

Towards timelier, sub-seasonal to seasonal streamflow forecasts in Australia to better meet user needs

2016 HEPEX Workshop

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Seasonal streamflow forecasting in Australia

Seasonal Streamflow Forecasts

Date: May–July 2016

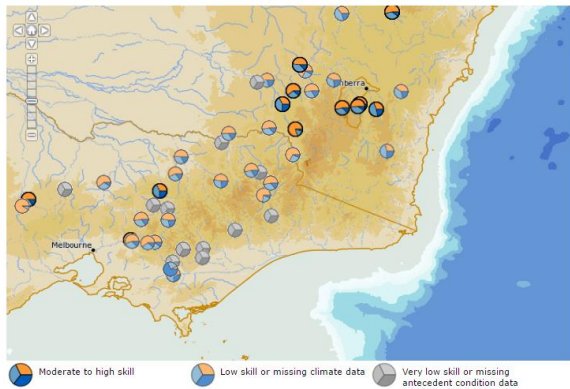
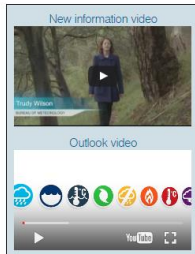
- Low streamflows more likely for May–July
- Low flows observed at over three quarters of locations in April
- El Niño enters its final weeks.

Streamflow forecast for May–July

For May to July 2016, low streamflows are more likely at 74 locations across Australia. Near-median flows are more likely at 21 locations and high flows at three. There is low to very low forecast skill for many locations across Australia. Locations with high skill are generally in northern parts of the country. Due to very low model skill or missing observation data, forecasts have not been issued for 42 locations. We suggest using the observed climatology for these locations.

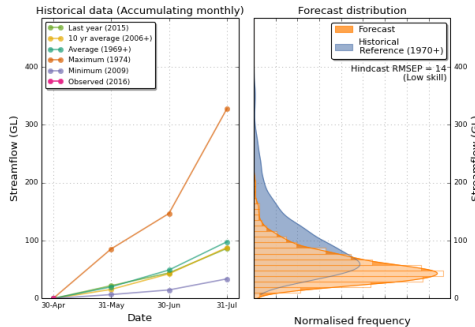
Use the map below to zoom and pan to view the forecast locations. Zoom in to view pie chart tercile forecasts, and then click on a pie chart to go directly to the latest forecast.

Notes: The locations on the map are either [site-based forecasts](#) or [total catchment inflow forecasts](#). [Site information](#) provides details on which locations are site-based or total inflow forecasts. For more details about how the pie chart forecasts are displayed go to the [Frequently Asked Questions](#).



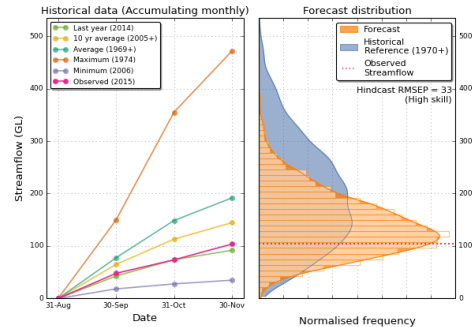
www.bom.gov.au/water/ssf

Murray River at Biggara (401012) Forecast period: May–Jul 2016



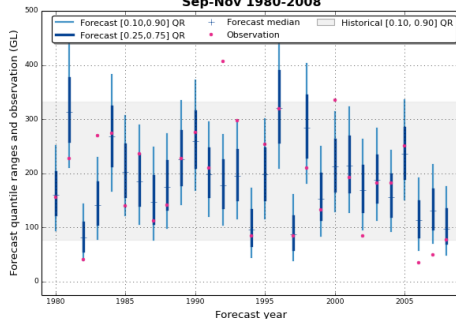
Generated: 17:15 06/05/2016 (ver. 2.1.2/1.8) ©Commonwealth of Australia 2016, Australian Bureau of Meteorology

Murray River at Biggara (401012) Forecast period: Sep–Nov 2015



Generated: 17:14 06/05/2016 (ver. 2.1.2/1.8) ©Commonwealth of Australia 2016, Australian Bureau of Meteorology

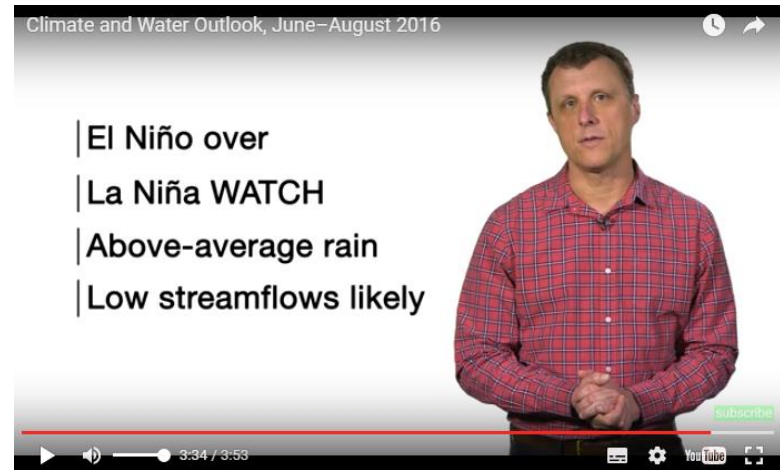
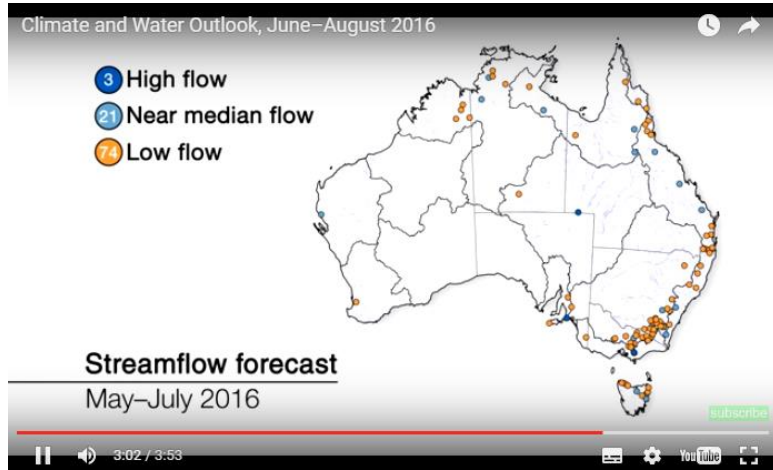
Forecast quantiles and observations versus year Murray River at Biggara (401012) Sep–Nov 1980–2008



Generated: 17:15 06/05/2016 (ver. 2.1.2/1.8) ©Commonwealth of Australia 2016, Australian Bureau of Meteorology

Exceedance Probability		Exceedance Probability	
Exceedance Prob. of Streamflow (%)	Streamflow Forecast (3 month total flow in GL)	Historical Reference (3 month total flow in GL)	
1	161.494	338.487	
2	142.118	273.426	
3	126.375	251.403	
4	117.245	234.592	
5	112.210	222.830	
6	107.652	207.404	
7	104.072	197.145	
8	99.977	187.965	
9	97.264	179.173	
10	94.524	172.793	
11	92.205	167.637	
12	89.310	162.083	
13	86.908	157.960	
14	85.443	153.905	
15	83.800	149.530	

Seasonal streamflow forecasting in Australia



www.bom.gov.au/water/ssf
www.bom.gov.au/climate/ahead

Upgrading the service to better meet user needs

- Sub-seasonal forecasts
 - Forecast in the first month
 - Monthly breakdown
- Timelier forecast release
 - Forecasts currently released at least 7 days late

The Bayesian joint probability (BJP) modelling approach

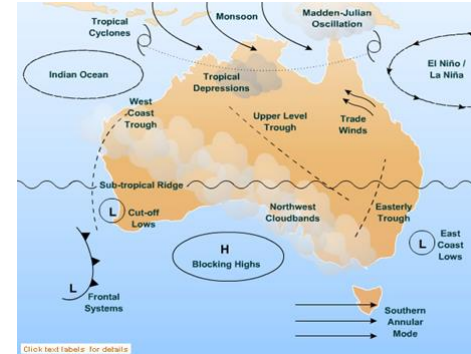
- Catchment + climate predictors → Streamflow predictands

- **Issues**

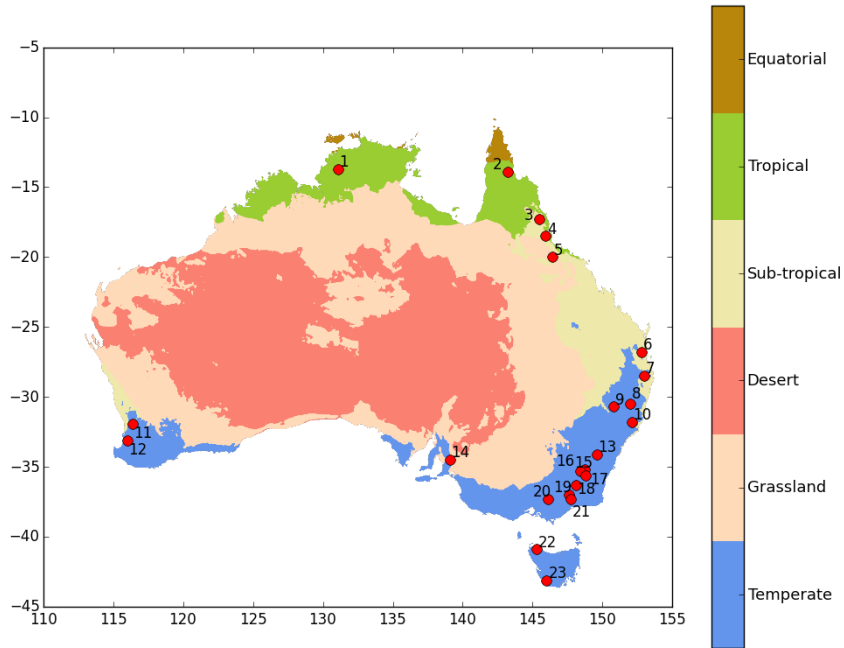
- Heteroscedasticity
- Zero value
- Data

- **The BJP solution**

- Transformations
- Censored data
- A joint probability model, with Bayesian inference



The BJP approach can be used to produce sub-seasonal and timelier forecasts



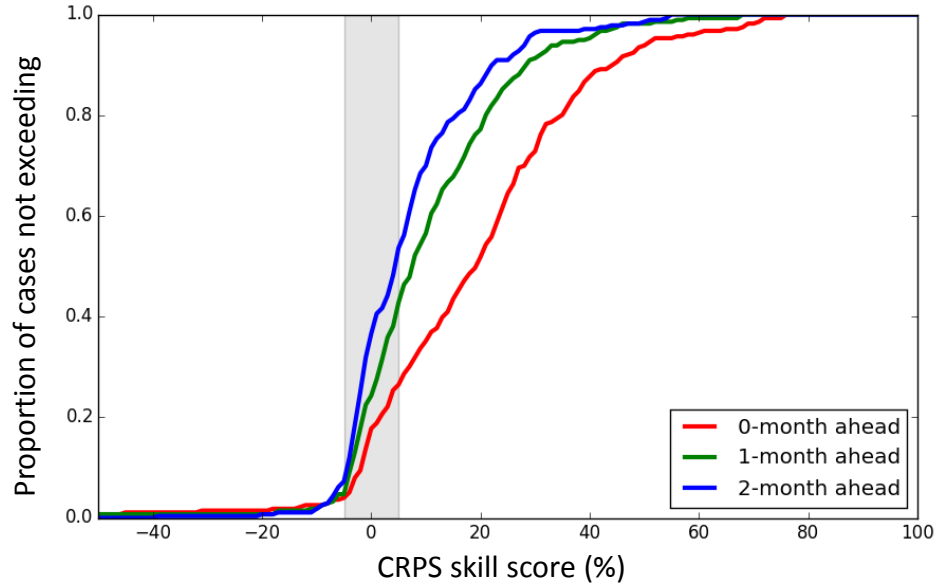
- 23 catchments
- Leave-five-years-out cross-validation
- 1982-2011

Sub-seasonal to seasonal forecasts

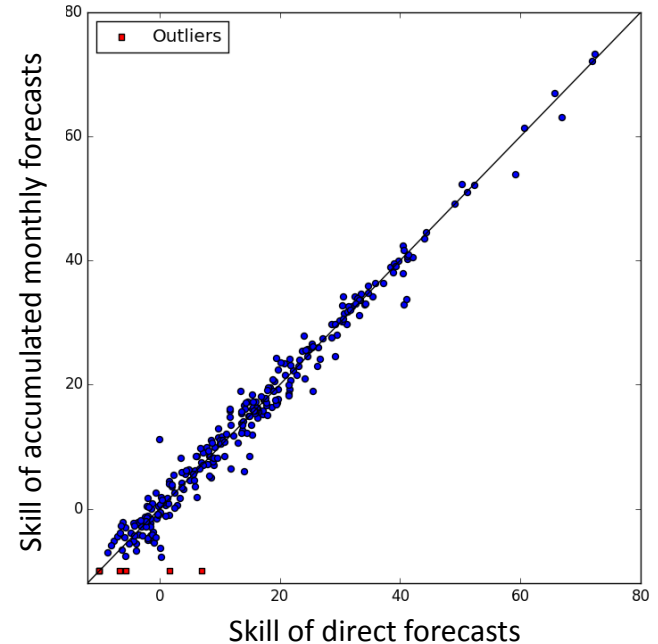
- We can take advantage of BJP to:
 - Jointly forecast several months ahead
 - Obtain ensemble time series output
- Monthly forecasts can be accumulated to seasonal totals

Skill of sub-seasonal to seasonal forecasts

Monthly skill

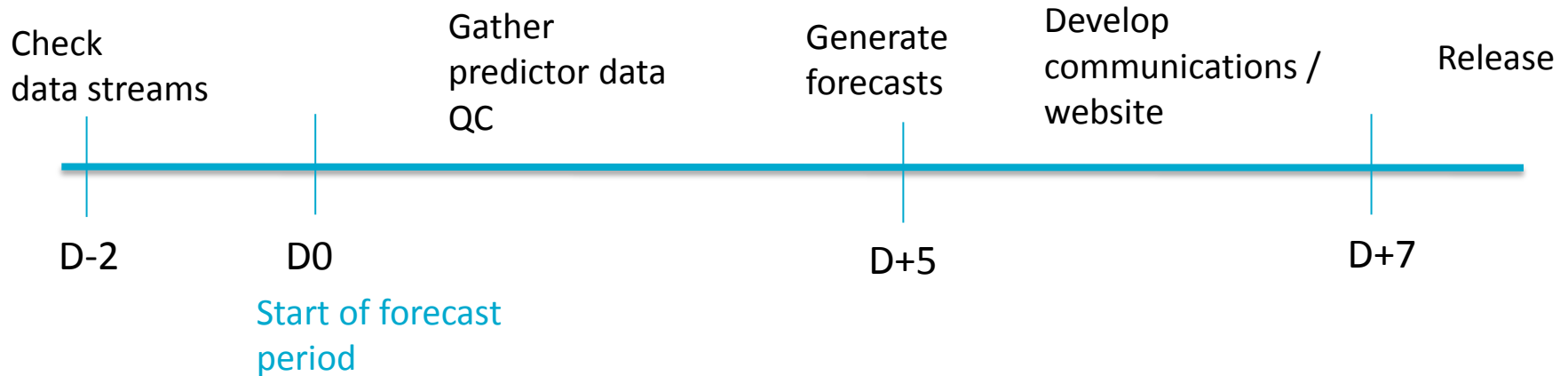


Seasonal skill



Current forecast release process

- Current BJP models rely on delayed monthly data sets
- 0-month lead time forecasts

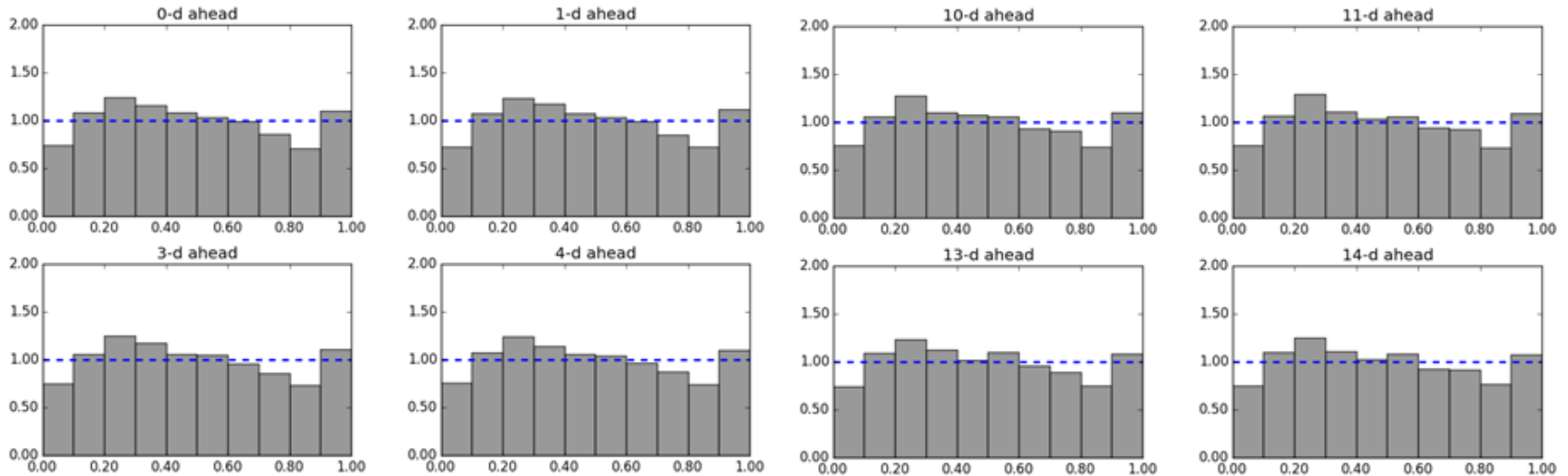


How to release timelier forecasts?

- Allow for N-day lead forecasts
- Establish predictors using 28-day sliding windows
- Derive streamflow and climate predictors from daily data

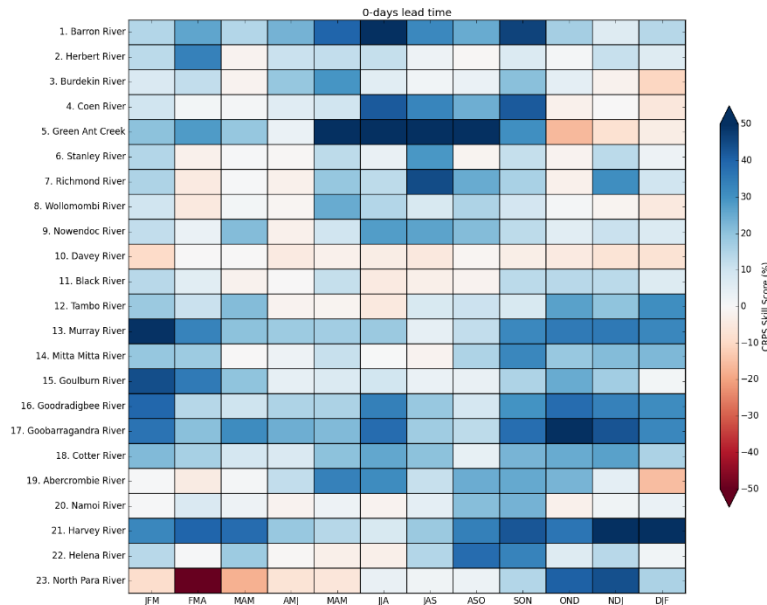
Reliability of timelier forecasts

Reliability with lead time

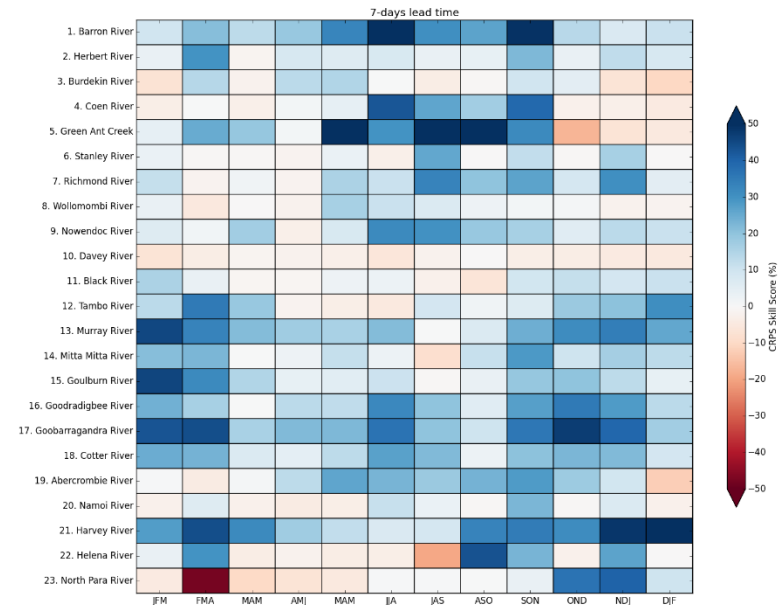


Skill of timelier forecasts

0-days lead time

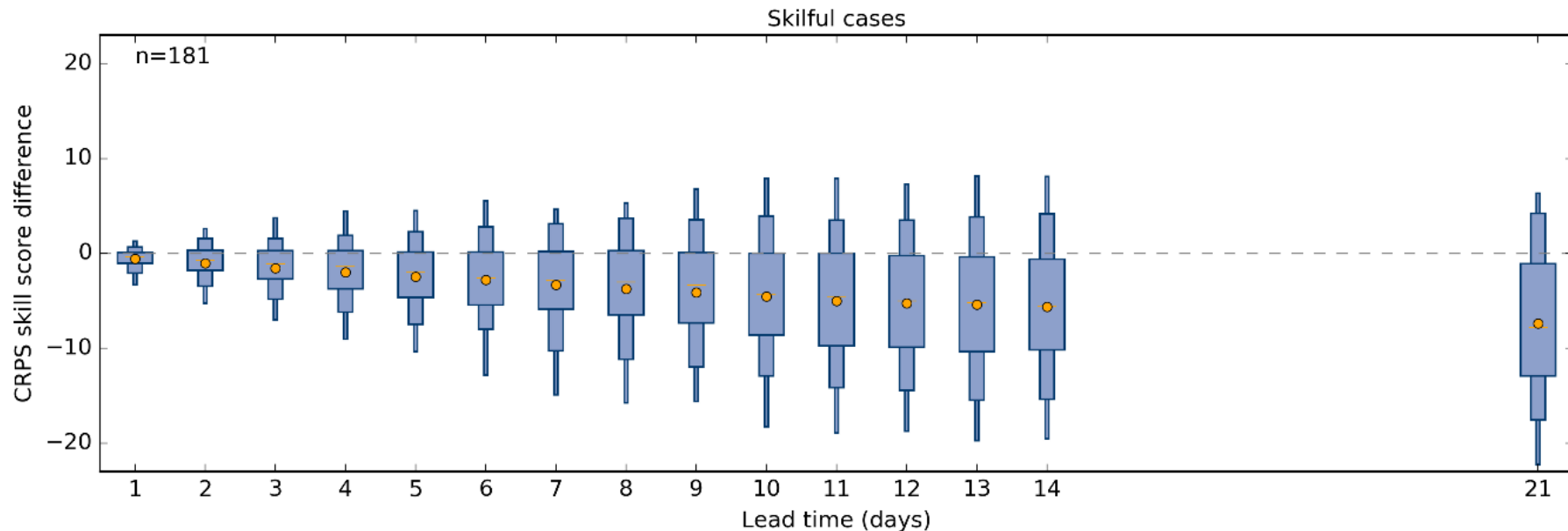


7-days lead time



Skill of timelier forecasts

Change in CRPS skill score as lead time increases



What is the optimal forecast lead time?

- The forecast release schedule should allow for:
 - Forecast preparation
 - Communication
 - User comprehension and use
- The N-days lead time system will allow flexibility

Conclusion

- The BJP model is robust for producing sub-seasonal forecasts
 - Ensemble time series forecasts
 - Seasonal forecasts through accumulations
- Timelier forecasts are possible
 - Use only daily streamflow and SST
 - Reliability is maintained
 - Small-moderate reductions in skill over 1-2 weeks
- Likely to transfer to operations through 2017

Thank you

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