FLIWAS, The Right Information at the Right Place at the Right Time for the Right Persons to Take the Right Decision

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Abstract

The risk of floods along the major rivers is a real danger in a large part of Europe. To prevent victims and minimize damage, mankind has to be well prepared for flood events. At such times up to date, unambiguous and reliable information is essential. The system FLIWAS collects and presents the information and predictions that are required in the case of (threatening) floods. In this way it contributes to better emergency response and disaster relief. FLIWAS is the acronym for FLood Information & WArning System. FLIWAS is a multi lingual web-based system and consist of different independently usable modules. FLIWAS will provide, share and communicate current information about imminent floods to the right persons, at the right time, at the right location, to take the right decisions. This way better decisions can be made and professionals are more aware of the impact of their decisions. FLIWAS is primarily intended for water management professionals and for decision makers on different levels. The water manager can access information that can be used to take appropriate practical actions during flood events (technical, organizational and communication level). Also information on current water levels and predictions or weak spots in embankments can be supplied. Decisions have to be taken about protecting and watching dykes (operational level). Supported by FLIWAS, decision makers on local, regional and even (trans)national level are better informed when they have to determine how to respond in a flood event (strategic level). Is the population at risk? Is evacuation required? Is military relief needed? Detailed geographical information and the results of flood modelling calculations show the impact of potential flooding. The information and maps supplied by FLIWAS make it possible to provide better answers. In this way uncertainties are reduced.

Key words: Flood, calamity management, information exchange

Background

Along rivers many organisations are responsible for water management issues. In general, high water management consists of different stages, with different actions and responsibilities involved. In fact, in all countries, the same type of hierarchic structure towards water management exists, which is represented in the following graph (see Figure 1).

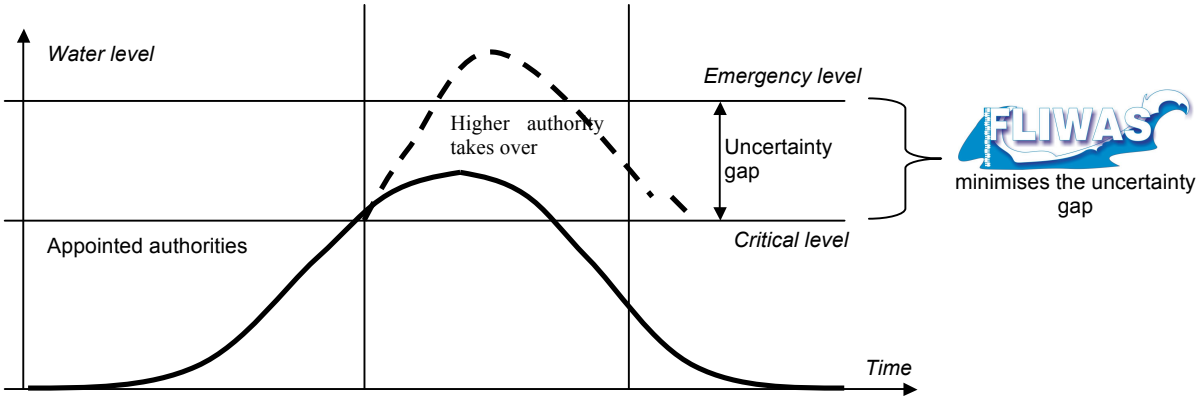

Figure 1: Responsibilities during high water event.

The graph shows that appointed authorities for water management, such as water boards or municipalities, are in charge during times of normal water levels. They are responsible for day-to-day maintenance of water works, for planning and preparation of flood scenarios and measures.

Figure 2: The water threats the city centre

During a period of rising water levels, these authorities remain primarily responsible to protect areas against flooding. Decisions whether or not to implement an action during high water and flooding events are made on the basis of the available information. This means that such information has to be as reliable as possible. Ideally, this is the case up to the emergency level, when a higher authority takes over the responsibility and disaster plans are effectuated.

Recent flood events and high water periods in different European river catchments (e.g. Maas in 1995 and 1995, Elbe in 2002, even more frequently Danube and Rhine) emphasized that it is very important that measures and actions are taken at the right place and at the right moment. The 'von Kirchbach-report' [Ref. 1] on the floods of the Elbe in 2002 shows that information was available but did not get to the right place, or not in a useful form. A large amount of information is exchanged, both within and between organisations and with the general public and media. As a result of stress and complexity during disaster situations, this information flow is often uncontrolled, not in time or unreliable, thus raising feelings of uncertainty at decision maker level and with the threatened population. The consequence is that the higher authority often already takes over in an early stage, at the critical level. Because of its nature, the critical level is subjective, and depends on actual or forecasted water levels, status of the water works and measures taken and, of utmost importance, the availability and reliability of the right information. This means that measures and actions (e.g. evacuation) could be taken unnecessary, resulting in avoidable and additional risks, damages and costs. Although an actual disaster may not occur, the impact and costs are still considerable, not to mention the responsibility claims between the involved governmental organizations after the event and, very important, the loss of trust of the general public in their water managers.

NOAH

Information transfer is a key factor in disaster management. And the human factor in operational flood management constitutes a significant risk regarding effective information transfer. The use of automated tools for operational flood management such as forecast and warning, but also for monitoring measures, communication and post event evaluation can reduce this risk. This is also stated in the European Flood directive. By using computers for what they are good at (storing information, handling predefined procedures), humans can focus on what they are better at: dealing with unexpected developments and making decisions based on incomparable criteria and data. Therefore, automation of information management can lead to a significant increase of safety and reduction of damage and personal risks caused by flooding.

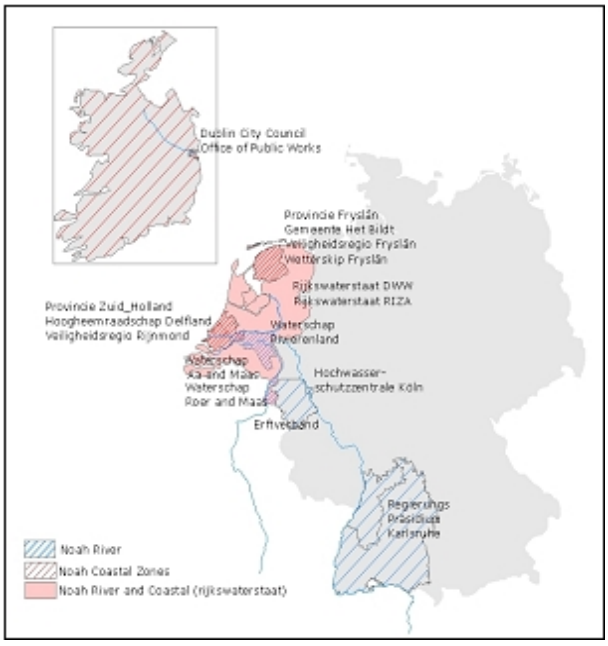

Figure 3: The NOAH project regions

Within the EU-Interreg funded project NOAH, partners from the Netherlands, Germany and Ireland (see Figure 3) joined forces to develop and implement such an automated tool, disaster plans and to increase public awareness of the advantages and dangers of water in the neighbourhood.

The project addresses the information and communication issues encountered in actual high water situations and bridges the information gap between early warning systems and disaster plans. Information management is supported by development and application of a new, innovative and generic information

system designed for use in a multi actor environment. The system is called FLIWAS. FLIWAS is available and accessible for all key players, focussing on short notice dynamic actions and reduction of uncertainties in high water management.

Development FLIWAS

The concept of FLIWAS is designed and developed in close co-operation with future end users of the NOAH-partners. Starting point was the knowledge of and experience with local prototypes in Germany (HzG [Ref. 2] and HOWISS [Ref. 3]) and the Netherlands (Geautomatiseerd Draaiboek Hoogwater [Ref. 4]). During workshop sessions users from the project regions specified their wishes and demands. This resulted in the overall functional design for FLIWAS.

FLIWAS builds upon existing measurement and flood forecast systems, geo-info, alert plans, flood risk maps and disaster scenarios. All relevant information of these building blocks are bundled and made available through an internet-oriented GIS based application. This is structured in such a way that decision makers, water management and disaster professionals as well as private companies and the public receives all relevant information, optimised for their needs and accessible at their level. The modular design of the information system enables organisations to install only the needed functionality. Authorisation using user profiles provide the users only the functionality and data needed for their role. After an intensive coordination effort with other ongoing projects, NOAH was able to incorporate other initiatives as well, such as the Dutch High Water Information System (HIS) [Ref. 5], which is being developed by Rijkswaterstaat (part of the Dutch Ministry of Transport and Public Works). Close co-operation with the VIKING program (Province of Gelderland and Nord-Rhein Westphalia) [Ref. 6] ensures that the communication to the disaster management organisations (police, fire-brigades) is optimised.

The right information on the right time for the right person ……

FLIWAS is primarily intended for water management professionals and for decision makers on different levels. The water manager accesses information that are used to take appropriate practical actions during flood events (technical, organizational and communication level). Also information on current water levels and forecasts or weak spots in embankments are supplied. Decisions have to be taken about protection and inspection of dykes (operational level). Supported by FLIWAS, decision makers on local, regional and even (trans)national level are better informed when they have to determine how to respond in a flood event (strategic level). FLIWAS helps in answering questions such as: Is the population at risk? Is evacuation required? Is military relief needed? Detailed geographical information and the results of flood modelling calculations show the impact of potential flooding. The information and maps supplied by FLIWAS make it possible to provide better answers and to take better decisions. In this way uncertainties are reduced.

In the preparation phase the required information is implementation in FLIWAS. Locations for measurement and forecasts are defined and digital connected to the measurement and forecasting systems. Measures, including trigger values, responsible employees, required resources equipment are implemented and expected leg time, are implemented in the structure of the disaster plan. Precalculated flooding scenarios and flood maps (maximum water dept and water front) are stored on the FLIWAS-server. Users are trained and practiced during exercises.

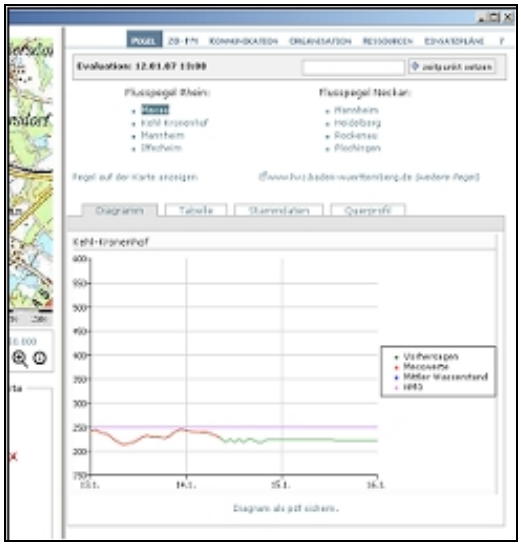

Figure 4: Measurements and forecasts

Spring starts, the temperatures rises and the snow melts in the upstream areas of the river. The water level on the river is rising slowly. FLIWAS receives automatically measurements and forecasts from external systems. The information is displayed per location and in a length profile combined with reference levels such as calamity levels, the crest level of the dike or historical values. The system shows when critical levels are crossed and alarm messages are send automatically.

Figure 5: The water level on the river is rising.

A lot of rain falls in parts of the catchment area of the river. Upstream the water level is rising faster now. The threat is getting serious, the forecast indicates a flood. Based on these forecasts and the implemented disaster plan FLIWAS gives the water manager the advices to scale up to a higher calamity levels. FLIWAS starts the operational measures as they are defined in the implemented disaster plan. Responsible employees and the coordination centre are informed automatically by email, sms or fax. FLIWAS informs external organisations, network partners, private companies and public by email or information on a public website.

Additional information on weak spots in embankments is communicated with the coordination centre. Additional, not foreseen measures are added to the disaster plan and communicated with the responsible employees. Messages to be shared with other employees or organisations are stored in a journal.

Figure 6: Parts of Jakarta are flooded.

The coordination centre monitors the progress of the execution of the measures. If more resources or equipment is required the coordination centre arranges additional resources.

The water levels keep rising. Is the dike strong enough for the expected water level or will it collapse? Will the water level reach the crest level of the dike? The water manager cannot guarantee the robustness of the embankment. Water and disaster managers have to decide about an evacuation. But how is the behaviour of the flooding? Which areas will be flooded and when? How many people live in these areas, is polluted industry present and are there special objects in the threatened area. Which roads can be used? What will be the maximum water dept? FLIWAS provides in advanced calculated flood maps with maximum water dept and waterfront and movies of the expected flooding. This information is communicated with the national crisis centre so a (trans) national overview is available. Based on this information an evacuation strategy is chosen and decisions about the use of resources and equipment is taken.

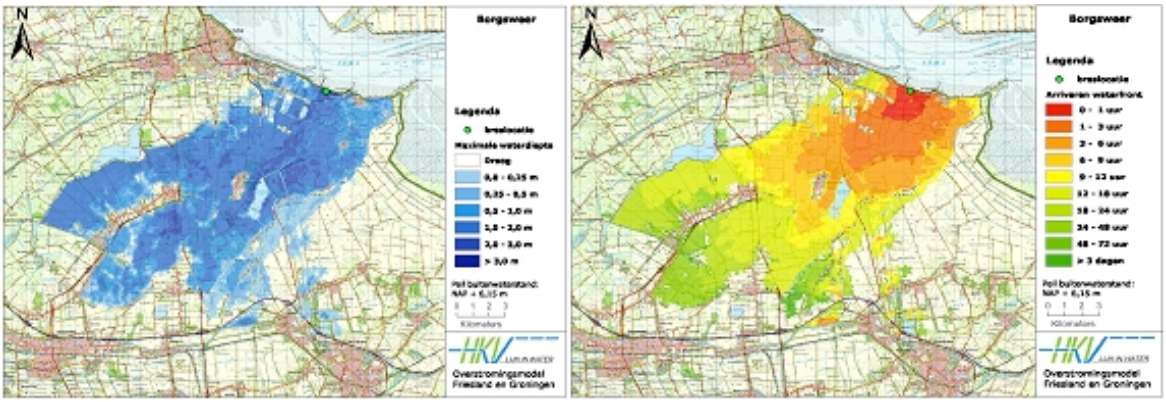

Figure 7: Maps with maximum water dept and waterfront.

During a disaster the responsibility is taken over by the disaster organisations. FLIWAS still provide these organisations with all the relevant and unambiguous information.

After a flood or a flooding FLIWAS provides information for an evaluation. When and by whom was which decision taken? Which information was available on that moment? Who took which measures, when, and how much time did it take? Which resources and equipment were available and used? Based on the evaluation disaster plans are optimised and employees are trained with a focus on special aspects. So the organisations are better prepared for the next flood.

Figure 8: Evaluation of a flood.

FLOODS IN THE BANAT, ROMANIA

In 1997, 1999, 2000, 2005 and 2006 flood events happened in the Timis river basin causing dike breaches and inundations at several locations. As a result hundreds of people were evacuated, houses were destroyed and crops were lost. Especially the downstream part of the Timis River near the border with Serbia proved to be prone to flooding. The dike breaches in 2005 caused one of the largest inundations ever to occur in the region.

Studies after the 2005 flood showed that the people and authorities active during flood events knew their tasks and responsibilities very well and carried them out as prescribed in the flood emergency plans. However the communication between different authorities, stakeholders and the public was not very well organized. Taking into account that

- the Romanian flood emergency organization is structured very clearly,
- modern methods like automatic monitoring stations and forecasting systems are widely installed and
- the fact that nowadays most people have mobile phones and internet access,
- perfect conditions for FLIWAS implementation in the Banat are available.

FLIWAS implementation in the Banat

A Dutch consortium consisting of HKV consultants, Royal Haskoning and STOWA (foundation for applied water research) recently supported Directia Apelor Banat with the implementation of FLIWAS. The implementation of FLIWAS was done in cooperation with the following Romanian organisations:

- Directorate of Emergency Situations Management of the Ministry of Environment (DMSU);
- National Administration Apele Române (ANAR);
- Directia Apelor Banat (DAB);
- National Institute of Hydrology and Water Management (INHGA).

The Timis river basin in the Banat region was selected for a pilot implementation of FLIWAS. The implementation is done by DAB in close harmony with the Dutch consortium. The water system under consideration is shown schematically below.

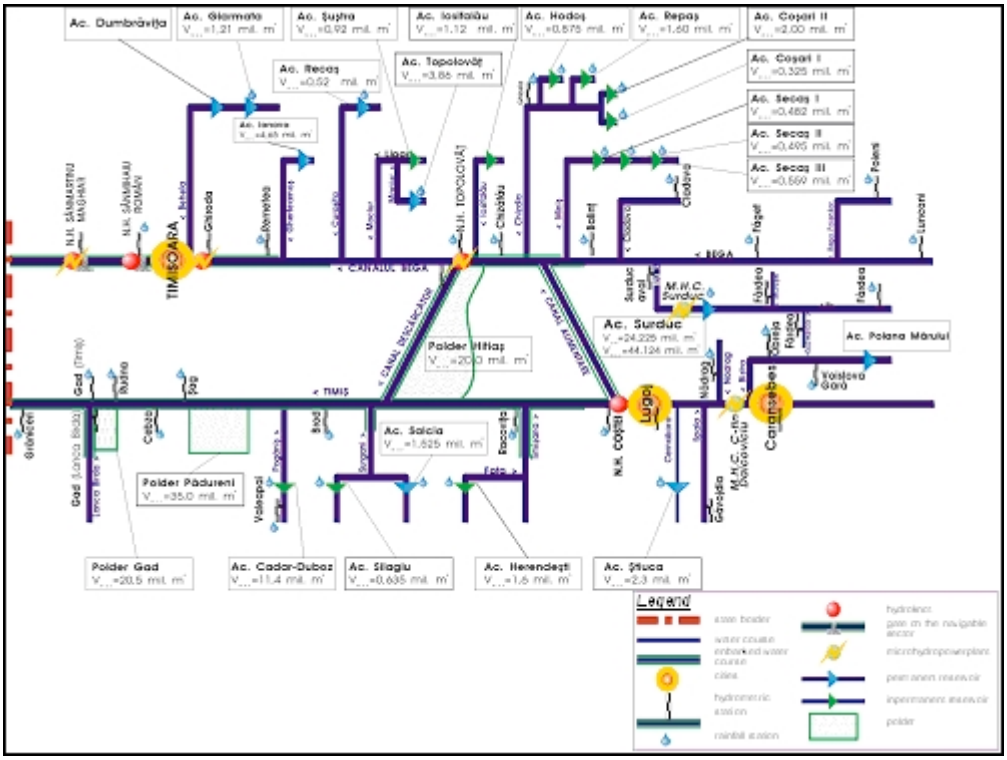

Figure 9: Water system under consideration.

The implementation started with the installation of FLIWAS on a web-server and the training of application and information managers. In the second step the emergency response plans of the DAB were analysed and transformed in the structure of FLIWAS. Missing parts were added. Supported by the consortium the users of the DAB filled in the data of measurement points, measures taken during a flood, responsible persons and criteria to start a measure and geo-data in FLIWAS. The operational users were trained using their own emergency response plan. The implementation was finalized with an operational test and a flood exercise. The evaluation of the exercise made clear that FLIWAS is a very useful tool to structure, monitor and communicate measures during a flood.

Reference

Kirchbach H.P., Franke .S and Biele H.: *'Report of the independent commission of the Saxony Government on the flood catastrophe in August 2002', 2002*

Kauppert and Leiner, Art & Engineering: *'Hochwasserinformationssystem zur Gefahrenabwehr', 'Pilotprojekt im Landkreis Rastatt', 'IT-Feinkonzept', April 2004*

J. Picht, CreativWare, 'Hochwasser-Informations und Schutz-System (HoWISS): *'Technical report, 1999.*

STOWA: *'Geautomatiseerd Draaiboek Hoogwater', Gebruikershandleiding, Januay 2002*

RWS Dienst Weg-en Waterbouwkunde, Royal Haskoning: *'Redesign Operationeel deel HIS – fase 2', 'Basisontwerp', 'Definitief rapport', 17 September 2004*

De Gooijer, Hoffman, Kauppert, De Klerk, HKV Consultants, Art & Engineering, IKM Engineering: *FLIWAS Comfort, Functional design, Version: 2.0a, July 6th 2007*

Programma VIKING*: www.programmaviking.nl*