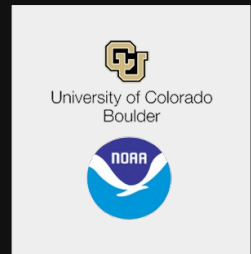


# Cool-Season Precipitation Forecasts Across CONUS and the West

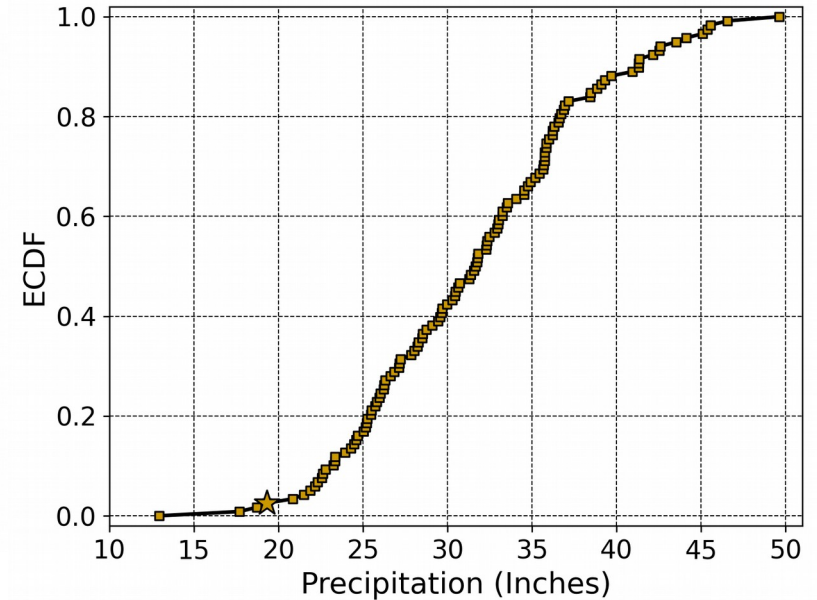
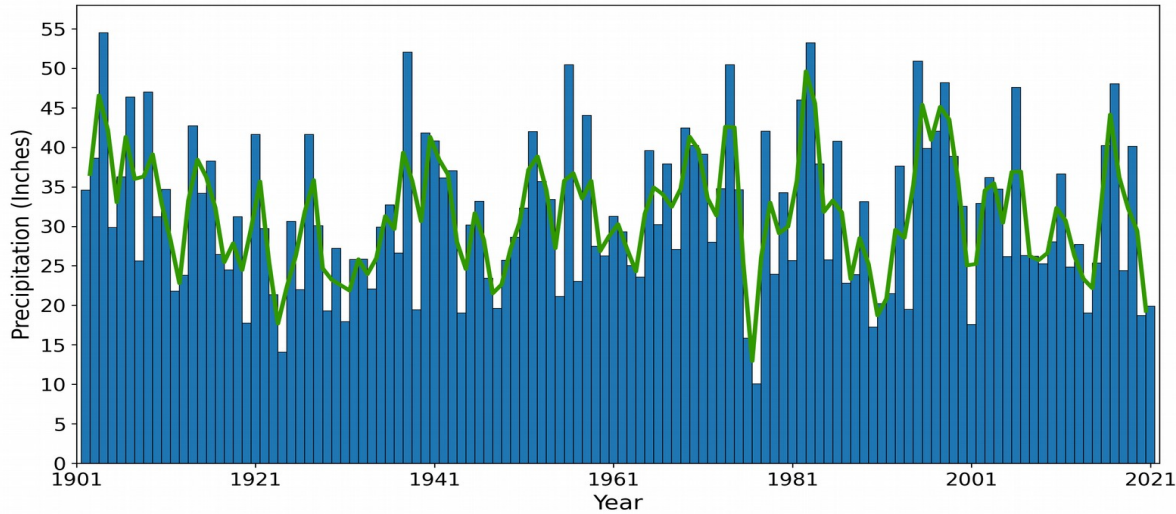
WOW - November 17, 2021

Matt Switanek



# How do the last couple of years compare?

Average November-March precipitation in:  
1) Klamath-Northern California Coastal,  
2) Sacramento,



# What do I aim to accomplish?

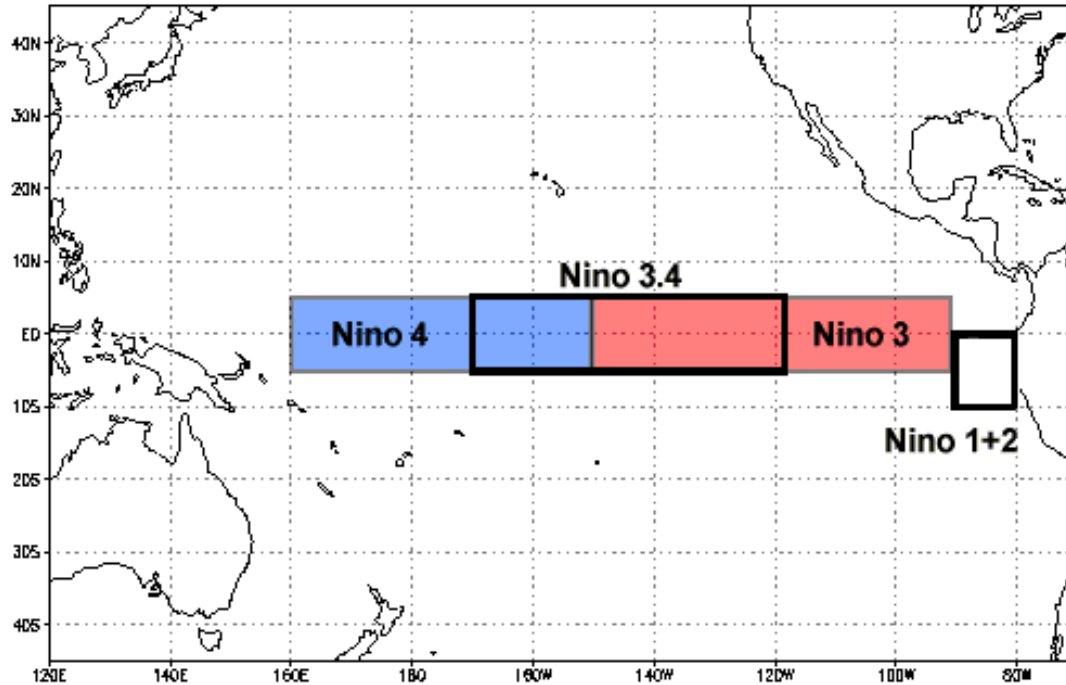
- Produce skillful cool-season (November-March) forecasts that are statistically significant across much of CONUS and the Western US.
- Additionally, show that the forecast skill is an improvement with respect to the NMME ensemble mean.

# Outline of Today's Talk

1. Simplest model, but still skillful.
2. Added complexity, what does that give us?
3. A reason for optimism.
4. Where are we headed next?

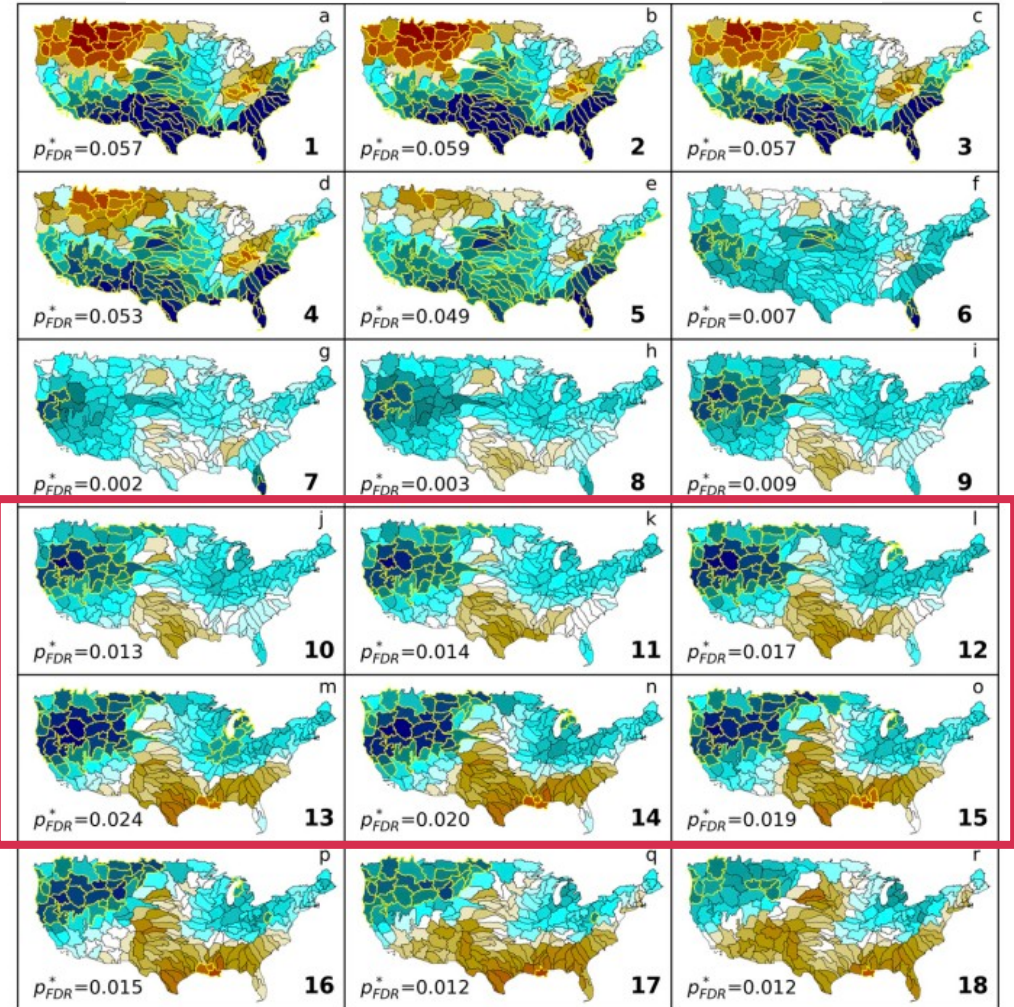
1. Simplest model, but still skillful.
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# Using only the NINO3.4 index



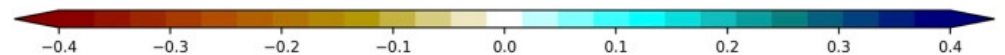
source: <https://www.ncdc.noaa.gov/teleconnections/enso/indicators/sst/>

# Anomaly Correlation 1901/02-2017/18



This is robust and useful

Switanek, M. B., Barsugli, J. J., Scheuerer, M., & Hamill, T. M. (2020). Present and past sea surface temperatures: a recipe for better seasonal climate forecasts. *Wea. Forecasting*, **54**, 6739–6756. doi: 10.1029/2018WR023153.



# The CLSST model

Combined-Lead Sea Surface Temperature (CLSST) model relies solely on the NINO3.4 SST time series as a predictor.

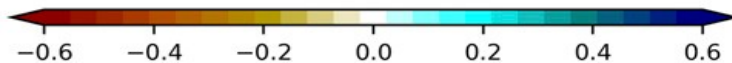
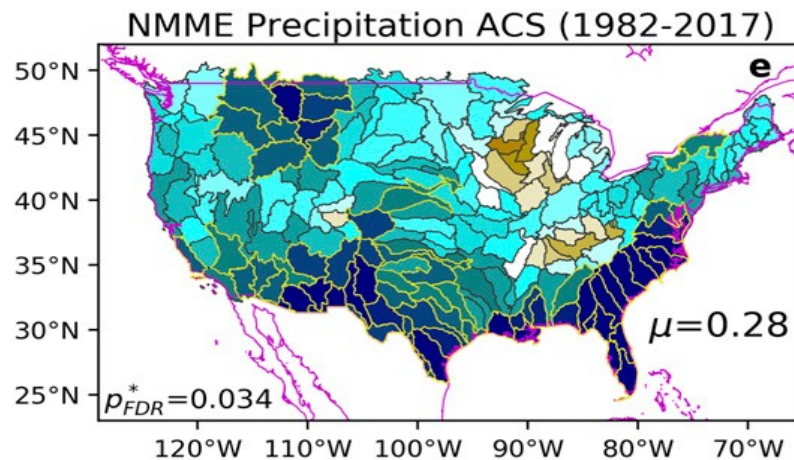
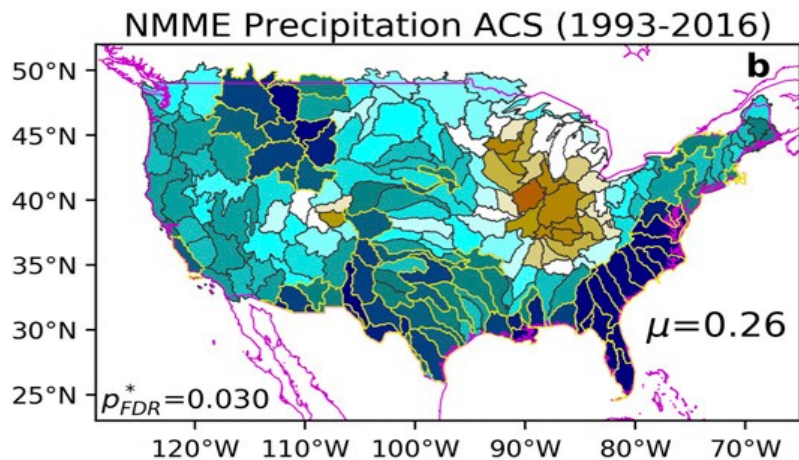
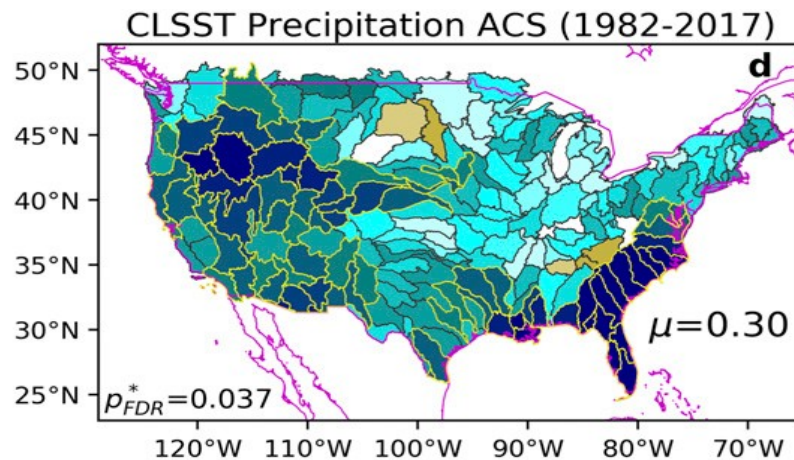
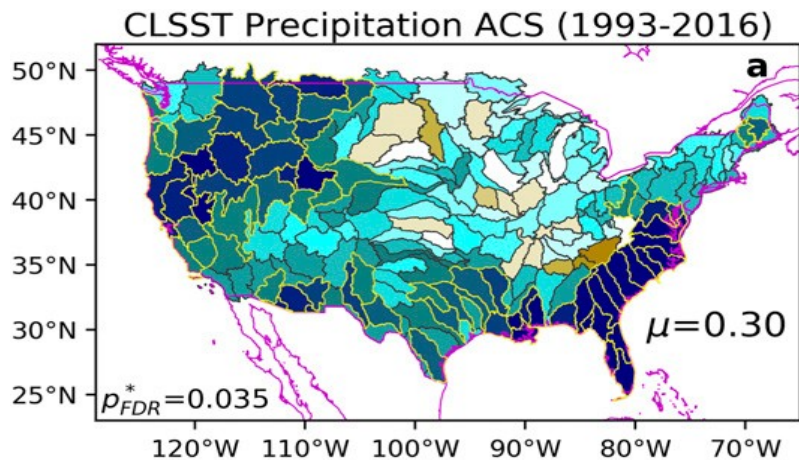
**1. Use dimensionality reduction.** Here, we are only predicting the leading five principal components of CONUS cool-season precipitation.

**2. The forecasts are a weighted ensemble mean**

where the forecasts in the validation period vary as a function of how well the hindcasts performed. For example, if NINO3.4 better predicted Northern California or Upper Colorado precipitation in our historical period at a lead time of 10 months, those forecasts would be weighted more than those with a lead time of 1 month.



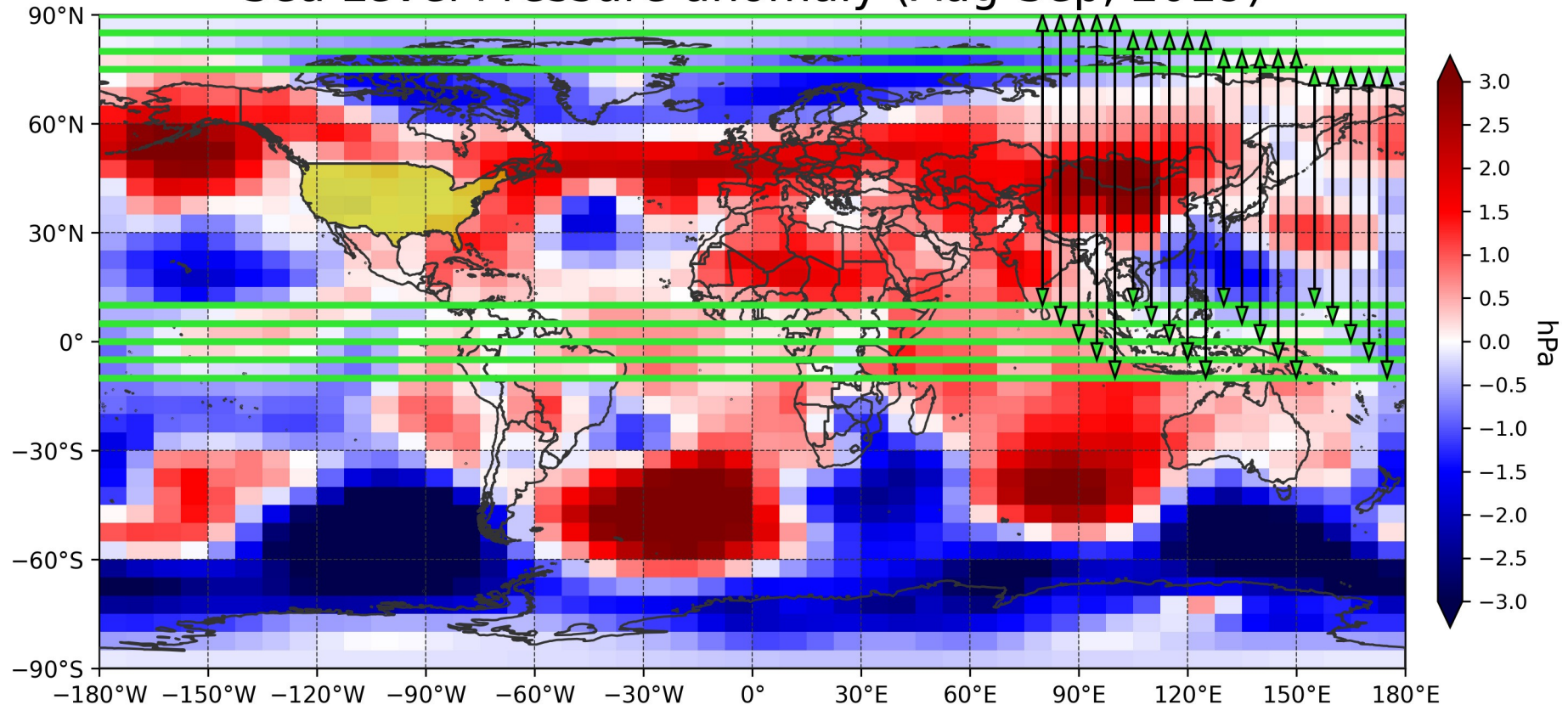
# The forecast skill of this simple model



1. Simplest model, but still skillful.
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# Extend the CLSST Model with Other Predictors (e.g., SLP, UWND, VWND)

Sea Level Pressure anomaly (Aug-Sep, 2019)



# The SCEF model

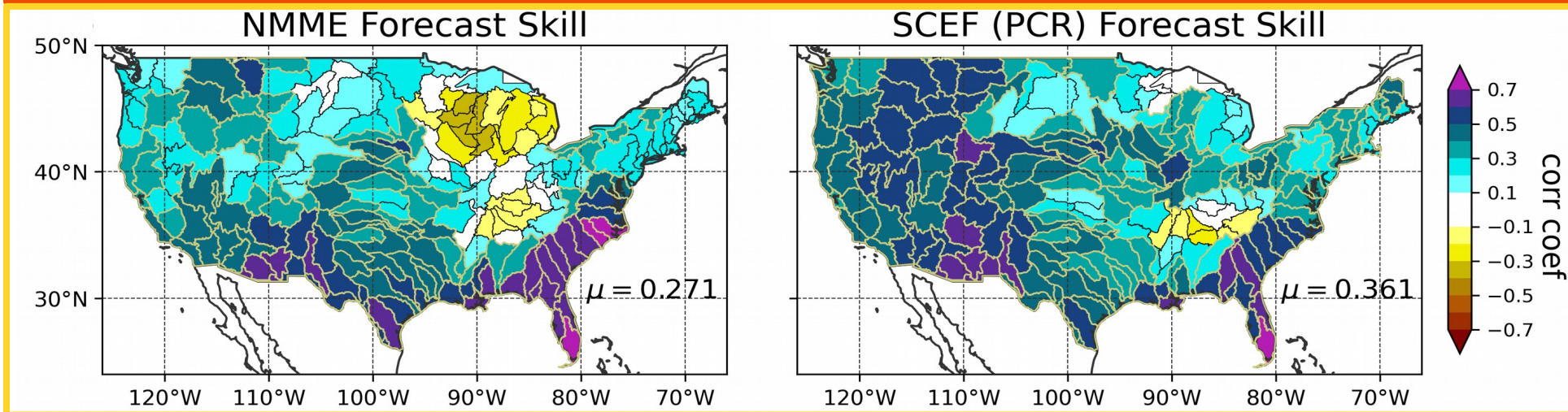
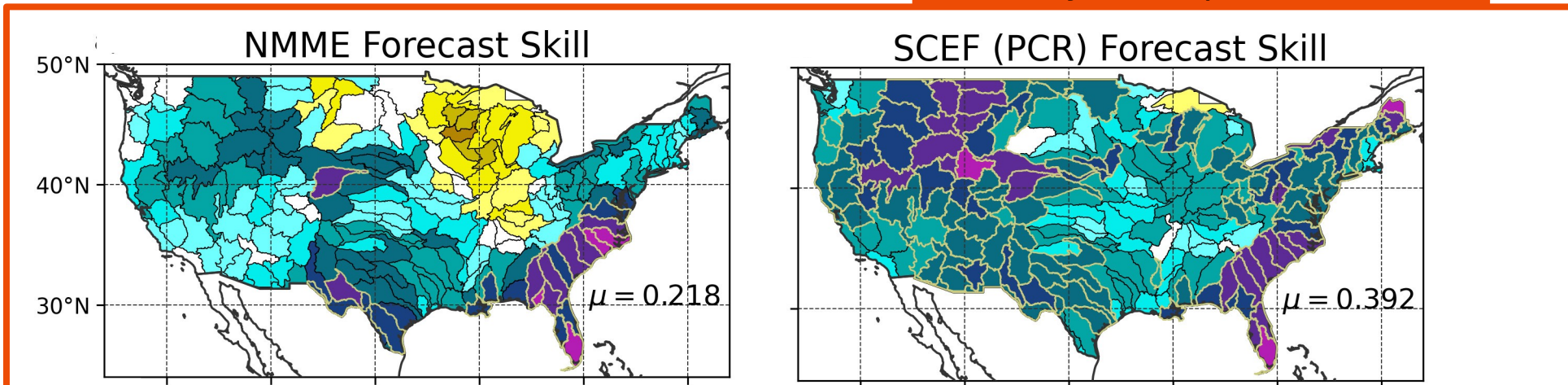
Statistical Climate Ensemble Forecast (SCEF) model relies on CLSST and other large-scale predictors.

- 1. Use dimensionality reduction** on our predictors and our predictands.
- 2. It is a principal component regression model**, or a multiple linear regression model that uses the leading predictor and predictand principal components.

Publication is forthcoming...

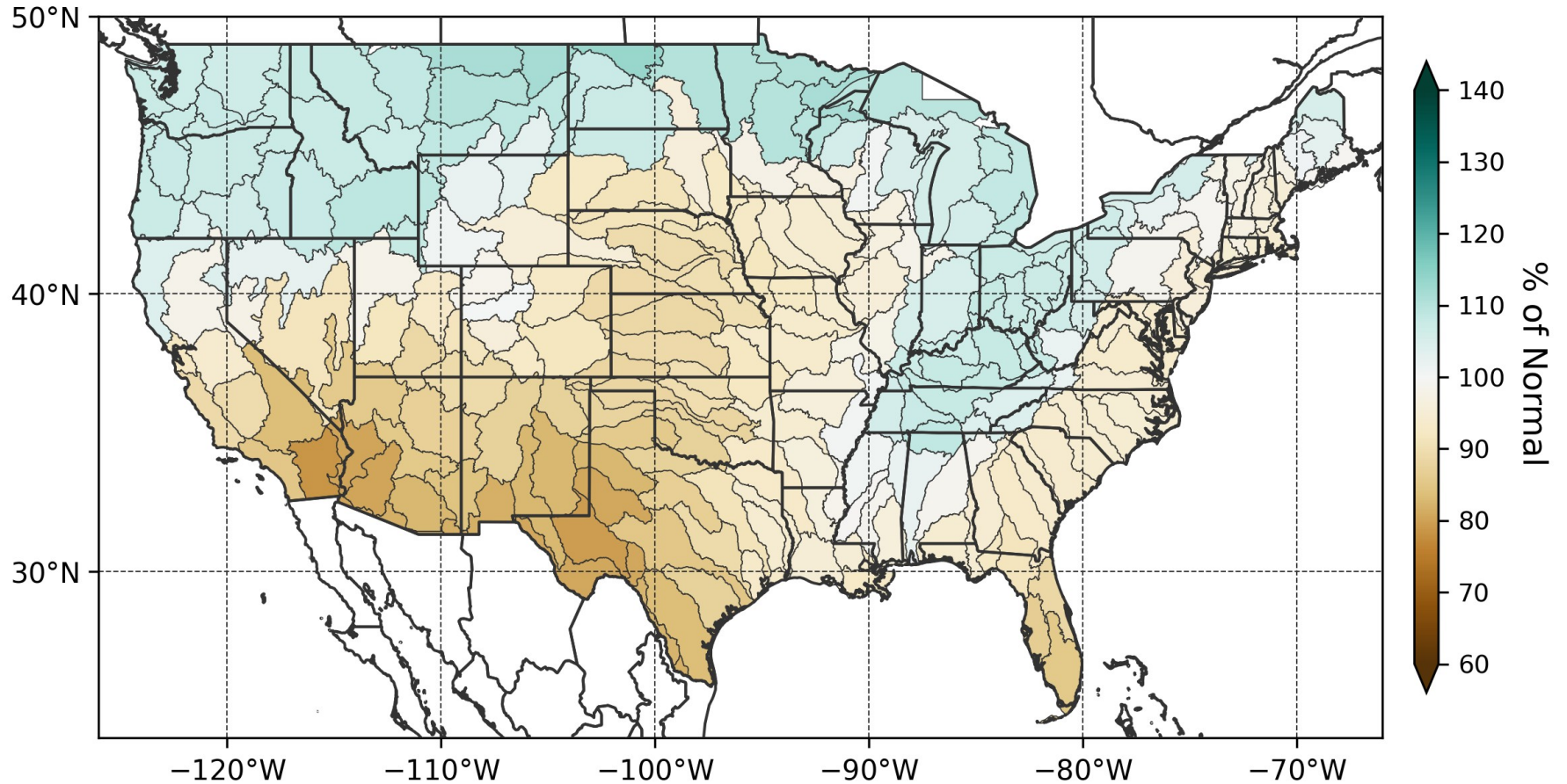
# The SCEF model

Last 20 years (split validation)



Last ~40 years (10-fold cross-validation)

# Our forecast for this cool-season (Nov-Mar 2021/2022)

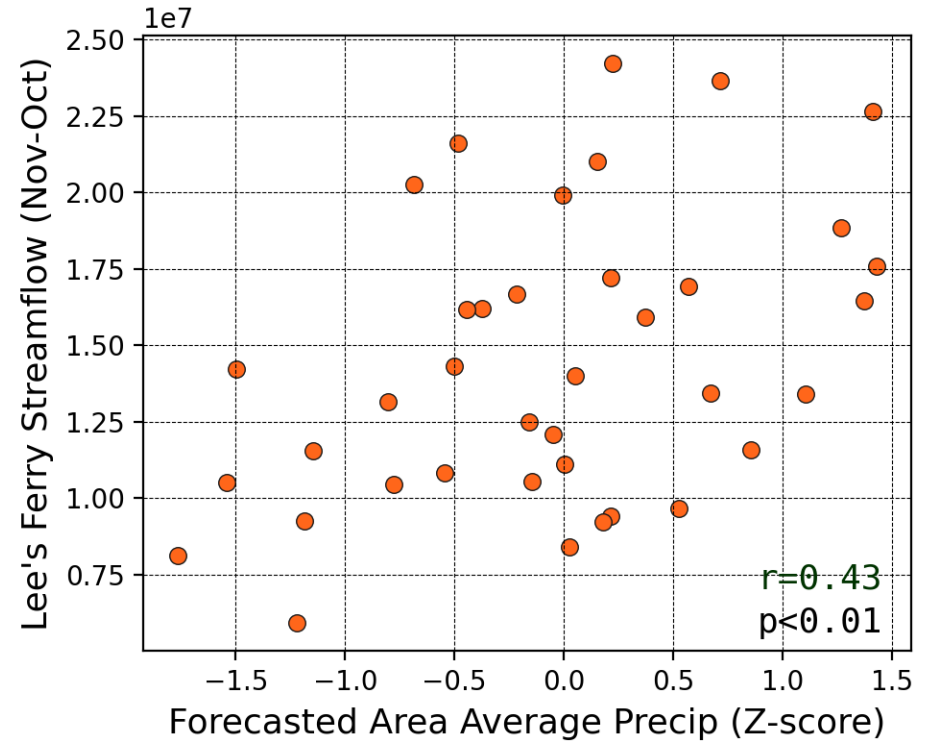
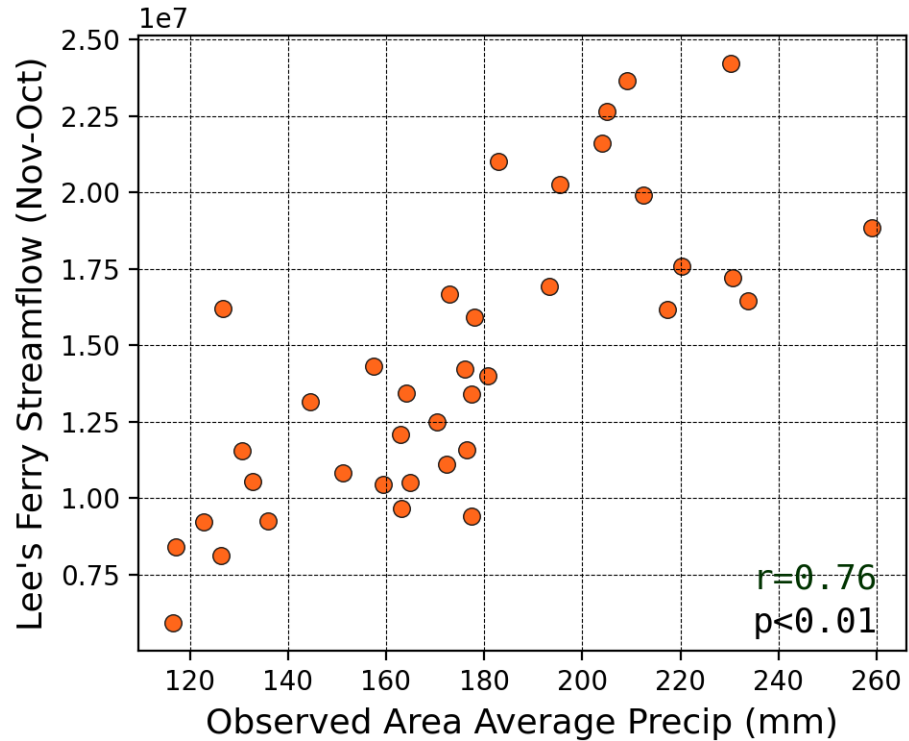


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HUC4 Basin Number	HUC4 Basin Name	SCEF Anomaly Corr	NMME Anomaly Corr	HUC4 Basin Number	HUC4 Basin Name	SCEF Anomaly Corr	NMME Anomaly Corr
1801	Klamath - N. Cal. Coastal	0.44	0.29	1401	Colorado Headwaters	0.35	0.09
1802	Sacramento	0.44	0.29	1402	Gunnison	0.41	0.11
1803	Tulare - Buena Vista Lakes	0.41	0.35	1403	Upper Colo - Dolores	0.52	0.27
1804	San Joaquin	0.43	0.26	1404	Great Divide - Upper Green	0.58	0.28
1805	San Francisco Bay	0.38	0.37	1405	White - Yampa	0.41	0.09
1806	Central Cal. Coast	0.41	0.45	1406	Lower Green	0.53	0.19
1807	Southern Cal. Coast	0.43	0.39	1407	Upper Colo - Dirty Devil	0.52	0.37
1808	North Lahontan	0.51	0.19	1408	San Juan	0.54	0.37
1809	N. Mojave - Mono Lake	0.47	0.43				
1810	S. Mojave - Salton Sea	0.51	0.43				

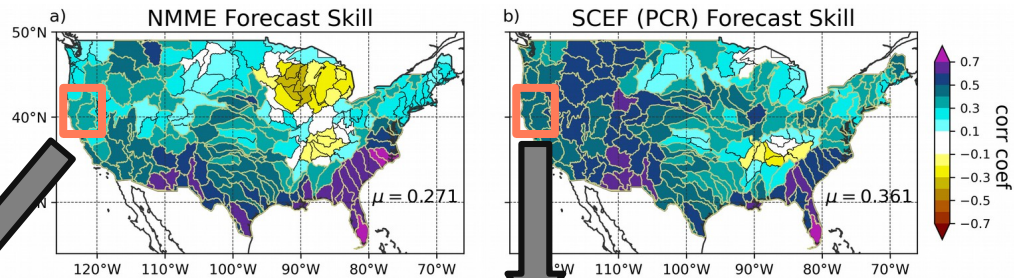


# Streamflow in the Upper Colorado River Basin

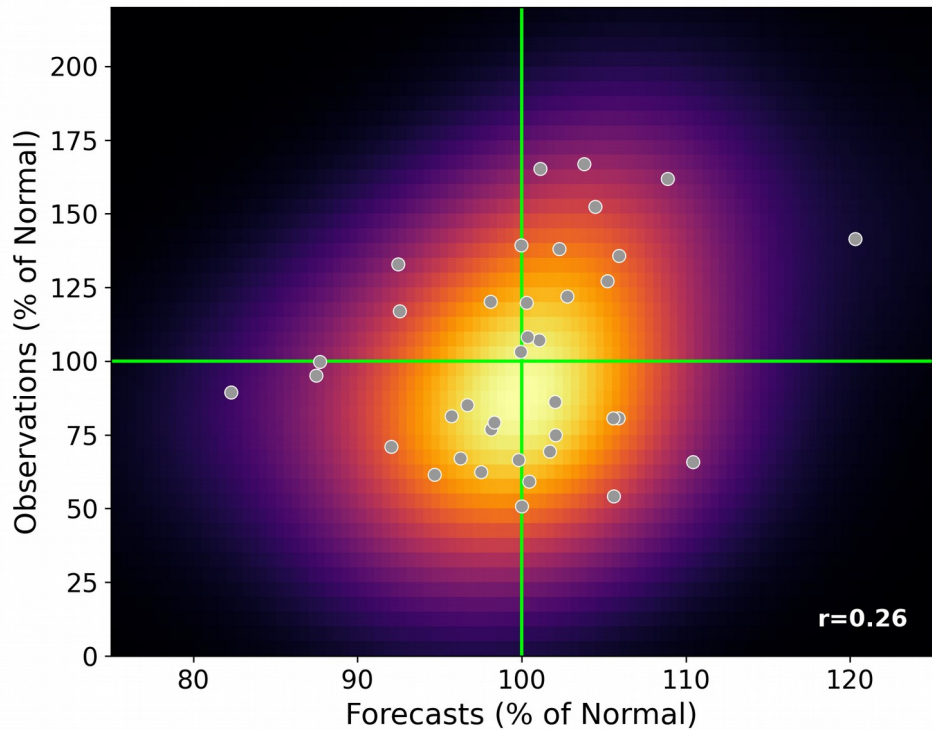


Period: 1981/82 - 2018/19

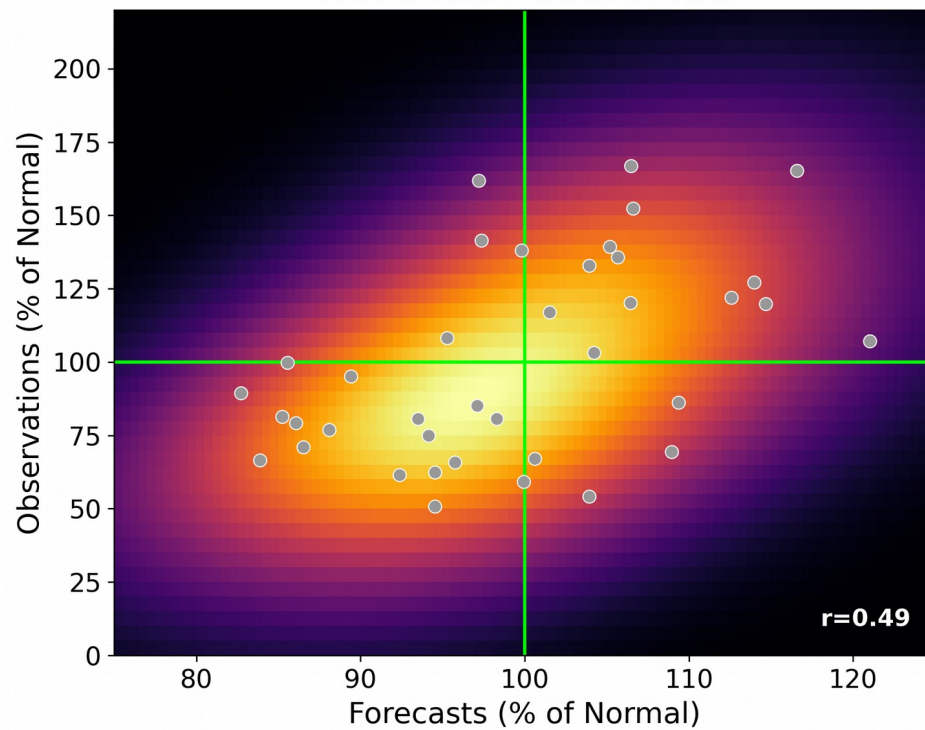
# California



## Northern California



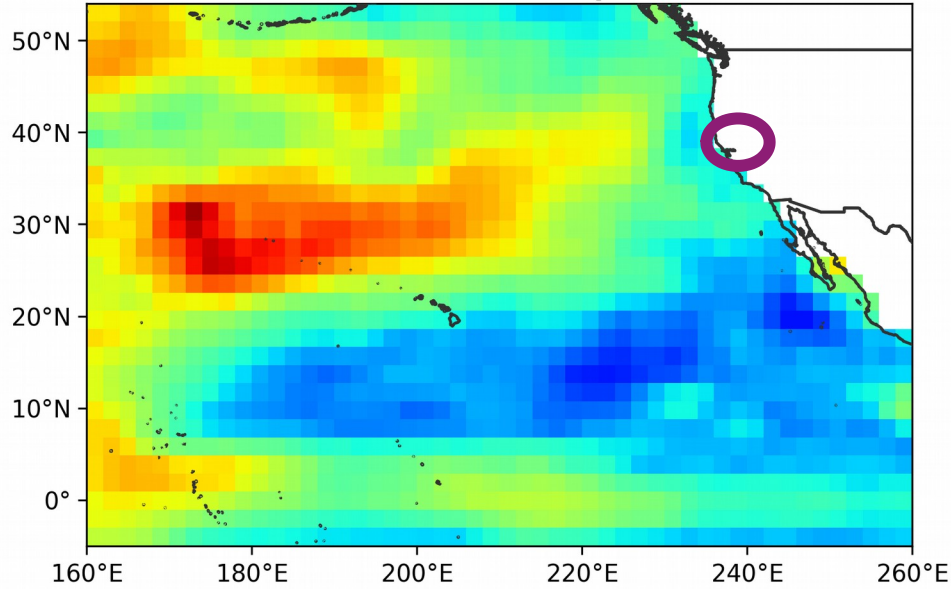
## Northern California



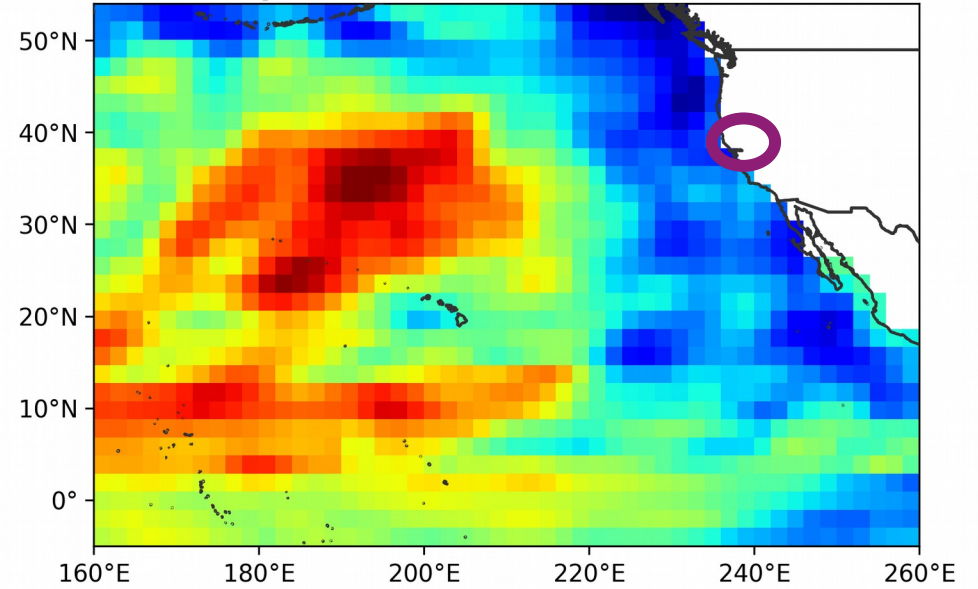
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# Subsurface ocean temperatures

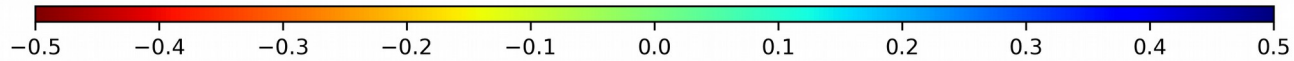
## Sea Surface Temperatures



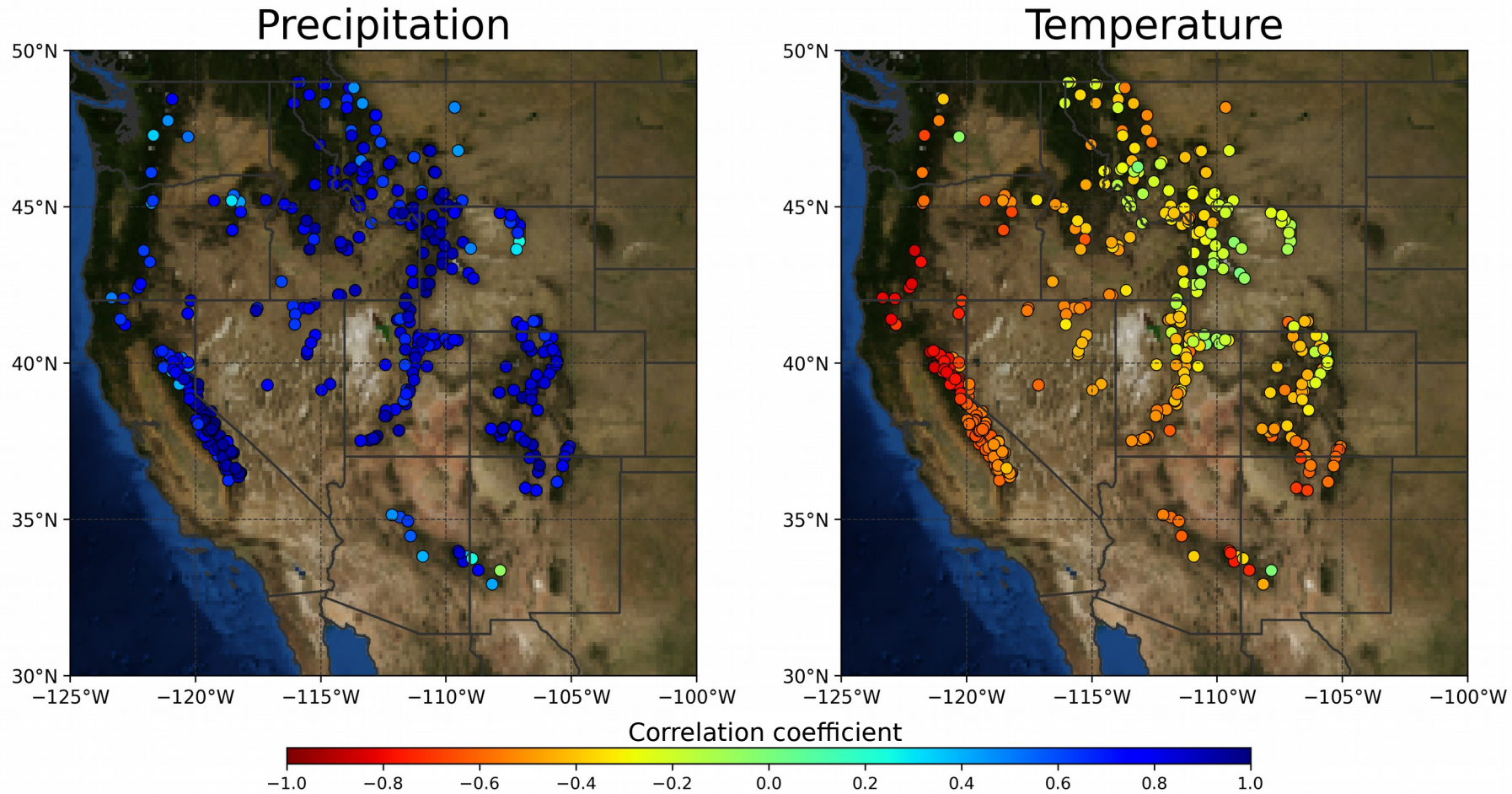
## Temperatures at 85 Meters



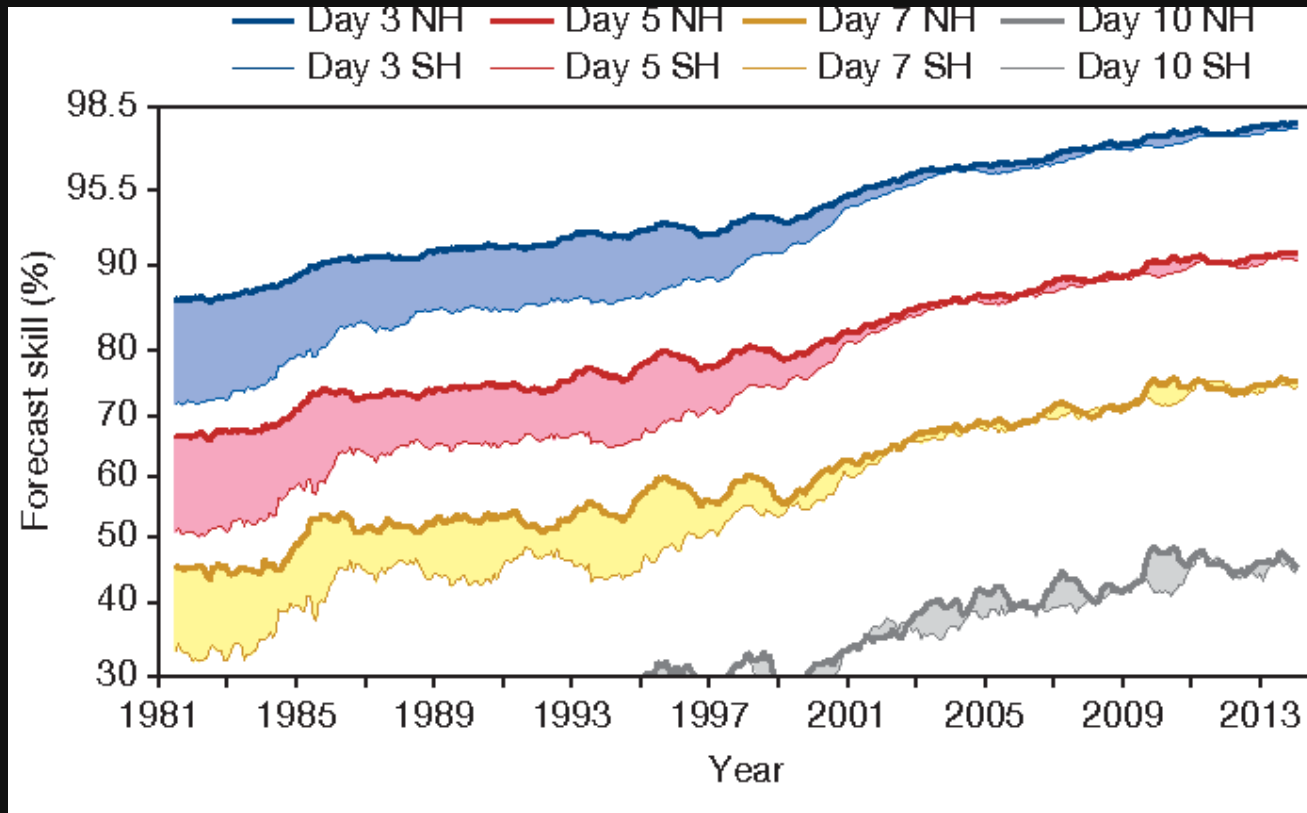
Correlation coefficient



# Directly forecast snow water equivalent



# Thank you!



Source: Bauer et al., 2015, The quiet revolution of numerical weather prediction.