

Piloting Australia's Water Tools to improve Drought Resilience in Cambodia – Support for the UN ESCAP Drought Mechanism

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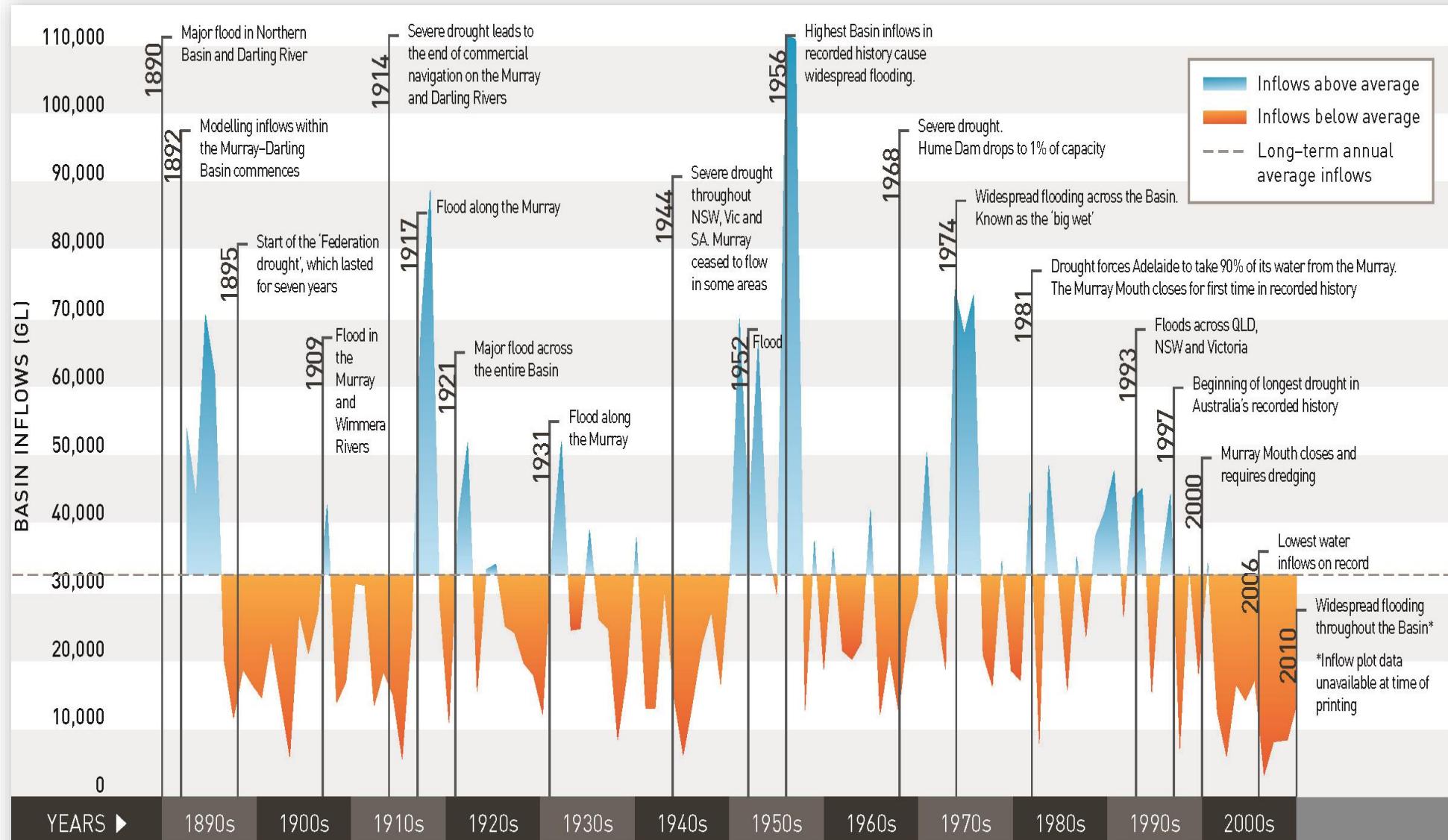
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Coping with Annual Variability embeds resilience



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Australia's National Water Tools to Manage Scarcity

- Australia's national tools and methods to build science-to-policy foundation for improving water resource management and use in response to scarcity.
- Applicable to national or regional governments where water scarcity is a threat to human health and wellbeing, economic development and/or environmental sustainability.
- WaterTools enables multiple entry points to build systems and processes to inform and enable water management and policy development at country or sub-national scale.



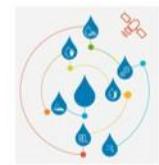
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- ESCAP is the regional development arm of the United Nations for the Asia-Pacific region.
- The Drought Mechanism is a program to Monitor Drought from Space. Through the Drought Mechanism, timely and free access to space-based data/products and services are provided to participating countries, who also receive training and other capacity building.
- eWater, Geoscience Australia and The Bureau of Meteorology are enhancing the ESCAP Cambodian Drought Mechanism pilot by integrating the WaterTools suite to supplement the space-based drought metrics with water balance and water availability tools to improve Cambodian Farmer's awareness of risk through CAVAC, a DFAT program to increase productivity and incomes for smallholder farmers in Cambodia.



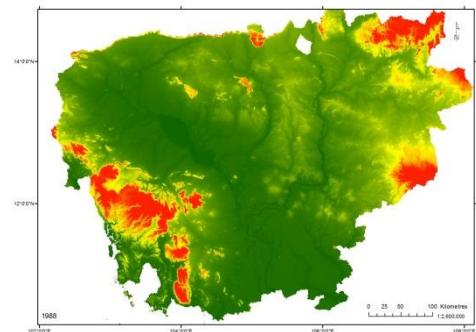
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Water Availability Analysis Workflow



Remote Sensing data
Landsat 5, 7, 8

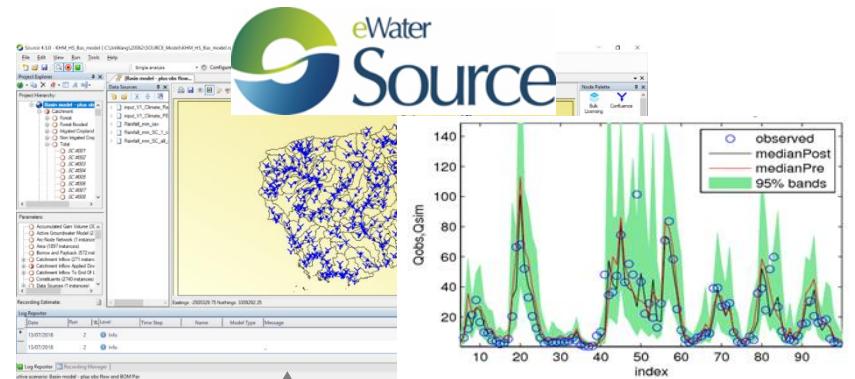
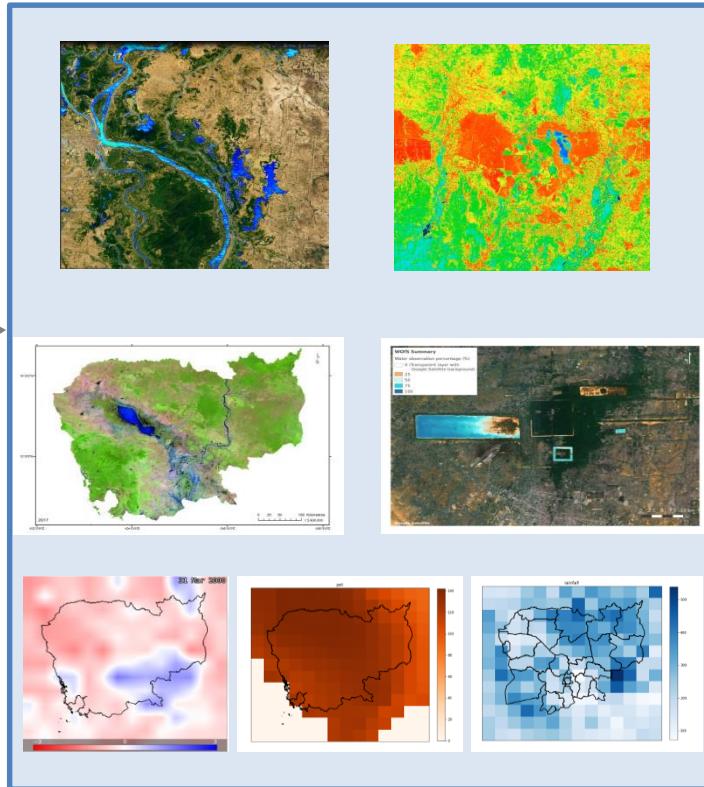


Environmental Data
Temperature
Digital Elevation Model (e.g. SRTM)

Australian Government
Bureau of Meteorology

Pluviographs + Gridded rainfall
Bias corrected data
Forecasted data

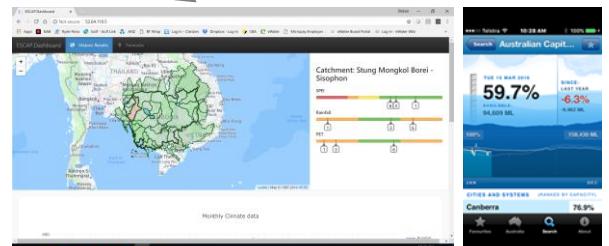
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eWater Source Ensembles of
Hydrological Response

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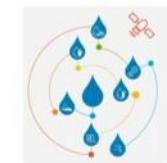
Drought Awareness
Dashboard



Australian Government
Bureau of Meteorology

eWater

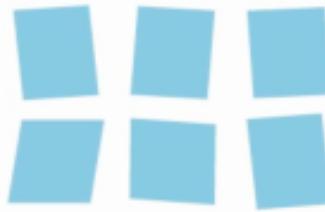
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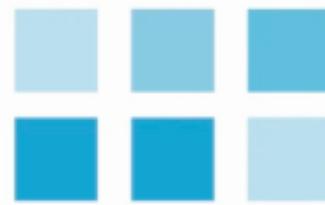
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What is the Digital Earth Australia Open Data Cube?

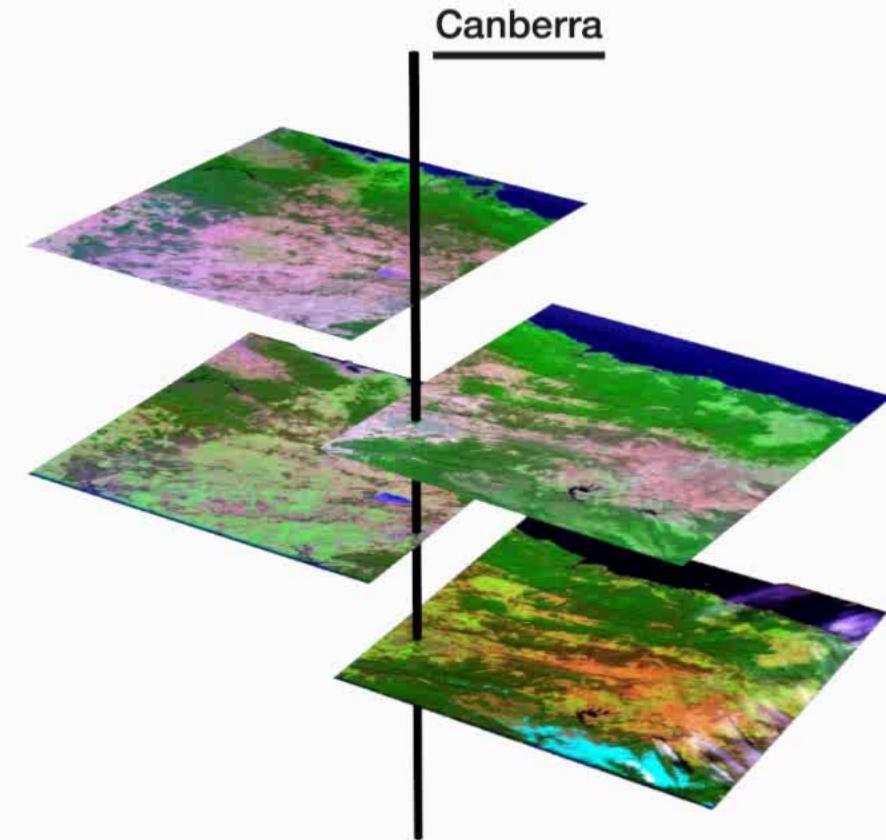
Orthorectification



Calibration



Time series



Annual geomedian images of Cambodia 1988-2017

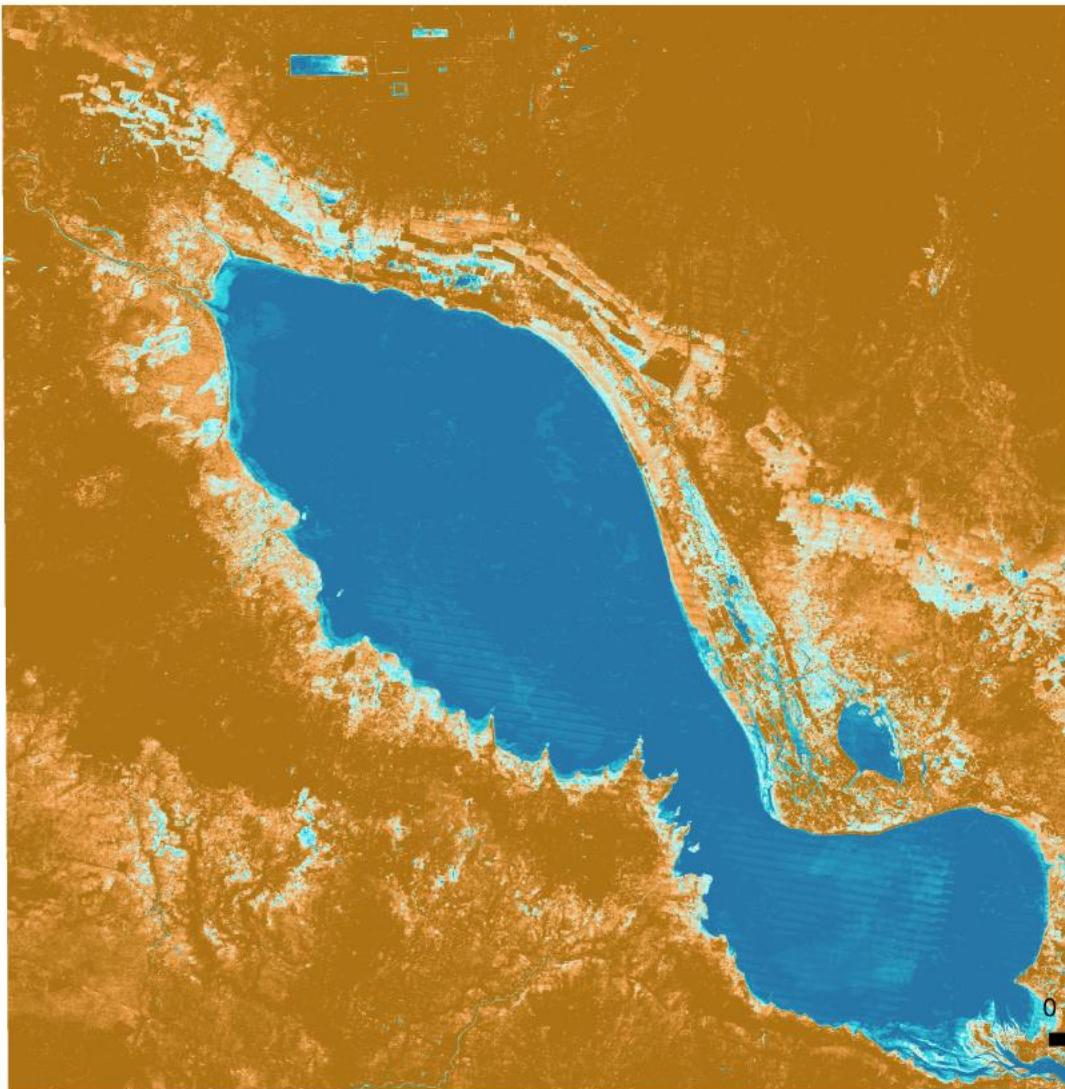
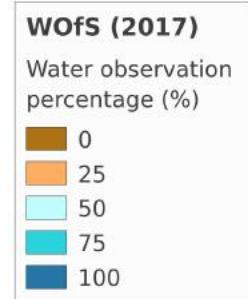


Annual geomedian images of Cambodia

- Created by [Erin Telfer](#) and [Norman Mueller](#), May 2018
- Geomedian images based on:
 - Roberts, D., McIntyre, A., & Mueller, N. (2017). High-dimensional pixel composites from earth observation time series. *IEEE Transactions on Geoscience and Remote Sensing*, 55(11), 6254–6264.
 - https://github.com/GeoscienceAustralia/datacube-stats/tree/master/datacube_stats



~30 Year Water Observations from Space (WOfs)



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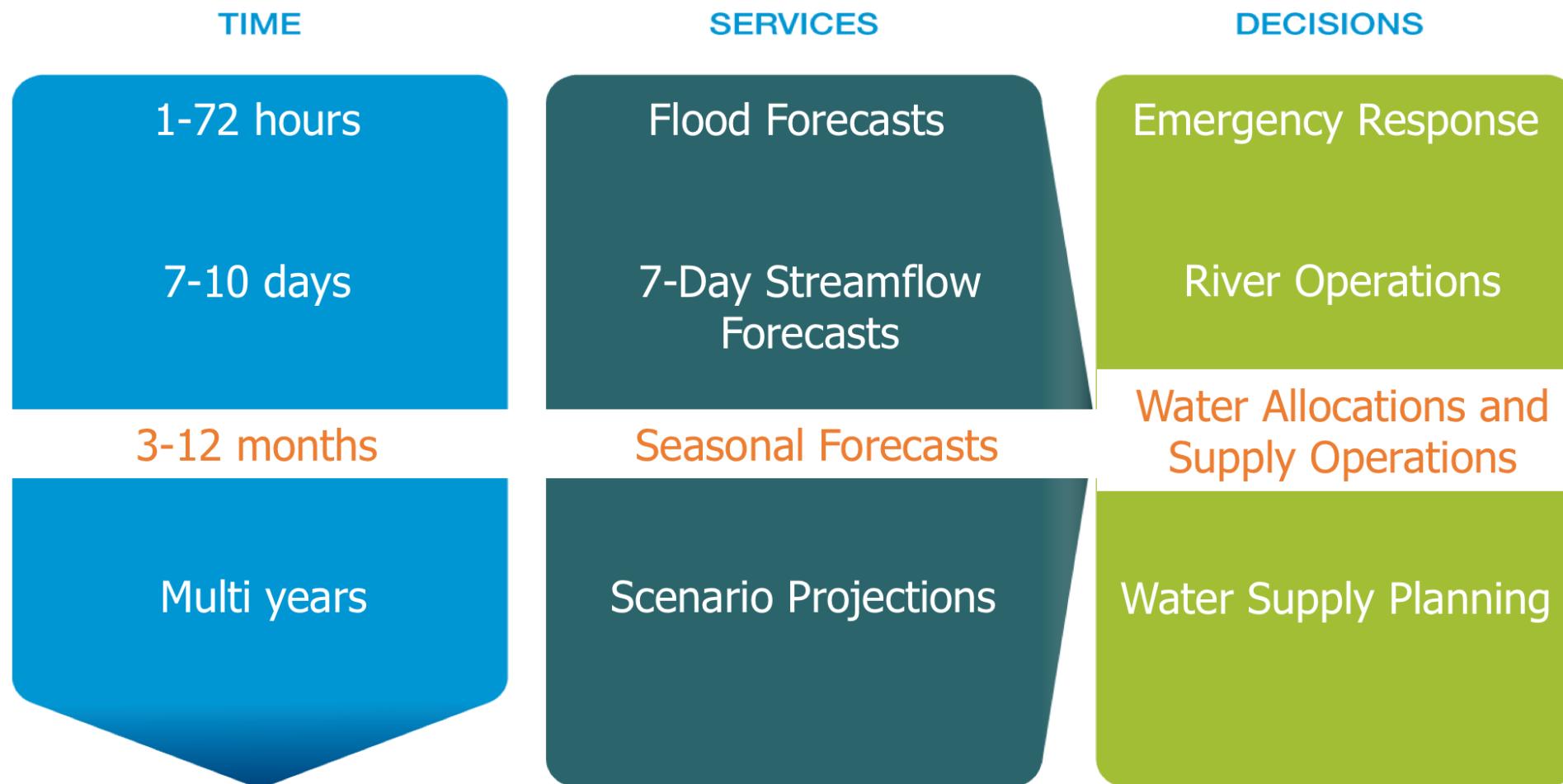
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Water forecasting services for Australia

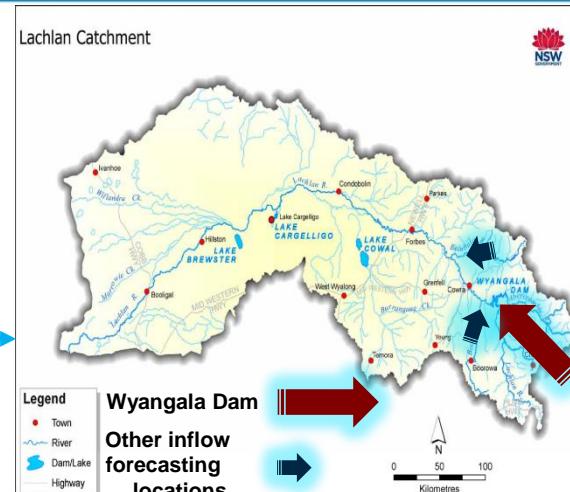
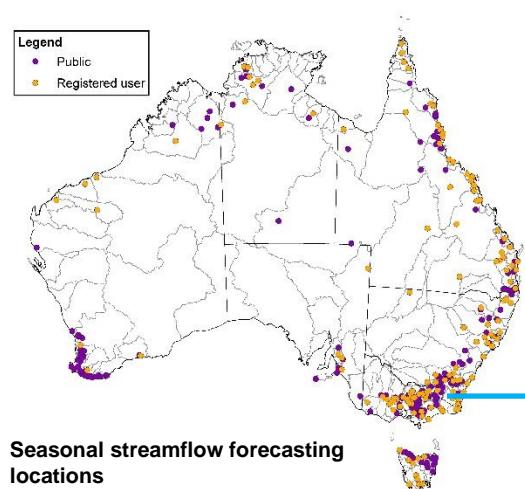
Bureau of Meteorology



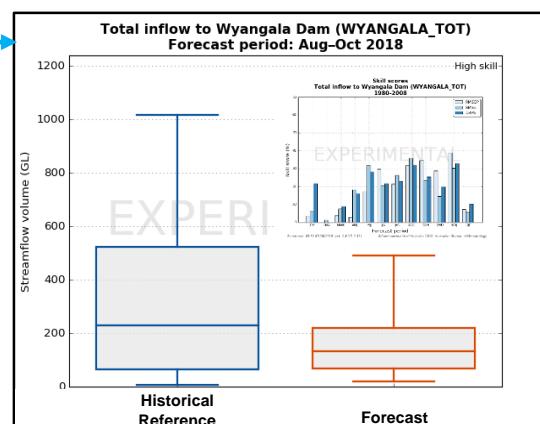
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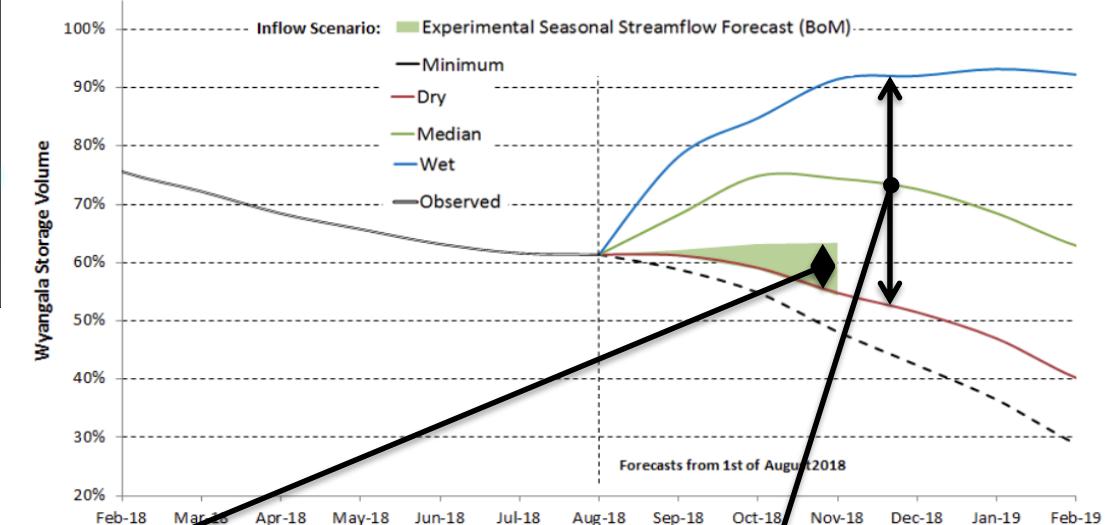
Water allocations and seasonal water forecasts



- Likely change in dam volume in 3 months
- Informed by likely dam inflows, current dam level, and likely water demand



Forecast Storage Volume



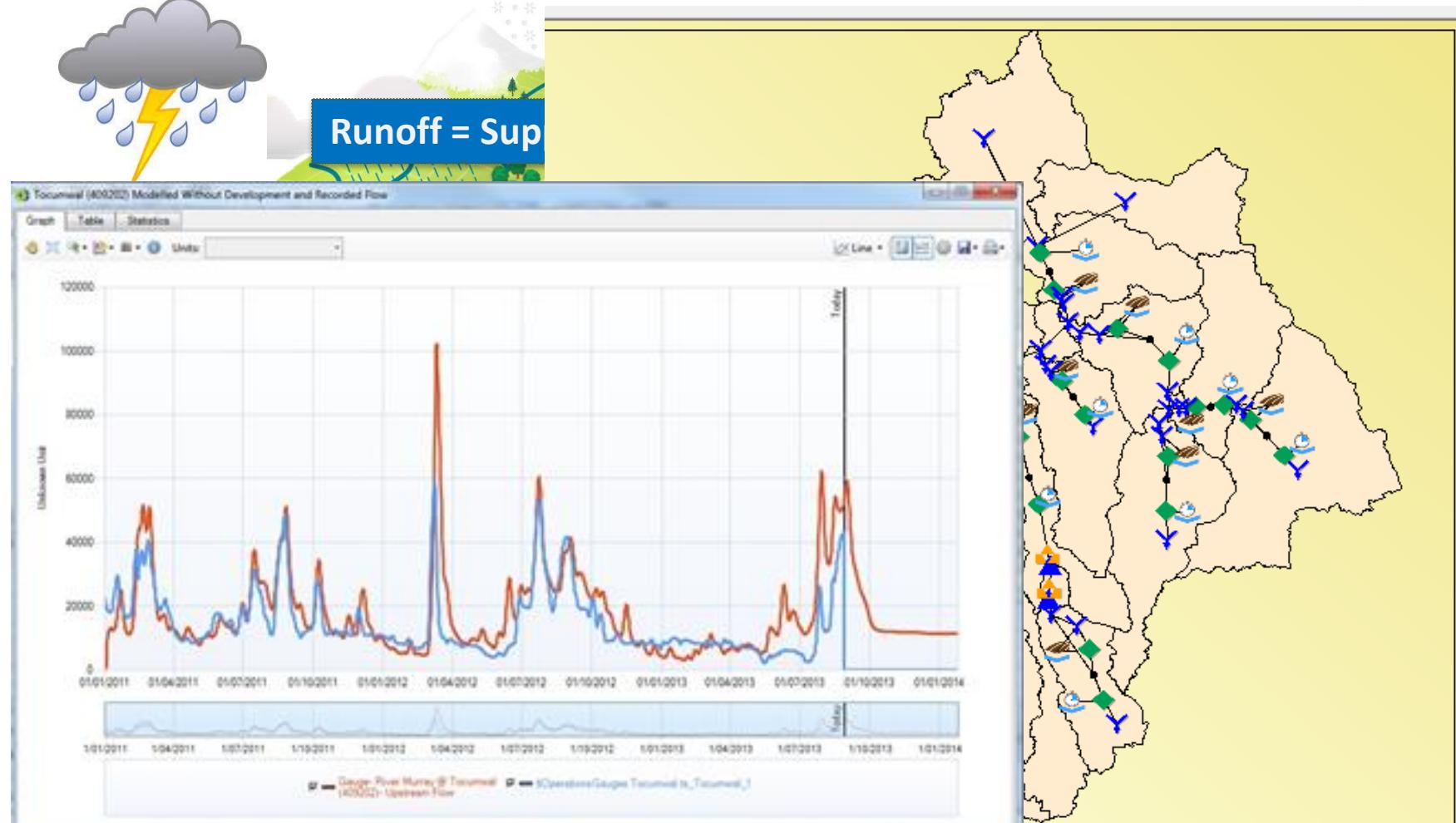
20%-80% percentile
BoM inflows

- Constrained by dam level & likely inflows

20%-80% percentile
Inflow Climatology

- Constrained by dam level only

eWater Source - Integrated supply and demand modeling of water quantity and quality from local to basin scale



TIES



TIES



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Australia's System of Entitlements and Allocations Recognises Water as an Asset

- A Water entitlement is a right to a share of the water available in the river system each year as a maximum volume of water that can be taken.
- Water has different levels of reliability depending on whether it is held in dams or dependent on local rainfall etc. These are generally divided into High Reliability (>90%) and Low Reliability (<90%)
- Users have different water 'products' that they can access depending on the type of needs (irrigators, cities etc).
- Each year, depending on the seasonal conditions, an annual allocation is made to each license holder as a percentage of the entitlement
- Some Allocations and Entitlements may be traded subject to regulations and approvals



Water Access in the River Basin by Entitlement Holders

Options

None Internal Spilling Allow Borrow above Target

Override Owner

Downstream State Owner False

Storage Ownership

Owner	Capacity Share %	Capacity ML	Initial Storage Share %	Initial Storage ML
Upstream State Owner	30	349500	30	349500
Downstream State Owner	70	815500	70	815500

“Owners” might include:

- **Jurisdictions:** States, Provinces etc.
- **Sources:** Surface, Groundwater, Desal, Recycled etc.
- **Sectors:** Hydropower, Irrigation, Urban, Environment etc.
- **Social/Political:** Social groupings, Economic Groupings

Policy is reflected in agreements between stakeholder groups which defines relative **Equity**

Water Account Holders and Shares of Available Water

KAS V1

- Upstream State Annual RAS
 - Upstream State Water Accounts
 - Irrigation
 - Industrial
 - Urban
 - Assess Each Time Step
 - Write off End of Year
- Downstream State Annual RAS
 - Downstream State Water Account
 - Irrigation
 - Industrial
 - Urban
 - Assess Each Time Step
 - Write Off End of Year

Accounts

Name	Account Host	Account Type	Unit Shares / Entitlement	ML	Initial Balance	ML
Irrigation	UpstreamIrrigators	Upstream State Water	100000		0	
Industrial	UpstreamIndustry	Upstream State Water	100000		0	
Urban	UpstreamUrbans	Upstream State Water	100000		0	

The 'user' who has the right to order water

The sector under which the user has the right

The share for this user as a portion of that available for the sector according to the agreements

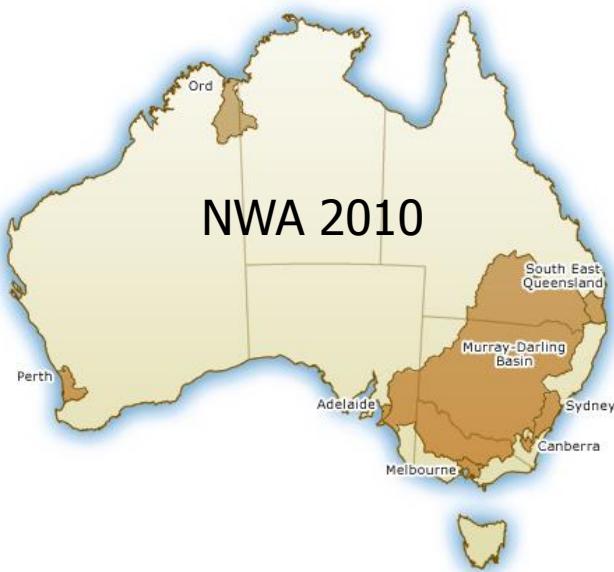
How to treat the 'Accounting' – rules like a financial system

Add Account Delete Account

 Annual Accounting provides sharing of water resources within a regulated river system on an annual cycle.

National Water Account

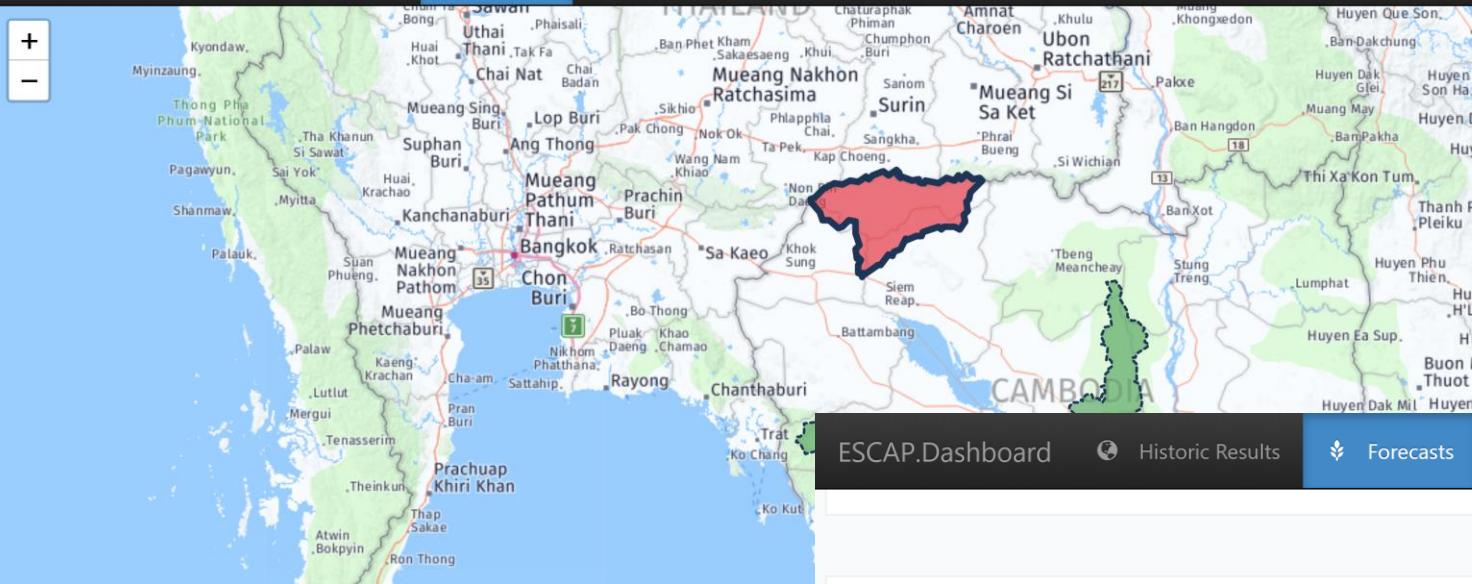
www.bom.gov.au/water/nwa



- Published online
- Input from many jurisdictional agencies

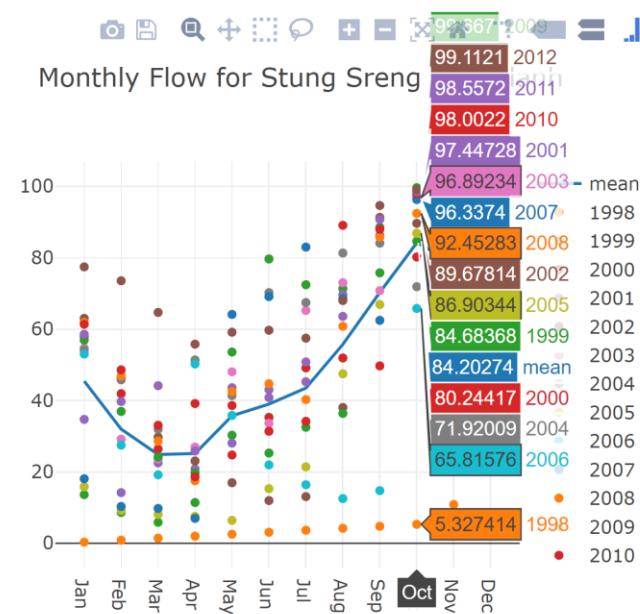
Physical Water Flow		
	Data Type	2010 ML
WATER INFLOWS		
Connected Surface Water Inflows		47,122,027
Groundwater Inflows		
15.1 Groundwater inflow from outside region		
15.1.1 Regional groundwater inflow	Estimated	2,578
15.1.2 Sea water intrusion into aquifers	Estimated	57
15.1.3 Other lumped groundwater inflow from outside region	Modelled	10,400
15.2 Groundwater recharge		
15.2.1 Diffuse groundwater recharge from landscape water	Modelled	1,753,711
15.2.2 Groundwater recharge from connected surface water	Modelled	204,390
15.2.6 Managed aquifer recharge	Measured	5,037
TOTAL Groundwater Inflows		1,976,173
		49,098,200
TOTAL WATER INFLOWS		
WATER OUTFLOWS		
Connected Surface Water Outflows		43,517,124
Groundwater Outflows		891,050
TOTAL WATER OUTFLOWS		44,408,174
Unaccounted-for difference		1,085,123
CHANGE IN WATER STORAGE		3,604,903
TOTAL WATER INFLOWS		49,098,200





Monthly Rainfall, PET, Flow and SPEI for subcatchments

Flow Rain PET SPEI



Monthly SPEI for Stung Sreng at Kralanh

Conclusions

- Investment in monitoring networks, quality assurance, data storage and management systems is important for successful implementation of advanced tools.
- However a blend of remote sensed information and ground-truthing can provide significant insights and guide investment choices through common format water accounts.
- Australia's WaterTools provide a robust scientifically defensible platform to test development scenarios and support sustainable policy from local to national scale.
- Come see us for live demos and lots more detail at “Australian Tools for Water Management” Friday 9am



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