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Emergency response planning along the River Thaya - dealing with pluvial and fluvial floods

Raimund Heidrich[1], Jürgen Waser[2]

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Introduction

Because of significant damages due to several pluvial and fluvial flood events in the past years in the River Thaya, its tributaries and in its catchment area, the local political leaders decided to get active. They founded two water boards, including 5 political districts and 24 municipalities with a total area of around 2600 km². The idea was to investigate the whole area for fluvial and pluvial flood hazards, as basis for the creation of emergency response plans.

Methods

The works started with the creation of base data for the hazard analysis, which has been done through hydrodynamic 2d modelling of pluvial and fluvial floods. With the involvement of stakeholders, relevant scenarios were selected for which vulnerability analyses were carried out. The last step was to define organisational and technical preparation and emergency measures.

The hydrodynamic 2d modelling was performed with the software Visdom, which solves the shallow water equations over a rasterized terrain model. Visdom allows simulating large areas even using a detailed raster with 1x1m resolution, which bases on airborne LIDAR-data. The graphically appealing, clear presentation of the calculation network and the integration of essential building parameters enables both the hazard and vulnerability analyses to be carried out directly in the modeling software. An export of the result data and the analysis in a GIS system could thus be omitted. The modelling works include simulations of river floods in the River Thaya and its tributaries for three different flood scenarios (low, medium and high return period) and simulations of pluvial floods based on up to four different rainfall scenarios of different rainfall intensity and duration. Additionally breach simulations of dams were also investigated. In the course of the hazard analysis, the relevant scenarios were evaluated in cooperation with local stakeholders. In the next step, a vulnerability analysis was performed for these selected scenarios. Taking into account the expertise of the local stakeholders, an object-oriented analysis of the

[1] Riocom, AUSTRIA, (raimund.heidrich@riocom.at)
[2] VRVis Zentrum für Virtual Reality und Visualisierung Forschungs-GmbH, AUSTRIA

impact on buildings was carried out. In the course of this, misinterpretations based on inaccuracies of the input data were eliminated.

The emergency response plans consist of three parts. Part A includes information about the legal situation, the responsibilities in different states of a flood event, the warning and alarm-system and communication rules for the municipalities and political districts. Those rules, guidelines and requirements were jointly defined with the relevant stakeholders (mayors, leaders of the political districts, civil protection officials, chiefs of local fire brigades and other emergency organizations).

Part B deals with measures. For each relevant scenario of pluvial or fluvial flooding preparatory measures and emergency measures, both organizational and technical were defined, considering parameters like preparation time, water depth in the flooded areas or the type of affected buildings. The effectiveness of technical preparation and/or emergency measures was evaluated directly in Visdom. Thanks to the excellent graphic display and the high performance, defense measures like sandbag-dykes brought in by local stakeholders could be implemented directly in Visdom with just a few clicks during the workshops. This enabled highly interactive work.

Part C is the appendix, including hazard maps, emergency maps that support the operational command and maps of “hot spots” in the case of pluvial flooding, where emergency measures are most effective.

Results and discussion

A main result of the extensive hazard analysis was the identification of areas that are potentially affected by pluvial flooding. This “hints for land use planning” are a very important information for mayors, who are not only responsible for emergency management in their municipality, but also are the building authority who determine the settlement development areas. The possible flood areas are often well known by locals. However, landowners like to ignore this danger. The authority now has map material and clear 3D visualizations in hand to take awareness-raising measures. Due to the size of the processing area, essential structures influencing the surface runoff such as sidewalk edges, garden walls or house entrances could not be taken into account. The flood areas shown in maps and videos are therefore subject to certain uncertainties. However, the professional graphic visualization does not suggest this. This was sometimes difficult to convey in the workshops, but it is important to mention it.

Figure 1 Example of pluvial flooding (shown in blue colour) in the village of Hohenau, Dobersberg after 50mm of rainfall in 15 minutes; building colour shows max. water depth: yellow = min. 50cm; red = min. 100cm