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National Research FLAGSHIPS
Water for a Healthy Country
CSIRO

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Seasonal Streamflow Forecasts: Assisting decision-making in water resource management

Perkins J, Jayasuriya D, Peatey T, Plummer N, Robertson D, Schepen A, Shin D, Wang QJ, Zhou S, Hawksworth C

19 October 2011
APEC Climate Symposium 2011, Honolulu

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Presentation Outline

- Potential applications
- The current operational service
- User engagement and how it influenced our service
- Research and development
- Next steps and future developments

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Potential applications

- Integrating seasonal forecasts with River Operator and River Manager modelling suite
- Improving water allocation announcements in key irrigation basins
- Enhancing the decision making process for announcing and lifting urban water restrictions
- Optimising water trading between agencies (rural and urban) and moving water around the Victorian (in south-east Australia) Water Grid
- Improving management of environmental flows
- ... Need to understand how users make decisions and influence changes in decisions

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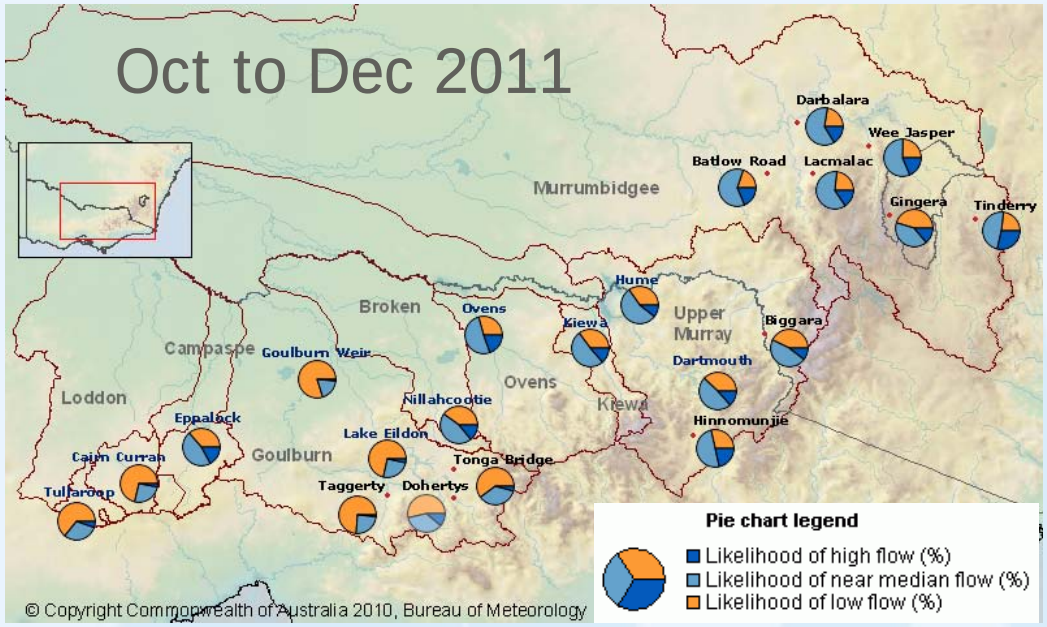
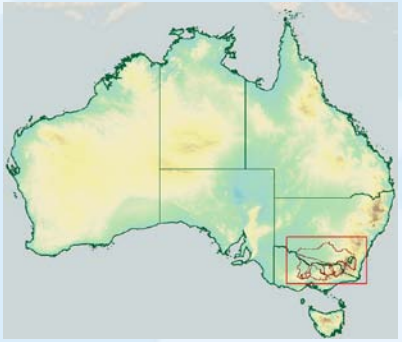
Operational Seasonal Streamflow Forecasts

- Started December 2010
- Initial target catchments in south east Murray-Darling Basin
  - 21 locations (8 storages)
- Public release via Bureau website
- Using CSIRO Bayesian Joint Probability Model
- Zero lead time 3 month forecasts
- Use statistical/dynamic modelling to extend nationally





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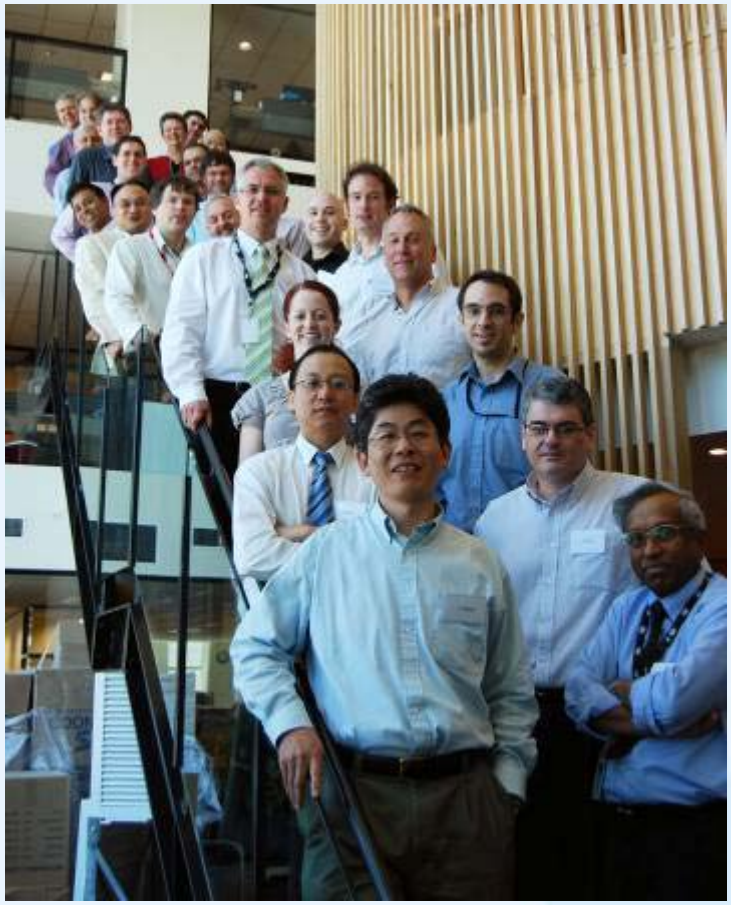
It started with stakeholder engagement



- Planning started in January 2009
  - Users, researchers, service providers
- Three workshops
  - Planning and requirements
  - Experimental products
  - Final product design
- Stakeholder meetings with over 20 agencies across Australia
- Experimental website starting December 2009

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Stakeholder influence
- two stage release of new sites and models

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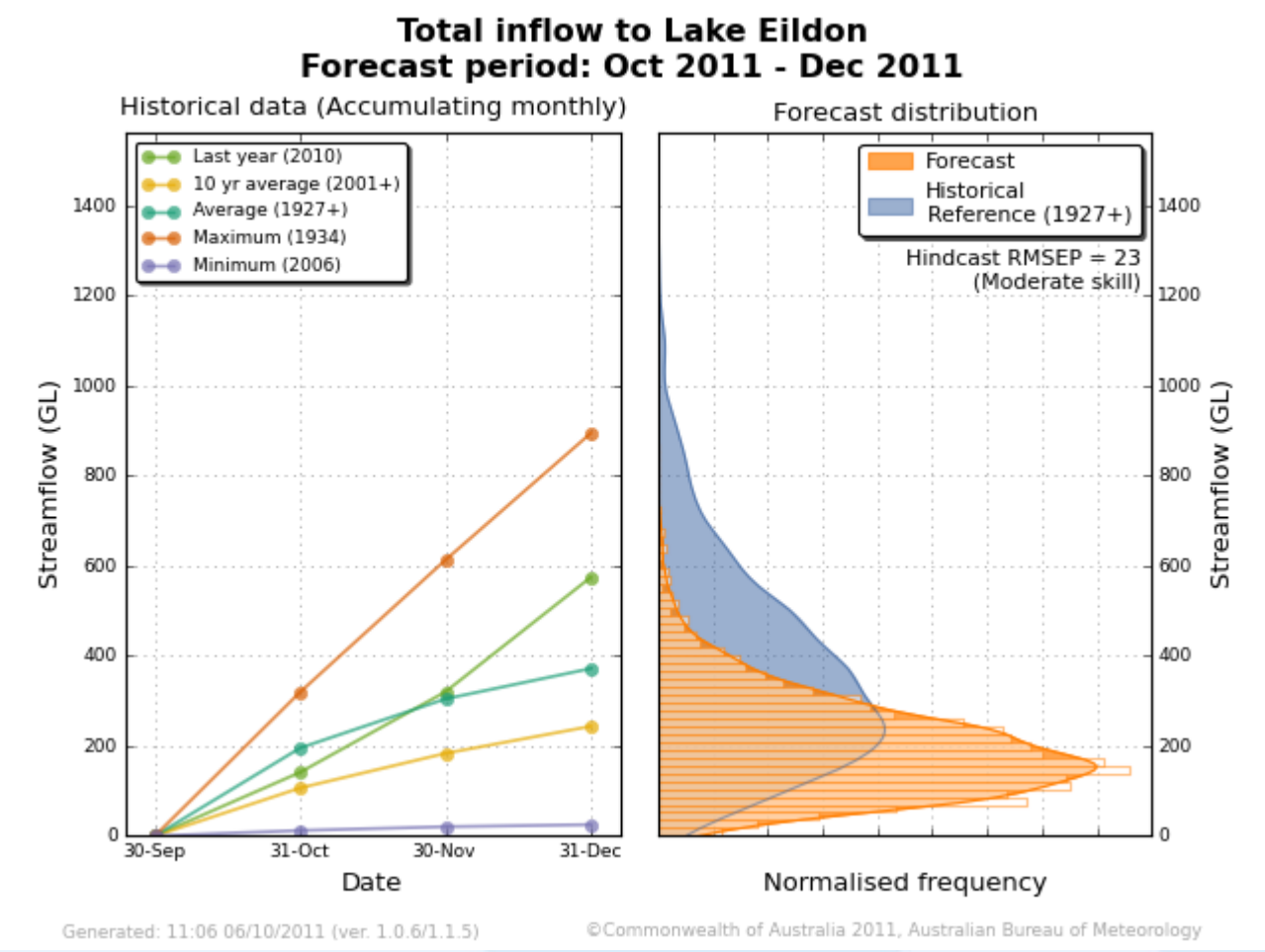
Stakeholder influence - product design



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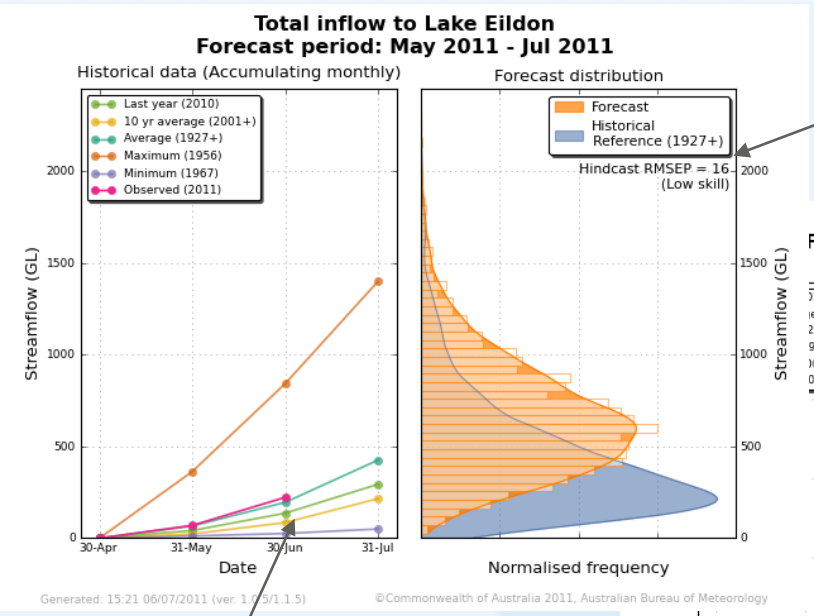
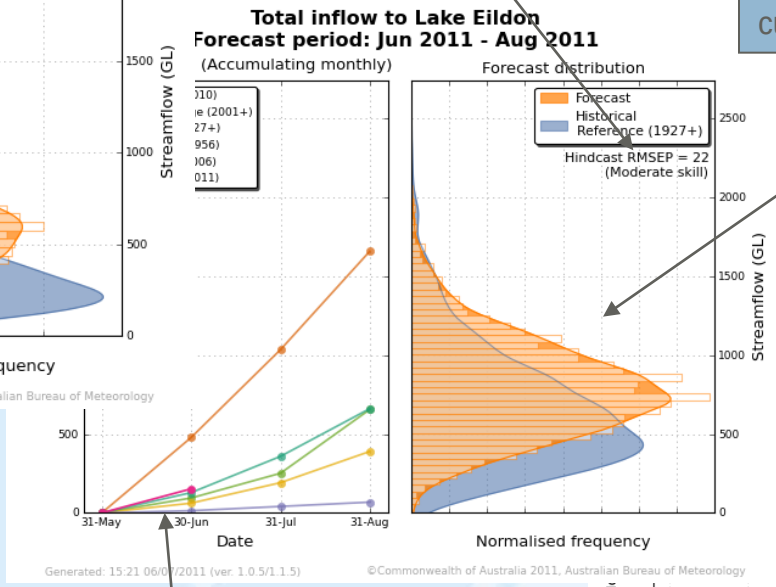
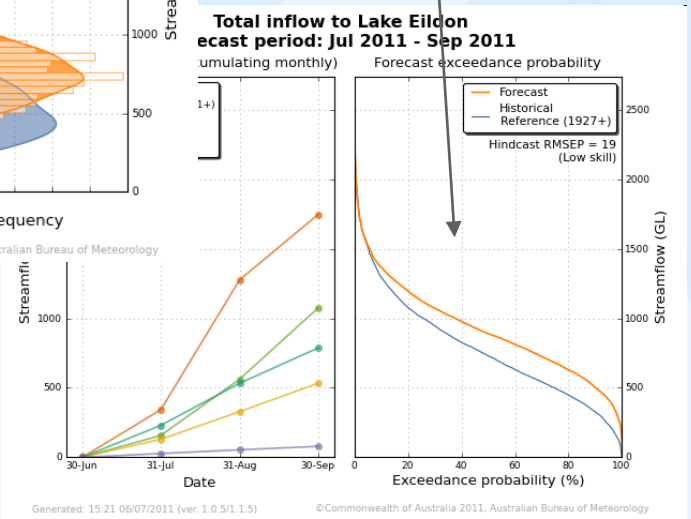
Stakeholder influence – product design



Include skill score

Visually compare forecast and historical probability distributions and exceedance probability curves





Historical analogues give context

Plot latest streamflow for verification

Stakeholder influence
- present and explain skill

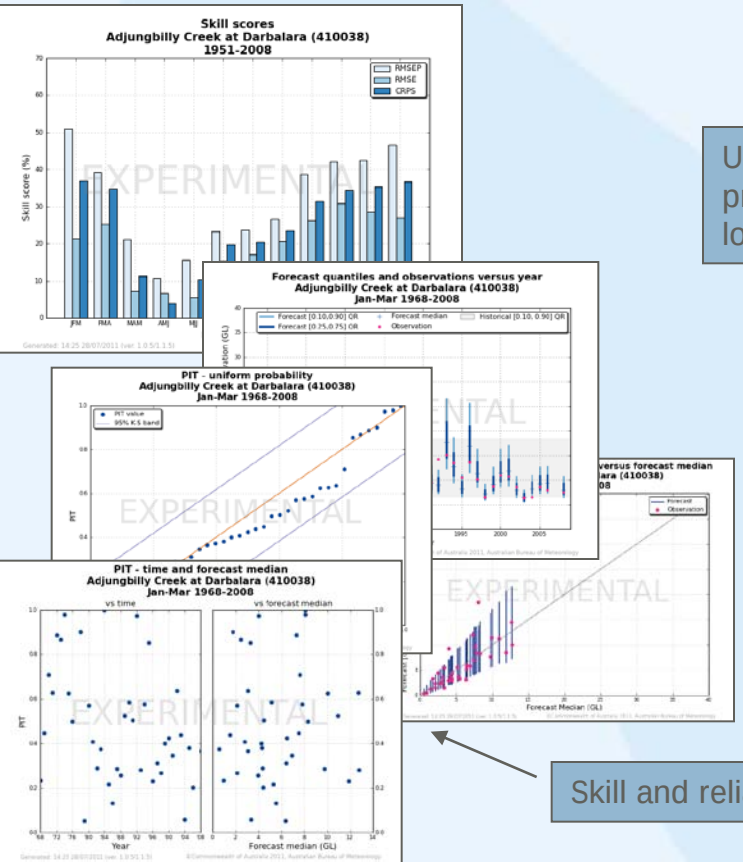
Moderate to high skill

Low skill

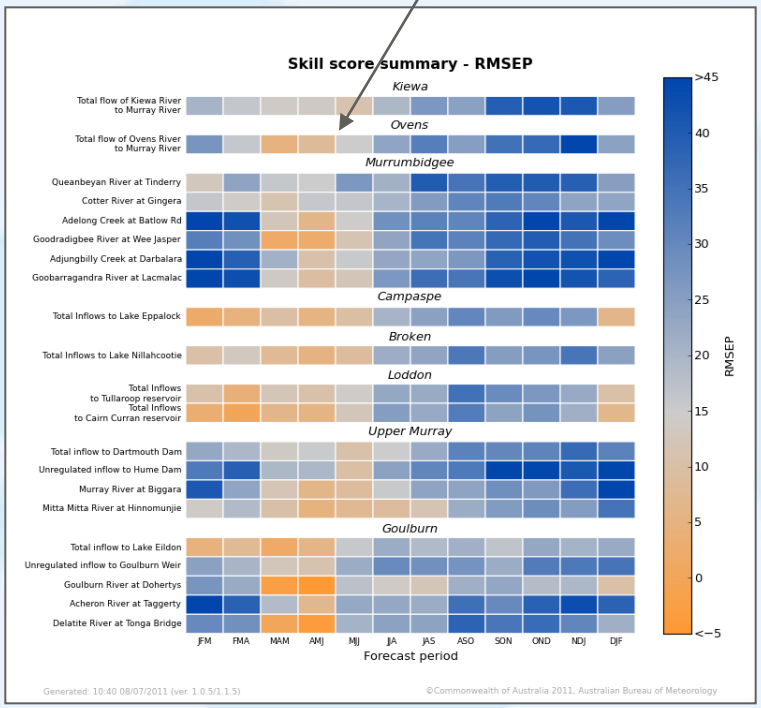
Very low skill (using historical probabilities)

Use historical probabilities for very low skill

Skill varies between months and sites



Skill and reliability are important



Stakeholder influence
- data behind the products

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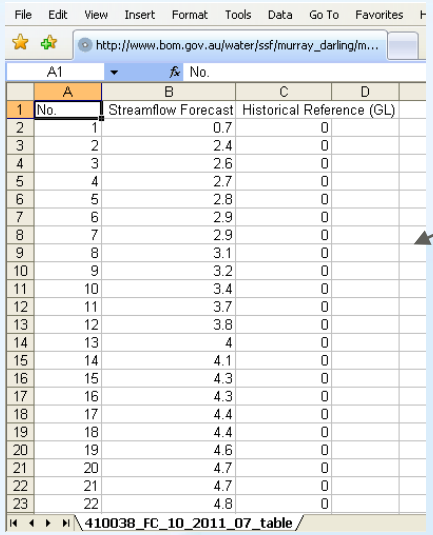
Historical Observations					
	Average (1967+) (GL)	Last year (2010) (GL)	Minimum (2006) (GL)	10 yr average (2001+) (GL)	Maximum (1974) (GL)
Jul	11.8	9.4	1.7	4.9	28.4
Jul-Aug	25.9	25.9	3.1	11.9	60.1
Jul-Sep	38.9	44.5	4.1	19.7	91.9

Basic statistics

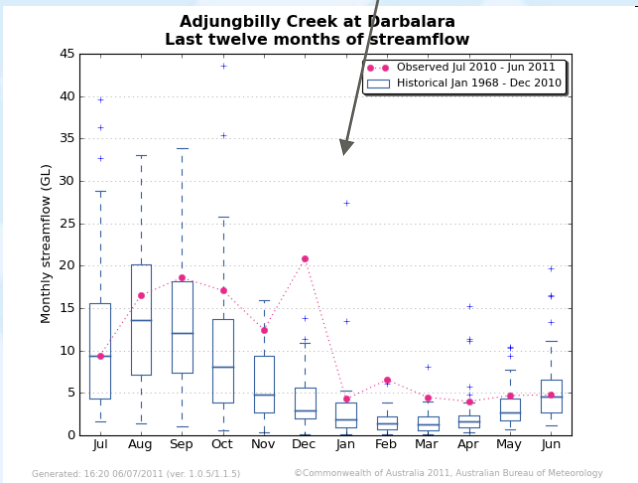
Basic Statistics		
	Streamflow Forecast (3 month total flow in GL)	Historical Reference (3 month total flow in GL)
25% Quartile	21.3	20.9
Median	30.8	35.0
Mean	34.9	38.8
75% Quartile	44.4	52.4
Interquartile Range	23.2	31.4



No.	Streamflow Forecast	Historical Reference (GL)
1	0.7	0
2	2.4	0
3	2.6	0
4	2.7	0
5	2.8	0
6	2.9	0
7	2.9	0
8	3.1	0
9	3.2	0
10	3.4	0
11	3.7	0
12	3.8	0
13	4	0
14	4.1	0
15	4.3	0
16	4.3	0
17	4.4	0
18	4.4	0
19	4.6	0
20	4.7	0
21	4.7	0
22	4.8	0

All ensemble members for input to other models

Trends in streamflow



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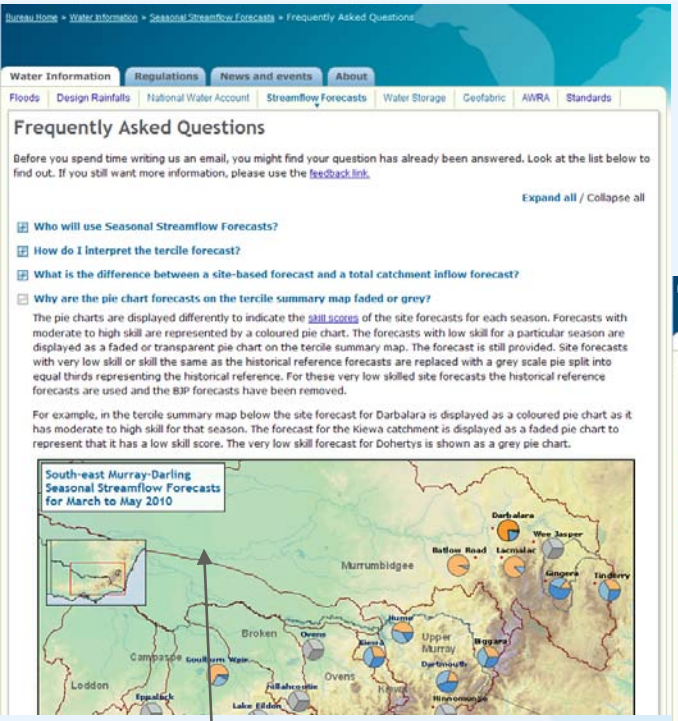
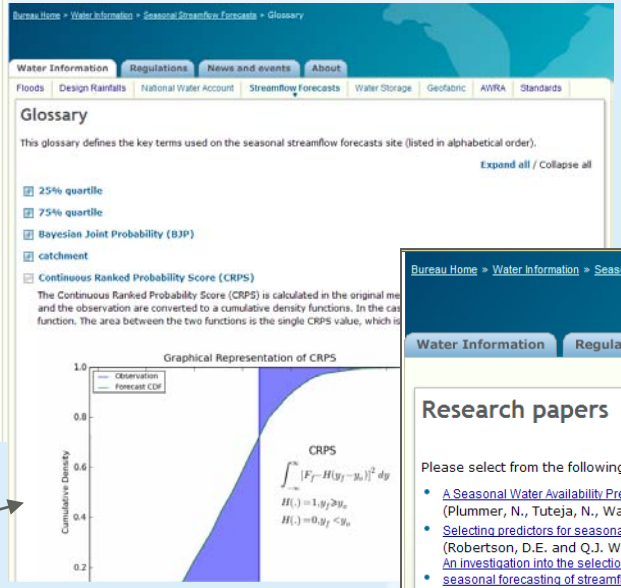
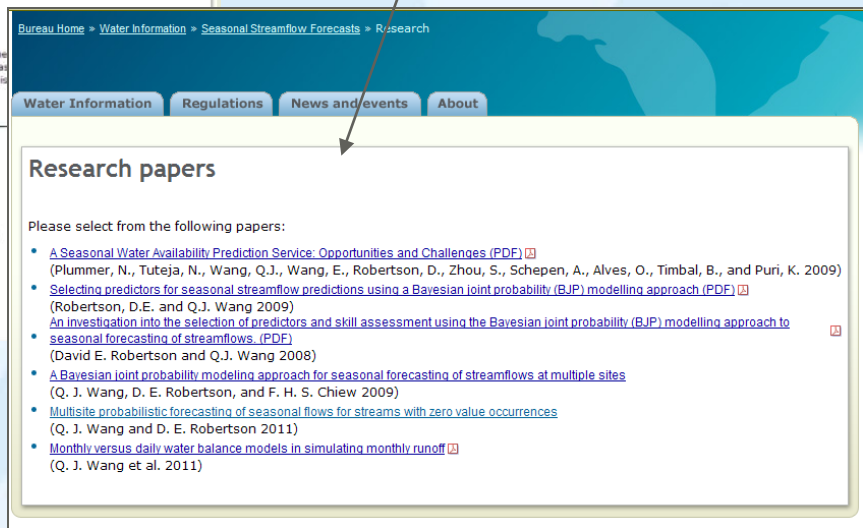
Stakeholder influence
- increase understanding with support information







Service backed by peer reviewed research

Break down the complexity

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Built on quality research and science

- Through WIRADA (Water Information Research and Development Alliance, with CSIRO):
  - CSIRO's Statistical Bayesian Joint Probability (BJP) approach
  - Downscaling climate inputs from global climate model to hydrological model
  - Dynamic hydrological modelling approach
  - Statistical-dynamical approaches
  - Improved climate predictions from the POAMA (Predictive Ocean Atmosphere Model for Australia) seasonal climate forecasts
- BATEA Uncertainty analysis (with University of Newcastle)

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Next steps and future developments

- Service extension and development
  - Releasing 15 new sites on public website in November
  - Extend to more sites using hybrid dynamic/statistical in 2012
    - BJP/POAMA/WAPABA – monthly timestep water balance model
  - September 2012: Pilot monthly and 3-monthly forecasts from daily time step dynamic modelling
  - June 2013: Operational seasonal forecasts from blended statistical/dynamic
  - Aim to have seamless integration at user/products interface

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Thank you

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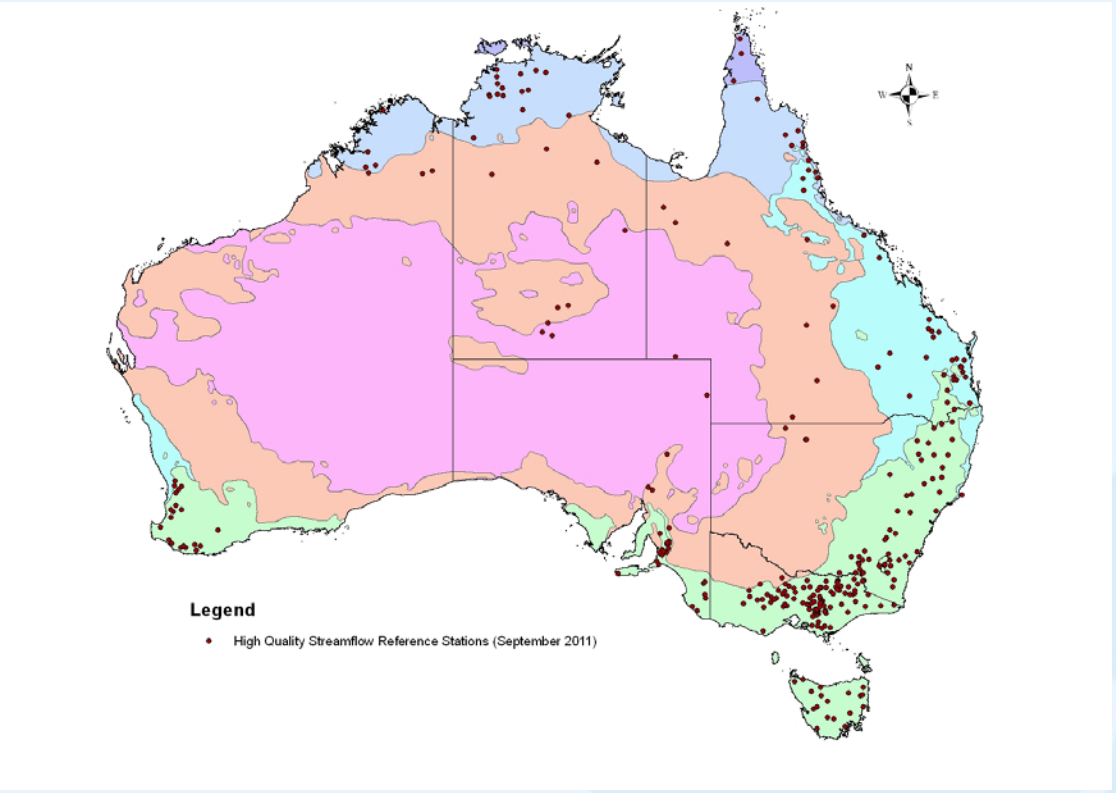
Stakeholder influence
- site selection and extension



HQSRS Sites overlaid on climate zones

- Leveraging the stakeholder engagement for the High Quality Streamflow Reference Stations project
- Finding new test sites have less skill than existing operational sites
  - Less catchment memory
  - Need better forecast rainfall
- Targeting high quality sites upstream of storages
- Careful release based on skill and need

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