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Storm impacts along European coastlines. Part 1: The joint effort of the MICORE and ConHaz Projects

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ABSTRACT

The current paper discusses the topic of marine storm impact along European coastlines, presenting results from two FP7 Projects currently focusing on this topic, one working on the physical aspects of the problem (MICORE) and the other one on the socio-economic implications (ConHaz).

The MICORE Project aims to provide on-line predictions of storm-related physical hazards (hydrodynamic as well as morphodynamic). The ConHaz Project addresses the socio-economic implications should these (or other) hazards actually materialize. Together these projects aim to deliver crucial information for emergency response efforts, while realizing the practical limitations for information processing and dissemination during crisis situations.

The MICORE Project has developed and demonstrated on-line tools for reliable predictions of the morphological impact of marine storm events in support of civil protection mitigation strategies. The project specifically targeted the development of early warning and information systems to support short term emergency response in case of an extreme storm event. The current paper discusses in detail the outcome of an activity of databasing historical storm data. No clear changes in storminess were observed, except for some storm proxies (e.g. surges) and only at some locations (e.g. northern Adriatic, southern Baltic, etc.).

The ConHaz Project undertook a desktop study of the methods normally used for evaluating the impact of marine storms and the associated coastal hazards considering direct costs, costs due to disruption of production processes, indirect costs, intangible costs, and costs of adaptation and mitigation measures. Several methods for cost estimation were reviewed. From the review it emerged that normally end-users only evaluate direct costs after the storms, while the cost of adaptation and mitigation measures is only done strategically in the context of Integrated Coastal Zone Management plans. As there is no standardized method for cost evaluations in this field, it is suggested that clear guidelines should be produced on the basis of simplicity for use by end-users. The integration between historical databases of the physical parameters of storms and detailed cost evaluation information would support the development of a knowledge background in end-users and justify the development of adaptation strategies.

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1. Introduction

Exceptional coastal storm impacts generated by tropical and extra-tropical weather systems cause societal, agricultural and industrial losses and affect at the same time developed and developing nations. For developing nations there is also a potential increase in risk due to the fact that large part of the populations are moving into coastal zones and that new industrial settlements are often located in areas prone to flooding or coastal erosion. For this reason, organizations such as the Intergovernmental Oceanographic Commission have recently delivered guidelines in support of hazard awareness and mitigation (IOC, 2009).

The last ten years were characterised by a large number of coastal disasters around the world (e.g. 2004 – Sumatra tsunami, 2005 – Hurricane Katrina in the US, 2010 – Xynthia storm in France and more recently the 2011 – tsunami in Japan and Typhoon Yasin – Australia). With these contemporary examples it is clear that a thorough preparation is crucial to maximise the potential for an effective emergency response, minimise the impacts under design conditions and promote post event recovery.

At the end of February 2010 a powerful Atlantic storm, named Xynthia, battered Western Europe with hurricane force, causing high waves and exceptional tide levels due to storm surges resulting in flooding. The results were widespread property damage, severe disruption to transport networks and infrastructure. The work by Mercier and Acerra (2011) reviews in a succinct view the event while Garnier and Surville (2010) provide a perspective in the context of the history on flood disasters in France from the Middle Ages to the current days. A recent study (Kolen et al., 2010) concluded that the most important part of the disaster management protocol failed, as the storm surge warning was not understood by the disaster management authorities and the public. As the population prepared for high winds and not for flooding, this was fatal for some of them. The conclusions of the study cited above clearly show the need for an appropriate flood warning system. It is also advisable to point out that the implementation of such a flood warning system is fully efficient on condition that (1) the warning system considers how local communities actually perceive the risk of storm, erosion and submersion; and that (2) the warning system takes into account the public awareness of how to react before the intervention of any emergency service (such as the Civil Protection).

The Xynthia example illustrates the need for new coastal information and warning systems in providing on-line predictions of storm impacts for both frequent and more extreme events. Events like Xynthia also point out the need to have access to standardized methods for post-event appraisal to damage quantification. Often end-users in charge of this activity do not undertake post-event evaluations either because they are not given the statutory responsibility for that or because they are not aware of the existence of standardized socio-economic methods.

The above examples illustrate that at least at European level there is an urgent need to reinforce the knowledge, effectiveness and management of damage control, prevention and response to natural hazards. The efforts made by both the MICORE and the ConHaz Project are resulting in added value to update methodologies, civil protection schemes and even in a prototype tool to predict impact of coastal storms in the future. The results of both projects will allow local governments, decision makers and stakeholders to increase the effectiveness of hazard response and management and climate change adaptation planning.

2. The MICORE Project

2.1. Goals and objectives of MICORE

The project involves 16 partners from 9 European countries (for details see www.micore.eu) and its primary goal is to develop and demonstrate on-line tools for reliable prediction of the morphological impact of storm events. The project aims to analyse and map storm related risks in sensitive European regions taking into account intensity, spatial extent, duration and hazard interaction effects. The project started in June 2008 and has duration of 40 months.

The specific scientific objectives of the MICORE Project are:

1. To undertake a review of historical marine storms that had a significant impact on a representative number of sensitive European regional coastlines. A range of coastal regions of the European Union was selected according to wave exposure, tidal regime and socio-economic pressures.
2. To collate data related to occurrence of significant extreme events and socio-economic impacts in a database. Parameters include the characteristics of the storms, the morphological impacts, the socio-economic impacts, an assessment of Civil Protection schemes and competences needed for optimum response strategies.
3. To undertake monitoring of nine European case study sites, collecting new data sets of bathymetry and topography using state-of-the-art technology, and simultaneously measure the forcing agents (wind and waves, tides, surges) that trigger the events.
4. To test and develop reliable methods for numerical modelling of storm-induced morphological changes evaluating the accuracy of off-the-shelf morphological models. Furthermore, to test and develop a new open-source morphological model for the prediction of storm impacts.
5. To set-up early warning systems and to demonstrate their use within Civil Protection agencies. Specific aims are to link morphological models with wave hindcast models, preparing early warning protocols.

2.2. Existing methods and new developments

In the United States, a Federal approach supported by the government through NOAA (http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms), classified storm events and assessed their effects on property and infrastructure. We believe that such level of public access to storm information is of utmost importance at a European level and MICORE has contributed actively to build a proper historical archive for Europe, adding data for recent storms carefully measured at