

Confederación Hidrográfica del Ebro (CHE) Early Warning System for flood prevention and management in the Ebro river basin

Confederación Hidrógrafica del Ebro (CHE) is the water authority that manages, regulates and maintains the Ebro river basin, which covers a surface area of around 85,000 km2 and takes in 347 large rivers in northeastern Spain. It is the most extensive watershed in the country and one of the largest in the European Mediterranean, accounting for 17% of the Spanish peninsula territory where around 3.2 million people live.

The challenge

The Ebro river basin provides a substantial amount of Spain's water resources. Its main river, which is 930 km long, flows through different climate zones in the north-east of the Iberian Peninsula, namely the Atlantic, the Mediterranean and a transition area characterized by a broad range of precipitation and transpiration rates.

The basin's unique combination of geomorphological and climatological factors, along with the growing impact of climate change, explain the advent of river, pluvial and flash floods in the area throughout the year. The aim of this project was to reduce flood damage and provide an early warning system (EWS) for civil defense and other stakeholders managing disaster situations in the Ebro river basin.

The solution

The deployment of the **Early Warning System (EWS)** application, which is part of the <u>Xylem Vue platform</u>, provides CHE with early warnings during floods in a variety of scenarios. The tool combines different technologies to compute, analyze and provide warnings and recommendations based on large amounts of data, provided by hydrological and meteorological sensors, rainfall radar, and weather forecasting models.

The application uses cloud computing and big data analytics for real-time, probabilistic hydraulic and hydrological modelling. It also applies geo-statistics and machine-learning techniques to improve data quality and leverages its AI inference engine and heuristics for better management recommendations. It runs every ten minutes for advanced preemption and includes a comprehensive, user-friendly interface for enhanced risk warning and awareness in the river basin.



Program highlights:

- Specific warnings and alerts for stakeholders
- Earlier activation of disaster management protocols
- Detection of potentially affected infrastructures and facilities
- Advanced dam management to reduce costs and protect communities
- Post-event flood response evaluation



VIGILAEbro rainfall maps. Use of geo-statistical and machine learning correction algorithms.



The EWS generates flood maps for different return periods, recommends actions for dams to minimize risks and damage, and helps to send warnings and alerts to mobile telephones and websites when necessary, depending on the type of users and their location.

The results

Thanks to this project, CHE can respond to different types of floods (localized heavy rainfall, river floods, with/without snowmelt) and anticipate events days or hours before they occur. The application forecasts flows and levels accurately and provides advance information on potentially affected infrastructures and facilities, such as bridges, roads, schools and commercial buildings. This enables earlier activation of disaster management protocols that take into account potentially affected infrastructures filtered by population and cost.

The performance of these management protocols, together with that of entities, and communications and software systems, is evaluated after every event to optimize the planning of future efforts and investments.

The EWS enables CHE to better understand the current and forecast hydrological status of the basin, and to reduce damage in dams thanks to advanced management, thus decreasing costs and minimizing the number of citizens affected.

The implementation of the EWS application, referred to as 'VIGILAEbro' by CHE, is in line with the European Floods Directive (2007/60/ EC), which includes the need to develop Flood Risk Management Plans. Thanks to this application, CHE is reducing flood damage and responding to these events earlier to protect communities in northeastern Spain.



Probabilistic flow forecast



Flood maps by return period



Alerts and warning dissemination for public



xylem.com

© 2025 Xylem Inc. All rights reserved. Updated January 2025