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JGrass-NewAge hydrological system: an open-source platform for the replicability of science.

Marialaura Bancheri (1), Francesco Serafin (1), Giuseppe Formetta (2), Riccardo Rigon (1), and Olaf David (3)

(1) Department of Civil, Environmental and Mechanical Engineering, University of Trento, Trento, Italy , (2) Natural environmental research council, Centre for Ecology and Hydrology, Wallingford, Oxfordshire, UK , (3) Department of Civil and Environmental Engineering, Colorado State University, Fort Collins, CO, USA

JGrass-NewAge is an open source semi-distributed hydrological modelling system. It is based on the object modelling framework (OMS version 3), on the JGrasstools and on the Geotools.
OMS3 allows to create independent packages of software which can be connected at run-time in a working modelling solution. These components are available as library/dependency or as repository to fork in order to add further features.
Different tools are adopted to make easier the integration, the interoperability and the use of each package. Most of the components are Gradle integrated, since it represents the state-of-art of the building systems, especially for Java projects. The continuous integration is a further layer between local source code (client-side) and remote repository (server-side) and ensures the building and the testing of the source code at each commit. Finally, the use of Zenodo makes the code hosted in GitHub unique, citable and traceable, with a defined DOI.
Following the previous standards, each part of the hydrological cycle is implemented in JGrass-NewAge as a component that can be selected, adopted, and connected to obtain a user “customized” hydrological model. A variety of modelling solutions are possible, allowing a complete hydrological analysis. Moreover, thanks to the JGrasstools and the Geotools, the visualization of the data and of the results using a selected GIS is possible.
After the geomorphological analysis of the watershed, the spatial interpolation of the meteorological inputs can be performed using both deterministic (IDW) and geostatistic (Kriging) algorithms. For the radiation balance, the shortwave and longwave radiation can be estimated, which are, in turn, inputs for the simulation of the evapotranspiration, according to Priestly-Taylor and Penman-Monteith formulas. Three degree-day models are implemented for the snow melting and SWE. The runoff production can be simulated using two different components, “Adige” and “Embedded Reservoirs”. The travel time theory has recently been integrated for a coupled analysis of the solute transport. Eventually, each component can be connected to the different calibration tools such as LUCA and PSO.
Further information about the actual implementation can be found at (https://github.com/geoframecomponents), while the OMS projects with the examples, data and results are available at (https://github.com/GEOframeOMSProjects).