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GEOframe-NewAge: a web-based early warning decision support system

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Monitoring and prediction of hydrological extremes is a critical challenge for any environmental and civil protection agency given the increasing number of extreme events. Therefore, the development and the adoption of a Decision Support System (DSS), based on the simulation, in near real-time, of the hydrological and hydraulic variables, was deemed important for the management and planning across the regional territory. Moreover, it is also critical to provide a friendly tool able to provide a synthesis of the most relevant hydrological variables involved in flood production and landslide triggering.
In this work, we present a DSS developed for the Civil Protection of the Basilicata region, which is based on a WebGIS and on an open source semi-distributed hydrological model, GEOframe-NewAge.
GEOframe-NewAge was built on top of the Object Modeling System v3, (OMS3), an environmental modeling framework based on the concept of components.
Each part of the hydrological cycle is integrated in a component, i.e. a self-contained unit of code that implements a single modelling concept. Each component can be selected and connected at run-time to obtain a user customized hydrological model. More then 50 components are already available, making the system flexible, expandable and applicable in a variety of modelling solutions. Moreover, two calibration algorithms are present in the core of OMS: Let Us CAlibrate (LUCA) and Particle Swarm Optimization (PSO), allowing the easy calibration of any hydrological parameter.
The model is able to manage complex data structure in input and output such as geographical objects, i.e. raster and shapefile, commonly used within the GIS and managed with the HortonMachine and Geotools libraries.
This infrastructure was implemented on the entire Basilicata region, which was discretized in around 160 Hydrologic Response Units (HRU). At HRU scale, atmospheric forcings have been spatialized using Kriging techniques and then the model applied to estimate water balance, evapotranspiration, soil water content, snow melting and runoff production.

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