

Hydrologists Workbench

Water for a Healthy Country

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Australian Government
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FLAGSHIPS
Water for a Healthy Country



The Hydrologists Workbench project is developing tools to automate common workflow processes to access, calibrate and use hydrological models and data.

The tools will enable operational and research hydrologists to more readily and reliably perform complex and repetitious tasks when integrating hydrological data and models.

Transforming Australia's water resources information

The need to accurately monitor, assess and forecast the availability, condition and use of Australia's water resources is now more important than ever. The past decade of severe drought and recent flood events pose significant challenges to the management of Australia's water resources as we attempt to deal with an ever-increasing demand for water. The Water Information Research and Development Alliance is transforming the way Australia manages water resources, by bringing together the

research and development expertise of CSIRO's Water for a Healthy Country Flagship in water and information sciences, and the Bureau of Meteorology's operational role in hydrological analysis and prediction.

Objective

Developing routine information products such as water accounts and regional resource assessments should be done in a standard, consistent and transparent way. The Hydrologists Workbench project has produced a framework to address the complexity of coupling hydrological and geoprocessing models in large-scale modelling tasks.

Key research areas

Hydrologists Workbench has developed an integrated hydrological modelling desktop application that provides the ability to:

- visualise spatio-temporal data from a variety of sources
- interface to external services and tools that manipulate and visualise hydrological data
- interface to hydrological models to integrate and orchestrate modelling tasks as part of larger workflows
- compose general-purpose calibration and optimisation workflows that are run on high performance computers
- save tasks to be rerun at a later date, providing the benefits of repeatability
- capture full provenance information during execution of a workflow, providing the benefits of transparency and auditability.

Delivering outcomes

Hydrologists Workbench allows hydrologists to select and integrate analysis, reporting and visualisation tools with other spatial processing products (e.g. ESRI's ArcGIS) and modelling applications (e.g. eWater's Source Rivers) to generate specific information products.



> Sunrise over Murray River (Image credit: Greg Rinder, CSIRO)

Hydrologists Workbench provides a means to automate and rerun repetitive tasks to increase consistency, rigour and auditability of modelling and reporting. It also provides a graphical environment for hydrologists and other users to gather and pre-process data, calibrate and compare models, trial different analyses and visualise results.

The Hydrologists Workbench has been used to successfully demonstrate the execution of the Australian Water Resources Assessment model, from input data discovery and pre-processing to publication of results.

Partners

From 2008 to 2013, the Water Information Research and Development Alliance is delivering the scientific and research innovation required by the Bureau to fulfil its national water information mandate. Through a strategic investment of \$50 million over five years, more than 40 researchers are focusing on several challenging areas. These include large-scale information architectures, earth observation, hydrologic modelling, water accounting, water resource assessment and water forecasting.

The advantage of scientific workflows

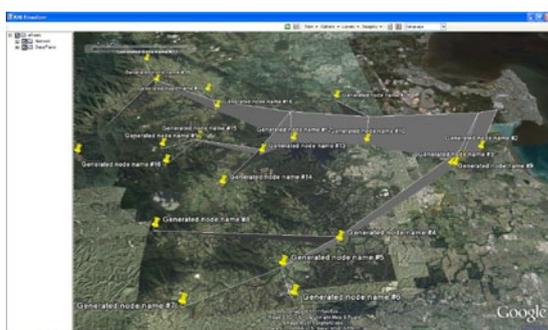
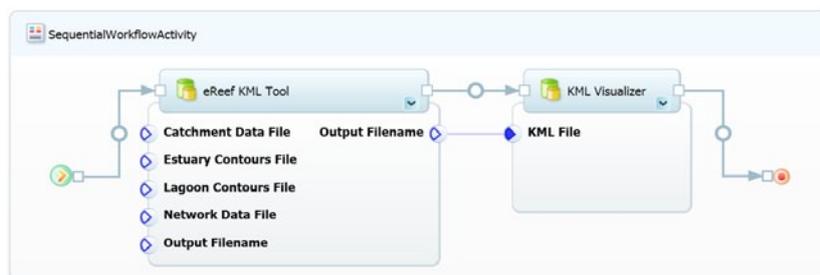
Workflow tools have their origins in large-scale enterprise systems that attempt to automate business processes typically involved in the manufacture of goods and services. The tools manage and track complex processes that may take days or weeks to complete, and involve multiple people, tasks and systems.

Scientific workflows are similar, but involve processes that require specialised computation services and high-volume, complex data management. They are based on the same principles as business workflows: clear sequencing of tasks, minimal manual intervention to reduce the risk of error, and efficient throughput.

In hydrology, scientific workflows can provide significant efficiency gains in rainfall-runoff model

calibration. In terms of task management and reproducibility of these models, there is currently a heavy reliance on individuals and manual steps for the process to sustain itself, often with inefficient use of technical skills and increased risk of non-reproducible results. Information on model configuration and input parameters comes from a variety of dispersed sources, ranging from 'wiki' sites to notes jotted onto bits of paper.

Typically, diverse toolsets and capabilities demand manual methods to bring them together, and basic traceability necessitates off-line documentation, which can be easily lost within an organisation. Applying scientific workflows can therefore improve the management and operation of hydrology models.



> Hydrologists Workbench can be used to visualise a time series associated with a set of nodes that are linked via a network diagram output to Google Earth.

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Find out more about the Water Information Research and Development Alliance at www.csiro.au/partnerships/WIRADA.html

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CSIRO and the Flagships program

Australia is founding its future on science and innovation. Its national science agency, CSIRO is a powerhouse of ideas, technologies and skills. CSIRO initiated the National Research Flagships to address Australia's major research challenges and opportunities. They apply large scale, long term, multidisciplinary science and aim for widespread adoption of solutions.

A water information R & D alliance between the Bureau of Meteorology and CSIRO's Water for a Healthy Country Flagship