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SWIFT2: Software for continuous ensemble short-term streamflow forecasting for use in research and operations

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Research undertaken through the Water Information Research and Development Alliance (WIRADA) has laid the foundations for continuous deterministic and ensemble short-term forecasting services. One output of this research is the software Short-term Water Information Forecasting Tools version 2 (SWIFT2).

SWIFT2 is developed for use in research on short term streamflow forecasting techniques as well as operational forecasting services at the Australian Bureau of Meteorology. The variety of uses in research and operations requires a modular software system whose components can be arranged in applications that are fit for each particular purpose, without unnecessary software duplication. SWIFT2 modelling structures consist of sub-areas of hydrologic models, nodes and links with in-stream routing and reservoirs. While this modelling structure is customary, SWIFT2 is built from the ground up for computational and data intensive applications such as ensemble forecasts necessary for the estimation of the uncertainty in forecasts. Support for parallel computation on multiple processors or on a compute cluster is a primary use case. A convention is defined to store large multi-dimensional forecasting data and its metadata using the netCDF library.

SWIFT2 is written in modern C++ with state of the art software engineering techniques and practices. A salient technical feature is a well-defined application programming interface (API) to facilitate access from different applications and technologies. SWIFT2 is already seamlessly accessible on Windows and Linux via packages in R, Python, Matlab and .NET languages such as C# and F#. Command line or graphical front-end applications are also feasible.

This poster gives an overview of the technology stack, and illustrates the resulting features of SWIFT2 for users. Research and operational uses share the same common core C++ modelling shell for consistency, but augmented by different software modules suitable for each context. The accessibility via interactive modelling languages is particularly amenable to using SWIFT2 in exploratory research, with a dynamic and versatile experimental modelling workflow. This does not come at the expense of the stability and reliability required for use in operations, where only mature and stable components are used.