

WaterML2.0 – an international open standard

Collaboration in developing a new international water data transfer standard (WaterML2.0 Parts 1 and 2) is ensuring water data management in Australia is aligned with world's best practice in water observations. The new standards are assisting in the understanding and management of fresh water resources worldwide by enhancing data sharing and exchange.

April 2013

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

Water observation data is the fundamental element of a water resources information system. Defining and developing new water data transfer standards and procedures allows the Bureau of Meteorology to receive data from existing water data providers in a consistent way, and subsequently to publish water data.

Australia's efforts in this field reflect a number of initiatives worldwide that are dealing with the large scale complexity of disparate data sets and working on improved standards for water information in both spatial and temporal data sets. Looking to leverage existing standards and methodologies where

possible, an international collaboration led by the Alliance developed WaterML2.0 Part 1: Time Series Encoding Standard, which is an international open standard harmonised with the Open Geospatial Consortium's Observations and Measurements standard. In Australia, WaterML2.0 is used to guide development of the Water Data Transfer Format, which is designed to help the Australian water industry share data with the Bureau.

The involvement of the Alliance in developing international water data transfer standards reflects a global push in information communities for consistent models for capturing spatial and temporal data and metadata, to improve interoperability of information systems. The driving need for the exchange of water observation data is varied and operates on different levels, from intra-agency sharing to sharing across international borders, but some of the universal objectives and benefits in developing shared models include:

- ♦ improved efficiency and quality of local information models and systems
- ♦ wider use and re-use of information
- ♦ new tool development
- ♦ new value to existing information via unexpected uses.

Key research areas

Taking the lessons learnt from developing the Australian standard for water data — the Water Data Transfer Format (WDTF) — the Alliance led the process of international standardisation through collaboration with international organisations. The team developed



Water treatment plant (Image credit: CSIRO)

WaterML2.0 under the auspices of the Open Geospatial Consortium and the World Meteorological Organisation's Hydrology Domain Working Group. Challenges included:

- ♦ determining best practice for water information at an international level
- ♦ developing flexible models and schemas that enable reuse of tools across countries and organisations, while supporting customisation for local jurisdictions
- ♦ understanding the complexity of water data so that concepts important to water can be represented formally and be machine processable (i.e. automated).

Following the adoption of WaterML2.0 Part 1: Time Series Encoding Standard by the Open Geospatial Consortium in August 2012, this project focuses on continuing activities based on Part 1, and also on developing a second standard — WaterML2.0 Part 2: Ratings, Gaugings and Cross Sections.



Australian Government
Bureau of Meteorology



Water Information
DATA > INFORMATION > INSIGHT

Rating curves and tables are used extensively in hydrology to estimate flow or volume, and are usually constructed from collections of gaugings: measurements of flow or volume in relation to stage taken at various times.

In Part 2, the project will collaborate with international partners to define a transfer model and related encoding that can be used by organisations to exchange rating, gauging and cross-section (survey) information in such a way that a client can reliably understand and consume ratings produced by other organisations.

Delivering Outcomes

CSIRO and the Bureau of Meteorology led the development of the new international water data transfer standard adopted by the Open

Geospatial Consortium, in collaboration with 47 registered participants in an OGC Standards Working Group.

The work of the Standards Working Group was informed by interoperability experiments, which applied the draft standard to real-world scenarios based on proof-of-concept demonstrators. Through these experiments, implementations of services using WaterML2.0 are becoming available.

The standard has been, or is being, implemented in a number of organisations, including the United States Geological Survey, the UK Centre for Ecology and Hydrology, KISTERS, Aquatic Informatics, 52°North, Deltares, and Natural Resources Canada. In Australia, both CSIRO and the Bureau of Meteorology are using WaterML2.0 Part 1.

WaterML2.0 Part 2 was presented in January 2013 at an Open Geospatial Consortium Technical Committee meeting. During 2013 a public discussion paper will be submitted – the first step in the process of the standardisation of Part 2.

“WaterML2.0 is the first public, open source, global standard for the exchange of water information through the internet. It is critical for linking local, regional, national and global water information sources into connected water information networks throughout the earth.”
— Dr David Maidment, Center for Research in Water Resources, University of Texas at Austin

The journey to a new international standard

In late 2006, Australia’s water resources had reached a crisis point, primarily due to persistent drought. The Australian Government responded with the Water Act 2007 and allocated responsibility to the Bureau of Meteorology to collate Australia’s water observations and produce regular water accounts and assessments. For this task, the Bureau realised they needed a common format for the information that would come to them from more than 200 organisations across Australia. CSIRO developed the Water Data Transfer Format (WDTF) to provide the Bureau with the means to more efficiently collect and process millions of data files of water resource information.

The speed with which the WDTF was completed required some compromises. To address these, CSIRO staff studied a number of water data encodings from around the world (including WaterML1.0, the US developed standard that was specific to the US, much like the WDTF for Australia), seeking to simultaneously mould the WDTF to the Open Geospatial Consortium’s Observations and Measurements standard.

In 2008, CSIRO and the Consortium of Universities for Advancement of Hydrologic Science began collaboration on developing an international standard for data exchange (WaterML2.0).

After an extensive process of public consultation and collaboration, in September 2012 the international standards body Open Geospatial Consortium adopted ‘WaterML2.0 Part 1: Time Series Encoding Standard’ as an official international standard for encoding and exchanging data describing the state and location of water resources, both above and below the ground surface. In addition, in November 2012, the World Meteorological Organisation recommended WaterML2.0 be investigated for adoption as a WMO/ISO standard.

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 working on WaterML2.0 include:

- ◆ Consortium of Universities for the Advancement of Hydrologic Science
- ◆ United States Geological Survey
- ◆ KISTERS
- ◆ Aquatic Informatics
- ◆ Centre for Ecology and Hydrology

CONTACT US

t 1300 363 400
+61 3 9545 2176
e enquiries@csiro.au
w www.csiro.au

YOUR CSIRO

Australia is founding its future on science and innovation. Its national science agency, CSIRO, is a powerhouse of ideas, technologies and skills for building prosperity, growth, health and sustainability. It serves governments, industries, business and communities across the nation.

FOR FURTHER INFORMATION

Mr Peter Taylor
Project Leader
CSIRO’s Water for a Healthy Country Flagship
t 61 3 6232 5530
e Peter.Taylor@csiro.au

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