

Predictability of Spring warmups, snowmelt and streamflow peaks in western United States

Prospects for the use of CDC Reforecast Ensembles

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Acknowledgments: Klaus Weickmann, Jeff Whitaker

Ongoing work

- Appropriate analog space (spatial domain, variables)
- Downscaled analogs (basin-specific sensitivity to ensemble forecast spread)
- Efficient web-implementation of the methodology (grid point, basin scale)
- Streamflow ensembles: Integration with other relevant observations (snowpack etc.)

Motivating context

Reservoir Operations and Springtime snowmelt in the West

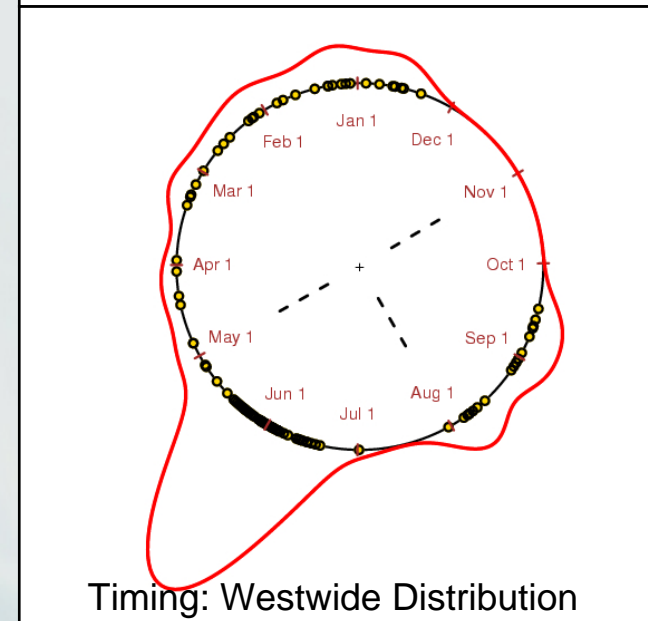
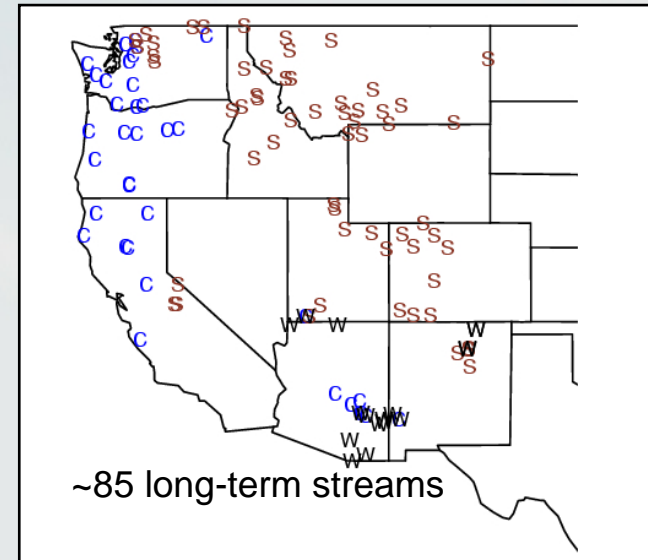
- Flood control related drawdown
- Issues related to rapid drawdown
 - Water Quality and ecosystems concerns
 - Riverbank stability and landslide risk
 - Loss of hydropower revenues
- Fish movement and emigration
- Adapted Rule Curves: Refill targets and storage

Western U.S. Hydrology:

Nature and Timing Streamflow peaks

- Three key seasons for streamflow peaks/floods (3-day maximum)
 - Cold Season
 - Spring/Summer
 - Warm Season (late-summer/fall)
- April-June Snowmelt and Weather: Key period for reservoir management
- Predictability of large-scale warmup episodes?

Timing of Flooding Peaks



Springtime Weather and Medium-range forecasts

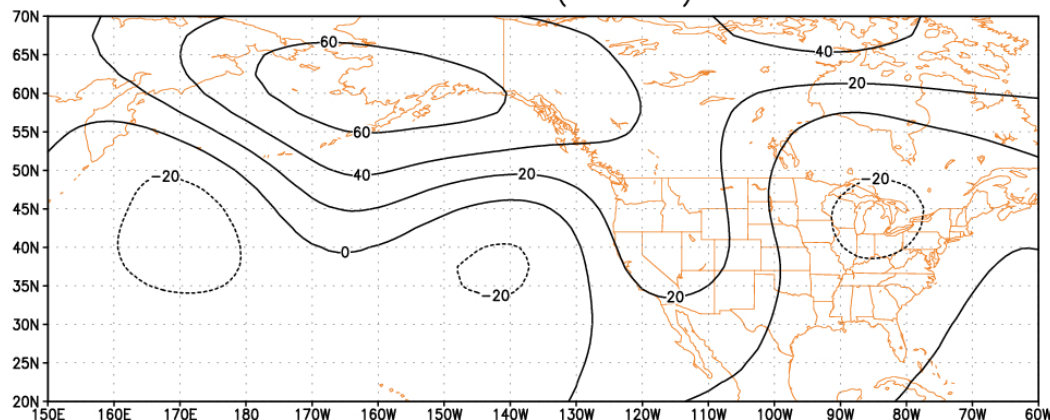
- Key large-scale patterns associated with warmups
- Predictability of large-scale warmup episodes?
- For select threshold/cases, assess the forecast system behavior during Spring
- CDC Reforecast Experiment/Forecast Archive
 - Tom Hamill and Jeff Whitaker Talk
 - 7-day forecast (ensemble mean; 1979-2004)
 - Area average Western US regional index

Large-scale Patterns

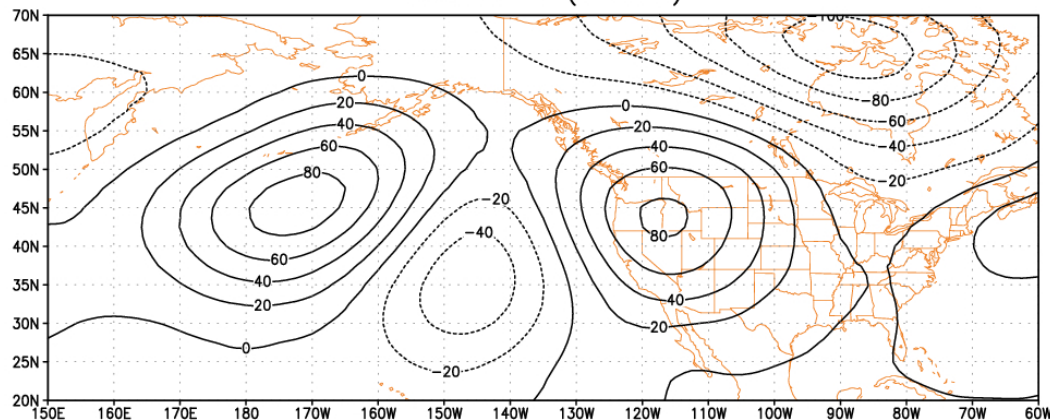
- 3 K-means clusters (922 cases)
- Warmups in observations (Regional Z500 index > 5720 m;
- Approx. 276K at 700mb (~10000 feet elevation)
- Percent of 7-day forecasts Z500 index > 5720m

Cluster 1	Cluster 2	Cluster 3
42%	31%	31%

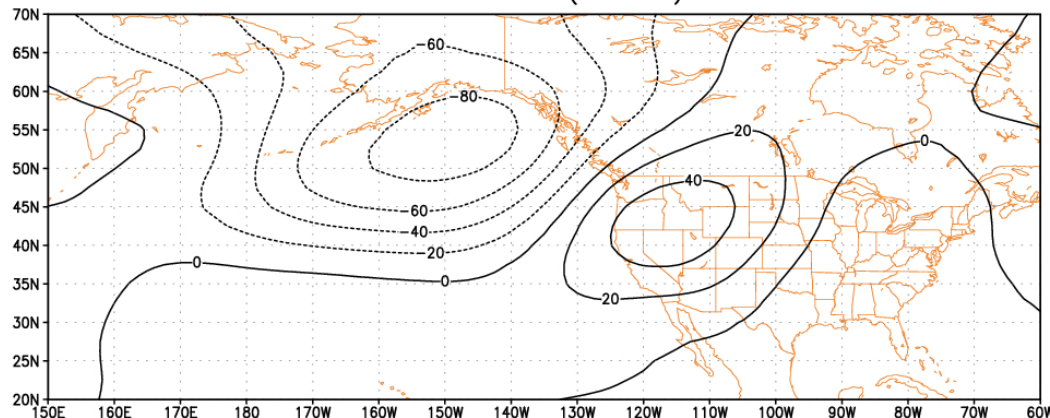
Cluster 1 (36.22%)



Cluster 2 (24.3%)



Cluster 3 (39.4%)



Corrected Analog forecasts for 2002-2004 period

- Analogs picked from the forecast archive of area-averaged western US Index
- Analogs based on the large-scale Z500 pattern similarity, with a further sub-sampling for area-average western US Index
- For 2002-2004 period, $n=273$ (all 7-day forecasts, for April 2-June 30 period)
- Analog selection from 1979-2001 forecasts.
- Methods competitive for Z500 Index > 5720 (Brier Skill Scores)
- Detailed assessment of analog forecast attributes

Web-implementation

<http://www.cdc.noaa.gov/ensemble/>



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CDC Ensemble Forecast Spread

Generate CDC ensemble forecast plot of surface air temperature or precipitation. Plots depict the 1-14 day forecasts from the Medium-Range Forecast (MRF) Model (run daily at CDC in Boulder, CO), emphasizing the spread of the 15 forecast runs. Typically, the most recent forecast available will be from the previous day.

Choose the forecast variable, initial date and location desired:

Variable desired:

☒ Surface Air Temperature ☐

Initial date:

☒ Most recent forecast available.
☐ Second most recent forecast.

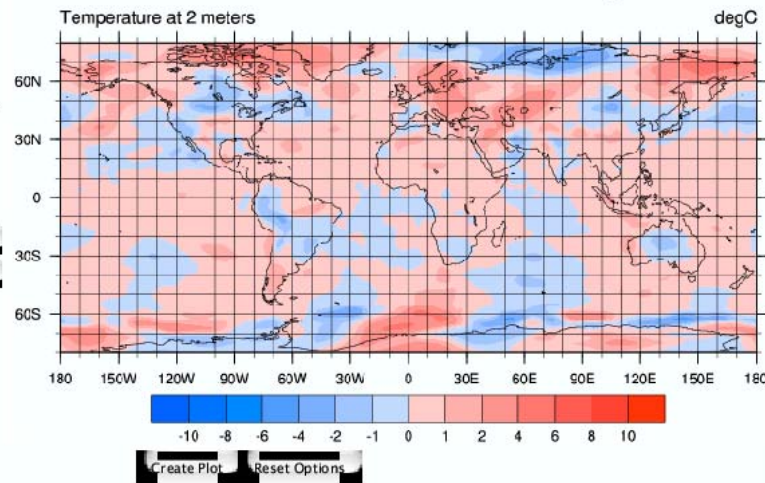
Input Location:

Longitude: or -105.0

Latitude: or 40.0

(Refer to map at right)

Forecast Anomalies: 26 Jul 2005 thru 01 Aug 2005



[NOAA-CIRES Climate Diagnostics Center](#)

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Updated: Apr 12, 2005 11:51:24 MDT

<http://www.cdc.noaa.gov/ensemble/index.html>

CDC Ensemble: Forecast Spread

Date submitted: Jul 19, 2005 07:22 MDT

Number of Runs: 15

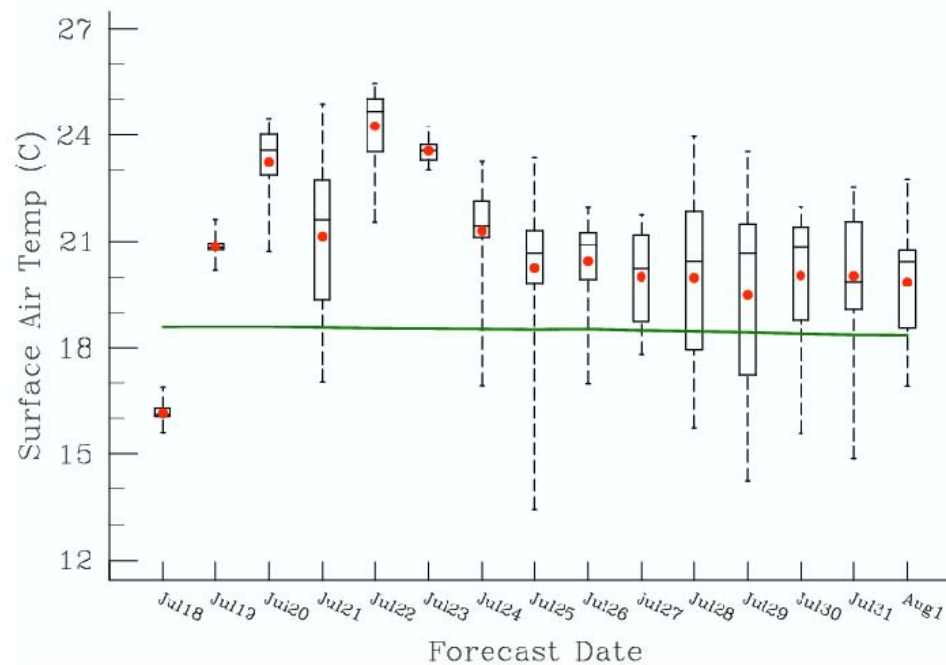
Longitude Location: -105.0

Latitude Location: 40.0

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CDC Ensemble Forecasts from Jul18 00Z



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