Monitoring Water Resources from Catchment to Continent

Australian water resources assessment projects have developed methods and technologies that will enable the Bureau of Meteorology to provide integrated surface and groundwater resource assessments, water accounts and water resource outlooks to Australian governments, business and people.

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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 extreme climatic events in Australia 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

Australian water resources assessment projects are developing the technology required to produce comprehensive information on the generation, distribution and use of water resources across Australia to support the Bureau of Meteorology's statutory functions. These include providing:

- an annual National Water Account
- a biennial Australian Water Resources Assessment report that interprets current water availability and trends in an historical context.

This information needs sufficient local detail, accuracy and currency to be useful. It also needs to be produced on demand in a robust and transparent manner. This is achieved by objectively assessing the performance of existing models that describe parts of the water cycle. The most suitable methods can then be integrated in a flexible modelling system, which is informed by a wide range of on-ground and satellite observations.

Key research areas

CSIRO researchers are developing an integrated continental water balance modelling system for detailed water balance analysis from the continental to the sub-catchment scale. The system will form an integral part of the Bureau's National Water Accounts and Australian Water Resources Assessment reports.

The system will contain models to estimate the:

- water balance of agricultural and forestry land, residential land, water bodies and natural vegetation
- generation and movement of river flows
- groundwater balance and its connection to surface waters.

Key features of the research approach include performance testing and model–data fusion.

Performance testing

Researchers will test the performance of existing models that describe components of the water cycle, and benchmark them against a wide range of observations. Performance tests are applied to assess the most appropriate model structure and complexity, and to allow objective, ongoing improvement.

**Rice plantations at Griffith.
(Image credit: Willem van Aken, CSIRO)**

Australian Government
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Water Information
DATA › INFORMATION › INSIGHT

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

Model–data fusion

Model–data fusion methods are being developed to reconcile model and observed data in ways that respect their inherent uncertainties, and ensure the best available information is used to estimate water balance. This involves:

- identifying key data sets and determining how they link to the model
- comprehensively considering model and observational errors across space and time
- choosing model–data fusion methods that are fit for purpose and computationally feasible.

Delivering outcomes

The first Australian water resources assessment modelling system

The landscape version of the Australian water resources assessment (AWRA) modelling system is now running at the Bureau, generating daily information with a national coverage. This information will enable the Bureau's annual National Water Account and regular water resource assessments, and also provide valuable, timely information to water management practitioners, policy makers and researchers.

The developing modelling system includes three components:

- a landscape water balance component that describes the vegetation and soil water balance at a daily time step and a resolution of about five kilometres
- a river component estimating water use, floodplain and river balances at the scale of river reaches and a daily time step
- a groundwater component estimating groundwater flows.

In addition, the system is regularly tested and updated with

- a benchmarking system allowing the model estimates to be compared against a range of observations including:
  - on-ground measurements such as river gauges, irrigation diversion metering, vegetation water use experiments and soil moisture sensors
  - satellite observations of vegetation cover, flooding, soil moisture, precipitation, evaporation and groundwater dynamics.
- Model–data fusion algorithms to combine models and observations and provide optimal estimates of components and parameters.

The system is capable of providing regular updates on soil water and groundwater storage, generation of streamflow, vegetation water use and other major components of the water balance.

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, hydrological modelling, water accounting, water resource assessment and water forecasting.

Other partners in projects around Water Resources Assessment and Water Use Accounting include:

- Monash University
- University of New South Wales
- Deltares, Netherlands
- VU University, Netherlands
- Technical University Vienna, Austria
- The Group on Earth Observations and The Global Earth Observation System of Systems
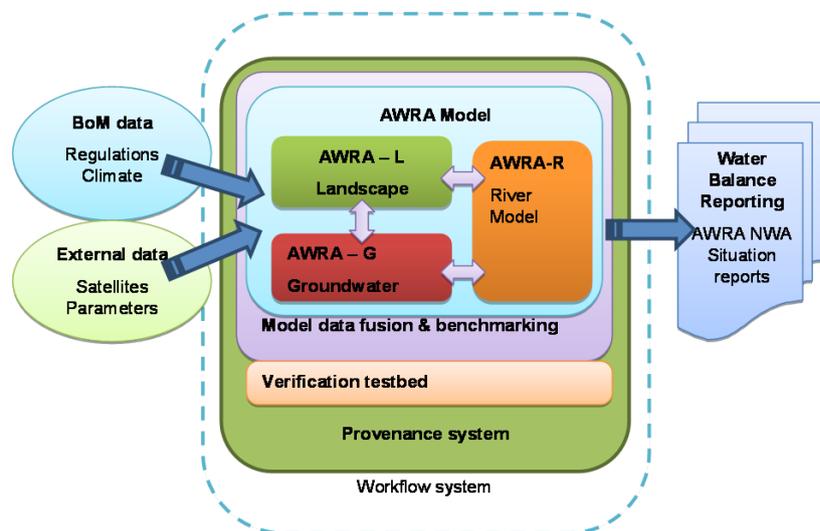
Visual representation of the Australian water resources assessment modelling system.