Geophysical Research Abstracts
Vol. 13, EGU2011-13008, 2011
EGU General Assembly 2011

Real-time 3D visualization of flood modelling for improving risk perception in medium hazard level areas

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Efficiency of flood risk management and mitigation projects is deeply dependant on the involvement of all stakeholders, including exposed populations. As part of a large multidisciplinary project, mainly coupling hydrological, geographical and sociological approaches, and whose aim is to propose a methodology for assessing risk and vulnerability in medium hazard level areas, some difficulties were experienced due to a low risk perception, even when at least one relatively major event occurred in the last decade. In these urban or suburban places, qualitative (semi-structured interviews) and quantitative (questionnaires and mental maps) techniques also highlighted a lack of knowledge. Moreover, lots of communication gaps had been noticed between decisions-makers, engineers and the public, for example during planning processes.

This work intends to improve risk perception by providing an easily understandable representation of different flood scenarios at local scale. Indeed, 2D representations of the risk, and spatial thinking techniques that had been used at a first phase of this project, appeared as requiring too much attention, skills and habits. So, to increase attention and involvement of the public, a real-time 3D visualization of flood modelling results had been developped, with some key features: easy access to multiple time-based animations of both past and simulated floods, corresponding to several return-periods, free navigation including an unlimited choice of views, zooms and perspectives, advanced but simple human-computer interaction...

Display is highly configurable, depending on the targeted category of stakeholders, and views are enhanced by some GIS data, such as points of interest. Locating is also facilitated throught an address geocoding service. Thanks to a specific LIDAR mission, flood modelling and 3D scenes at local scale, which means representing the water surface and depth in a small district, are very precise and realistic. Heights of buildings, vegetation and of course terrain are respected. However, the aim is not to propose an urban flood modelling, but to achieve a pertinent representation of the risk for communication and prevention purposes. More technically, if we except the development phase, engineering is limited to numerical simulation, as flood modelling results are automatically integrated. This virtual environment, powered by one of the currently most powerful virtual-reality engine (Unity), is also designed to be a 3D viewer inside a client-server infrastructure, with the ability to be remotely updated at any time. In a crisis context it is possible to make a new simulation available, for example based on the latest forecast.

First qualitative results are encouraging since they show a raised flood awareness, and a better comprehension of past events. Accurately representing the risk at local scale does increase its perception and participants' involvement, as triggering some kind of emotion. Furthermore, and even if it was not an initial objective, this work interests researchers and engineering departements, as it offers higher productivity with immediate and rich visualizations of flood modelling results.

Future plans are to reach a quantitative evaluation of the gain in efficency, and to evaluate how this work could help to improve preparedness and effective warning. This requires to take into consideration officials and public acceptance and responses.