

ENSO Forcing of Streamflow Conditions in the Pearl River Basin

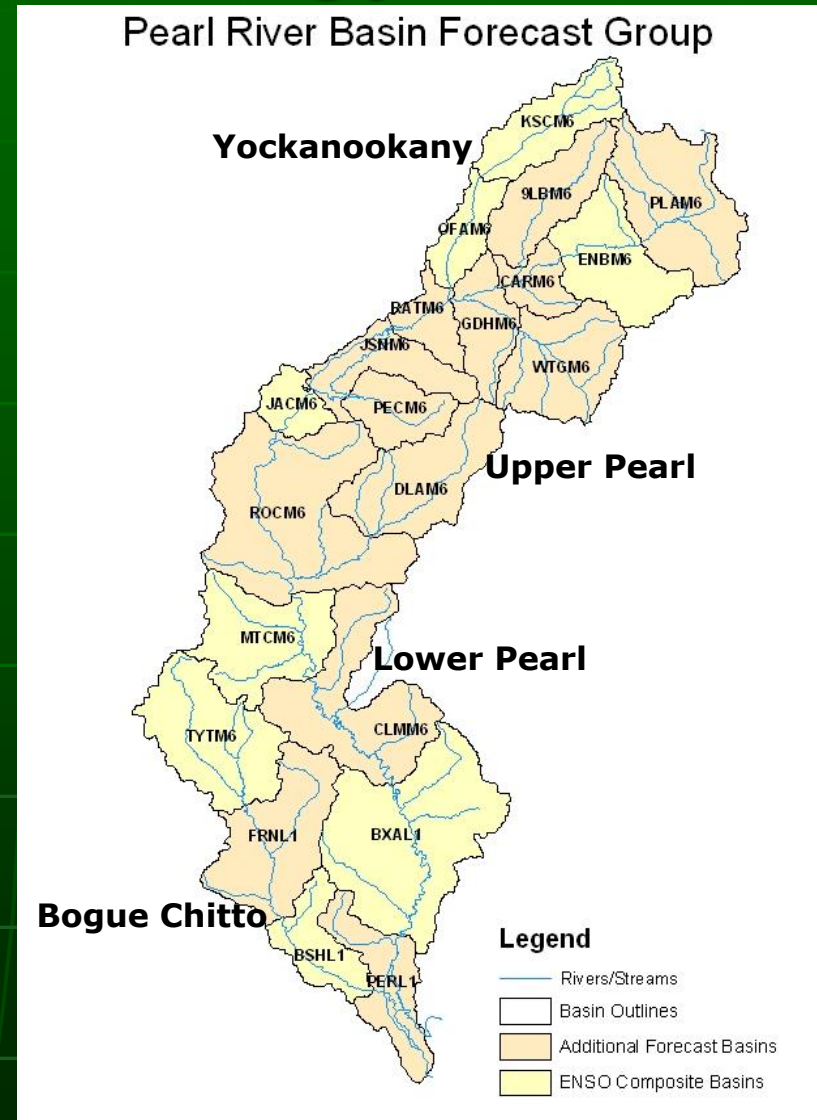
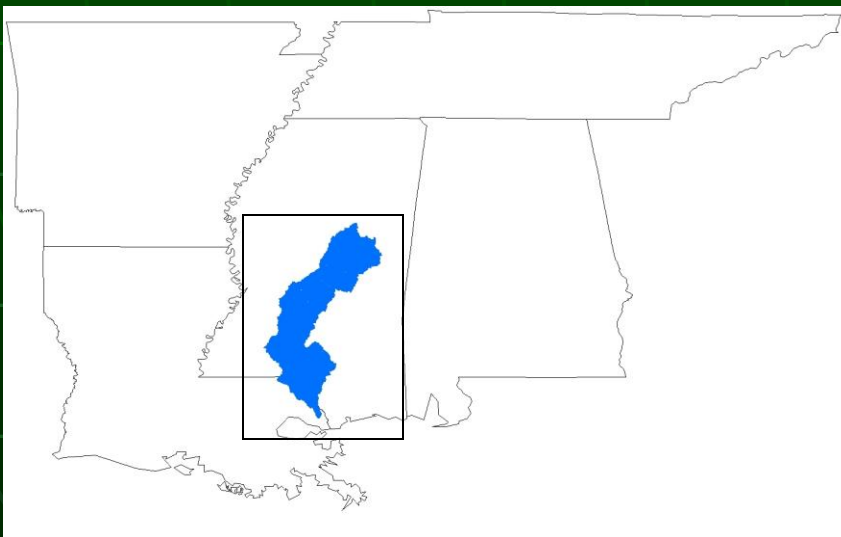
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and

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Regional Hydrology

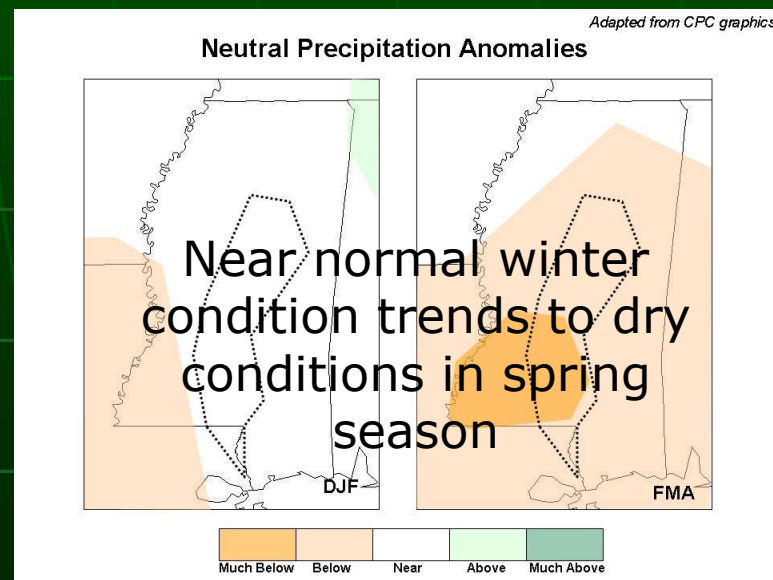
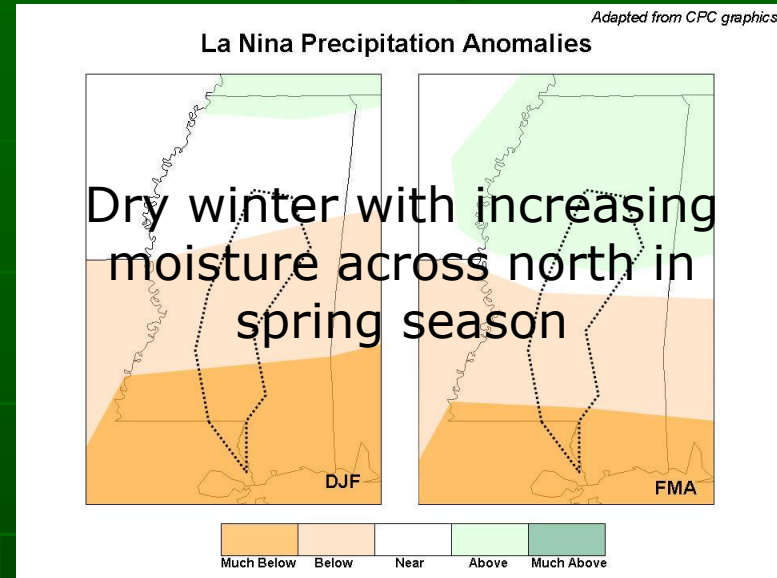
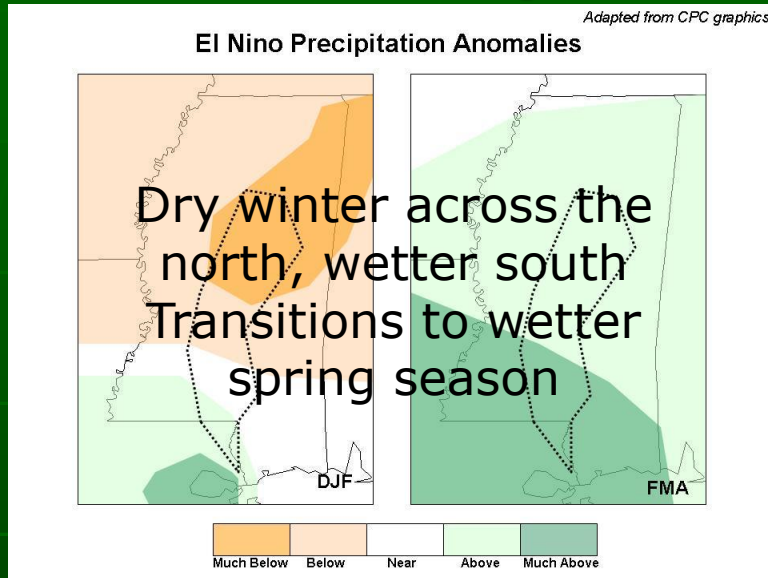
- Pearl River Basin
 - Yockanookany River
 - Pearl River
 - Bogue Chitto River
 - Among others...



Streamflow Events

- Daily mean streamflow in cfs
- 75th/25th Percentile values from USGS used to denote above/below normal streamflow days
- Monthly counts for high/low flow events calculated
- Missing data were considered to be non-events for conservative estimates of actual event days

ENSO Impacts on Precipitation



Composite Analysis Methodology

- ONI values and ENSO episode assigned to monthly streamflow event counts
- Terciles computed to determine above/near/below normal conditions
- Counts for each ENSO episode-category performed (e.g. ENa, LNb, NUn)
- Probabilities for each event define the historical composites
- Only statistically significant (90% confidence) and at least half of sites within the Mainstem, Yockanookany, or Bogue Chitto must indicate similar relationships

Historical Composites for La Nina 75th Percentile Events in the Pearl River Basin

Yockanookany

Mainstem Pearl

Bogue Chitto



	KSCM6	OFAM6	JACM6	ENBM6	MTCM6	BXAL1	TYTM6	BSHL1
JFM	Above 47.1% Below 23.6%	Above 41.0%	NS	NS	Below 20.9%	Below 27.5%	NS	NS
FMA	NS	NS	NS	Below 13.3%	Below 13.3%	Below 20.0%	Above 0.0%	Above 0.0%
MAM	NS	NS	NS	NS	NS	NS	NS	Above 6.7%
AMJ	NS	Below 53.3%	NS	NS	NS	Above 66.7%	NS	Below 66.7%
MJJ	NS	NS	NS	NS	Below 53.8%	Above 76.9%	NS	NS
JJA	NS	NS	Above 53.8%	Above 53.8%	NS	NS	NS	NS
JAS	NS	NS	NS	NS	NS	NS	NS	NS
ASO	NS	NS	NS	NS	NS	Below 18.8%	NS	NS
SON	NS	NS	NS	NS	NS	NS	NS	NS
OND	Below 26.3%	NS	Above 42.0%	NS	NS	NS	NS	NS
NDJ	NS	NS	NS	NS	NS	Below 40.1%	NS	NS
DJF	Below 15.0%	Below 20.0%	Below 30.0%	NS	NS	NS	NS	NS

Cool Season Wet Tendency

DRY AT COAST
MIGRATES
NORTH IN
SPRING

Cool Season Wet Tendency

*** Only statistically significant relationships (90% confidence interval) are shown. NS indicates no signal identified.

Historical Composites for Neutral 75th Percentile Events in the Pearl River Basin

Yockanookany

Mainstem Pearl

Bogue Chitto



	KSCM6	OFAM6	JACM6	ENBM6	MTCM6	BXAL1	TYTM6	BSHL1
JFM	NS	NS	Above 11.5%	NS	Below 57.7%	Below 57.7%	NS	NS
FMA	NS	NS	Below 13.2%	Below 50.0%	Below 53.3%	Below 55.7%	NS	NS
MAM	Below 12.9%	NS	NS	NS	NS	NS	NS	NS
AMJ	NS	NS	NS	NS	NS	NS	Above 14.3%	Above 10.7%
MJJ	NS	Below 46.7%	NS	NS	NS	NS	NS	NS
JJA	NS	NS	NS	NS	NS	NS	NS	NS
JAS	NS	NS	NS	NS	NS	NS	NS	Above 40.0%
ASO	Above 20.8%	Above 41.3%	Above 33.3%	Below 37.5%	Below 18.8%	NS	Below 50.0%	NS
SON	NS	NS	NS	NS	NS	NS	Below 57.1%	NS
OND	Above 10.0%	Above 10.0%	Above 10.0%	Above 50.0%	Below 55.0%	NS	Below 57.1%	Above 15.0%
NDJ	Below 60.0%	Below 65.0%	NS	NS	Above 15.0%	Above 15.0%	Below 80.0%	Below 60.0%
DJF	NS	NS	NS	NS	NS	NS	NS	Above 40.0%

DRY CONDITIONS NEARLY PREDOMINATE COOL SEASON

MIXED SIGNALS IN THE SUMMERTIME

DRY CONDITIONS NEARLY PREDOMINATE COOL SEASON

*** Only statistically significant relationships (90% confidence interval) are shown. NS indicates no signal identified.

Historical Composites for El Nino 75th Percentile Events in the Pearl River Basin



Yockanookany

Mainstem Pearl

Bogue Chitto

	KSCM6	OFAM6	JACM6	ENBM6	MTCM6	BXAL1	TYTM6	BSHL1
JFM	NS	NS	NS	NS	NS	NS	Above 46.2% Below 23.1%	Above 46.2% Below 23.1%
FMA	NS	NS	NS	NS	NS	NS	Below 18.2%	Below 0.0%
MAM	NS	NS	NS	NS	NS	NS	Below 20.0%	Below 0.0%
AMJ	NS	NS	NS	Below 15.4%	NS	NS	Above 46.2%	Above 38.5% Below 23.1%
MJJ	NS	Below 23.1%	Below 0.0%	Below 7.7%	Above 53.8% Below 15.4%	Above 53.8% Below 30.3%	NS	NS
JJA	NS	NS	NS	NS	NS	NS	NS	Above 7.7%
JAS	NS	NS	NS	NS	NS	NS	NS	NS
ASO	NS	NS	NS	NS	NS	NS	NS	NS
SON	Above 50.0%	NS	NS	NS	NS	NS	NS	NS
OND	Above 47.1%	NS	NS	NS	NS	NS	NS	Above 47.1%
NDJ	NS	NS	Above 5.9%	NS	NS	NS	NS	Above 41.2%
DJF	Below 62.5%	Above 12.5% Below 68.8%	NS	NS	NS	Above 56.3%	NS	NS

**Cool Season Wet Tendency at Coast
Migrates Northward in Spring**

**DRY NORTH
EARLY IN COOL
SEASON**

**Cool Season
Wet
Tendency at
Coast**

*** Only statistically significant relationships (90% confidence interval) are shown. NS indicates no signal identified.

25th Percentile Composites

- No signal in seasons: MAM, AMJ, JJA, JAS, SON, OND, and NDJ
- Increased/decreased probability of below/above normal low flow days in Bogue Chitto during El Nino

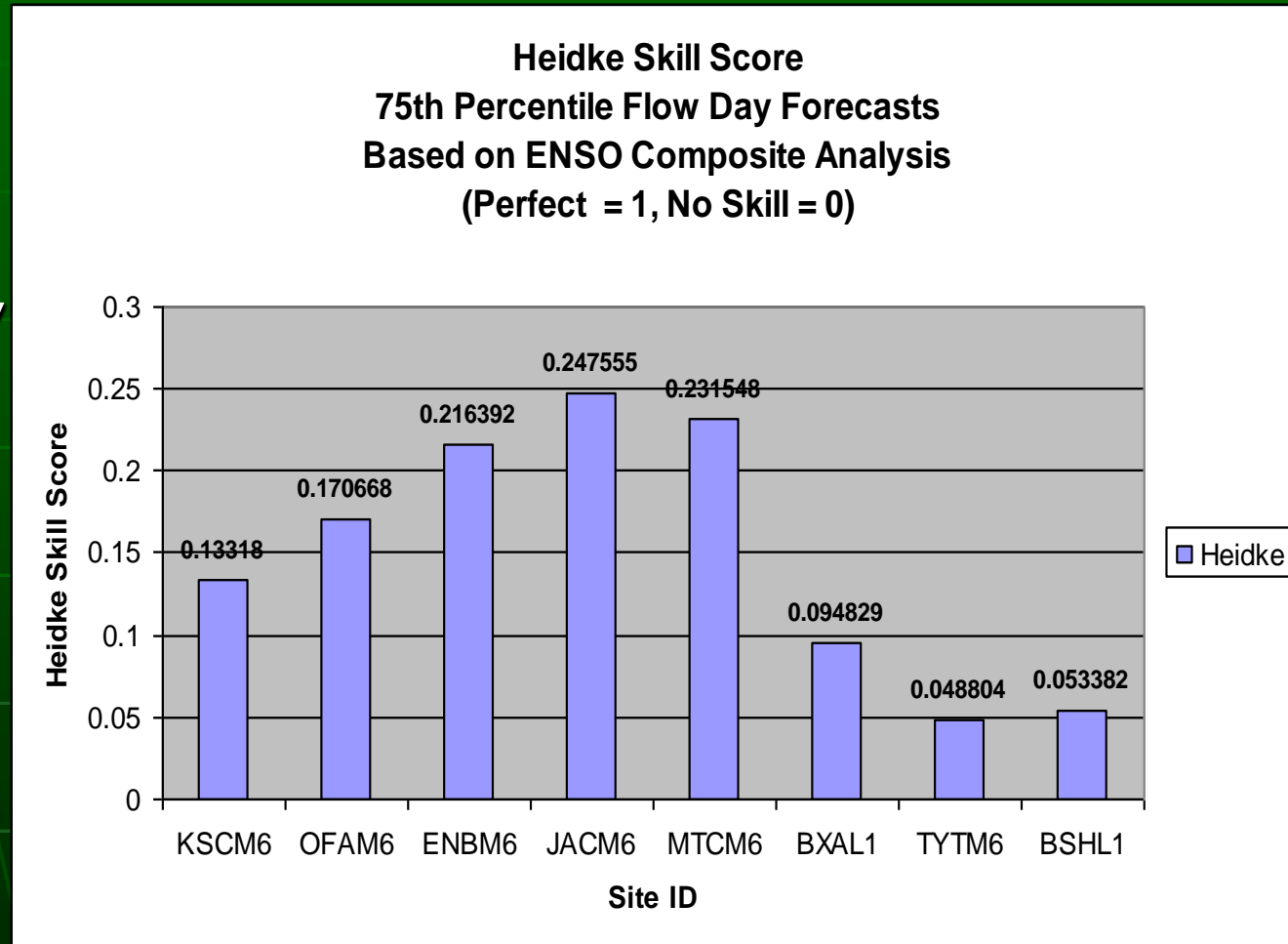
Forecast Verification

- 1982-2005 CPC Nino 3.4 SST Forecast probabilities combined with historical composites to produce hindcasts for each month
- Only 0.5 month leads utilized
 - Decreasing forecast accuracy with increasing lead time
 - 90-day outlooks for SFPO
- Contingency tables used to compute statistical scores

Heidke Skill Scores

Skill relative to random chance

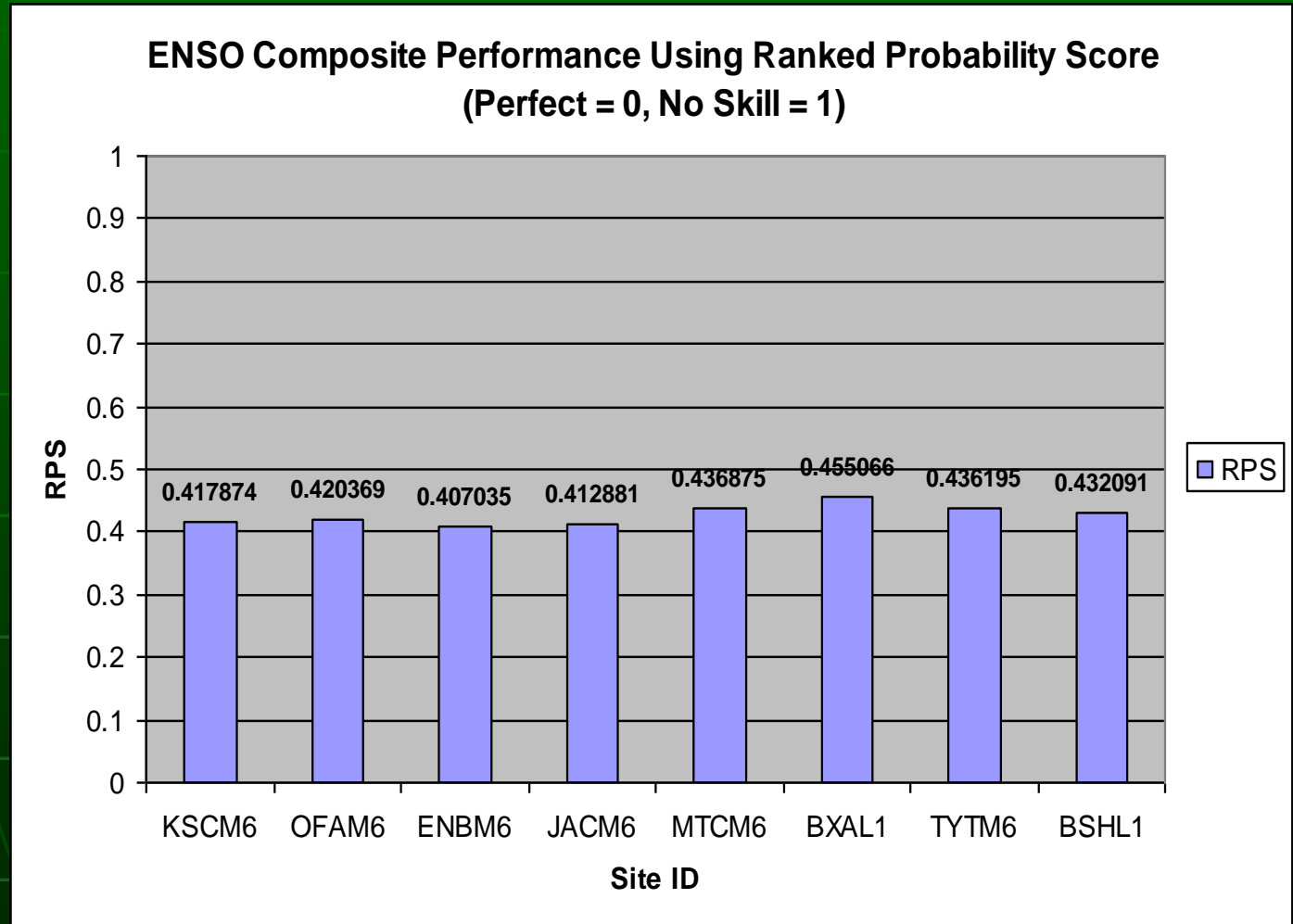
- Least skill in southernmost basins
 - BXAL1, TYTM6, and BSHL1
- Mainstem and Yockanookany ranged from 0.13 to 0.25



Ranked Probability Scores

Skill in predicting the proper category

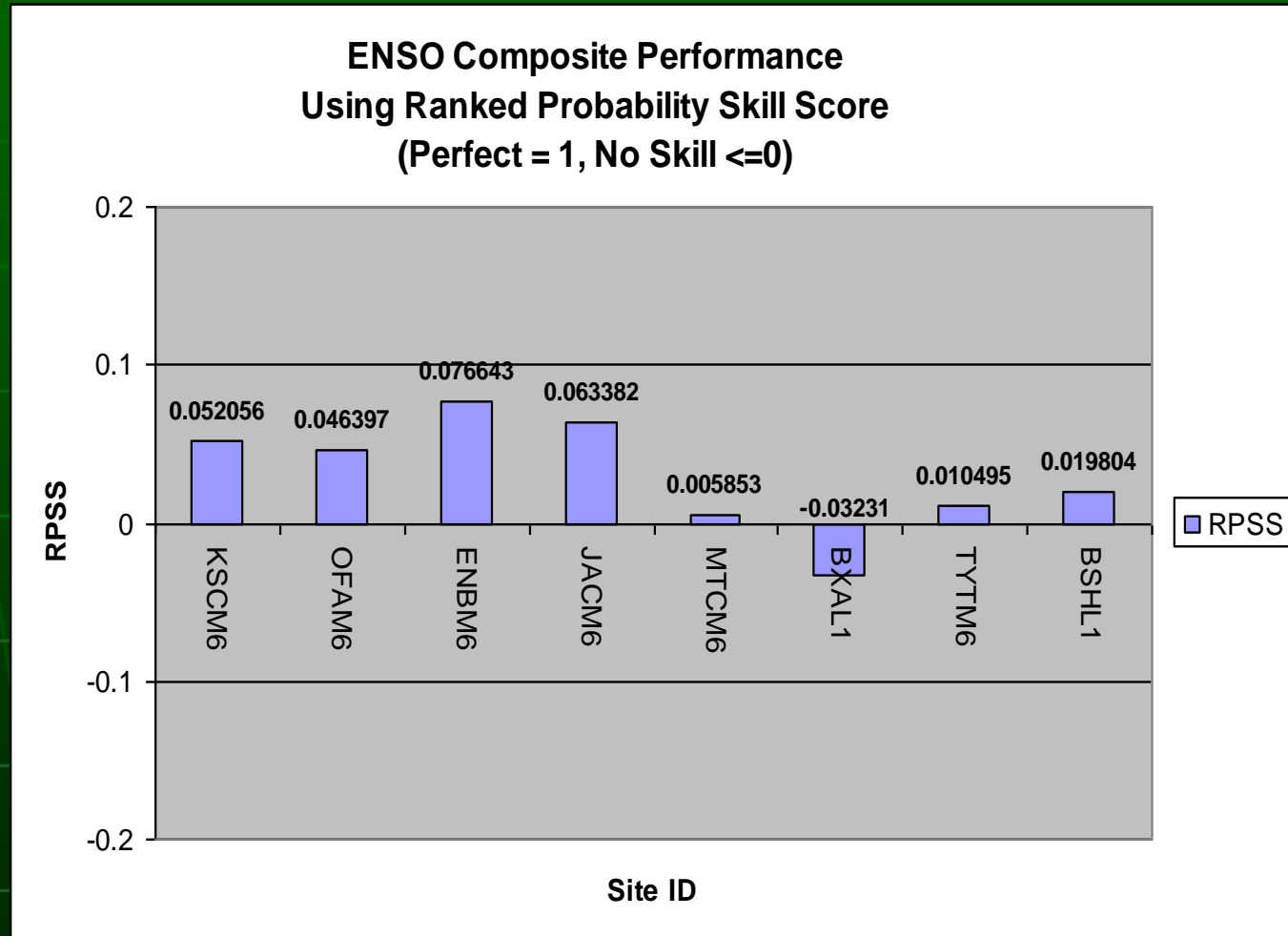
- Marginal skill indicated with RPS of 0.40 to 0.46



Ranked Probability Skill Score

Skill relative to climatology

- Limited improvement over climo in upper Pearl; little or no skill across lower Pearl



Conclusions

- Precipitation departures attributed to ENSO episode correlate well with streamflow events
- Locations near the Gulf of Mexico exhibit least improvement over climatology (localized forcing)
- ENSO-based composites yield greatest forecast improvement in upper Pearl River Basin
- Smaller basins can produce contradictory signals compared to larger mainstem basins

Future Research

- Include lag-time response in computations
- 25th percentile hindcast verification
- Ensemble streamflow prediction and Spring Flood Potential Outlook applications
- Web access to composites and forecasts