FLOOD EARLY WARNING SYSTEM: SENSORS AND INTERNET

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We present the UrbanFlood flood early warning system (EWS): a system that monitors data from sensor networks in flood defenses (embankments, dikes, levees, dams, etc.), detects sensor signal abnormalities using artificial intelligence, calculates dike failure probability given the actual dike strength and load, and models scenarios of dike breaching, the resulting hydrograph and flood spreading and characteristics in near real time.

The relevant information and model simulation results are used in an interactive decision support system that assists dike managers and public authorities in making their often difficult decisions during flood events. It reduces uncertainties and offers relevant information through an accessible map-based interface residing on a multi-touch table, suitable for use by multi-person emergency units. 'What-if' scenarios are easily set up and quickly calculated, while access to libraries of pre-calculated detailed flood scenarios is provided for reference and comparison. The EWS will also offer an on-line 'dashboard' giving access to a selection of the functionality.

The system will be designed to also support dike managers in routine dike quality assessment and management. In this way it supports an important part of their responsibilities and becomes an integral part of the daily work, which ensures that staff members have the necessary routine and practice to use the EWS effectively and with confidence whenever infrequent flood emergencies occur.

The flood EWS is built on a generic Internet based EWS, and able to use virtually all types of digital (sensor) information. It can run computational demanding applications like near real time (flood) modeling in the 'cloud', allocating computational resources according to priority and requirements. For dependable use during flood emergencies the right combination of its advanced Internet computing options and the robustness and reliability of running parts of the system on traditional local computing resources clearly needs to be deployed.

For advanced research into dike stability and failure mechanisms and for training the EWS artificial intelligence module on signals related to dike instability a Virtual Dike computational module has been developed.

This paper describes the UrbanFlood EWS design and functionality, the main stakeholder requirements, the workflow, the individual modules and their integration and the first results of EWS monitoring and performance benchmarks. It also describes the pilot sensor network installations in the Netherlands and in the UK.

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