Effectiveness and Efficiency of Early Warning Systems for Flash Floods

Project Partners

- TU-Darmstadt, Section for Engineering Hydrology and Water Resources Management (Coordinator)
- GRAHI-UPC (Barcelona), Group of Applied Research on Hydrometeorology
- University of Natural Resources and Applied Life Sciences (Vienna), HB16 Institute of Water Management, Hydrology and Hydraulic Engineering
- ProAqua (Aachen), Engineering Society
Background

- Flood alerts are an important component in flood risk management strategies
- Utility depends on the forecast lead time, reliability and response time of the hydrological system

Understanding of terms:

<table>
<thead>
<tr>
<th>Effectiveness:</th>
<th>Efficiency:</th>
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<tbody>
<tr>
<td>Accomplishment of the intended purpose (preventing flood damages)</td>
<td>Aspect of required expenses comes into play (analysing the costs of achieved benefits)</td>
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Objectives

- Relate the concept of risk analysis to the evaluation of early warning systems (EWS)
- Compare forecast reliability and economic benefit
- Analyse and quantify uncertain factors of the warning production chain
  - Guidelines for EWS assessment
  - Comparison of EWS to other non-structural and structural measures
Workpackages

WP2 Uncertainty analysis of rainfall forecast
WP3 Uncertainty analysis of flood forecasts
WP4 Impact analysis of failures in EWS operation
WP1 Study basins: Besòs, Traisen
WP5 Risk Assessment, economic evaluation
WP6 Assessment of EWS efficiency

Methodology

Forecast reliability | Economic benefit | EWS assessment

Effectiveness | Efficiency
Forecast reliability

- Input uncertainty
- Model parameter uncertainty
- Model structure uncertainty (model intercomparison)
- Malfunction of measurement devices

Uncertainty of risk

<table>
<thead>
<tr>
<th>Water level [m asl]</th>
<th>Hydraulic</th>
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<tbody>
<tr>
<td>Flood Probability [1/a]</td>
<td>Q [m³/s]</td>
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<tr>
<th>Water level [m asl]</th>
<th>Loss adjustment</th>
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<tr>
<td>Flood Probability [1/a]</td>
<td>Q [m³/s]</td>
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<tr>
<th>Water level [m asl]</th>
<th>Annual Expectation of loss</th>
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<tr>
<td>Q [m³/s]</td>
<td>Loss [€]</td>
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Study Basins

- Medium sized river basins prone to flash floods
- Two case studies with EWS in operation

- Besòs (1024 km²)
- Mediterranean climate
- Torrential character, flood magnitude (2500 m³/s)
- Continuous urbanisation process (especially in the delta)
- 1,000,000 inhabitants
- Seven discharge gauging stations
- Dense instrumentation with telemetered sensors
- Weather radars (Spanish and Catalonian weather service)
Study Basins

- Traisen (920 km²)
- Alpine climate
- Pluvio-nival discharge regime
- Flood magnitude (HQ_{100} 750 m³/s)
- Short response time
- Human settlements concentrated in the lower (northern) part of the catchment
- Seven discharge gauging stations
- Uncertain meteorological forecasts
- Poor performance of weather radar

Further information available on:
www.ewase.net

...thank you very much for your attention