

# A Modular and Open Hydrometeorological Platform for Operational Decision Support in Flood Forecasting

(Oral)

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## ABSTRACT

Preventive flood-risk management requires fast, reliable and fully traceable computational chains, capable of turning raw numerical weather predictions into inundation maps that can be used directly by operators and decision-makers. This work presents a full-web operational decision-support platform developed by **BHS Engineering**, designed as an integrated, modular and open environment that covers the entire forecasting chain, from the acquisition of meteorological data to the dynamic mapping of potentially flooded areas.

The platform is built around six complementary modules. The **Meteorology module** integrates three Numerical Weather Prediction models at complementary scales — ALADIN (~8 km, 72 hours), AROME (~1.3 km, 104 hours) and ECMWF-15J (~9 km, 15 days) rendered as animated rasters on an interactive Leaflet map. The **Rainfall module** produces daily and multi-hourly cumulative rainfall maps as well as catchment-scale aggregation through a spatial "point-in-polygon" processing. The **Hydrology module** drives HEC-HMS via an advanced eight-step data-assimilation pipeline, which calibrates the initial conditions on a 7-day observation window (configurable depending on the catchment size) in order to significantly reduce the uncertainty on discharges and reservoir levels, and then restarts a second simulation using the forecast data over the horizon of the selected weather model. The **Hydraulics module** prepares and runs HEC-RAS 2D using the forecast outputs of the Hydrology module as input, extracts the HDF5 results, reprojects them and renders water depths, velocities as well as hazard maps (depth × velocity) as animated rasters. The **Configuration & Scheduling module** provides the management of scenarios (combination of the hydrological model with a weather model), entity mappings, the depth × velocity hazard matrix and automated scheduled tasks. Finally, the **Run Management module** ensures historical tracking, restart and deletion of meteorological, hydrological and hydraulic simulations.

The platform includes a **two-profile account management system**: the **Administrator**, who has full control (configuration of models, scenarios, mappings, schedules and users), and the **Forecaster**, dedicated to the monitoring and visualization of forecast results. This separation ensures operational governance and full traceability of actions.

A key strength of the solution lies in its **open architecture**: the platform is designed to allow the addition, replacement or modification of the meteorological, hydrological and hydraulic models used, without disrupting the overall chain. To this end, **BHS Engineering offers specific developments for each client**, in order to adapt the platform to local models, national reference frameworks, operational constraints and existing information systems. By combining meteorology, hydrology and 2D hydraulics within a unified and Big-Data-ready environment, the platform thus constitutes a robust, scalable and customizable tool for operational flood forecasting and early-warning services.

**Keywords:** Flood forecasting; Decision-support system; HEC-HMS / HEC-RAS 2D; Data assimilation; Open modular platform.