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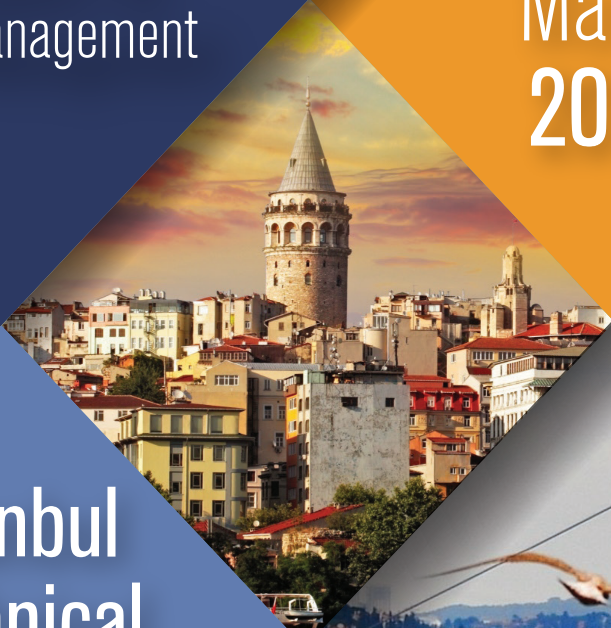
18-21 March 2018



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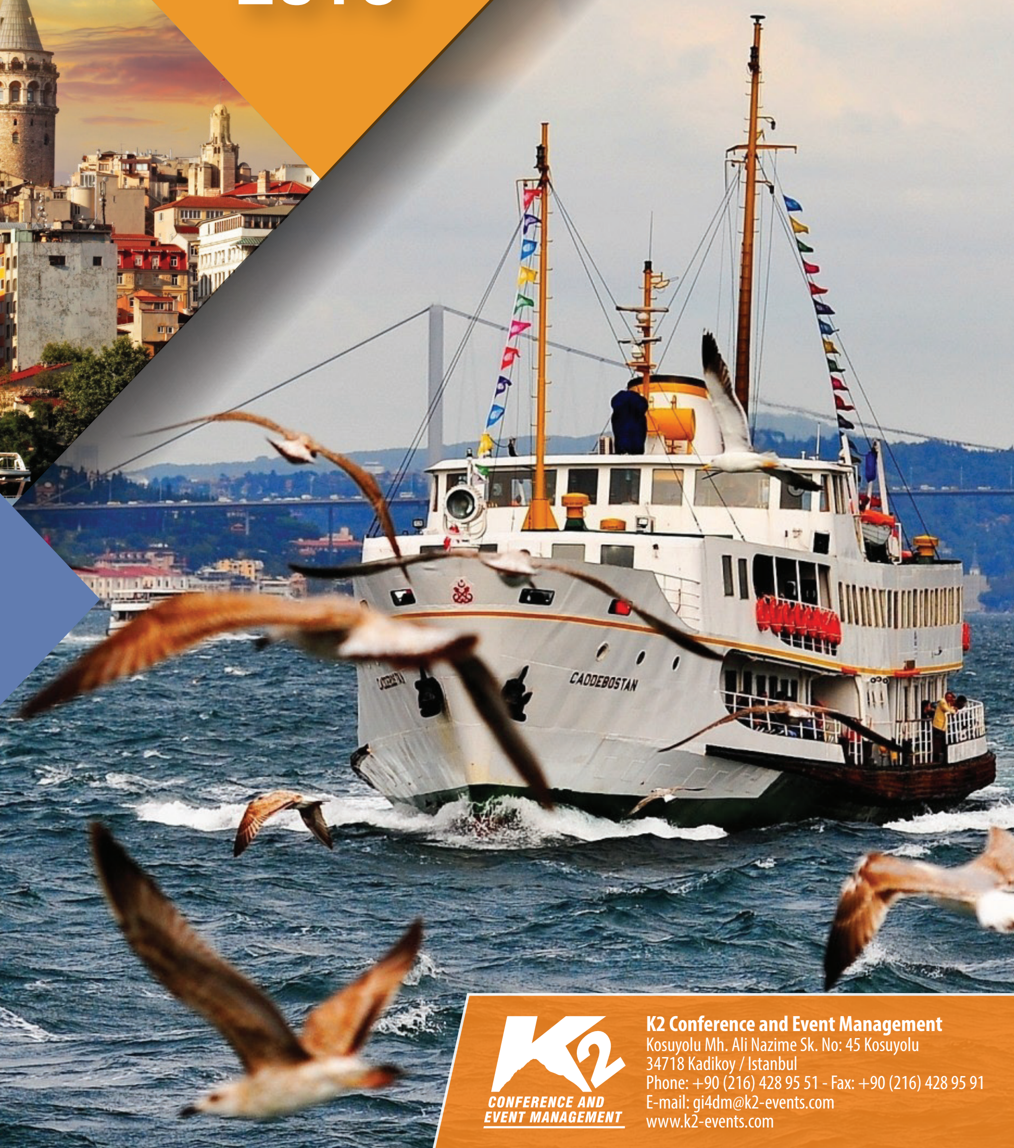

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PREFACE

The increase of natural and anthropogenic disasters is a phenomenon that has been witnessed all around the world. While the scientific knowledge and the technical solutions available to understand and combat this issue are significant, they span a diverse range of disciplines, are sometimes obscure, and often involve great skill to apply in practice. Many of the challenges are interdisciplinary and require sophisticated solutions. These challenges include a wide variety of sensor systems including ground penetrating radars to search for buried people and objects and the opportunistic detection of EM emissions from communications devices including cell phones, PDAs, which can help to locate lost persons. In both cases the radio scientist is involved in the antenna design, the propagation of wideband signals through dispersive ground media and also the signal processing. The remote sensing community then requires sophisticated search and recognition strategies to quickly identify targets.

URSI and ISPRS are two leading global scientific societies providing complementary support and leadership to their respective communities. URSI is responsible for stimulating and co-ordinating, on an international basis, studies, research, applications, scientific exchange, and communication in the fields of radio science. It encompasses the knowledge and study of all aspects of electromagnetic fields and waves. ISPRS is the International Society for Photogrammetry and Remote Sensing. It covers complementary disciplines of interest for a wide scientific community. The Scientific Unions of ISPRS and URSI together possess the knowledge and skills of these domains, and thus, through harmonious and continuous co-operation, offer relevant solutions regarding public protection and disaster relief (PPDR). In 2009, URSI and ISPRS agreed to organize common workshops on “disaster management”. Joint sessions where organized in Antalya (2010, GI4DM), Istanbul (2011, URSI GASS), Melbourne (2012, ISPRS GA) with contributions to the "VALID" document (The Value of Geo information for Disaster and Risk Management, 2013), edited by Professor Orhan Altan. As a continuation of the programme, an URSI-ISPRS session was organized during the XXIII ISPRS Congress 2016 in Prague and focused on "Disaster and Risk Management”. At the end of the session, the creation of a joint working-group was discussed to support longer-term coordination between ISPRS and URSI.

This intended longer-term coordination between ISPRS and URSI has been reflected in Gi4DM 2018 - Geoinformation for Disaster Management conference, held at Istanbul Technical University, Istanbul - Turkey, on 17 - 21st March, 2018. In this conference, it is aimed to address the use of GeoInformation technologies in the disaster management and to create a platform for exchanging the ideas among scholars and practitioners of public and private sectors. The conference addressed diverse topics related to methodologies and technologies within a unique forum keeping participants up to date with the latest advances in disaster management.

The proceedings of the Gi4DM 2018 consist of Archives papers which have been selected based on a review of the submitted abstracts. All Archives abstracts submitted were evaluated by the Scientific Committee according to content, significance, originality, relevance and clearness of presentation. Altogether there have been 67 oral and 19 poster papers included in ISPRS Archive. These, together

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with free pre-conference radar training workshop given to young scientists, serve to demonstrate the importance of the Gi4DM conference for sharing ideas and findings with national and international communities.

We thank to all those who have contributed to producing such a fruitful and successful conference and the members of the Scientific Committee for their valuable reviews. Our special thanks go to four invited speakers Deren Li, Steven Ramage, Ed Parsons and Alik Ismail Zadeh, to the workshop lecturers, to the organizing committee, and to the sponsoring institutions/firms, without whom, this important event would not have been realized. Enough thanks cannot be expressed to Copernicus officers for their successful management of the reviewing process and uploading of papers and final program. Last, but not least we would like to thank Mrs. Ayçıl Yeşilırmak from K2 Conference and Event Management Company, for helping us through everything in successful organization.

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ADAPTATION TO FLOODING EVENTS THROUGH VULNERABILITY MAPPING IN HISTORIC URBAN AREAS

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ABSTRACT:

Historic urban areas are complex and inter-reliant systems, vulnerable to natural hazards. Over the recent years, the increase frequency in extreme precipitation events and sea-level rise, have impacted on a large number of historic areas, growing concern over disaster mitigation related to climate change.
Most of the changes in the climatological indicators may have adverse impacts on historic areas, leading to physical, social and cultural consequences and should be included in urban planning practice. The importance of addressing cultural heritage in disaster risk has also been included in The Sendai Framework, considering the dimensions of vulnerability, adaptive capacity and exposure through systematic evaluation.
Urban planning decisions involve an understanding of complex interactions between different aspects of the city, in its constructive, social, economic, environmental and cultural system. The analysis of these interactions requires a systemic approach as the components operate on different spatial and temporal scales and generate a large amount of data. This information can be used to determine the vulnerability of historic areas by assessing it at the building level, through the creation of typologies representing the building stock, often characterized by similarities and common constructive elements.
The comprehension of the information can be supported and homogenized by a multi-scale urban model, to facilitate the understanding of interactions and the link among the different disciplines involved. This paper describes the methodology proposed for vulnerability mapping in historic urban areas, by using a categorization method supported by an information strategy and a multi-scale urban model.

1. INTRODUCTION

During the last decades, cultural heritage has been threatened by diverse conditions such as demographic change, mass tourism and climate change, which are posing new challenges to conservation practice. Many restorative or conservative approaches of historic areas are still linked to single monuments or group of buildings, leaving aside the overall urban setting, the socio-economic conditions and the public spaces which are part of a more complex, living and dynamic ecosystem. Cultural heritage areas are seen as belonging to the past and disconnected from the present and from each other (Moylan et al. 2009).

Historic areas and the heritage that shape them, form interdependent systems within nowadays cities. Conservation strategies and policies should therefore consider the changing environment as an added element of planning and find a balance between urban growth and quality of life in a sustainable way. Physical forms, spatial organization, natural features and social, cultural and economic values should be therefore interrelated. This is only feasible through a holistic vision and the integration of specific oriented policies, such as disaster risk management and cultural heritage conservation, within wider goals of overall sustainable development (Kelman et al. 2015).

The effective management of historic areas, especially in disaster prone areas, should be based on a new generation of information and adapted strategies, involving local communities and predictive or possible future scenarios. The development of new and integrated urban governance dynamics calls for a complex, multidisciplinary and interdisciplinary approach involving a cross-section of different stakeholders and decision makers.

As climate change and its related negative impacts have become more widely accepted, its scope has broadened, shifting from the management of the hazard direct physical manifestation to disaster risk management approaches, considering the variables of exposure, vulnerability and hazard (IPCC 2014). The uncertainty of climate change and its possible impacts calls for iterative risk management approaches, involving different profiles and levels of stakeholders in all the phases of the decision-making scenario: prevention, preparedness, response and recovery.

As part of the prevention phase, possible impacts on cultural heritage and its vulnerability should be addressed as a first step towards the increase of resilience of historic areas. Climate change impacts, with the support of appropriate data and information, have been assessed by a wide range of methods and tools, as they can vary widely, depending on the subject, time frame, geographic coverage and purpose of the assessment (UNFCCC 2011).

established, it is possible to extrapolate the result for the entire study area, giving the same value to all the buildings belonging to the same category, as can be seen in Figure 3.

Figure 3 Building vulnerability index visualization

As additional functionality, the tool allows also the visualization of different flood maps using WMS services, as can be seen in Figure 4.

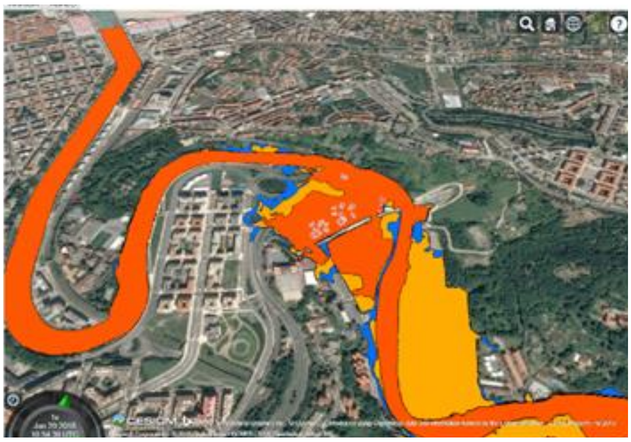

Figure 4 Flood maps visualization

4. CONCLUSIONS AND FUTURE WORK

The main objective of the work presented in this article is the implementation of a methodological approach that facilitate decision-making in the adaptation to flooding events in historic areas, using a multiscale urban data model. The vulnerability is calculated first, identifying the sample building of the case study by mean of building stock categorization method; second, using MIVES methodology to calculate the vulnerability maps.

The development of 3D city models based on the OGC CityGML standard allows city and building levels to be integrated within a single model that includes both semantic and geometric information. Such a model can be used to support multiple applications that different agents, such as urban planners, managers and citizens may employ.

The buildings stock categorization is based on a modelling strategy based on sample buildings. The described method for building stock categorization proposes a reduced an easily acquired set of parameters (year of construction, use, existence of basement, cultural value and socio-economic status) that gives optimal balance between the number of typologies and the represented percentage of the building stock.

The vulnerability index has been calculated by structuring the information in hierarchical levels and by comparing indicators of different nature through the use of value functions. MIVES has been used to help the decision-making process based on multicriteria analysis by using the multi-stakeholders' perspective, enabling an integrated analysis of aspects considered. The result is a final and unique vulnerability index which yields a ranking vulnerability of sample buildings.

The validation of the sample building modelling strategy and MIVES methodology in the case study of San Sebastian was carried through a survey campaign in 100 buildings, which were inspected, in order to check the accuracy of results obtained. The comparison between the categorization method and the use of real data resulted in a margin of error of 9%.

The work presented in this paper is mainly focused in assessing building vulnerability according the structure and architectural characteristics of the building itself. Other kinds of analysis, such as economic loss, impacts on natural landscapes, and social studies can complement the vulnerability assessment.

The results presented in this paper open several possibilities for future work. First of all, the model can be extended for its use in the implementation phase, by including scenario simulations of possible adaptive measures. Furthermore, the inclusion of real tome data coming from different sources such as sensors or satellite images, can further expand the use of the model in the response and recovery phases.

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REFERENCES

Aydar, S.A. et al., 2016. Establishing a national 3D geo-data model for building data compliant to citygml: Case Of Turkey. In *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archives*. pp. 79–86.

Ballarini, I., Corgnati, S.P. & Corrado, V., 2014. Use of reference buildings to assess the energy saving potentials of the residential building stock: The experience of TABULA project. *Energy Policy*, 68, pp.273–284.

Biljecki, F. et al., 2015. Applications of 3D City Models: State of the Art Review. *ISPRS International Journal of Geo-Information*, 4(4), pp.2842–2889.

Catita, C. et al., 2014. Extending solar potential analysis in buildings to vertical facades. *Computers and Geosciences*, 66, pp.1–12.

Chen, R., 2011. The development of 3D city model and its applications in urban planning. *2011 19th International Conference on Geoinformatics*, pp.1–5.

Coccolo, S. et al., 2016. Integration of outdoor human comfort in a building energy simulation database using CityGML