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Design and Implementation a Distributed Computation Framework (OpenHydro) for Streamflow Prediction in Ungauged Basin

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Since International Association of Hydrological Sciences (IAHS) initiated the Decade for Prediction in Ungauged Basins (PUB) in 2003, PUB has attracted various research groups around the world and model regionalization, which aims to relate the model parameters with basin descriptors, has been widely attempted. In order to achieve satisfied regionalization results, one suitable conceptual model should be calibrated for many basins within one region. So the model calibration is a time-consuming work for model regionalization study. Meanwhile, the model users usually need the flexibility to modify or redevelop the modules of hydrological modeling software to reflect the actual physical processes in their study area. Furthermore, the data preparation for conceptual models is still a tedious and time-consuming work for the model users.

In order to solve these problems, a Java-based distributed computation framework: OpenHydro is developed. Including three components: OpenHydro-Server, OpenHydro-Calibrator, and OpenHydro-Viewer, OpenHydro firstly solves the time-consuming problem of model calibration with a distributed computation method. OpenHydro-Server stores the user submitted job XML files which describe the basic information about calibration job: such as basin name, calibration period, validation period, model name, model structure, calibration algorithm name, objective functions' names etc. Running in other idle computers, OpenHydro-Calibrator acquires the job

XML file from OpenHydro-Server, completes the calibration, and returns the calibration results back to OpenHydro-Server. Finally, OpenHydro-Viewer provides a toolset to visualize the calibration results. Because the calibration is completed in separated computers, the time for model calibration in model regionalization study is significantly reduced. Meanwhile, OpenHydro separates the implementation of conceptual models, calibration algorithms, and objective functions using object-oriented design and uses a XML (eXtensible Markup Language) file to describe the structure of a conceptual model, e.g. the tank name, the name of module adopted by the tank, and the linkage between different tanks. This design gives the model developers a flexibility to design the conceptual models, the calibration algorithms, and the objective functions. Furthermore, OpenHydro also provides functions to download streamflow data and climatic data from Environmental Canada's websites and calculate the regional precipitation and temperature within a basin using Thiessen polygon method. In the future, this function will be extended for other countries. This function can exempt the model users from the tedious data preparation work.