floods are located in the southwestern part of Slovakia on the border with Austria and Hungary and include the city area of

Bratislava with its surroundings. These measures were established to address gaps in the existing Danube flood protection system and to cope with underprotected areas in the Slovak territory in general and the Bratislava area specifically. High flow of the Danube during extreme floods can have disastrous consequences, such as the flooding of an urban area of 383 km^2 and 2000 km^2 of agricultural land, which would directly affect some 490 000 people.
The above-mentioned structural flood mitigation measures include the reconstruction of existing and construction of new flood control structures on both sides of the Danube. These structures include dams, levees, reinforced concrete protective walls, mobile elements, etc... All these structures are designed for a peak flow value of the Danube in Bratislava of 13 $500m^3\ s^{-1}$, which has an estimated return period of around 1000 yr. The requested security freeboard along the Danube is 0.5m above the design flood water level.
Finally, we should emphasize that the structural measures constructed within the "Bratislava – Flood protection" project were implemented by the Government of Slovakia and co-financed by the Cohesion Fund (up to 85 %). The planning and permitting process started in 2004, while the construction started in 2007 and was completed in December 2010. The objectives of the "Bratislava-Flood protection" project are listed below; they were all completely achieved: construction of new flood protection lines in urban and suburban areas of Bratislava, complete restoration (replacement and increase) of the initial flood protection line in Bratislava Old Town, increase in the flood protection line in the Petržalka Bratislava municipality, increase in the safety of levees on the left side of the flue channel in the Gabˇcikovo municipality, prevention of economic damages in the project area, including the capital city Bratislava and its neighbouring municipalities, prevention of environmental damages in the project area, including prevention of contamination of drinking water sources.

Belgrade, capital of the Republic of Serbia, is situated on the confluence of the Danube and the Sava rivers. The city of Belgrade is situated approximately 450 km southeast of Bratislava. The Danube river distance from Belgrade to Bratislava is 716 km. The old part of the town developed along a hilly area on the right side of the Sava River. The area on the left side of the river bank used to be unpopulated wetlands. The first construction in this area was a fortification, which was built in 1720 by the Austrian monarchy on the border between the Ottoman Empire and Austria. First discussions on the potential development of the wetland area started much later, after the First World War. After the Second World War the development of the area on the left side of the Sava River was strongly supported by the government of the Federal People Republic of Yugoslavia. Hence, New Belgrade and some new parts of the city started to be developed on elevated left areas of the Sava River. The layer of excavated sand from the Danube main channel is about 3.5m thick, on average. The water level elevation corresponding to the 100 yr return period flood is estimated to be about 76 m, one metre below the surface elevation.
The highest water level recorded since 1921 is around 76 m, observed in 2006. Besides, the water level of 76m is also introduced here because the Iron Gate I Hydroelectric Power Station impacts the water levels upstream the corresponding dam, namely, the installed water level of this hydropower station is 76 m. Whereas no damage was caused by surface water during the 2006 flood event, the groundwater was affected (Stanic et al., 2008). Therefore, a study was carried out to investigate the impact of flood duration on groundwater rise (Babic et al., 2003).
In the 1950s, large wetlands containing a few metres of sediment dredged from the rivers covered an urban area more than 10 km2 at the confluence of the Sava River and the Danube. The amount of the dredged material was approximately 6.7 billion m^3 (Hranisavljevic , 1963). In the 1960s, a new part of the town was constructed there. During the Danube flood in 1965, and later floods, there was no damage or disturbance in the aforementioned heavily urbanized raised area. The built-up area is arranged with a friendlier landscape and is safer; less land is dissipated than with levees (Brilly, 2001).
In the territory of the Belgrade city, most of the urban flood protection was made in the period from 1972 to 1989. At that time, about 8.3 km of bank fortifications and nearly 234 km of embankments were built or reconstructed, more than 97 km of basins were regulated and also three small reservoirs were built. After 1989 the investment in the flood protection system was significantly reduced. Thus, between 1989 and 1995, only 3.5 km of levees were built and approximately 1.6 km of Sava River banks were regulated (Babic et al., 2003; Milanovic et al., 2010). Nowadays, flood control along the

Danube and Sava rivers in Belgrade city is mainly provided by the concrete floodprotection walls (within the inner city circle), and levees (outside the inner city circle). All these protective structures are built up between 1.5 to 1.7m above the water level associated with a flood with a 100 yr recurrence interval at the confluence of the Sava and the Danube, 76ma.s.l. (Babic et al., 2003).

Based on the critical analysis of structural measures that were taken to cope with flooding along the Danube, the following conclusions could be drawn:

1. Analysing the structural flood defense system measures in these case studies, it can be concluded that even with significant investment, flood risk can be reduced, but not completely eliminated. There will always be the presence of the remaining (residual) risk which has to be accepted by the society. Hence, informing the affected population of the potential risks, including remaining risks that could occur, is indispensable. Besides, correct risk communication and preparedness of the populations is necessary.
2. Flood management measures can occupy large areas and have a strong impact on urban space development. A proactive approach, whereby structural measures are taken before urban development, would be more efficient, but difficult to promote in practice.
3. As flood defences can be very costly to design, construct, and maintain, the flood control projects are in general very expensive and take years to complete. In the cities of Vienna and Belgrade the construction of flood-protection systems started in the 1970s, but still have not been finalized. Because local communities usually cannot afford the costs resulting from large mitigation projects, significant investments by governments are required. Moreover, political decisions supported by a referendum could help in successful project development for a long period of time, sometimes even for many election periods.
4. The level of protection in the City of Vienna against floods is assured with a recurrence interval of 10 000 yr. On the other hand, in the cities of Bratislava and Belgrade, the level of protection is around 1 in 1000 yr.
5. For sufficient, appropriate, and successful flood protection along international rivers, good transboundary cooperation is indispensable. This depends above all on understanding and recognition of the problems and needs of transboundary partners as well as the causes of these problems with respect to natural and social processes. For progress to occur, common goals and agreed strategies are needed, as well as, in some cases, compensation mechanisms to balance advantages and burdens. These can only be reached if the partners meet and work together frequently and share access to all relevant information, thus creating the necessary level of trust.
6. In the future, the concept of flood defence systems will have to be based on contemporary world trends (e.g. living with floods), which are to be introduced by respecting the current best practices throughout the world. Often, this concept is limited by the economic possibilities of the society which lives in the floodprone areas.
7. As flood safety in most vulnerable areas cannot be achieved with the help of structural means only, further flood risk reduction via non-structural measures is usually indispensable (Kundzewicz, 2002a, b), and a site-specific mix of structural and non-structural measures seems to be a proper solution.

Additional results in other KULTURisk case studies are described in the deliverables D4.3, D4.4 and D4.5. Part of the text above was taken from the following publication, which summarises the main WP4 outcomes: Kryžanowski, M. Brilly, S. Rusjan, and S. Schnabl, Review Article: Structural flood-protection measures referring to several European case studies, *Natural Hazards and Earth System Sciences*, 14, 1-8, 2014.

Risk Communication and Dialogue with Stakeholders

(WP5, led by KCL)

There is a wide variety of approaches to communicating risk in each of the various KULTURisk case studies and a range of different data available to the project for evaluating their effectiveness. Given this heterogeneity, we seek to provide greater comparative coherence by organizing our analysis of the KULTURisk case studies around a five-step warning-response process outlined by Meyer et al. (2011):

1. Reception: a signal may be screened out by operational processing routines such that it fails to reach a recipient with sufficient authority to act;

2. Attention: new information may not attract the notice of recipients distracted by other information sources or agenda overload due to other competing concerns;

3. Acceptance: recipients may reject the issue framing of a warning or dismiss its specific predictions about the probability or consequences of an event as insufficiently credible;

4. Prioritisation: even if a prediction is received and believed by its recipients, they may not be convinced that the issue at hand is sufficiently pressing given other demands on resources;

5. Mobilisation: resource constraints or other exogenous factors, such as political opposition, may prevent decision-makers mobilising action in response to early warnings they find credible and pressing.

This framework was applied to the different KULTURisk case studies and allowed us to highlight where breakdowns are most likely to occur in the communicating and response to early warning systems. More details are published in D5.3: Assessing risk communication strategies and effectiveness in early warning.

One of the most striking outcome is that, although the development of early warning systems in flood risk management has become a norm in many European countries (Cloke and Pappenberger 2009; Golnaraghi 2013), most energy has been invested in developing new modelling capacities rather than to improving the communication of and response to them. Thus, this section intends to summarise the main findings of our analysis as well as to identify best practice of risk communication that be develop to overcome the tensions we have raised for each case study.

Reception: Most of problems we have seen occurring during this phase were related to the format of the information received by civil protection agencies (CPA), or to their practices which are not always well known by hydro-meteorological centres. For example, the fact that people were not able to access their e-mails while on the field or that the person responsible to access EWS products through specialised websites is absent or cannot remember their password can be an important source of ignorance if a early warnings do not reach their recipients.

Best Practice: A way to make sure information gets properly transmitted during the reception phase is to ensure that EWS are not only received by one high ranked person but also by many different recipients. Knowing that some CPAs need EWS to improve their preparation tasks as well as their field intervention it is thus important to improve knowledge of CPAs and operational forecasters daily tasks. This better knowledge would allow EWS providers to tailor their products to those realities and avoid technical problems preventing forecast users to be reached by the information.

Attention: As we have seen, problems during the attention phase are often related to the feeling of being inundated with information and thus being unsure about which information should be consulted. We have highlighted that there were problems with visualisation aspects and with how the message is conveyed to recipients. For example, the problem of scale has been an recurrent issue. Most recipients thought that while EWS were clear nationally, it is not always clear where events are likely to happen and what kind of events are predicted. The case study of Barcelonnette, for example, showed that while EWS are seen as being potentially interesting to CPAs, the fact that the Ubaye Valley is not covered by the vigicrue map makes it very unlikely that CPAs working in Barcelonnette will consult them. There is also the complaint that while the vigilance map of Météo-France contains interesting information, highlighting a complete Department without having a finer analysis might lead some users to avoid paying attention to alerts on the basis that thresholds as well as scales are not representative of their realities and needs.

As we have highlighted, blockages occurring during the attention stage are often related to unclear information, when users do not know what to do with this information. This is the case for what has been collected for the Swiss and Danube case studies, forecast users such as CPAs prefer turning themselves towards information they understand. For example, as we have highlighted in section 3, problems of EWS communication associated to the attention phase in France, the UK or the other countries involved in the overall project are often related to the oversimplification of information that can be visualised through hazard mapping. As we demonstrated in D 5.2, France represents flood and severe weather warnings through a 'traffic light' model that reduces complexity of continuous probability distributions for given events to 4 colour-coded categories of risk, a colour systems also found and all case studies. However, evidence for the effectiveness of these reduced form of risk communication can vary (Nobert et al. 2010; Frick and Hegg 2011; Priest et al. 2011; de Roo et al.2011; Ramos et al. 2010; Stephens et al. 2012), and in specific case of flood forecasts, there is no consensus among experts about the most salient information to extract from ensemble predictions and what can be simplified away without adversely affecting the robustness of decision-making (Demeritt et al. 2010; Pappenberger et al. 2012).

Best Practice: The difficulty EWS adds to the potential to improve robust decision-making is also linked to the overwhelming sources of information and product many users are accustomed to which in turn prevent them to prefer and even consult EWS information. One way to overcome those problems is to ensure e that EWS are providing a source of information that is unique and that corresponds to the geographical areas CPAs are working in, this means that the problem of spatial resolution should be addressed before imposing this information to local centres and CPAs units that could misunderstand how to use EWS in their reality of practitioners. Improvement at this level should be more technical, whereby EWS providers should make extra efforts to define products that are clear in their meanings as well as establishing clear guidelines about how information should be used. There is also a need for forecast providers to remind operational centres as well as CPAs about the value of EWS for planning and about using probabilistic messages in conjunction with other sources of information that might improve their capacity to draw a clear picture of the potential risks to which they are exposed to.

Acceptance: While it is fair to say that many professional users agree that EWS and probabilistic forecasting provide them with surplus of information that is useful, how do they accept the scenarios of this information and apply them to their daily routine remain unclear. For example, the qualitative approaches that most case studies have applied through their fieldwork shows that when EWS are consulted, they are not always part of the decision-making process making operational flood forecasters and CPAs taking their decision on action. The general feeling we encountered in all case studies is that while EWS are seen as valuable, many users are unsure of what to do with them and thus leading them to wider tensions located between acceptance and prioritisation. This in turn, has important consequence on whether or not an EW forecast is going to be accepted. The Danube case study is particularly striking in that sense. As most countries are in the process of been introduced to EWS and to the probabilistic science that is driving their development, the reflex to go back to deterministic old fashion methods is often more appealing (Demeritt et al. 2013) than accept EWS. This lack of familiarity often leads users to reject EWS on the basis that they are not enough credible. In other instances, and this is more common in countries developing their in-house EWS flood systems such as for France, Switzerland and the UK, there are strong disciplinary protocols whereby professionals such as operational forecasters are not so interested in divulging information that is not entirely certain about the potential risk forecasted through EWS, as it undermines their credibility as experts. There is also the general paternalistic view conditioned by operational hierarchy whereby operational forecasters want to maintain their status of experts and are not interested in providing their users with information containing probabilities (Demeritt et al. 2010). Thus, in every case study, excluding for the Soča-Isonzo River, the general obstacles to using EWS has been related to the potential confusion that can emerge from the communication of EWS to users that might not be able to deal with uncertain answers. The acceptance moment is not only shaped by the practices of forecasting and field intervention put in place by CPAs, it also linked to expectations about the role of communication in risk management but also, more generally, about the role of science as a way to develop more adapted prevention and preparedness strategies.

Accepting or rejecting EWS is not only linked to wider implications of being wrong and false alarms, but it is also linked to the belief that EWS information should be accurate. This is an issue that has been raised throughout the Danube case studies, but also in France where scientific authority in the context of risk management is seen as vital and thus knowledge used to plan prevention, preparedness and evacuation protocols are meant to be certain, leading users to reject message that might be falling outside those expectations. However, in Switzerland, EWS are seen as useful and accepted by CPAs for their capacities to improve preparedness and we have noticed reluctance in using probabilistic EWS if their meaning could not be clarified by meteorologists or hydrologists.

Best Practice: Thus, while EWS are seen as interesting information in most case studies, accepting their content seems more difficult than it looks like and this is mainly related to question of scientific authority and limited experience at handing uncertainties from sophisticated users, and this in turn, may lead to non-acceptance of EWS forecasts. A way to overcome those problems, and that can be also related to the best practice we flagged for the reception step, which consists of allowing forecast providers is to engage with their users and to realise how EWS are used, which in turn should allow providers to identify potential gaps in the communication of their EWS and provide products and means of communication that will make EWS uncertainties easier to measure and integrate in operational as well as CPAs tasks which in turn will play a role in improving their risk literacy (Giegerenzer 2002).

Prioritisation: While phases of attention and acceptance are dealing with set of issues that are overlapping on the prioritisation phase, this latter has been generally occurring when EWS were conflicting with other problems that needed to be managed in the now rather than in the medium-term time-frame provided by EWS. As we have exposed in this report, EWS are seen as valuable source of information for most users, however their communication might not always be as straight forward as expected by forecast providers and this is mainly because they are assuming that preparedness and prevention is more important than evacuation protocols, when for most users, it is only when risk of evacuation becomes eminent that information going beyond 24 hours is needed, as other demands such as paying attention to hourly forecast might have priority. The interest into time-scales reflecting intervention has been noticed in most case studies, as what seems to be crucial for most users is how they could use forecasting information that are helping them to answer questions require deterministic answers, such as the too often popular questions asked by non-sophisticated to operational forecasters about the moment the threshold of flooding is going to be reached.

Best Practice: The communication required for this kind of situation would more likely lead operational forecasters to prioritise deterministic information. Finding solution to the communication of EWS that could reduce the tension created during this phase is not easy as extreme weather events such as floods require rapid action and this is particularly true for area prone to flash flooding. However, there is a need to emphasise the benefits of using EWS to monitor current situation that might escalate into extreme events such as flooding and thus enlarging the spectrum of interests of sophisticated users by instating a culture of prevention in which medium term planning and dealing with uncertainties will have their place. Thus, we recommend a development of EWS that would provide information that can be communicated to CPAs with their uncertainties and to assure that there is governmental initiative to develop risk management policies that will integrate uncertain information.

Mobilisation: As this report has demonstrated, the question of communication of EWS during the phase of mobilisation is far more political than scientific. This is not new to the challenge of communicating and dealing with uncertainties in political environments in which responsibilities are legally bonded and policies embodied by a deterministic understanding of risk. Thus, drawing on each case study, we were able to show that the main communication problem occurring during the mobilisation phase was mainly animated by a blame gaming politics and by risk governance regimes built on aversion to failures and in which false alarms are impossible. Thus, acting on uncertainties is practically impossible for many EWS users and this is mainly related to the responsibilities they bear in the chain of risk communication and to high costs communicating information that might be wrong.

Best Practice: The French sociologists Michel Callon, Pierre Lascoumes and Yannick Barthe (2001) are engaging with the problem of secularisation of science that is underlying the mobilisation phase, whereby EWS are developed following the more developed science and concept of uncertainties that is defined through the frame of scientific practices, thus reducing uncertainties to the sole experience of science. Thus, by their interest in developing hybrids forums through which scientists, in the case of this report meteorologists and hydrologists, would open themselves to what Callon et al. (2001) called "savoir minoritaire" or what we can translate as non-technical knowledge which gives more space to the practices of the everyday experience EWS developers seems to ignore. While this engagement needs to be inclusive, it is not only the development of science that might be improved from this new forms of relationship, but also the very idea of democracy and politics, both fundamental in shaping approach to risk and uncertainties. Although some experiments have been done in this direction by Landström et al. (2011), their interest has been mainly oriented towards technological development, there is a need here to study a bit more closely how this kind of hybrid forums inspired by the sociology of translation can also be involved in rethinking relationships to uncertainties and risks.

Validation and Generalisation of the KULTURisk methodology

(WP6, led by CORILA)

Key recommendations for the case studies

One of the two main objectives addressed in WP6 was to validate and enhance the KULTURisk water related methodology, taking into consideration the outcomes of its application to the case studies (WP 2, 3 and 4) and the feedbacks from relevant end-users (public authority and/or service in charge of flood risk assessment and management at regional and local level), who have been identified by CORILA in cooperation with the responsible of each case study.

To this end, a questionnaire has been developed by the Ca’ Foscari University of Venice and proposed to specific end-users associated to different case studies, along with a concise summary of the KULTURisk method and of the overall results of the relative case study application. The questionnaire was structured in two parts: the first part (divided in three sections) concerned KULTURisk methodology conceptual framework and concepts and the Risk Assessment Procedures (RRA and SERRA) and the second part consisted of a list of questions focused on the case studies applications and outcomes.

The end-users survey was developed in order to verify if the relevant stakeholders would agree on the comprehensiveness and suitability of the KR framework, to identify any critical points and/or weaknesses of the KR methodology and to suggest recommendations for improving it. Considering the six KULTURisk cases studies in Europe, we distributed 9 questionnaires and received back 6 filled questionnaires. The results of the questionnaires exercise were summarized and condensed in deliverable 6.1.

In general, the end-users were satisfied about the overall fitness of the methodology to their needs: most of them affirmed that the results of the application are relevant and realistic to the specific needs of the region. This results allowed us to confirm the appropriateness of the methodology proposed, when applied by involving adequately the relevant stakeholders and by considering the peculiarities of the sites. The survey provided useful indications, suggestions and inspirations for the enhancement of the methodology, that have been included in the deliverable 6.3.

Evaluation of the adaptability of the methodology developed in WP1 to other natural hazards

The other wider objective of WP6 was to explore the possibility of generalizing the KULTURisk methodology by exploring its applicability to other types of natural hazards (seismic, volcanic, forest fires etc.).

A second specific questionnaire was prepared by the Ca' Foscari University of Venice and proposed, together with a concise summary of the methodology, along with the results from the test studies, to a panel of experts which consisted of 14 scientists: the majority of them came from seismic and volcanic risk, one came from avalanches risk, one from forest fires risk , one from windstorm risk, one from floods risk and two persons were experts of general risk management approaches. The questions proposed took into consideration the overall conceptual framework, the regional and integrated risk assessment methods with tailored questions for the different receptors, as well as the procedure used to apply the methodology to the various case studies.

The experts were asked to evaluate, in their peculiar field of expertise, to what extent the methodology captures the essence of the risk, as well as the benefits of prevention measures and finally what would be needed to modify the KULTURisk method to make it better applicable to other natural hazards different from water-related risks. We received 16 filled questionnaires. The results of the questionnaires exercise with some basic statistics and comments were summarized in Deliverable 6.2.

In summary, the experts concluded that the methodology is applicable to other types of hazard by making necessary changes in the hazard component and modelling it based on each kind of hazard. Further considerations have been included in the deliverable 6.3.

Multi-hazard experts workshop

The results of both questionnaires and the outcomes of the applications of the KULTURisk methodology to different case studies have been discussed during the 3rd KULTURisk workshop (Deliverable 7.6) held in Venice on 19th-20th September 2013 (month 33) on "The benefits of disaster prevention measures: consolidating and widening an innovative risk assessment methodology". All the presentations have been published on CORILA website, www.corila.it and linked by the KULTURisk web site.

The main objectives of the two days workshop was to analyze and discuss the Risk Assessment Methodology developed from the different perspective of end-users, experts in flood risk assessment and management, and experts in other natural hazards.

The participants were asked to identify critical issues of the methodology and to discuss recommendations in order to foster the development of a flexible risk assessment methodology, by means of a participative discussion and consensus-based outcomes.

The participants to the workshop addressed all the relevant aspects of the methodology in a holistic and multi-faceted approach, and pointed out precious comments and observations. Validation and generalization, in this sense, have to be considered as a common and convergent effort that can move towards the overall enhancement of the methodology. Also the workshop outcomes, together with final considerations, have been included in the deliverable 6.3

Lessons learned

The WP objectives and tasks have been fully completed, with a substantial participation of all the partners foreseen. The foreseen deliverable have been completed. The end-users, experts, and other numerous participants to the Venice's workshop, also those not included in the project as partner, had an extensive and very fruitful discussions on the KULTURisk methodology and more in general on risk reduction strategy. The workshop was also the occasion to discuss some general topics of the disaster risk management like public awareness, information and education, risk perception and multi-

risk analysis. The impact of the workshop was also beyond the project borders and contributed to the possible future exploitation of the project results.
The KR methodology proved to be very effective in all the different case studies of the project, affected by water-related risks, and the discussions occurred confirmed the general suitability of the KR framework methodology to other kind of risks, underlining that a specific work should be done for every one of the hazard concerned.

Potential impact, main dissemination activities and exploitation of results (WP7, led by UNESCO-IHE)

Publications

More than 60 peer reviewed journal papers published, 30 conference proceedings, 60 presentations at conferences and workshops and 25 posters. The compelte list can be found under the results section of the KULTURisk website www.kulturisk.eu/results, where some posters and presentations can be downloaded. Please refer also to document D7.8 – Publications.

KULTURisk at the EGU Leonardo Conference

On 14th-16 th November 2012, the EGU Leonardo Conference was held, this time in Turin (Italy). The topic of the conference was Hydrology and Society, Connections between Hydrology, Population dynamics, Policy making and Hydro-Power Generation. The KULTURisk project was directly involved in the co-organisation of the session "Governance of Water-related Risks". In addition, six oral presentations and eight poster presentations (related to KULTURisk) were made at the conference; available at (http://www.eguleonardo2012.polito.it/abstracts/presentations/). Immediately after the conference, a KULTURisk progress meeting was held and the statuses of the case studies were presented. Furthermore, the risk assessment methodology was introduced and discussed.

Third KULTURisk Workshop

The 3rd KULTURisk workshop entitled 'Benefits of disaster prevention measures: consolidating and widening an innovative risk assessment methodology', was held in Venice, Italy, on 19-20 September 2013.The workshop was articulated into three main sessions: Towards a new culture of prevention: from international DRR strategies to local implementation; KULTURisk methodology for assessing the benefits of prevention measures; From water-related hazards to other natural hazards. Presentations can be downloaded at the CORILA website http://www.corila.it/?q=node/180. This link is also available at www.kulturisk.eu. For details please refer to document on deliverable D-7.6 Third Workshop.

KULTURisk at the Global Platform for Disaster Risk Reduction

The KULTURISK methodology of the tangible and intangible values (e.g. cultural heritage) involved in risk evaluation was presented by Pierpaolo Campostrini at the Global Platform for Disaster Risk Reduction, Geneva, Switzerland, May 2013. His presentation can be seen online at www.kulturisk.eu.

KULTURisk project at the OECD High Level Risk Forum

On 12 September 2013 the insights of the KULTURisk project was presented at the Introductory Session of the Expert Meeting on Risk Prevention and Mitigation: Governing Effective Prevention and Mitigation of Disruptive Shocks, held at the OECD Conference Centre in Paris. After a welcoming address by Mr. Mario Marcel, deputy director of Public Governance and Territorial Development Directorate of the OECD, and an overview of the objectives of the expert meeting by Cathérine

Gamper (PGTDD), Leonardo Alfonso, co-Manager of the KULTURisk Project, made the kick-off presentation entitled: "Why prevention pays", which formally opened the discussion sessions. These discussions included the topics of risk prevention and mitigation in times of fiscal constraints, engagement of the private sector in risk prevention and mitigation, the roles of sub-national governments in risk prevention and mitigation as well as the role of international collaboration. The expert meeting lasted two days and counted with the participation of 21 expert panelist from the OECD members. Presentations and summary of the expert meeting can be found at the OECD - Risk Management website:

http://www.oecd.org/gov/risk/governingeffectivepreventionandmitigationofdisruptiveshocks.htm

KULTURisk project at various conferences

KULTURisk project results were presented at a number of various conferences (see list of publications), the largest of which is European Geosciences Union Assembly held in Vienna in 2011, 2012, 2013.

Final Conference

To provide an opportunity to gather and to present achievements and main project conclusions, the KULTURisk Final Conference was held between the 2nd and the 4th of December 2013 in Barcelonnette, Ubaye Valley, France, one of the project case study sites. The document D-7.9 presents a summary of the final conference, including the agenda of the event and highlights of the main product of the conference: the Second Policy Briefs.

Knowledge Base Platform

To raise risk awareness among the general public and train professionals in the use of the most appropriate tools and make risk-based approaches an integral part of their working culture, the KULTURisk project has developed its Knowledge Web-based Platform (KWBP), which can be accessed at http://kwbp.kulturisk.eu/ . It aims at or accumulating, classifying and relating various knowledge items and making knowledge accessible, searchable, and transferable.

Report D.7.5 describes the characteristics of the platform, including a technological description of the database and the ways this database is accessed and updated. Important improvements were introduced with respect to the prototype version created in the first half of the project, which include connection with public databases that contain different kind of resources created for different types of audiences. For instance, the KRWB allows direct searching in the UN-ISDR database stored in the PreventionWeb website (specialized material in disaster risk reduction), Scopus and Google Scholar (databases specialized in scientific publications).

Additionally, it is possible to search in well-known public databases with potentially interesting material, such as YouTube (video repository from the public), Google News (for recent risk-related events) and Google Images. The KWBP platform allows the user to interact –besides the KR database described before, with these public databases, according to his/her keyword selection.

Policy Briefs

The second policy briefs contain the main messages and lessons learned from the project. A first draft of the document was prepared and then discussed during the Final Conference. A new version was later discussed in Brussels on Monday 9 December 2013 during the presentation of key findings of the KULTURISK project and then updated considering the emerging discussion points.

Four main project messages were generated: Prevention strategies can be accountable and key to secure a smart, sustainable and inclusive growth of well being; Intangible and indirect damages matter; social capacities can change prevention actions if accounted for; Recognizing and estimating uncertainty lead to more robust risk assessment; Two-way risk communication increases consensus about prevention measures and trust in authorities. The document can be downloaded at http://www.kulturisk.eu/results.

Educational Material

Software implementation of the KULTURisk Methodology

After designing and successfully applying the KULTURISK Methodology on a few European case a tutorial to give students insight and understanding of the methodology was designed. The tutorial was elaborated by UNESCO-IHE as part of a programming language course in MATLAB (MathWorks, 2004). The material can be downloaded at http://www.kulturisk.eu/educational-material#KR_Method

Training Exercises in Flood modelling

A series of computer-based exercises were designed for independent learning for students of undergraduate level and above. The exercises introduce users to numerical flood modelling using both hypothetical and real-life data, and then use the results to create risk maps, estimate uncertainty and look at flood prevention measures.

Material is available to download at the School of Geographical Sciences http://www.bristol.ac.uk/geography/research/hydrology/models/lisflood/training/

KUTURisk Summer School

One of the activities to disseminate the KULTURisk project findings, was a Summer School carried out between 9 to 12 September 2013 in UNESCO-IHE, Delft, The Netherlands, and it was called Flood risk reduction: perception, communication, governance. The general setup of the Summer School was a 4-days event with lectures in the morning and workshops in the afternoon.

The content of the Summer School was discussed mainly during the second workshop in Trieste, Italy, with representatives of different work packages. The following topics, which are core in the project, were then considered to be part of it: Introduction to risk prevention and risk reduction; terminology of disaster risk management; International policies in disaster risk reduction; governance of risk; structural protection measures; early warning and preparedness; assessments, mapping, planning and risk transfer; risk perception and communication: importance, assessment, challenges.

Please refer to document D.7-10 for further details.

Project Coordination

(WP8, led by UNESCO-IHE)

UNESCO-IHE led WP8 and the KULTURisk project and therefore took the lead in: the finalization of the consortium agreement, the communication with partners on day-to-day management issues, provision of feedbacks to the EC officer, as well as in the development of the periodic report and the current final report.

At the beginning of the project a consortium agreement (D8.1) was signed by all the partners. This document was "based upon the regulation (EC) N. 1906/2006 of the European Parliament and of the Council of 18 December 2006 laying down the rules for the participation of undertakings, research centres and universities in actions under the Seventh Framework Programme and for the dissemination of research results (2007-2013) hereinafter referred to as Rules for Participation and the European Commission Grant Agreement, adopted on 10 April 2007".

According to our agreement, the General Assembly (consisting of one representative of each partner) is the decision-making body of the KULTURisk consortium, while the coordinator is the legal entity acting as the intermediary between the partners and the European Commission. The Management Support Team assists the General Assembly and the Coordinator. In particular, it was agreed that the chairperson shall convene ordinary meetings of the General Assembly at least once every six months and shall also convene extraordinary meetings at any time upon written request of any Member. Also, the chairperson shall send each Member a written original agenda no later than 14 calendar days preceding the meeting, or 7 calendar days before an extraordinary meeting. The General Assembly shall not deliberate and decide validly unless two-thirds (2/3) of its Members are present or represented (quorum). All the meetings went smoothly, we did not experience conflicts and all decisions were taken unanimously.

Furthermore, an accessible and periodically updated web-site (D8.2) was developed since the first month of the project. The web-site also includes a private area, which has been used by all partners to share documents and drafts of the KULTURisk deliverable.

From the point of view of submission of deliverables, the project coordination has been successful, with all deliverables timely submitted. The first policy briefs were delayed 3 months to account for input and comments from the international workshop co-organized by the EC and the UN-ISDR (Bruxelles) while the signature of the consortium agreement was delayed by 4 months due to several changes requested by the legal departments of a few partners to the DESCA model which was used as the basis for the agreement preparation. These delays did not represent a risk for the continuity of the project, which has gone regularly. Also, all critical comments by the two KULTURisk reviewers were carefully addressed and some deliverables were revised accordingly.

Table of Deliverables

WP	*N*	*Title*	*Due*	*Delivered*
1	1	*Review of the existing EU, national and international policies in the field of risk prevention*	30/06/2011 (6 months)	22/08/2012
1	2	*Review of existing risk assessment and management methodologies*	30/06/2011 (6 months)	20/02/2013
1	3	*Development of a strategy to evaluate risk perception of water-related natural hazards*	30/06/2011 (6 months)	22/08/2012
1	4	*Review of the economic costing methodologies and conceptualizations of loss-damages*	30/06/2011 (6 months)	22/08/2012
1	5	*Risk prevention policy framework in the considered case studies*	31/12/2011 (12 months)	22/08/2012
1	6	*Framework for comprehensive assessment of the risk prevention measures*	30/06/2012 (18 months)	23/08/2012
1	7	*Development of a risk assessment methodology to estimate risk levels*	31/12/2012 (24 months)	21/01/2013
1	8	*Evolution of risk perception in each case study*	30/06/2013 (30 months)	23/08/2013
2	1	*Catalogue with an assessment of existing early warning systems in Europe*	30/06/2011 (6 months)	22/08/2012
2	2	*Baseline for the application of the risk-based methodology*	31/12/2011 (12 months)	22/08/2012
2	3	*Alternative scenarios for the application of the risk-based methodology*	31/12/2012 (24 months)	21/01/2013
2	4	*Demonstration of how an acceptable level of risk can be reached in case studies*	30/06/2013 (30 months)	23/08/2013
2	5	*Summary of the existing early warning systems for water related hazards in Europe*	31/10/2013 (34 months)	27/11/2013
3	1	*Report of non-structural measures (mapping, planning and risk transfer)*	30/06/2011 (6 months)	22/08/2012
3	2	*Baseline for the application of the risk-based methodology developed by WP1*	31/12/2011 (12 months)	22/08/2012
3	3	*Alternative scenarios for the application of the risk-based methodology developed by WP1*	31/12/2012 (24 months)	21/01/2013
3	4	*Demonstration of how an acceptable level of risk can be reached in case-studies*	30/06/2013 (30 months)	23/08/2013
3	5	*Description of the non-structural measures for water related hazards*	31/10/2013 (34 months)	27/11/2013
4	1	*Critical review of structural measures referring to the KULTURisk case studies*	30/06/2011 (6 months)	22/08/2012
4	2	*Baseline for the application of the risk-based methodology developed by WP1*	31/12/2011 (12 months)	22/08/2012
4	3	*Alternative scenarios for the application of the risk-based methodology developed by WP1*	31/12/2012 (24 months)	21/01/2013
4	4	*Demonstration of how an acceptable level of risk can be reached in case-studies*	30/06/2013 (30 months)	27/11/2013
4	5	*Description of the structural measures for water related hazards*	31/10/2013 (34 months)	14/01/2014
5	1	*Review of risk communication literature*	30/06/2011 (6 months)	22/08/2012
5	2	*Communication and transfer to decision makers, stakeholders and end users with standard methods*	31/12/2011 (12 months)	20/02/2013
5	3	*Assessing risk communication strategies and effectiveness*	31/12/2012 (24 months)	27/11/2013

WP	***N***	***Title***	***Due***	***Delivered***
5	4	*Report assessing the role of risk communication*	30/06/13 (30 months)	18/02/2014
5	5	*Best practice guidelines*	31/10/13 (34 months)	18/02/2014
6	1	*Feedbacks of end-users on the WP1 methodology applied to the project case-studies*	31/08/2013 (32 months)	14/01/2014
6	2	*Collection of feedback on adaptability of WP1 methodology to other natural hazards (experts survey)*	31/08/2013 (32 months)	14/01/2014
6	3	*Recommendations on amendments and gaps of WP1 methodology*	31/10/2013 (34 months)	14/01/2014
7	1	*Organisation of the 1st workshop*	31/07/2011 (7 months)	23/08/2012
7	2	*1st policy briefs*	31/08/2011 (8 months)	22/08/2012
7	3	*Organisation of the 2nd workshop*	30/06/2012 (18 months)	23/08/2012
7	4	*2nd policy briefs*	31/08/2012 (20 months)	14/01/2014
7	5	*Web-based platform*	31/12/2012 (24 months)	23/01/2013
7	6	*Organisation of the 3rd workshop*	30/06/2013 (30 months)	19/12/2013
7	7	*Education materials*	31/10/2013 (34 months)	14/01/2014
7	8	*8 scientific publications on peer-reviewed journals and conferences*	31/12/2013 (36 months)	14/01/2014
7	9	*Final conference*	31/12/2013 (36 months)	14/01/2014
7	10	*Specific training*	31/12/2013 (36 months)	14/01/2014
7	11	*KULTURisk Guidelines*	31/12/2013 (36 months)	14/01/2014
7	12	*3rd policy briefs*	31/12/2013 (36 months)	14/01/2014
8	1	*Signed consortium agreement*	31/01/2011 (1 months)	23/08/2012
8	2	*Accessible KULTURisk web-site*	30/04/2011 (4 months)	23/08/2012
8	3	*Periodic Report*	30/06/2012 (18 months)	27/08/2012

USE AND DISSEMINATION OF FOREGROUND

Many dissemination activities were carried out within the KULTURisk (see above) to target different groups, such as local stakeholders, end-users, young scientists, scientific community, and policy makers. A web-site and, in particular, a web based platform was developed to generate educational material for the general public and professionals (engineers working for government, regional authorities, consultants, academics conducting relevant research and students).

The active involvement of local stakeholders and end-users was based on guidance documents on stakeholder participation, such as the EC guidance documents, resulting from the HARMONI-COP project). Moreover, involving informed stakeholders (with access to key information) in the various stages of planning in the context of participatory approach resulted in a more socially robust and accepted mitigation measures (see above, description of KULTURisk case studies). In addition, the KULTURisk project aimed to specific training of young scientists (MSc and PhD students, postdoctoral researchers, etc...) by means of tailor-made courses on risk prevention (see above). The involvement of Prof. Alberto Montanari (former Chair of Hydrological Science Division of the European Geoscience Union) in the scientific advisory board contributed to increase the KULTUrisk impact to the scientific community. In particular, we organized special conference session on risk prevention at the EGU Leonardo Conferences in 2011 and 2012. During this special conference sessions the KULTURisk team could interact with other relevant project teams working and doing research on risk prevention. The involvement of Dr. Salvano Briceno (former Director of UN-ISDR) in the scientific advisory board also contributed to increase the KULTUrisk impact to the scientific community and policy makers. The collaboration with other network, such as the UN-ISDR platforms was also strongly promoted and is still ongoing.Progress reports were regularly provided to the EU, in agreement with the contract rules.

The main project results were made available to the general scientific community through peer reviewed articles published in ISI accredited journals (see below) and presentations at national and international conferences, workshops and seminars. A special logo and the EC logo was used in poster and oral presentations at meetings to easily recognize results coming from the project and to emphasize EC funding. Younger collaborators were strongly encouraged to submit these papers as first authors, in order to improve their international scientific record. A publication strategy was organized between the participants in order to join related publications in the same issue of a journal thereby leading to the largest impact of project results on the scientific and industrial user community. In addition, each of the main research partners presented not only their specific knowledge at congresses and seminars, but also the knowledge acquired by other Project partners. Thus, the efficacy of the dissemination was maximized. The project information flow was not only directed to the scientific community, but great effort was made to reach interested industrial (e.g. hydropower industry) and socioeconomic (civil protection, water authorities) entities. Also, a Website was made available for the public at www.kulturiskeu.

The Website provided timely information regarding the project and addressed environmental problems for which the studied processes might be of interest to attract the attention of end-users. The same website was used as a discussion forum for all stakeholders involved in flood management. Furthermore, a brochure providing information on the project was designed and spread through relevant governmental bodies to potential interested entities and end-users.End-users of the exploitation objects coming from this project are environmental agencies, water boards and authorities, industries, civil protection, hydropower industries, (re-)insurance companies. Round-table discussions were organized during end-users meetings with the stakeholders, which comprise water boards and authorities, civil protection, etc. According to their feedbacks, the KULTURisk approach was fine tuned in line with the regional and European soil and water policy (see also below, the "report on societal implications").

TABLE A1: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES										
	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year	Relevant pages	Permanent identifiers[1] (if available)	Is/Will open access[2] provided to this publication?
1	*Probabilistic evaluation of flood hazard in urban areas using Monte Carlo simulation.*	*Aronica, G.*	*Hydrological Processes*	*No 26, Feb, 2012*	*John Wiley & Sons*	*United States*	*2012*	*pp. 3962–3972*	*10.1002/hyp.8370*	*No*
2	*Operational early warning systems for water-related hazards in Europe*	*Alfieri, L.*	*Environmental Science and Policy*	*No 21, 2012*	*Elsevier BV*	*Netherlands*	*2012*	*pp. 35–49*		
3	*GloFAS – global ensemble streamflow forecasting and flood early warning*	*Alfieri, L.*	*Hydrology and Earth System Sciences*	*No 17, 2013*	*Copernicus publications*	*Germany*	*2013*	*pp. 1161-1175*	*10.5194/hess-17-1161-2013*	*Yes*
4	*Advances in pan-European flood hazard mapping*	*Alfieri, L*	*Hydrological Processes*	*July, 2013*	*John Wiley & Sons*	*United States*	*2013*		*10.1002/hyp.9947*	*No*
5	*A Conceptual Framework for Comprehensive Assessment of Risk Prevention Measures: The Kulturisk Framework (KR-FWK)*	*Balbi, S*		*July, 2012*			*2012*		*10.2139/ssrn.2184193*	*No*
6	*Integrating remote sensing data with flood inundation models: how far have we got?*	*Bates, P.D.*	*Hydrological Processes*	*No 16, 2012*	*John Wiley & Sons*	*United States*	*2012*	*pp. 2515-2521*	*10.1002/hyp.9374*	*No*

[1] A permanent identifier should be a persistent link to the published version full text if open access or abstract if article is pay per view) or to the final manuscript accepted for publication (link to article in repository).
[2] Open Access is defined as free of charge access for anyone via Internet. Please answer "yes" if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.

7	*How much does participatory flood management contribute to stakeholders' social capacity building? Empirical findings based on a triangulation of three evaluation approaches*	*Buchecker, M.*	*Natural Hazards and Earth System Science*	*No 13, June 2013*	*Copernicus publications*	*Germany*	*2013*	*pp. 1427-1444*	*10.5194/nhess-13-1427-2013*	*Yes*
8	*Technical Note: The normal quantile transformation and its application in a flood forecasting system*	*Bogner, K.*	*Hydrology and Earth System Sciences*	*No 16, 2012*	*Copernicus publications*	*Germany*	*2012*	*pp. 1085-1094*	*10.5194/hess-16-1085-2012*	*Yes*
9	*Improving the evaluation of hydrological multi-model forecast performance in the upper Danube catchment.*	*Bogner, K.*	*International Journal of River Basin Management*	*No 1, 2012*	*Taylor & Francis*	*United Kingdom*	*2012*	*pp. 1–12*	*10.1080/15715124. 2011.625359*	*No*
10	*Uncertainty in design flood profiles derived by hydraulic modelling*	*Brandimarte, L.*	*Hydrology Research*	*No 6, 2012*	*International Water Association (IWA)*	*United Kingdom*	*2012*	*pp. 753–761*	*10.2166/nh.2011.086*	*No*
11	*The role of risk perception in making flood risk management more effective*	*Buchecker, M.*	*Natural Hazards and Earth System Science*	*No 11, 2013*	*Copernicus publications*	*Germany*	*2013*	*pp. 3013-3030*	*10.5194/nhess-13-3013-2013*	*Yes*
12	*Natural hazard risk assessment and management methodologies review: Europe.*	*Cirella, G.T.*	*NATO Science for Peace and Security Series C: Environmental Security*	*2014*	*Springer Netherlands*	*Netherlands*	*2014*	*pp. 329-358*	*10.1007/978-94-007-7161-1_16*	*No*
13	*The European Flood Alert System (EFAS) and the communication, perception and use of ensemble predictions for operational flood risk management*	*Demeritt, D.*	*Hydrological Processes*	*No 1, 2013*	*John Wiley & Sons*	*United States*	*2013*	*pp. 147–157*	*10.1002/hyp.9419*	*No*
14	*Towards understanding the dynamic behaviour of floodplains as human-water*	*Di Baldassarre, G.*	*Hydrology and Earth System Sciences*	*No 3, 2013*	*Copernicus*	*Germany*	*2013*	*pp. 3869-3895*	10.5194/hess-17-3235-2013	*Yes*

	systems				*publications*					
15	*Timely low resolution SAR imagery to support floodplain modelling: a case study review*	*Di Baldassarre, G.*	*Surveys in Geophysics*	*No 3, 2011*	*Springer*	*United States*	*2011*	*pp. 255-269*	*10.1007/s10712-011-9111-9*	*No*
16	*Is the current flood of data enough? A treatise on research needs to improve flood modelling*	*Di Baldassarre, G.*	*Hydrological Processes*	*No 1, 2012*	*John Wiley & Sons*	*United States*	*2012*	*pp. 153-158*	*10.1002/hyp.8226*	*No*
17	*Prospettive scientifiche sulla gestione del rischio alluvionale (in Italian)*	*Di Baldassarre, G.*	*Atti dell'Accademia Nazionale dei Lincei*	*2012*		*Italy*	*2012*			*No*
18	*Detailed data is welcome, but with a pinch of salt: Accuracy, precision, and uncertainty in flood inundation modeling*	*Dottori, F.*	*Water Resources Research*	*No 9, Sep 2013*	*John Wiley & Sons*	*United States*	*2013*	*pp. 6079-6085*	*10.1002/wrcr.20406*	*No*
19	*Flooding and the framing of risk in British broadsheets, 1985-2010*	*Escobar ,M.*	*Public Understanding of Science*	*Sep, 2012*	*Sage Publications*	*United States*	*2012*	*pp. 1985-2010*	*10.1177/096366251 2457613*	*No*
20	*Benchmarking urban flood models of varying complexity and scale using high resolution terrestrial LiDAR data*	*Fewtrell, T.J.*	*Physics and Chemistry of the Earth*	*No 7-8, 2011*	*Elsevier BV*	*Netherlands*	*2011*	*pp. 281-291*	*10.1016/j.pce.2010. 12.011*	*No*
21	*Geometric and structural model complexity and the prediction of urban inundation*	*Fewtrell, T.J.*	*Hydrological Processes*	*No 20, 2011*	*John Wiley & Sons*	*United States*	*2011*	*pp. 3173-3186*	*10.1002/hyp.8035*	*No*
22	*Flood risk and uncertainty*	*Freer, J.*	*Risk and uncertainty assessment for natural hazards*	*2013*	*Cambridge University Press*	*United Kingdom*	*2013*	*pp. 190-233*		*No*

23	*Integrated Risk Assessment of Water Related Processes*	*Giupponi C.*	*Hydro-Meteorological Hazards, and Disasters*	*2014*	*Elsevier BV*	*Netherlands*	*2014*			*No*
24	*Discussion: modelling the hydraulics of the Carlisle 2005 flood event*	*Horritt, M.*	*Proceedings of the Institution of Civil Engineers, Water Management*	*No 2, 2011*	*Institution of Civil Engineers (ICE)*	*United Kingdom*	*2011*	*pp. 103-103*	*10.1680/wama.1000094*	*No*
25	*Comparative flood damage model assessment: towards a European approach'*	*Jongman, B*	*Natural Hazards And Earth System Sciences*	*No 12, 2012*	*Copernicus publications*	*Germany*	*2012*	*pp. 3733-3752*	*10.5194/nhess-12-3733-2012*	*Yes*
26	*Review" Structural flood-protection measures referring to several European case studies"*	*Kryžanowski, A.*	*Natural Hazards and Earth System Sciences Discussions*	*No 1, 2013*	*Copernicus publications*	*Germany*	*2013*	*pp. 247-274*	*10.5194/nhessd-1-247-2013*	*Yes*
27	*Coupled 1D–Quasi-2D Flood Inundation Model with Unstructured Grids*	*Kuiry, S.N.*	*Journal of Hydraulic Engineering*	*No 8, 2010*	*American Society of Civil Engineers (ASCE)*	*United States*	*2010*	*pp. 493-506*	*10.1061/(ASCE)HY.1943-7900.0000211*	*No*
28	*Application of the 1D-Quasi 2D model TINFLOOD for floodplain inundation prediction of the River Thames*	*Kuiry, S.N.*	*Journal of Hydraulic Engineering*	*No 1, 2011*	*American Society of Civil Engineers (ASCE)*	*United States*	*2011*	*pp. 98-110*	*10.1080/09715010.2011.10515036*	*No*
29	*Visualisation approaches for communicating real-time flood forecasting level and inundation information*	*Leedal, D.*	*Journal of Flood Risk Management*	*No 2, 2010*	*John Wiley & Sons*	*United States*	*2010*	*pp. 140-150*	*10.1111/j.1753-318X.2010.01063.x*	*No*
30	*Quantifying the uncertainty in future coastal flood risk estimates for the UK*	*Lewis, M.*	*Journal of Coastal Research*	*No 5, 2011*	*Coastal Education and Research Foundation (CERF)*	*United States*	*2011*	*pp. 870–881*	*10.2112/JCOASTRES-D-10-00147.1*	*Yes*
31	*Flooding hazard mapping in floodplain areas affected by piping breaches in the PoRiver, Italy*	*Mazzoleni, M.*	*Journal of Hydrologic Engineering*	*May, 2013*	*American Society of Civil Engineers (ASCE)*	*United States*	*2013*		*10.1061/(ASCE)HE.1943-5584.0000840*	*No*
32	*metodo dell'erosione potenziale: proposte*	*Milanesi L.*	*L'Acqua*	*No 1, 2013*			*2013*	*pp. 37-47*		

	innovative ed appplicazioni in ambito alpino									
33	*Data errors and hydrological modelling: The role of model structure to propagate observation uncertainty*	*Montanari, A.*	*Advances in Water Resources*	*2013*	*Elsevier BV*	*Netherlands*	*2013*	*pp. 498-504*	*http://dx.doi.org/10.1016/j.advwatres.2012.09.007*	*No*
34	*Evaluating a new LISFLOOD-FP formulation using data for the summer 2007 floods in Tewkesbury, UK*	*Neal, J.C.*	*Journal of Flood Risk Management*	*No 2, 2011*	*John Wiley & Sons*	*United States*	*2011*	*pp. 88-95*	*10.1111/j.1753-318X.2011.01093.x*	*No*
35	*Probabilistic flood risk mapping including spatial dependence*	*Neal, J.C.*	*Hydrological Processes*	*No 9, 2013*	*John Wiley & Sons*	*United States*	*2013*	*pp. 1349-1363*	*10.1002/hyp.9572*	*No*
36	*How much physical complexity is needed to model flood inundation?*	*Neal, J.C.*	*Hydrological Processes*	*No 15, 2012*	*John Wiley & Sons*	*United States*	*2012*	*pp. 2264-2282*	*10.1002/hyp.8339*	*No*
37	*Urban flood modelling*	*Neal, J.C.*	*Floods in a changing climate: inundation modelling*	*2013*	*Cambridge University Press*	*United Kingdom*	*2013*	*pp. 69-77*	*10.1017/CBO9781139088411*	*No*
38	*HESS Opinions "On forecast (in) consistency in a hydro-meteorological chain: curse or blessing?"*	*Pappenberger, F.*	*Hydrology and Earth System Sciences*	*No 7, 2011*	*Copernicus publications*	*Germany*	*2011*	*pp. 2391-2400*	*http://dx.doi.org/10.5194/hess-15-2391-2011*	*Yes*
39	*HP today: on the pursuit of (im)perfection in flood forecasting*	*Pappenberger, F.,*	*Hydrological Processes*	*2013*	*John Wiley & Sons*	*United States*	*2013*	*pp. 162–163*	*10.1002/hyp.9465*	*No*
40	*Visualising probabilistic flood forecast information: expert preferences and perceptions of best practice in uncertainty communication*	*Pappenberger, F.,*	*Hydrological Processes*	*No 1, 2013*	*John Wiley & Sons*	*United States*	*2013*	*pp. 132–146*	*10.1002/hyp.9253*	*No*

41	*Deriving global flood hazard maps of fluvial floods through a physical model cascade*	*Pappenberger, F.,*	*Hydrology and Earth System Sciences*	*2012*	*Copernicus publications*	*Germany*	*2012*	*pp. 4143-4156*	*10.5194/hess-16-4143-2012*	*Yes*
42	*Reducing inconsistencies in point observations of maximum flood inundation level*	*Parkes, B. L.*	*Earth Interactions*	*No 6, Aug, 2013*	*American Meteorological Society, American Geophysical Union, and Association of American Geographers*	*United States*	*2013*	*pp. 1-27*	*http://dx.doi.org/10.1175/2012EI000475.1*	*Yes*
43	*Discussion on Experimental investigation of reservoir geometry effect on dam-break flow*	*Pilotti, M.*	*Journal of Hydraulic Research*	*No 2, 2013*	*Taylor & Francis*	*United Kingdom*	*2013*	*pp. 220-222*		*No*
44	*Data set for hydrodynamic lake model calibration: A deep prealpine case*	*Pilotti, M.*	*Water Resources Research*	*No 10, 2013*	*John Wiley & Sons*	*United States*	*2013*	*pp. 7159-7163*		*No*
45	*Flood-risk management, mapping, and planning: the institutional politics of decision support in England*	*Porter, J.*	*Environment and Planning A*	*No 10, 2012*	*Pion*		*2012*	*pp. 2359-2378*	*10.1068/a44660*	*No*
46	*Selecting the appropriate hydraulic model structure using low-resolution satellite imagery*	*Prestininzi, P.*	*Advances in Water Resources*	*No 1, Jan 2011*	*Elsevier BV*	*Netherlands*	*2011*	*pp. 38–46*	*10.1016/j.advwatres.2010.09.016*	*No*
47	*The contribution to future flood risk in the Severn Estuary from extreme sea level rise due to ice sheet mass loss*	*Quinn, N.*	*Journal of Geophysical Research: Oceans*	*No 11, Nov 2013*	*John Wiley & Sons*	*United States*	*2013*	*pp. 5887-5898*	*doi:10.1002/jgrc.20412*	*No*
48	*Do probabilistic forecasts lead to better decisions?*	*Ramos, M. H.*	*Hydrology and Earth System Sciences*	*2013*	*Copernicus publications*	*Germany*	*2013*	*pp. 2219-2232*	*10.5194/hess-17-2219-2013,2013*	*Yes*

49	*Levee Breaches Statistics, "Geotechnical Uncertainty", Residual Risk in Flood Hazard Mapping*	*Ranzi R.*	*Proceedings of the 35th IAHR World Congress*	*2013*	*Tsinghua University Press*	*China*	*2013*	*pp. 9*	*ISBN 978-7-89414-588-8*	*Yes*
50	*An entropy approach for the optimization of cross-section spacing for river modelling*	*Ridolfi, E.*	*Hydrological Sciences Journal*	*No 1, Nov, 2013*	*Taylor & Francis*	*United Kingdom*	*2013*	*pp. 1-12*	*10.1080/02626667.2013.822640*	*No*
51	*Uncertainty propagation for flood forecasting in the Alps: different views and impacts from MAP D-PHASE*	*Rotach M. W.*	*Natural Hazards And Earth System Sciences*	*No 12, 2012*	*Copernicus publications*	*Germany*	*2012*	*pp. 2439–2448*	*10.5194/nhess-12-2439-2012*	*Yes*
52	*Toward a space-time framework for integrated studies*	*Ruin, I.*	*Bulletin of the American Meteorological Society*	*No 10, Oct 2012*	*American Meteorological Society*	*United States*	*2012*	*pp. 589-591*	*http://dx.doi.org/10.1175/BAMS-D-11-00226.1*	*Yes*
53	*Using terrestrial laser scanning data to drive decimetric resolution urban inundation models*	*Sampson, C.C.*	*Advances in Water Resources*	*No 41, Jun 2012*	*Elsevier BV*	*Netherlands*	*2012*	*pp. 1-17*	*10.1016/j.advwatres.2012.02.010*	*No*
54	*An automated routing methodology to enable direct rainfall in high resolution shallow water models*	*Sampson, C.C.*	*Hydrological Processes*	*No 3, Oct 2012*	*John Wiley & Sons*	*United States*	*2012*	*pp. 467–476*	*10.1002/hyp.9515*	*No*
55	*Future challenges for water hazard early warning systems*	*Salamon, P.*	*Environmental Science and Policy*	*No 297, Sep 2012*	*Elsevier BV*	*Netherlands*	*2012*	*pp. 35-49*	*10.1016/j.envsci.2012.01.008*	*Yes*
56	*The accuracy of sequential aerial photography and SAR data for observing urban flood dynamics, a case study of the UK summer 2007 floods*	*Schumann, G. J.-P.*	*Remote Sensing and the Environment*	*No 10, 2011*	*Elsevier BV*	*Netherlands*	*2011*	*pp. 2536-2546*	*10.1016/j.rse.2011.04.039*	*No*
57	*Evaluation a coastal flood inundation model using hard*	*Smith, R.A.*	*Environmental Modelling and Software*	*No 30, Apr 2012*	*Elsevier BV*	*Netherlands*	*2012*	*pp. 35-46*	*10.1016/j.envsoft.2011.11.008*	*No*

	and soft data									
58	*Problems with binary pattern measures for flood model evaluation*	*Stephens, E.*	*Hydrological Processes*	*Aug, 2013*	*John Wiley & Sons*	*United States*	*2013*		*10.1002/hyp.9979*	*No*
59	*The impact of uncertainty in satellite data on the assessment of flood inundation models*	*Stephens, E.*	*Journal of Hydrology*	*No 414-415, Jan 2012*	*Elsevier BV*	*Netherlands*	*2012*	*pp. 162–173*	*10.1016/j.jhydrol.2011.10.040*	*No*
60	*Communicating probabilistic information from climate model ensembles—lessons from numerical weather prediction*	*Stephens, E.*	*WIREs Climate Change*	*No 5, Aug 2012*	*John Wiley & Sons*	*United States*	*2012*	*pp. 409-426*	*10.1002/wcc.187*	*No*
61	*Post-processing hydrological ensemble predictions intercomparison experiment*	*van Andel, S.J.*	*Hydrological Processes*	*No 1, 2013*	*John Wiley & Sons*	*United States*	*2013*	*pp. 158–161*	*10.1002/hyp.9595*	*No*
62	*Forecasters priorities for improving probabilistic flood forecasts*	*Wetterhall, F.*	*Hydrology and Earth System Sciences Discussion*	*No 10, 2013*	*Copernicus publications*	*Germany*	*2013*	*pp. 2215-2242*	*10.5194/hessd-10-2215-2013*	*Yes*
63	*Exploring the potential of SRTM topographic data for flood inundation modelling under uncertainty*	*Yan,K.*	*Journal of Hydroinformatics*	*No 3, Jul 2013*	*International Water Association (IWA)*	*United Kingdom*	*2013*	*pp. 849–861*	*10.2166/hydro.2013.137*	*No*

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES

No	Type of Activity	Main leader	Title	Date/Period	Place	Type of audience	Size of audience	Countries addressed
1	*Magazine article*	*Dr. Alfonso*	*KULTURisk experiences*	*to be published*	*Delft, Netherlands*	*Accessible publicly*	*-*	*several*
2	*Briefs*	*Dr. Alfonso*	*Second set of policy briefs*	*9th December, 2013*	*Barcelonnette, France*	*General public, Scientific Community , Industry, Civil Society, Policy makers*	*-*	*Europe*
3	*Briefs*	*Dr. Alfonso*	*Second set of policy briefs [Spanish]*	*9th December, 2013*	*Delft, Netherlands*	*General public, Scientific Community , Industry, Civil Society, Policy makers*	*-*	*several*
4	*Briefs*	*Mr. Yan*	*Second set of policy briefs [Chinesse]*	*9th December, 2013*	*Delft, Netherlands*	*General public, Scientific Community , Industry, Civil Society, Policy makers*	*-*	*several*
5	*Conference*	*Dr. Di Baldassarre*	*KULTURISK Final conference*	*2nd-4th December, 2013*	*Barcelonnette, France*	*Scientific Community , Industry, Policy makers*	*~50*	*Europe*
6	*Workshop*	*Dr. Di Baldassarre*	*Benefits of disaster prevention measures: consolidating and widening an innovative risk assessment methodology ; (3rd KULTURisk workshop)*	*19th-20th September 2013*	*Venice, Italy*	*Scientific Community , Industry, Civil Society, Policy makers*	*~50*	*Europe*
7	*Presentation*	*Dr. Alfonso*	*Introductory Session of the Expert Meeting on Risk Prevention and Mitigation: Governing Effective Prevention and Mitigation of Disruptive Shocks: (OECD High Level Forum)*	*12th September 2013*	*Paris, France*	*Scientific Community , Industry, Civil Society, Policy makers*	*~20*	*OECD*
8	*Educational material*	*Dr. Di Baldassarre*	*Summer school: Flood risk reduction; perception, communication, governance*	*9th-12th September, 2013*	*Delft, Netherlands*	*Scientific Community*	*~15*	*several*
9	*Educational material*	*Dr. Alfonso*	*Software implementation of the KULTURisk Methodology*	*September, 2013*	*Delft, Netherlands*	*Scientific Community*	*-*	*several*
10	*Poster*	*Dr. Balbi*	*Estimating flood damage costs to people using spatially distributed Bayesian networks*	*8th-10th July, 2013*	*Bilbao Bizkaia, Spain*	*Scientific Community*	*-*	*Europe*

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES								
No	**Type of Activity**	**Main leader**	**Title**	**Date/Period**	**Place**	**Type of audience**	**Size of audience**	**Countries addressed**
11	*Educational material*	*Dr. Neal*	*Training Exercises in Flood modelling*	*2013*	*Bristol, UK*	*Scientific Community*	*-*	*several*
12	*Presentation*	*Dr. Peirpaolo Campostrini*	*Global Platform for Disaster Risk Reduction*	*19th-23rd May, 2013*	*Geneva, Switzerland*	*Scientific Community , Industry, Civil Society, Policy makers*	*-*	*Europe*
13	*Flyer*	*Dr. Alfonso*	*KULTURisk summer school*	*April, 2013*	*Delft, Netherlands*	*General public*	*-*	*several*
14	*Presentation*	*Prof. Ranzi*	*Laboratory for a culture of risk prevention in primary schools (Scuola Primaria Sacra Famiglia)*	*18th January, 2013*	*Trento, Italy*	*General public*	*-*	*Italy*
15	*Web*	*Dr. Alfonso*	*Knowledge Web-based Platform (KWBP), (http://kwbp.kulturisk.eu/)*	*2013 - ongoing*	*Delft, Netherlands*	*Accessible publicly*	*online*	*several*
16	*Conference*	*Dr. Di Baldassarre*	*European Geosciences Union (EGU) Leonardo Conference : Hydrology society, connections between Hydrology, Population dynamics, Policy making and Hydro-power generation*	*14th-16th November 2012*	*Turin , Italy*	*Scientific Community*	*~200*	*Europe*
17	*Poster*	*Mr. Mojtahed*	*Estimating flood damage costs and the impact of risk mitigation policies*	*14th-16th November 2012*	*Torino, Italy*	*Scientific Community*	*-*	*Europe*
18	*News letter*	*Dr. Alfonso*	*KULTURisk newsletter - number 3*	*November, 2012*	*Delft, Netherlands*	*General public*	*-*	*several*
19	*News letter*	*Dr. Alfonso*	*KULTURisk newsletter - number 2*	*June, 2012*	*Delft, Netherlands*	*General public*	*-*	*several*
20	*Workshop*	*Michele Ferri*	*Second KULTURisk workshop*	*24th-25th May, 2012*	*Trieste, Italy*	*Scientific Community , Industry, Policy makers*	*~50*	*Europe*
21	*Poster*	*Dr. Alfonso*	*KULTURisk project summary*	*April, 2012*	*Barcelonnette, France*	*Scientific Community , Industry, Civil Society, Policy makers*	*-*	*Europe*
22	*Poster*	*Dr. Alfonso*	*KULTURisk project summary [in French]*	*April, 2012*	*Barcelonnette, France*	*Scientific Community , Industry, Civil Society, Policy makers*	*-*	*Europe*
23	*Workshop*	*Dr. Alfonso*	*Stakeholder consultation*	*16th-19th April, 2012*	*Barcelonnette, France*	*Scientific Community , Industry, Policy makers*	*~30*	*Europe*

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES								
No	**Type of Activity**	**Main leader**	**Title**	**Date/Period**	**Place**	**Type of audience**	**Size of audience**	**Countries addressed**
24	*Poster*	*Mr. Mukolwe*	*Probabilistid flood mapping and visualisation issues: Application to River Ubaye, Barcelonnette (France)*	*April, 2012*	*Vienna, Austria*	*Scientific Community*	*-*	*France*
25	*Poster*	*Mr. Yan*	*Flood inundation modelling under uncertainty using globally and freely available remote sensing data*	*April, 2012*	*Vienna, Austria*	*Scientific Community*	*-*	*Italy*
26	*Poster*	*Dr. Ridolfi*	*Optimisation of floodplain monitoring sensors through and entropy approach*	*April, 2012*	*Vienna, Austria*	*Scientific Community*	*-*	*UK*
27	*Poster*	*Prof. Ranzi*	*Uncertainty in flood hazard mapping*	*1st-2nd December, 2011*	*Bologna, Italy*	*Scientific Community*	*-*	*Europe*
28	*Poster*	*Mr. Yan*	*Flood inundation modelling in Large rivers under uncertainty using globally and freely available remote sensing data*	*November, 2011*	*Bratislava, Slovakia*	*Scientific Community*	*~250*	*Italy*
29	*Poster*	*Dr. Ridolfi*	*An entropy approach for the optimisation of river-crossectional spacing*	*November, 2011*	*Bratislava, Slovakia*	*Scientific Community*	*~250*	*Italy*
30	*Conference*	*Dr. Di Baldassarre*	*European Geosciences Union (EGU) Leonardo Conference :Floods in 3D: Process, Patterns, Predictiosn*	*23rd-25th September, 2011*	*Bratislava, Slovakia*	*Scientific Community*	*~250*	*Europe*
31	*Briefs*	*Dr. Alfonso*	*First policy brief*	*September, 2011*	*Delft, Netherlands*	*General public, Scientific Community , Industry, Civil Society, Policy makers*	*online*	*several*
32	*Educational material*	*Dr. Neal*	*shareware flood inundation model LISFLOOD-FP*	*through project*	*Bristol, UK*	*Scientific Community*	*online*	*several*
33	*News letter*	*Dr. Alfonso*	*KULTURisk newsletter - number 1*	*June, 2011*	*Delft, Netherlands*	*General public*	*-*	*several*
34	*Workshop*	*Dr. Di Baldassarre*	*Joint EFAS & KULTURisk meeting*	*12th-13th April, 2011*	*Stresa, Italy*	*Scientific Community*	*~20*	*Europe*

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES								
No	**Type of Activity**	**Main leader**	**Title**	**Date/Period**	**Place**	**Type of audience**	**Size of audience**	**Countries addressed**
35	*Flyer*	*Dr. Alfonso*	*KULTURisk Brochure (3)*	*2011-2013*	*Delft, Netherlands*	*General public*	*-*	*Europe*
36	*Workshop*	*Dr. Di Baldassarre*	*KULTURISK kickoff meeting*	*26th-28th January, 2011*	*Delft, Netherlands*	*Scientific Community*	*~50*	*Europe*
37	*Web*	*Dr. Alfonso*	*KULTURisk website*	*2011 - ongoing*	*Delft, Netherlands*	*Accessible publicly*	*online*	*several*

REPORT ON SOCIETAL IMPLICATIONS

A General Information

Grant Agreement Number:	265280
Title of Project:	KULTURisk
Name and Title of Coordinator:	Giuliano Di Baldassarre, PhD

B Ethics

1. Did your project undergo an Ethics Review (and/or Screening)? • If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports? Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 *'Work Progress and Achievements'*	***No***
2. Please indicate whether your project involved any of the following issues	
RESEARCH ON HUMANS	
• Did the project involve children?	No
• Did the project involve patients?	No
• Did the project involve persons not able to give consent?	No
• Did the project involve adult healthy volunteers?	No
• Did the project involve Human genetic material?	No
• Did the project involve Human biological samples?	No
• Did the project involve Human data collection?	No
RESEARCH ON HUMAN EMBRYO/FOETUS	
• Did the project involve Human Embryos?	No
• Did the project involve Human Foetal Tissue / Cells?	No
• Did the project involve Human Embryonic Stem Cells (hESCs)?	No
• Did the project on human Embryonic Stem Cells involve cells in culture?	No
• Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	No
PRIVACY	
• Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	No
• Did the project involve tracking the location or observation of people?	No
RESEARCH ON ANIMALS	
• Did the project involve research on animals?	No
• Were those animals transgenic small laboratory animals?	No
• Were those animals transgenic farm animals?	No
• Were those animals cloned farm animals?	No
• Were those animals non-human primates?	No
RESEARCH INVOLVING DEVELOPING COUNTRIES	
• Did the project involve the use of local resources (genetic, animal, plant etc)?	**No**
• Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	**No**
DUAL USE	
• Research having direct military use	No

• Research having the potential for terrorist abuse	No

C Workforce Statistics

3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).

Type of Position	Number of Women	Number of Men
Scientific Coordinator	0	1
Work package leaders	0	8
Experienced researchers (i.e. PhD holders)	2	11
PhD Students	1	4
Other	2	6

4. How many additional researchers (in companies and universities) were recruited specifically for this project?	**11**
Of which, indicate the number of men:	3

D Gender Aspects

5. Did you carry out specific Gender Equality Actions under the project?

- [x] Yes
- [ ] No

6. Which of the following actions did you carry out and how effective were they?

Action	Not at all effective				Very effective
❑ Design and implement an equal opportunity policy	○	○	○	○	○
■ Set targets to achieve a gender balance in the workforce	○	●	○	○	○
❑ Organise conferences and workshops on gender	○	○	○	○	○
❑ Actions to improve work-life balance	○	○	○	○	○

○ Other:

7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

- [ ] Yes- please specify
- [x] No

E Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

- [x] Yes (see Education Material at www.kulturisk.eu/results)
- [ ] No

9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

- [x] Yes (see Education Material at www.kulturisk.eu/results)
- [ ] No

F Interdisciplinarity

10. Which disciplines (see list below) are involved in your project?

- [x] Main discipline[3]:
  There was no main discipline.
  The approach was multi-disciplinary and involved (using the list below, Frascati Manual):
  1.1, 1.4, 2.1, 5.2, 5.3, 5.4
- [ ] Associated discipline[3]:
- [ ] Associated discipline[3]:

G Engaging with Civil society and policy makers

11a Did your project engage with societal actors beyond the research community? *(if 'No', go to Question 14)*

- [x] Yes
- [ ] No

11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

- [ ] No
- [ ] Yes- in determining what research should be performed

[3] Insert number from list below (Frascati Manual).

- ○ Yes - in implementing the research
- ● Yes, in communicating /disseminating / using the results of the project

11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?	○ ●	Yes No

12. Did you engage with government / public bodies or policy makers (including international organisations)

- ○ No
- ● Yes- in framing the research agenda
- ● Yes - in implementing the research agenda
- ● Yes, in communicating /disseminating / using the results of the project

13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?

- ● Yes – as a **primary** objective (see areas below)
- ● Yes – as a **secondary** objective (see areas below)
- ○ No

13b If Yes, in which fields? (indicated in bold and underlined)

Agriculture Audiovisual and Media Budget Competition Consumers Culture Customs Development Economic and Monetary Affairs **<u>Education, Training, Youth</u>** Employment and Social Affairs		Energy Enlargement Enterprise **<u>Environment</u>** External Relations External Trade Fisheries and Maritime Affairs Food Safety Foreign and Security Policy Fraud Humanitarian aid		Human rights Information Society Institutional affairs Internal Market Justice, freedom and security Public Health Regional Policy **<u>Research and Innovation</u>** Space Taxation Transport	

13c If Yes, at which level? ◉ Local / regional levels ◉ National level ◉ European level ◉ International level	

H Use and dissemination

14. How many Articles were published/accepted for publication in peer-reviewed journals?	More than 60 papers
To how many of these is open access[4] provided?	
How many of these are published in open access journals?	
How many of these are published in open repositories?	
To how many of these is open access not provided?	
Please check all applicable reasons for not providing open access:	
■ publisher's licensing agreement would not permit publishing in a repository ❑ no suitable repository available ■ no suitable open access journal available ■ no funds available to publish in an open access journal ❑ lack of time and resources ❑ lack of information on open access ❑ other[5]: ……………	

15. How many new patent applications ('priority filings') have been made? *("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).*	**None**

16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	
	Registered design	
	Other	

17. How many spin-off companies were created / are planned as a direct result of the project?	**None**
Indicate the approximate number of additional jobs in these companies:	

18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:

❑ Increase in employment, or	❑ In small & medium-sized enterprises
❑ Safeguard employment, or	❑ In large companies
❑ Decrease in employment,	■ None of the above / not relevant to the project
❑ Difficult to estimate / not possible to quantify	

19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (*FTE = one person working fulltime for a year*) jobs:	*Indicate figure:*

[4] Open Access is defined as free of charge access for anyone via Internet.
[5] For instance: classification for security project.

Difficult to estimate / not possible to quantify	☒

I Media and Communication to the general public

20. As part of the project, were any of the beneficiaries professionals in communication or media relations?

◉ Yes ○ No

21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?

◉ Yes ○ No

22 Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?

☒	Press Release	☒	Coverage in specialist press
☒	Media briefing	☒	Coverage in general (non-specialist) press
☐	TV coverage / report	☐	Coverage in national press
☐	Radio coverage / report	☐	Coverage in international press
☒	Brochures /posters / flyers	☒	Website for the general public / internet
☐	DVD /Film /Multimedia	☒	Event targeting general public (festival, conference, exhibition, science café)

23 In which languages are the information products for the general public produced?

☐	Language of the coordinator	☒	English
☒	Other language(s)		

***Question F-10*:** Classification of Scientific Disciplines according to the Frascati Manual 2002 (Proposed Standard Practice for Surveys on Research and Experimental Development, OECD 2002):

FIELDS OF SCIENCE AND TECHNOLOGY

1. NATURAL SCIENCES
1.1 Mathematics and computer sciences [mathematics and other allied fields: computer sciences and other allied subjects (software development only; hardware development should be classified in the engineering fields)]
1.2 Physical sciences (astronomy and space sciences, physics and other allied subjects)
1.3 Chemical sciences (chemistry, other allied subjects)
1.4 Earth and related environmental sciences (geology, geophysics, mineralogy, physical geography and other geosciences, meteorology and other atmospheric sciences including climatic research, oceanography, vulcanology, palaeoecology, other allied sciences)
1.5 Biological sciences (biology, botany, bacteriology, microbiology, zoology, entomology, genetics, biochemistry, biophysics, other allied sciences, excluding clinical and veterinary sciences)

2 ENGINEERING AND TECHNOLOGY
2.1 Civil engineering (architecture engineering, building science and engineering, construction engineering, municipal and structural engineering and other allied subjects)
2.2 Electrical engineering, electronics [electrical engineering, electronics, communication engineering and systems, computer engineering (hardware only) and other allied subjects]
2.3. Other engineering sciences (such as chemical, aeronautical and space, mechanical, metallurgical and materials engineering, and their specialised subdivisions; forest products; applied sciences such as geodesy, industrial chemistry, etc.; the science and technology of food production; specialised

technologies of interdisciplinary fields, e.g. systems analysis, metallurgy, mining, textile technology and other applied subjects)

3. MEDICAL SCIENCES

3.1 Basic medicine (anatomy, cytology, physiology, genetics, pharmacy, pharmacology, toxicology, immunology and immunohaematology, clinical chemistry, clinical microbiology, pathology)

3.2 Clinical medicine (anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, dentistry, neurology, psychiatry, radiology, therapeutics, otorhinolaryngology, ophthalmology)

3.3 Health sciences (public health services, social medicine, hygiene, nursing, epidemiology)

4. AGRICULTURAL SCIENCES

4.1 Agriculture, forestry, fisheries and allied sciences (agronomy, animal husbandry, fisheries, forestry, horticulture, other allied subjects)

4.2 Veterinary medicine

5. SOCIAL SCIENCES

5.1 Psychology

5.2 Economics

5.3 Educational sciences (education and training and other allied subjects)

5.4 Other social sciences [anthropology (social and cultural) and ethnology, demography, geography (human, economic and social), town and country planning, management, law, linguistics, political sciences, sociology, organisation and methods, miscellaneous social sciences and interdisciplinary , methodological and historical S1T activities relating to subjects in this group. Physical anthropology, physical geography and psychophysiology should normally be classified with the natural sciences].

6. HUMANITIES

6.1 History (history, prehistory and history, together with auxiliary historical disciplines such as archaeology, numismatics, palaeography, genealogy, etc.)

6.2 Languages and literature (ancient and modern)

6.3 Other humanities [philosophy (including the history of science and technology) arts, history of art, art criticism, painting, sculpture, musicology, dramatic art excluding artistic "research" of any kind, religion, theology, other fields and subjects pertaining to the humanities, methodological, historical and other S1T activities relating to the subjects in this group]