Risk of coastal flooding in northern Aegean - GR

1. Policy Objective & Theme

- ADAPTATION TO RISK: Preventing and managing natural hazards and technological (human-made) hazards

2. Key Approaches

- Knowledge-based
- Technical

3. Experiences that can be exchanged

A methodology for estimating the risk of flooding in coastal areas caused by extreme sea conditions, namely conditions of extreme wave heights and storm surges. Based on this methodology, flood hazard maps can be produced, indicating the extent of flooding in coastal areas, for supporting flood management agencies to define and decide about coastal protection.

4. Overview of the case

A methodology for estimating the risk of flooding has been developed and implemented to selected coasts of the East Macedonia-Thrace coastal region. Inundation of selected Greek coastal areas, caused by extreme weather and marine conditions has been assessed and flood hazard maps, showing the estimated flood extent, prepared.

5. Context and Objectives

a) Context

The study area is the coastal region of East Macedonia and Thrace, which approximately lies between the estuaries of the rivers Nestos and Evros. Different locations of this continuous coastal line, which are prone to flooding and in which various human activities are collected, were selected to apply the proposed methodology. The development of this methodology is based upon the Water Framework Directive on the assessment and management of flood risks.

b) Objectives

The estimation of the risk of coastal flooding and flood hazard maps are essential for the successful implementation of a range of flood hazard mitigation measures (such as land use regulation, insurance, emergency measures and assessing damage potential) and are also important in controlling future development in hazardous areas. They may also help in informing the public, raising flood awareness and motivating mitigation activity. Flood hazard maps for coastal areas provide the residents of the selected regions with information on the range of possible damage and the disaster prevention activities and are used as a tool to establish a warning and a possible evacuation system. They are also used for planning purposes, to inform decisions regarding where to locate new developments.

Coastal flood hazard and flood risk maps can allocate areas which are most at risk and can help to plan against, and tackle, flood risks in coastal areas. In fact, coastal flood hazard and flood risk maps can provide a basis for a common terminology related to coastal flooding among different areas. The use of a common risk classification and a common terminology could allow for uniform forecasting and prevention of risk activities and emergency management. In addition, exact knowledge of the expected consequences could be possible in a certain area at risk, if the risk scenarios were referred to in common standards. The existence of a common risk classification could also make it possible to have almost objective criteria for the distribution of

funds to different countries, regions, provinces and cities, giving priority to areas characterised by higher risk levels. In addition, this way of proceeding could be the basis for having common strategies for risk mitigation in areas with the same level of risk, even if belonging to different countries.

6. Implementation of the ICZM Approach (i.e. management, tools, resources)

a) Management

The methodology and the case presented were developed by a research team in the Division of Hydraulics and Environmental Engineering of the Civil Engineering Department of Aristotle University of Thessaloniki, Greece.

b) ICZM Tools

The analysis of the risk of coastal flooding includes the identification and characterisation of risk sources (storm surges, waves) causing adverse effects (flooding) in the coastal zone, the estimation of the inundation of the coastal area taking into account beach modification, as well as the evaluation of the physical consequences of a coastal storm. High wave conditions and high mean water levels (tide + storm surge) offshore (including processes of wave generation and the interaction of waves with each other) and transformed to nearshore, are typically considered as the “source” of coastal flooding. A description of risk sources will help to deliver the hydrological and hydraulic boundary conditions which will be needed to describe the loading of flood defence structures or will already be the key input for the probability of flooding.

The parameter which best describes the phenomenon of coastal flooding is the total water level at the shoreline. Regarding the water level, the available data should comprise time-series of wave characteristics (wave height and period), storm surge and tide levels. The data sets are processed using Extreme Value Theory (EVT) and the resulting extreme quantiles of wave heights, wave periods and storm surges (10, 50 or 100 years return levels) are used as input to a beach evolution model (a) to produce the water level elevation and the setup as well as the change of the beach profile in the nearshore region and (b) to determine the flood extent. SBEACH was applied in this study to calculate wave setup and run-up taking into consideration incident waves, storm surges and tide levels, considering its advantage of calculating beach profile change and the effect of these changes on the above phenomena. The determination of the water level elevation and the setup, as well as the change of the beach profile in the nearshore region and the calculation of the flood extent are used for the preparation of flood hazard maps for coastal areas, which are prone to flooding.

Flood hazard maps produced in the study indicate the extent of flooding in coastal areas and can provide the residents of the selected regions with information on the range of possible damage and the disaster prevention activities and can also be used as a tool to establish a warning and a possible evacuation system, as well as for planning purposes, to inform decisions regarding where to locate new developments.

7. Cost and resources

The case study presented had a budget for the work of €38.480. I

8. Effectiveness (i.e. were the foreseen goals/objectives of the work reached?)

The methodology developed is a modern approach of predicting coastal flooding which has been lacking in the past. Analysis and assessment of coastal flood risk, coastal flood hazard and flood risk maps are a good resource for identifying which areas are most at risk and will help professionals plan against and tackle flood risks in coastal areas.

9. Success and Fail factors

The availability of the datasets needed to perform the analysis, as well as communication with the local communities from the outset was proved to be significant to the success of the work. Continuous funding has also been important for the success of the work. It should be noted that flood maps in coastal areas need to be kept up-to-date and accurate due to land use

changes, climate trends and projected changes, which change flood frequencies and magnitudes. These maps should be updated for these factors, and if possible, specifically after each major flood event. Flood hazard and flood risk maps also need to be kept up to date to avoid potential liability issues of those that are responsible for maintaining public safety.

10. Unforeseen outcomes

None

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