EARLY WARNING SYSTEMS AND DECISION SUPPORT SYSTEM

Floods are the most common and frequent natural disasters worldwide, causing considerable loss of life and damages to property and the environment. Worldwide, water authorities and decision makers are aware of this problem and increasingly making progress towards the implementation of so-called early warning systems or eventuality decision support systems, in which SICE is an expert.

Early Warning Systems, known as EWS, are a set of procedures and tools through which predictable adverse events can be monitored, such as tsunamis or flooding events. In addition, EWS systematically collect and process data, providing the final user with time-framed predictions about their consequences and possible effects. Millions of people all around the world save their lives and their livelihood thanks to the implementation of these systems.

In general terms, these systems consist of three main components, namely the Hydrological Information System, which gathers data, the Decision Support System which, through modelling, allows to save time when identifying risks and their potential effects, and finally, the Population Warning System whose objective is to warn the authorities and affected population to guarantee their protection and minimize damages.

HYDROLOGICAL INFORMATION SYSTEM

Hydrological Information Systems (HIS) are based on real-time environment monitoring networks, that encompass rain gauges, river or channel gauging, and their corresponding communication systems (GPRS, satellite, radio, etc.).

These systems allow monitoring the amount of liquid precipitation, river levels, etc., so as to accurately forecast floods.

In addition to these hydro-meteorological data, the system is provided with:

- Weather forecasts issued by meteorological agencies.
- Reservoir operation rules.
- Information about weather radars.

Accordingly, SICE develops tailored solutions for water authorities in order to collect the necessary data to assess the current state of the basin.

Decision Support System

Building on the data provided by the HIS, the Decision Support System (DSS) aims at modelling the hydrological response of the river basin at three levels:

- **Hydrological model:** simulates the generation of runoff in every basin or sub-basin based on observed or expected rainfall or snowfall.
- **Hydraulic model:** it is used for channel and overland-flow routing in the precipitation-runoff modelling system.
- **Reservoir management model:** it is connected to the hydraulic model and models reservoir operations for flood management and real-time decision support.

The system allows forecasting flow values in pertinent river locations in conjunction with several reservoir parameters, such as storage volumes, pool levels, controlled and uncontrolled releases. These values depend on the reservoir operation rules set up, and enable the end-user to evaluate their impact on the system and thus create and use better information for supporting decision-making tasks.

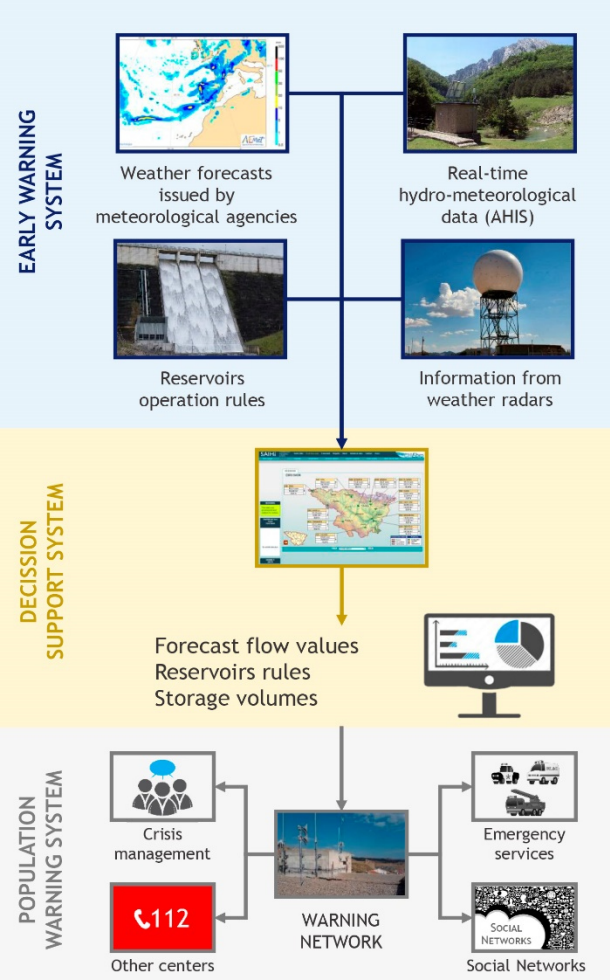
Objectives:

- Assist in reservoir management during flood events.
- Early detection of flood events and their potential consequences, and early warning systems connected to emergency action plans.

Outcomes:

- Expected flows in relevant river locations, gauging stations and reservoir spillways and outlet works.
- Optimized operation rules for reservoirs.
- Stored volumes within the water basin system, in the form of reservoir, soil, underground or snow storage. These volumes also serve as initial conditions for subsequent simulations, setting up a continuous running system.

System Schema Proposed by SICE



Population Warning System

Floods are one of the most devastating and unavoidable natural disasters, hence the importance of preliminary proceedings and early detection.

Forecasting river floods in due time allows triggering emergency action plans, evacuations and many other actions in order to avoid loss of life or damage to property and the environment.

Accordingly, a proper population warning system is essential. The objective is to warn the population in identified hazardous areas to take the necessary measures, assess the situation and follow the safety procedures prescribed by competent authorities.

This warning is usually carried out using a set of alarms or public address systems. The complementary use of other warning systems is also considered, such as massive telephone warning (SMS), mass media, variable message panels, social networks, mobile public address system, etc.

All these warning systems are accompanied by dissemination campaigns and emergency evacuation drills which inform the population about how to deal with the different situations that may occur.