Theme 2 Risk management: Innovative risk mitigation and sustainable flood defence

Sub theme 2.2 Flood Event Measures

Task 17 Emergency flood management – evacuation planning

<table>
<thead>
<tr>
<th>Work package number</th>
<th>Task 17</th>
<th>Start date or starting event:</th>
<th>Month 25</th>
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<tr>
<td>Activity Type</td>
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<tr>
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<tr>
<td>Participant name</td>
<td>HRW WI</td>
<td>Delft IOER ENPC VITUKI JRC-IPSC</td>
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<td>Person-months per participant</td>
<td>17.7 13.9 2.3 13.9 4.8 9.5</td>
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Objectives
The objective is to develop a method and tools for identifying appropriate evacuation and rescue plans.

Description of work - Overview

The proposed approach relies on the concatenation of outputs from a flood forecasting system and pre-defined modules to assess the vulnerability of communities and of transportation networks. Related to the scale of the floods we shall develop two methods. The first relies on already well-established flood forecasting and flood simulation and puts emphasis on the merging of information on exposure and on vulnerability and on the optimisation of computing time. The second is a pioneering effort to develop a comparable approach for flash floods and is rather a feasibility study.

Evacuation management in lowland rivers

In the case of medium to large river floods where substantial warning times are possible, it is proposed to expand an existing open modelling Framework (EFFS Project) to include:

- A generic 2-D inundation model and
- Evacuation models.

The 2-D propagation model allows the identification of isochrones of the flood wave propagation, including calculation of flow velocities and water depths. The inundation model can be either fully physically based (shallow water equations) or based on water diffusion to neighbouring cells within a GIS framework.

The overlap of the results of the inundation model with the local road infrastructure within a GIS framework allows to isolate escape routes. Thus evacuation can be planned in time by tracing inundation isochrones and identifying the most exposed communities and properties.

To speed up the performance of the end-to-end system, rule-mining and data-mining techniques should be applied to exploit information stored in pre-run model-scenario databases. In this manner the system does not need to be run from scratch during the flood event. The proposed system will be tested for a Pilot Area (see Theme 4). Best-practice guidelines will be established and disseminated through end-user workshops (see Theme 4).
Flash-flood warning for road networks

In order to produce a generic method, we will build upon standard databases of road management services and on classical DTM.

In the case of flooding due to extreme convective storms, the risk can have a double source:
- Under very intense rain, the road itself can concentrate sufficient flow to threaten people in cars,
- Small rivers can suddenly submerge roads in particular at bridges and along protection dikes.

For the case of the direct road concentration of the rain waters, it will be tested whether the existing technical databases contain enough information to identify critical points of submersion.

For the case of submersions due to small rivers crossing roads, a two step method is followed to assess the road network vulnerability:
- identification of road /river crossing points on maps, and determination from DTM of upstream watershed characteristics,
- analysis of the discharge capacity on the basis of technical data on bridge and dike design that can vary with the type of road or its date of construction.

Tested rainfall - runoff models (WP 2.2.a) will be coupled to the road vulnerability module in order to determine the road submersion risk comparing discharges with the estimated capacities of the pipes and bridges.

The method will be validated with the observations done after the Gard river 2002 flood (WP 2.1.a), in collaboration with the Flood Warning Centre of the Gard department.

The tasks are distributed between the partners as follows:

- Evacuation management in lowland rivers
  - DELFT and HRW: 2-D inundation modeling
  - DELFT and JRC: Evacuation models, population flows model and evacuation measures
  - HRW: Data Mining

- Flash flood warning for road networks
  - IOER and VITUKI: Identification of road/river crossing points on maps
  - ENPC: Analysis of discharge capacity and hazard zones
  - ENPC, JRC: Coupling of rainfall-runoff models to road vulnerability modules

Deliverables

- Open system model integration framework for 2-D inundation modelling  D17.1  Month 36
(in combination with flood forecasting) and an evacuation module for escape-route optimisation and timing. This open system allows working with this type of software produced by forecasting authorities over entire Europe.

- Report including best-practice guidelines for evacuation management in lowland rivers
- Maps of road/river crossings.
- Report on the vulnerability identification in a flash-flood prone area.
- Prototype vulnerability database of the Gard region.
- Final common End-user workshop.

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<th>Milestones and expected result</th>
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<tr>
<td>Delivery of open model system</td>
<td>M17.1 Month 36</td>
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<td>Inventory of the observed road submersions during the Gard 2002 flood</td>
<td>M17.2 Month 36</td>
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<td>Report on evacuation management for lowland rivers</td>
<td>M17.3 Month 48</td>
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<td>Prototype vulnerability data base for the test region of the Gard.</td>
<td>M17.4 Month 48</td>
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<td>Final common end-user workshop</td>
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<td>Specifications of a flash-flood warning system for roads</td>
<td>M17.6 Month 60</td>
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