Australian Water Resources Assessment Modelling System (AWRAMS): From Application to End User Needs

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Presentation Outline

- **Water User's Perspective**

- **Australian Water Resources Assessment Modelling System**

- **Current use of AWRAMS in Bureau's Water Products**

- **Future directions of AWRAMS**

- **Summary**

Water managers have a lot to worry about…

Floods

Climate

Enviro flows

Urban growth

Drainage

Allocation

Type of Questions AWRAMS will Answer

- How much resource has been generated?

- How much water is used by whom, for what?

- How much water have we got left?

- How does this compare with the past?

- Is a trend or shift emerging?

- How can we expect water availability to develop?

- What is the observed impact of extraction/land use/farm dams/ bushfires on water security and environment?

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AWRA Modelling System

- **Input: Climate (AWAP) and water data**

- **Integrated hydrological simulation system**

- **Single, integrated modular modelling system**

- **Provide seamless water balance information and data**

- **Makes best use of available data and generates seamless water resources data**

- **Continental and regional coverage (5x5Km)- Daily**

- **Operational system generate sub-annual outputs**
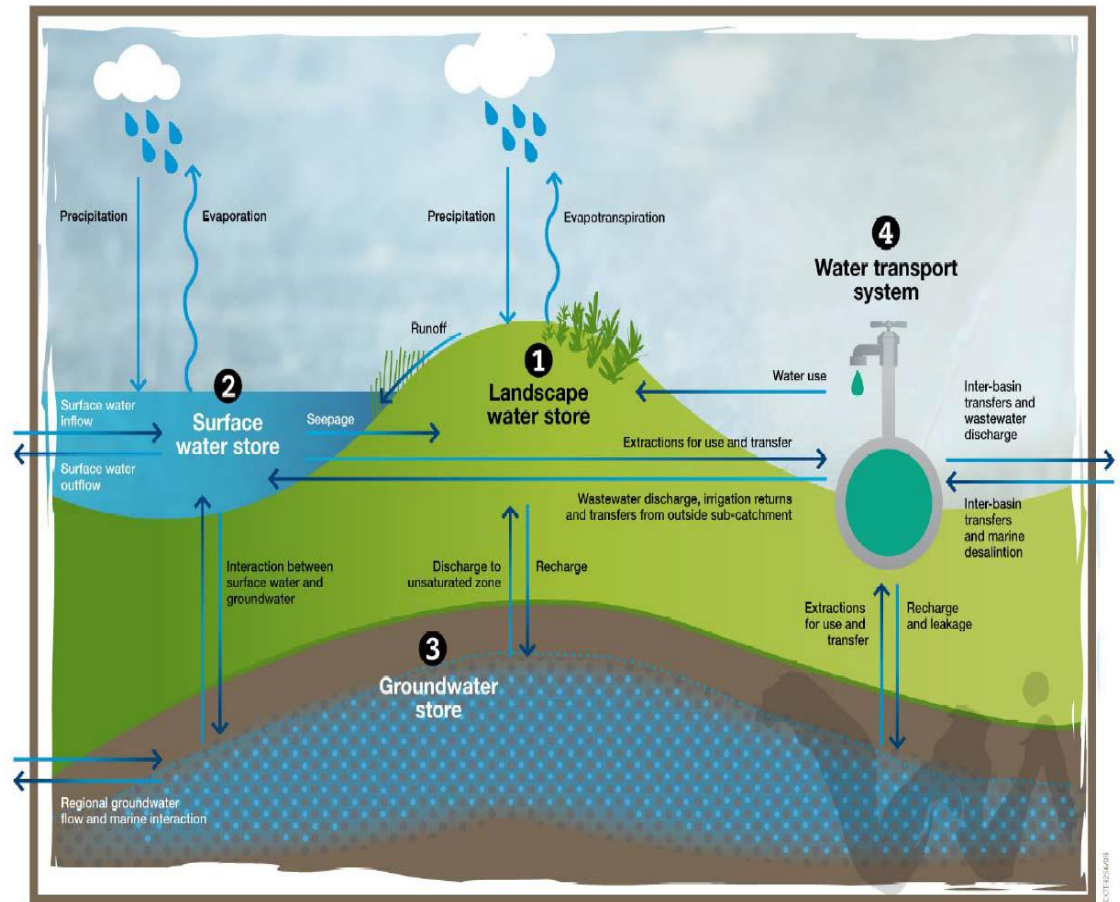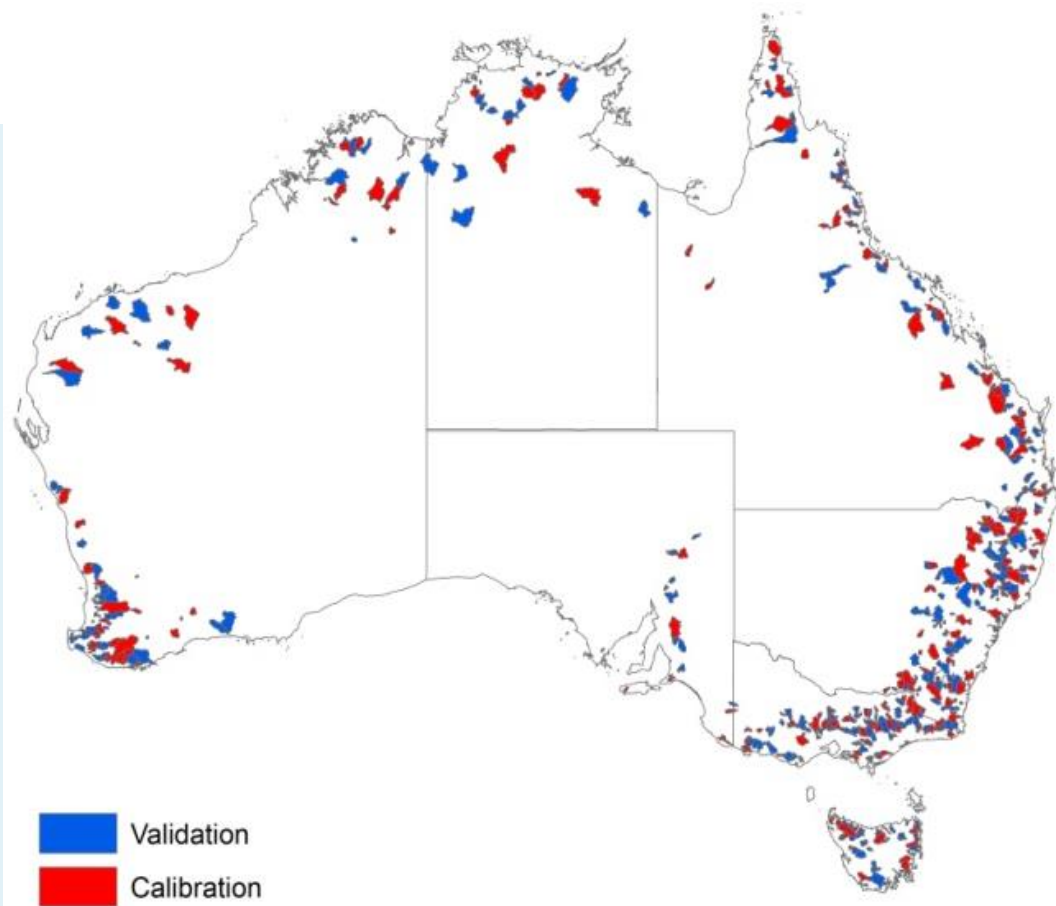
AWRA Modelling System

- Landscape

- River

- Calibration and validation

- Benchmarking

- Operational system
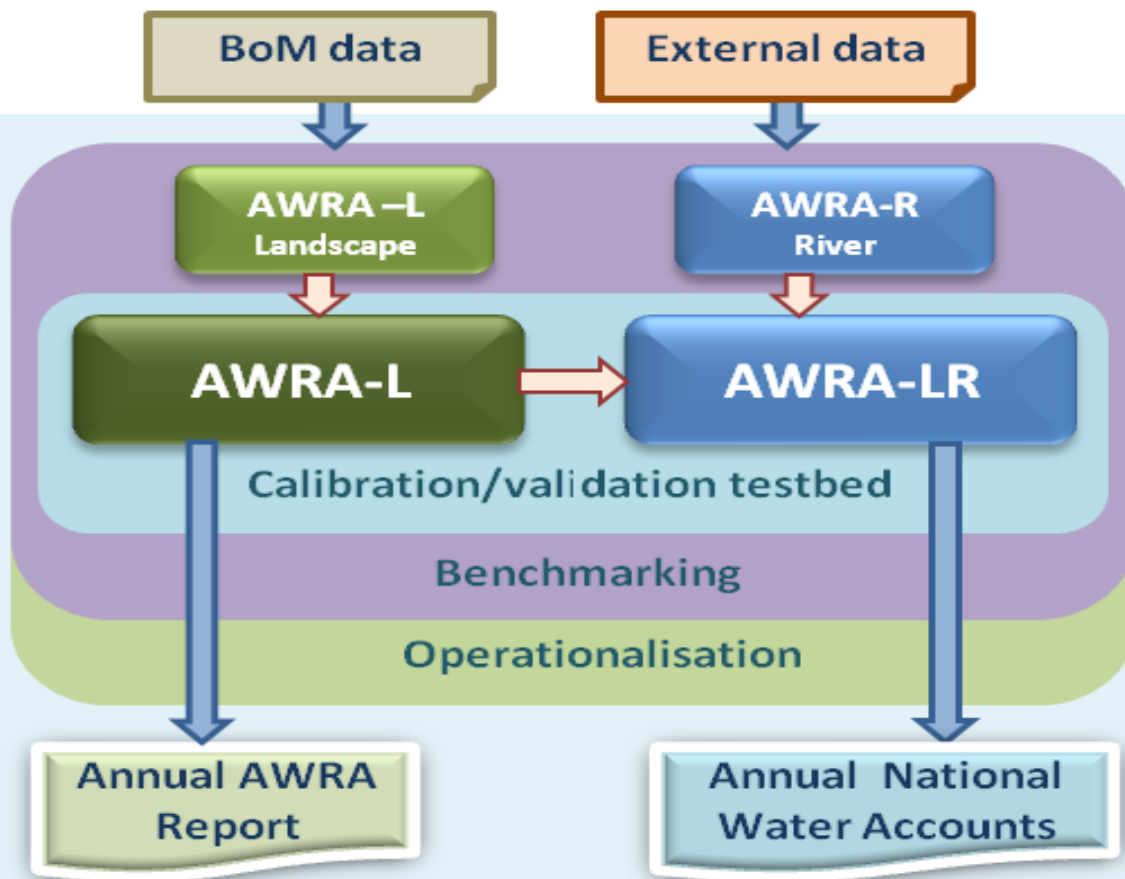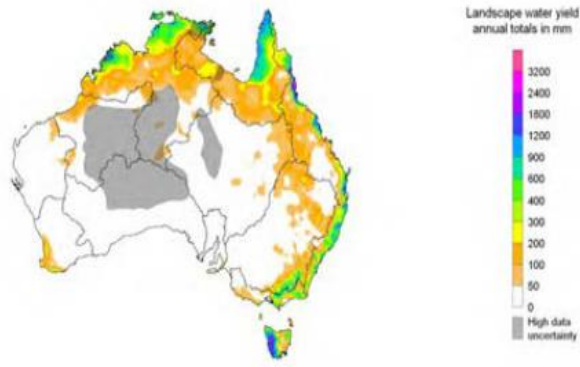
Evaluation of AWRA-L Model

Catchment and Point Scale

- **Streamflow** – 589 unimpaired catchments (295 for Calibration and 294 for validation)

- **ET** -CMRS, SLS & Fluxnet Towers

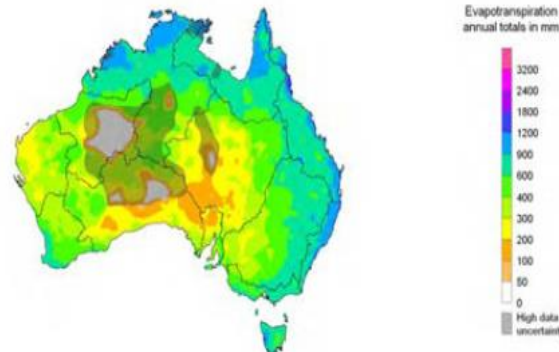- **Soil moisture** -AMSR-E, ASCAT & Murrumbidgee OzNet

Validation
Calibration

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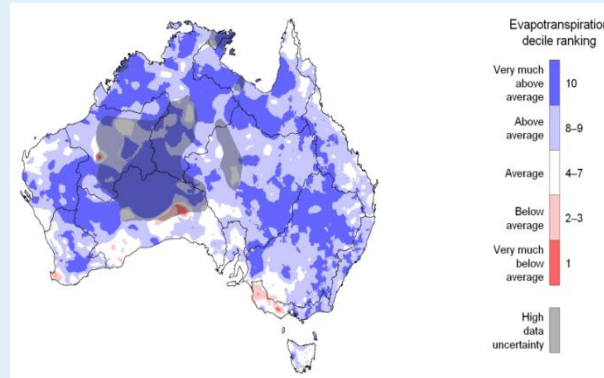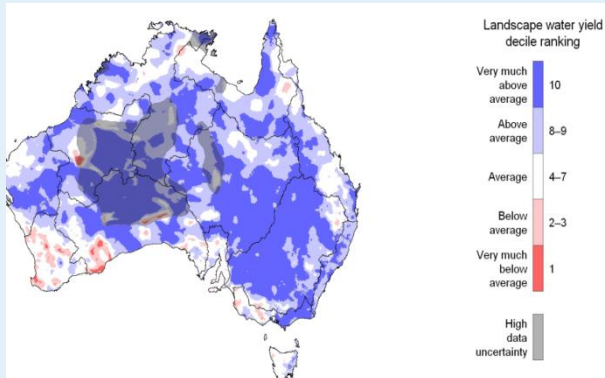
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AWRA-L Model Outputs for 2011-12
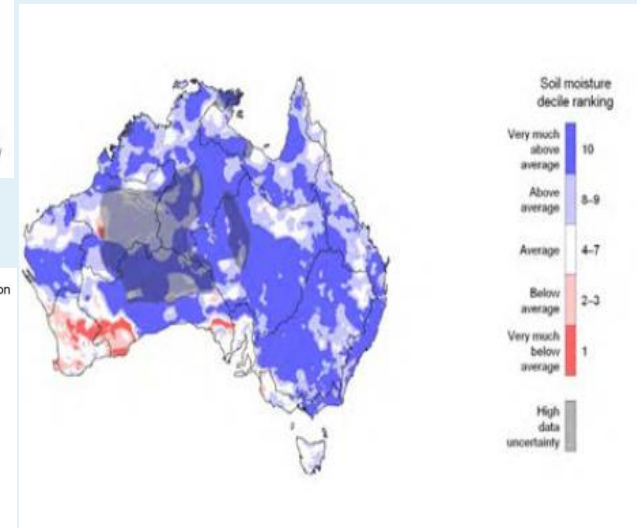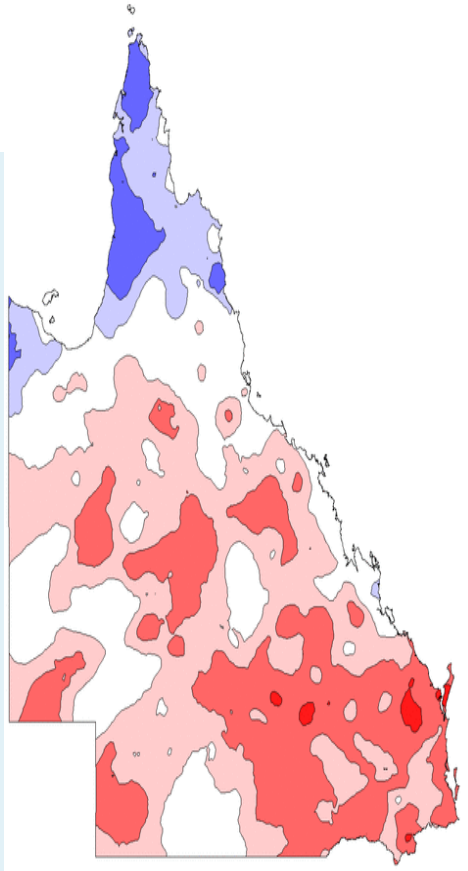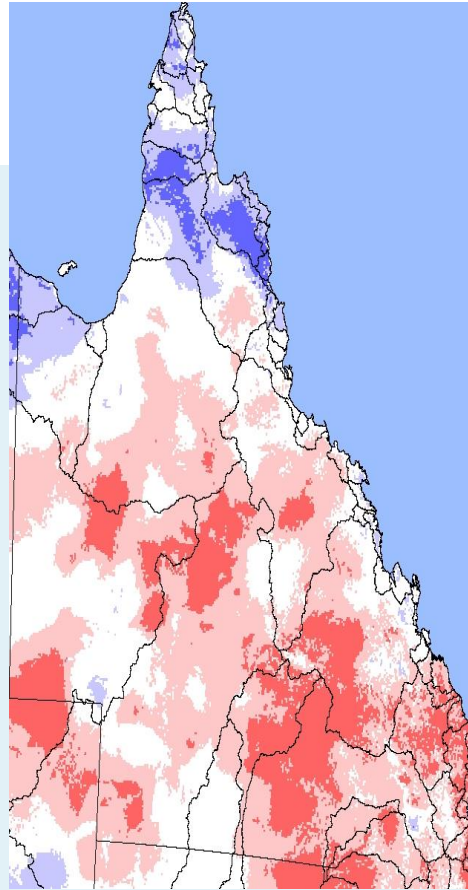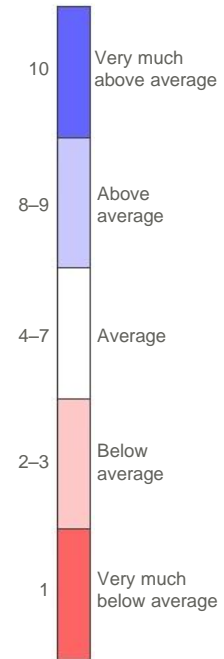
Landscape Water Yield

Evapotranspiration

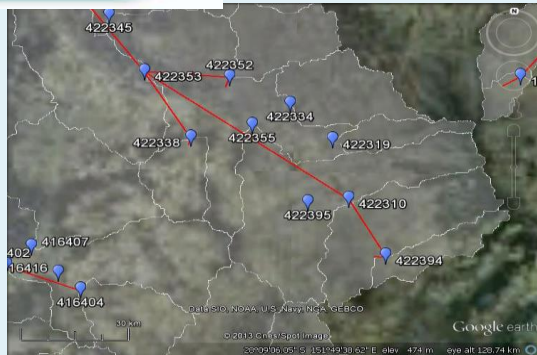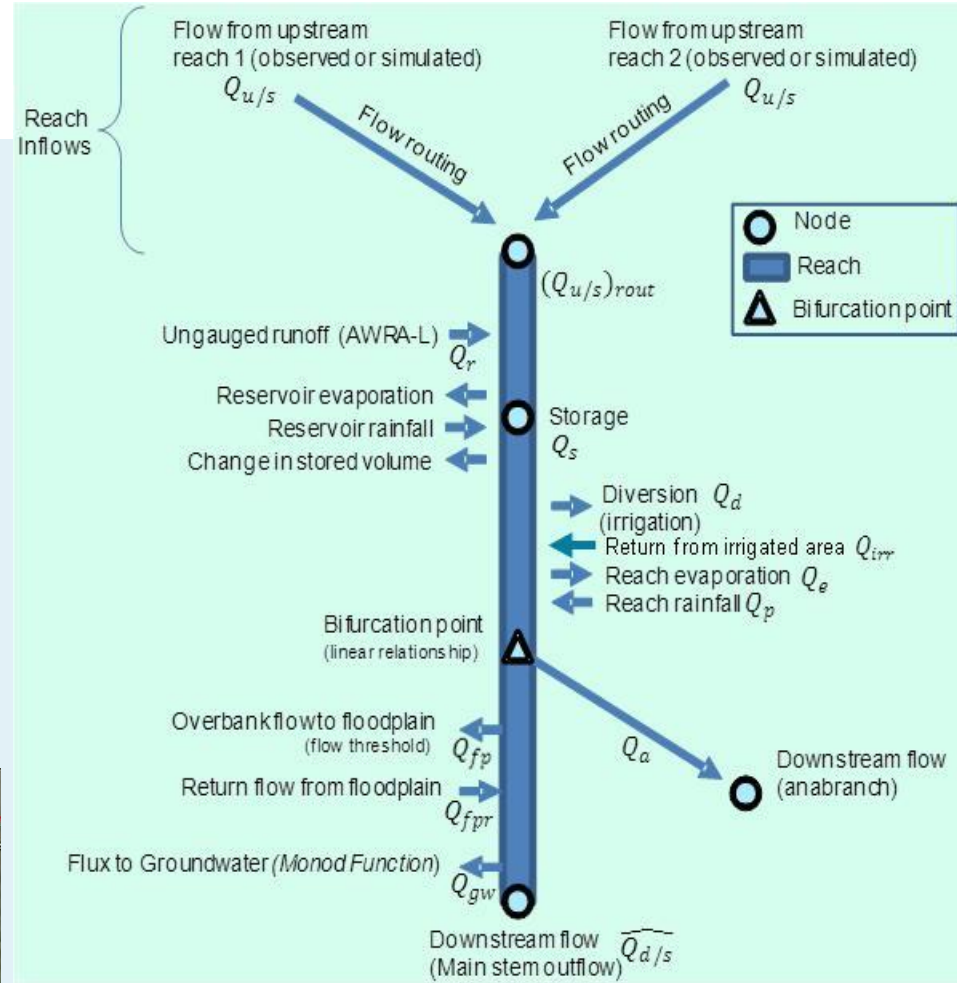**Soil Moisture**

Soil moisture 2013–14

Rainfall

Soil moisture 0–1m depth

10	Very much above average
8–9	Above average
4–7	Average
2–3	Below average
1	Very much below average

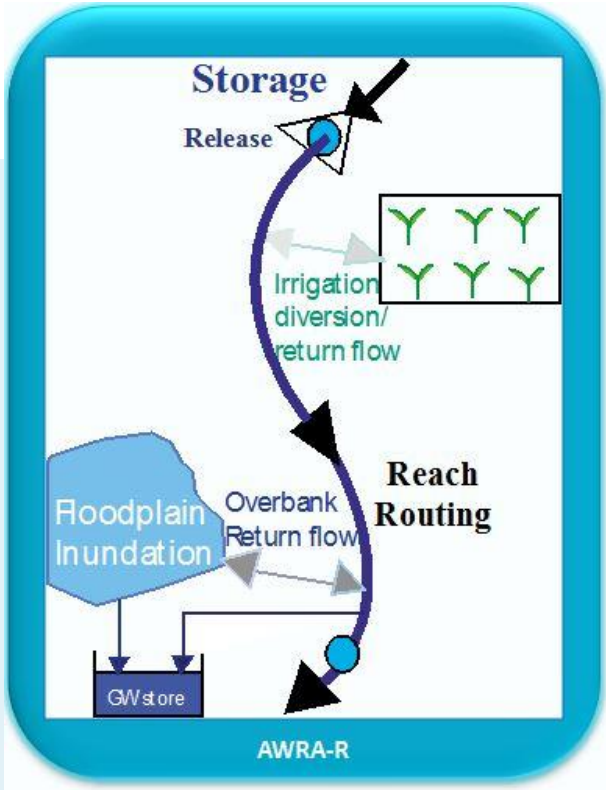Australian Government
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AWRA-R Model

Similarity and Differences between AWRA-R and other daily River System models

Modelling components/processes	AWRA-R – Retrospective Water Accounting	Other daily models (e.g., IQQM/Source) - Planning
Node-link structure	Yes	Yes
Rainfall-runoff modelling	Continentally calibrated AWRA-Landscape model	Locally calibrated rainfall-runoff model
Flow routing	Muskingum routing	Similar approach
Irrigation diversion model	Daily model based on FAO56	Similar approach
Overbank flow	Explicit modelling using floodplain volume-area relationship to account for floodplain fluxes/stores including floodplain recharge	Simple loss function (no floodplain recharge or, other physically based concept)
Loss from river to groundwater	Explicit method using AWRA-L soil and groundwater store parameters	Simple loss model to complex models
Urban diversion	Time series	Time series
Management rule	Not required	Fully implemented
Calibration approach	Auto-calibration inbuilt (with both reach-by-reach and system calibration approach)	Only reach-by-reach approach (no auto-calibration method in built)

AWRAMS Applications

Bureau Data Regulations Climate

External Data Satellites parameters

AWRA Modelling System

Outputs

Streamflow
Run-off
Evapotranspiration
Soil moisture
landscape water yield

Landscape
Regulated river
Irrigation area
Floodplain area
Groundwater

Continental

Assessment

Continental & Regional

Sub-annual products
•Gridded
•Drought

Regional

Accounting

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Australian Water Resource Assessments

Review of Australia's Water Resources — 1963

Australian Water Resources Commission — 1975

Review of Australia's Water Resources and Water Use — 1985

Australian Water Resources Assessment — 2000

National Land and Water Resources Audit — 2000

Australian Water Resources — 2005

National Water Commission — 2005

Australian Water Resources Assessment — 2012

Bureau of Meteorology — 2010 – 2012

…

Insight into issues

- How is water availability changing?
- Do we have enough to meet our needs?
- Who gets how much: how is water shared among users?

Target audience

- Policy makers, industry groups, informed public

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Water Resources Assessments

State of water resources

Report on:

- **Availability**
- **Use**
- **Quality**

- **Scientifically robust**
- **Water balance**
- **Long-term record**
- **Regular**
- **Consistent methods**
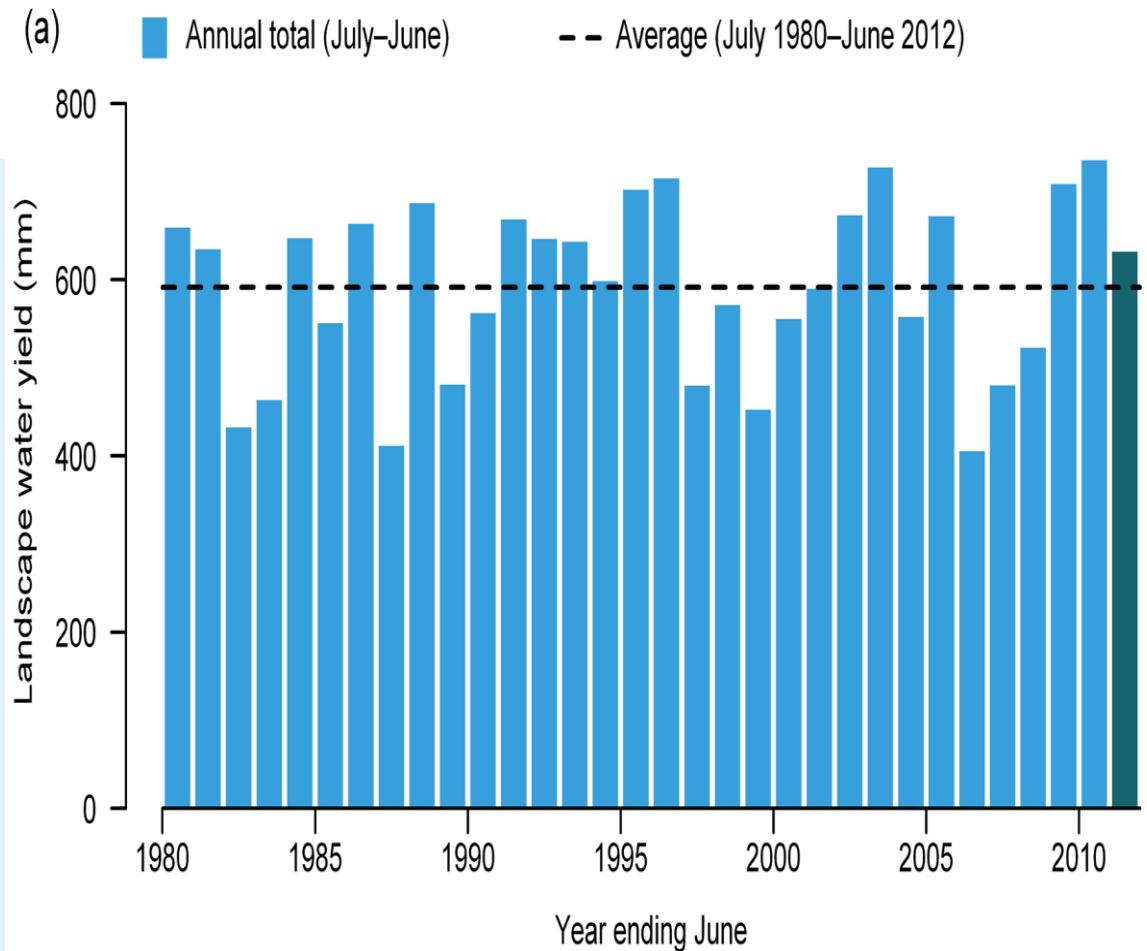
National Water Account
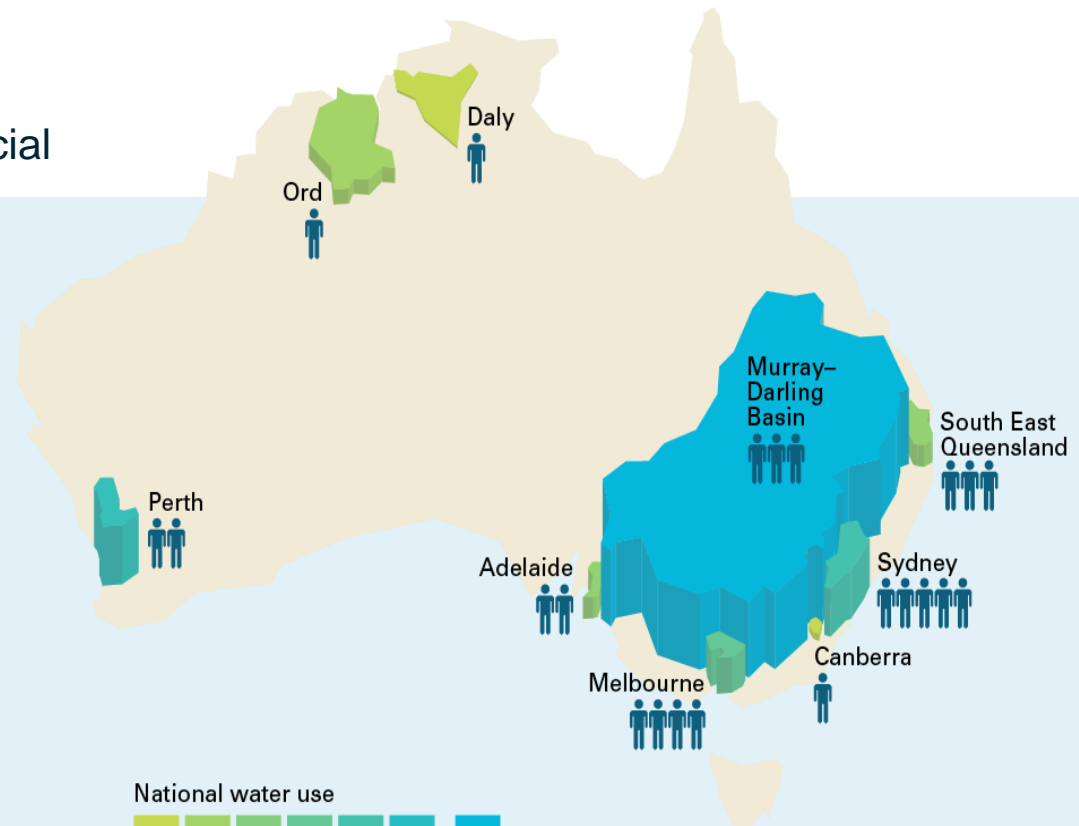
- What is the National Water Account?
  - Set of region reports
  - Product of hydrology and financial accounting
  - Underpinned by accounting standards
- What is the purpose?
  - To disclose the amount of water available, allocated and accessed for use
  - Increase transparency of water management
- The regions cover
  - 80% of Australia's population
  - 70–80% of Australia's water use
  - 70% of Australia's urban water supply
  - Almost all trading
  - Most horticultural growing areas

National water use

| <1% | 1% | 2% | 3% | 4% | 5% | 60% |

National population

- <5%
- 5–10%
- 10–15%
- 15–20%
- 20–25%

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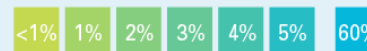
AWRAMS to Meet End User Needs

- A national picture on water availability over time (spatial and temporal trends across the continent) to guide water reforms that are happening across Australia

- Provide valuable information on Australia's water status for water management practitioners, policy makers and researchers

- Schedule daily availability of soil moisture, landscape water yield, evapotranspiration and recharge product at continental scale

- Water Balance estimates at catchment and continental scale will lead to better-informed policy and infrastructure decisions

- Use of AWRA-R for closing river water balance in regulated systems

- Irrigation related stores and surface water fluxes for irrigated areas

- Potential use of AWRA-L model derived soil moisture product includes guidance for numerical weather prediction, bushfire risk, flash flood risk, landslip risk, and guidance for farmers.

- Potential use for drought monitoring

- Potential use for flood plain inundation monitoring and environmental watering

Future Developments

- **Benchmarking of AWRA-R model against other jurisdiction models (e.g. IQQM, REALM and actual irrigation diversion data) for selected river basin is under progress.**

- **Presenting the AWRA-R model science, implementation and benchmarking results to external stakeholders (Irrigation and Water Managers) is on high priority for building stakeholder confidence for future adoption of the model.**

- **Rollout of AWRA River model for National Water Accounting across Australia**

- **Downscaling AWRAMS output to local scale**

- **Possible development of scenario analysis option**

- **Use of AWRAMS for future Bureau's water products including:**

    - **Water in Australia**

    - **Regional Water Statistics**

    - **Monthly Water Updates**

- **Sharing the AWRA-L model data outputs and codes (open source) with wider research and scientific community in Australia and overseas**

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Summary

- **Assessments—more regular, using consistent methods and techniques provide transparency and public confidence**

- **Water balance modelling gives complete coverage**

- **Integrated modelling (landscape and river systems) a way forward**

- **Improved and validated dataset and outputs (streamflow, soil moisture, evapotranspiration)**

- **Over the coming years, the Bureau plans to:**

  - **consolidate and fully integrate the AWRAMS as a regulated river system model (AWRA-LR)**

  - **benchmarking AWRA-L and AWRA-R models against observations and other peer jurisdictional model outputs to get stakeholders confidence**

- **Start using AWRAMS as an operational hydrological modelling system within the Bureau's Linux based IT infrastructure.**

- **Sharing 100 years simulation outputs of AWRA-L model with registered users – March 2015**

Thank you…

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