

FLIWAS, The right information on the right time for the right person to take the right decision

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The risk of floods along the major rivers is a real danger in a large part of Europe. To prevent victims and minimize damage, authorities have to be well prepared for flood events. During the threat of a disaster up to date, unambiguous and reliable information is essential. FLIWAS collects and presents the information and forecasts that are required in the case of (threatening) floods, contributing to better emergency response and disaster relief.

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).

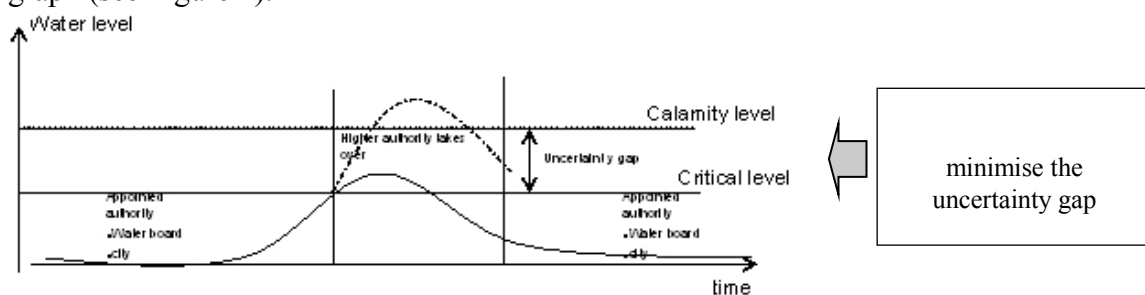


Figure 1: Responsibilities during high water event.

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.

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 or measure 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 calamity level, when a higher authority takes over the responsibility and disaster plans are effectuated.



Figure 2: The water threatens the city centre.

Recent flood events and high water periods in different North West 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.] 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.

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 provides and communicates the relevant and unambiguous information about imminent floods to the right persons, at the right time, at the right location, enabling them to take the right decisions. This way better decisions are made and professionals are more aware of the impact of their decisions.

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.

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.

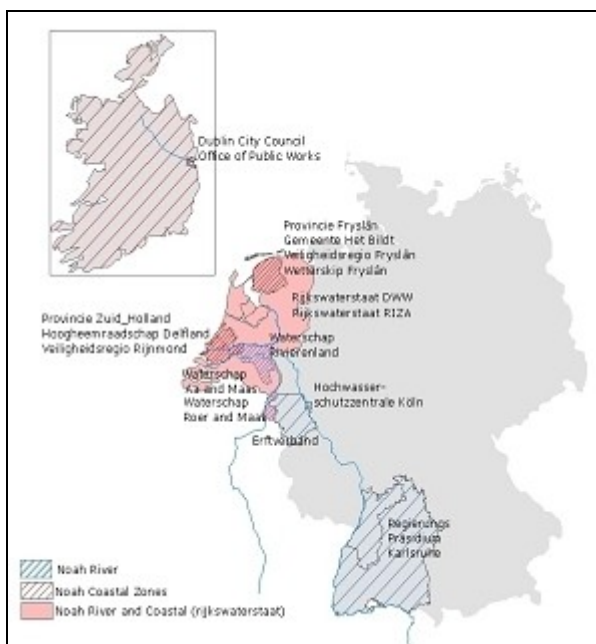


Figure 3: NOAH project partners

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.

WHY FLIWAS?

FLIWAS can be used as the common information and communication system. Using FLIWAS all involved organisations share the same data from one common source. So all decisions are based on the same information. This is information concerning the current and foreseen situation on the water system, additional events and circumstances and decisions taken on operational or management level. FLIWAS provides not only all information but is also used as a communication system. Using

automatic communication the responsible employees are informed automatically about scheduled measures, network partners, private organisations and the public are informed automatically about the consequences of the flood and the scheduled measures. Information stored in FLIWAS can be attached to an email message. So FLIWAS serves as the system for monitoring, starting and monitoring measures, communication and other messages.

DEVELOPMENT OF 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.] and HOWISS [Ref.]) and the Netherlands (Geautomatiseerd Draaiboek Hoogwater [Ref.]). 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.], 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.] 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 implemented 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.

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.

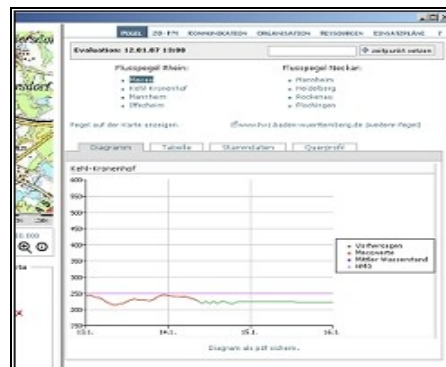


Figure 4: Measurements and forecasts.



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



Figure 5: Operational measures are taken to provide areas against flooding.

employees or organisations are stored in a journal.

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.



Figure 6: Parts of Jakarta are flooded.

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.

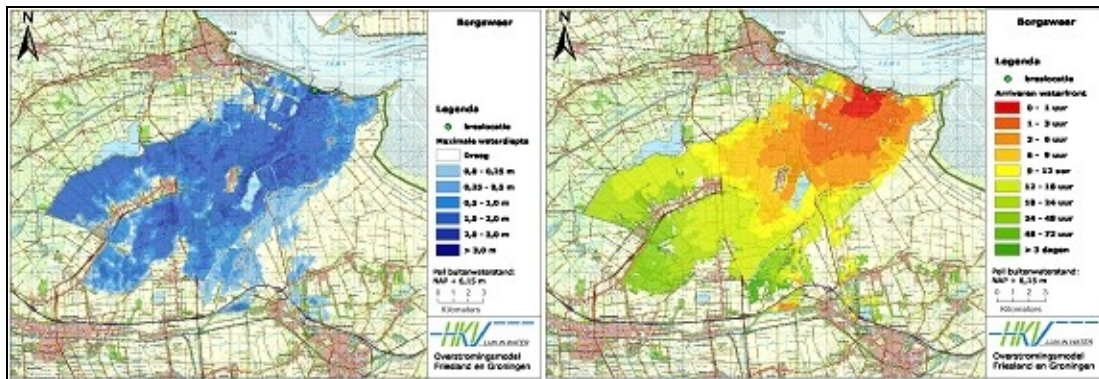


Figure 7: Maps with maximum water depth and waterfront.

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.

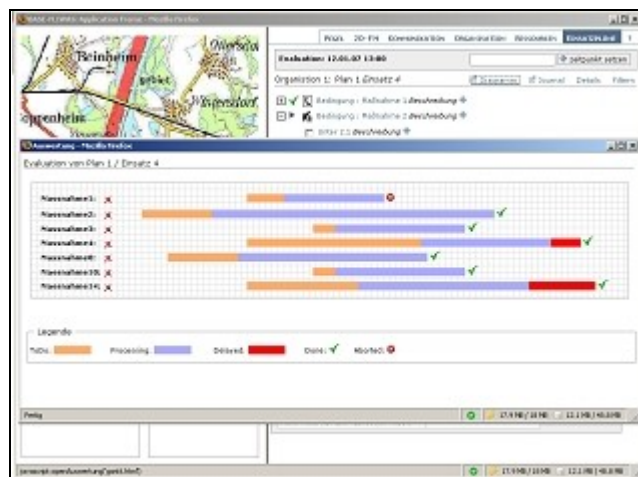


Figure 8: Evaluation of a flood.

NEXT STEPS

In the past two years FLIWAS is implemented at Rijkswaterstaat and a number of waterboards in The Netherlands, in water management and disaster organisations in Nord-Rhein Westphalia and Baden Württemberg (Germany) and two communities in Ireland. More implementations in The Netherlands, Germany and Romania are started or planned.

FLIWAS is tested in nationwide exercises in The Netherlands and Germany. Based on the experiences and results of the use of FLIWAS during the national exercise 'Waterproof' last year in The Netherlands the Dutch minister of Transport and Public Works decided to recommend a national implement of FLIWAS. The Dutch ministry of Transport and Public Works has also a key position in the setup for the trans

national organisation for support and maintenance.

CONCLUSIONS

With the development of FLIWAS a state of the art information system is available for decision takers, managers, coordinators and operational employees in water and calamity management to support the information exchange during flood and threatened flooding. The system is proven during large scale exercises in The Netherlands , Germany and Ireland. An extended install base of FLIWAS will increase the continuity and quality of the system.

REFERENCES

1. 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
2. Kauppert and Leiner, Art & Engineering, 'Hochwasserinformationssystem zur Gefahrenabwehr', 'Pilotprojekt im Landkreis Rastatt', 'IT-Feinkonzept', April 2004
3. J. Picht, CreativWare, 'Hochwasser-Informationen und Schutz-System (HoWISS)', Technical report, 1999.
4. STOWA, 'Geautomatiseerd Draaiboek Hoogwater', Gebruikershandleiding, January 2002
5. RWS Dienst Weg-en Waterbouwkunde, Royal Haskoning, 'Redesign Operationeel deel HIS – fase 2', 'Basisontwerp', 'Definitief rapport', 17 September 2004
6. Programma VIKING: www.programmaviking.nl