Group 4: Event Prediction

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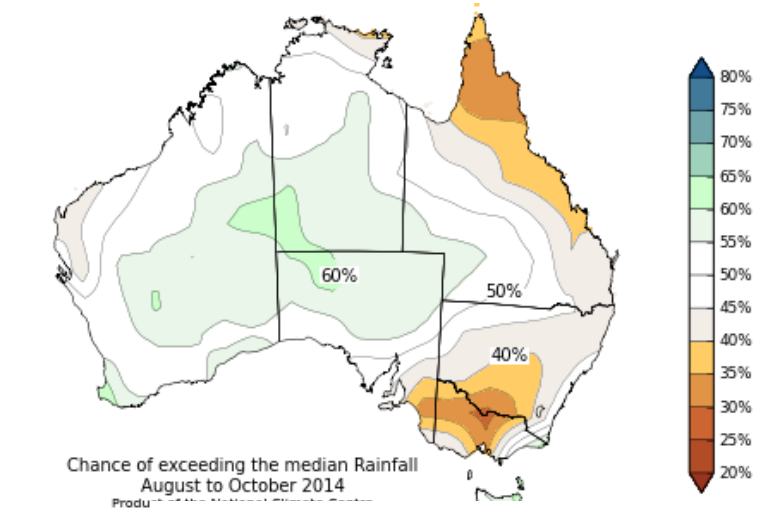
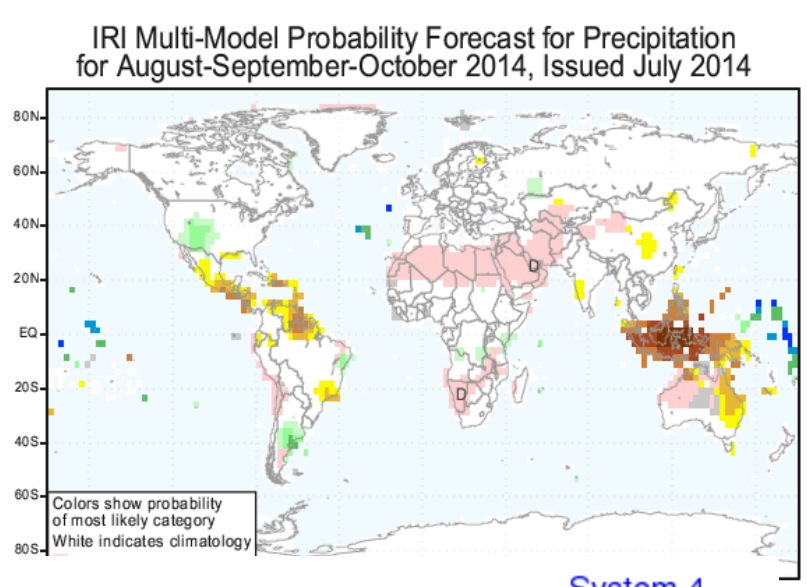
Overview

- Background & Motivation
- Is there skill for forecasts of means and extremes?
- How does ENSO influence model skill?
- Is there any additional skill in the extremes?

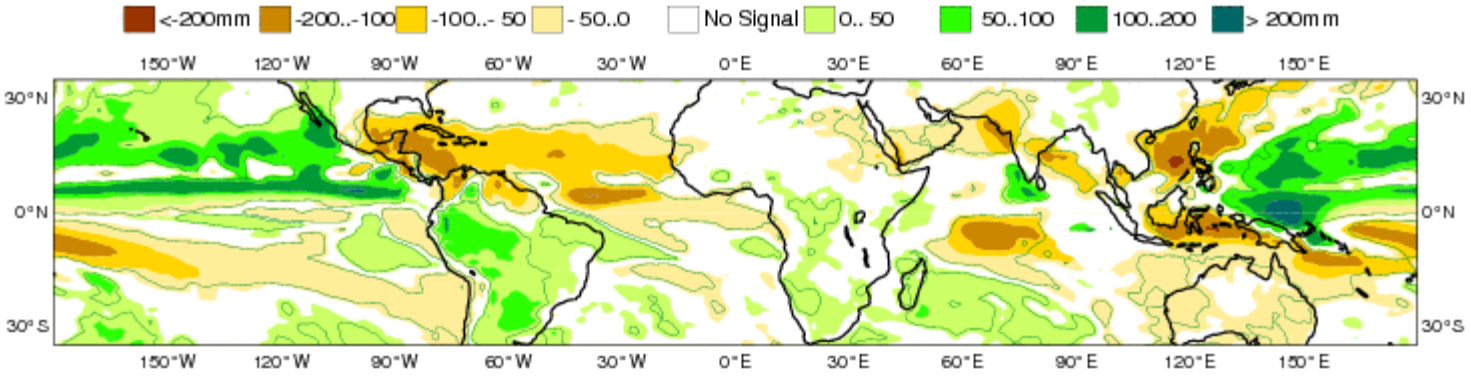
Seasonal outlooks of means are important





ECMWF Seasonal Forecast
Mean precipitation anomaly
Forecast start reference is 01/07/14
Ensemble size = 51, climate size = 450

System 4
ASO 2014
Shaded areas significant at 10% level
Solid contour at 1% level



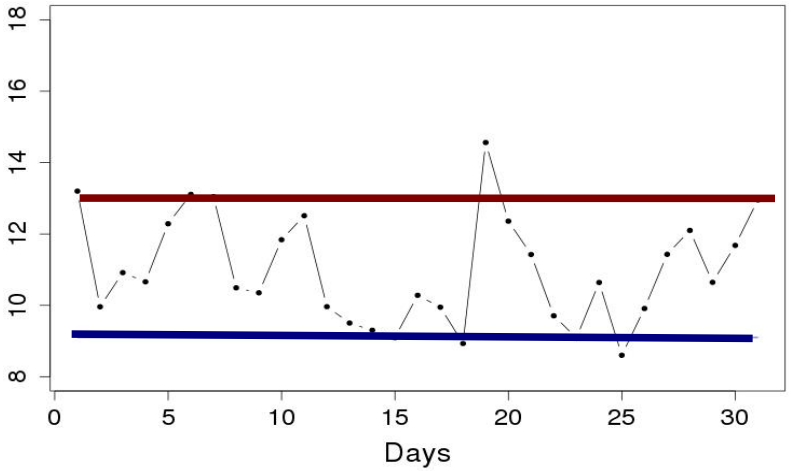
Extremes have a larger impact than means

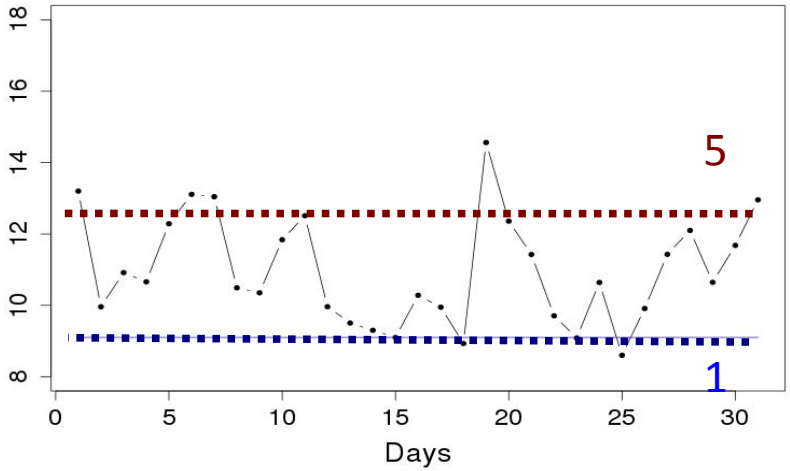
- Heatwaves and human health
- Frosts impact agriculture
- Heavy rain and floods cause massive damage
- Can we forecast extremes?

Background

Parameters of interest: ‘mild extremes’

- 90th percentile of daily Tmax and precipitation
- 10th percentile of daily Tmin
- Both numbers of days > threshold & change in threshold value
- Values are MONTHLY, then averaged over a season





Background

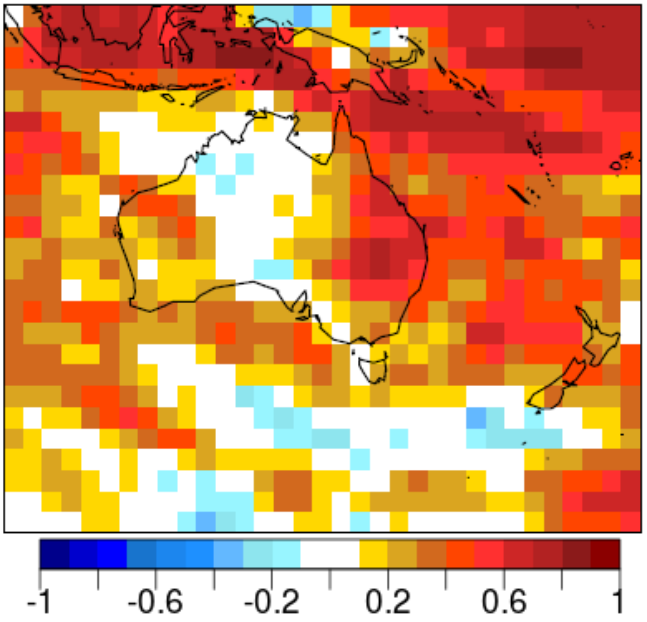
- Temporal Resolution:
  - 7-month forecasts on the 1st of Feb/May/Aug/Nov, 1979-2005
  - Focus on average monthly values for one seasons
  - Lead time 1 month

- Data
  - 5 models, 9 ensemble members
  - ERAI for global observations

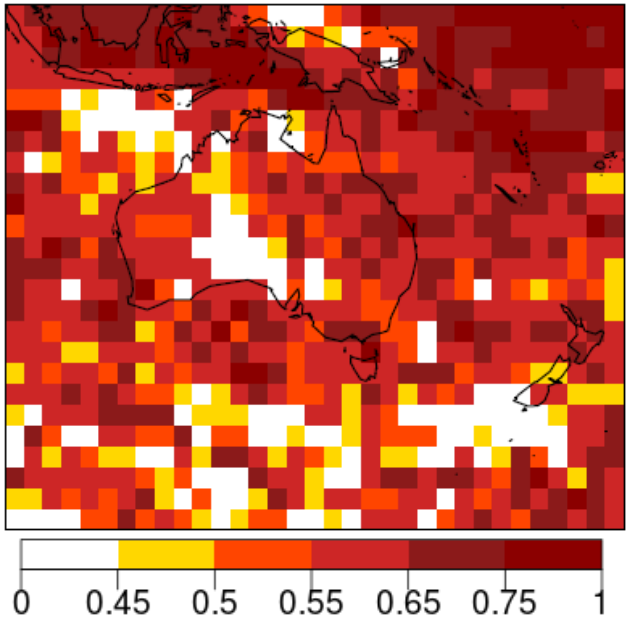
Skill

- Forecasts are for anomalies
- We measure „Skill“ as the correlation between forecast and observed (ERA-I) anomalies
- Patterns of skill are broadly similar across metrics

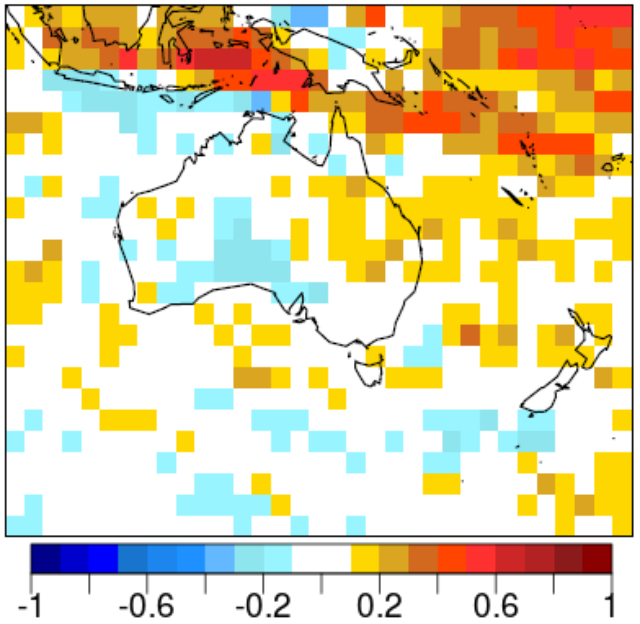
Anomaly correlation



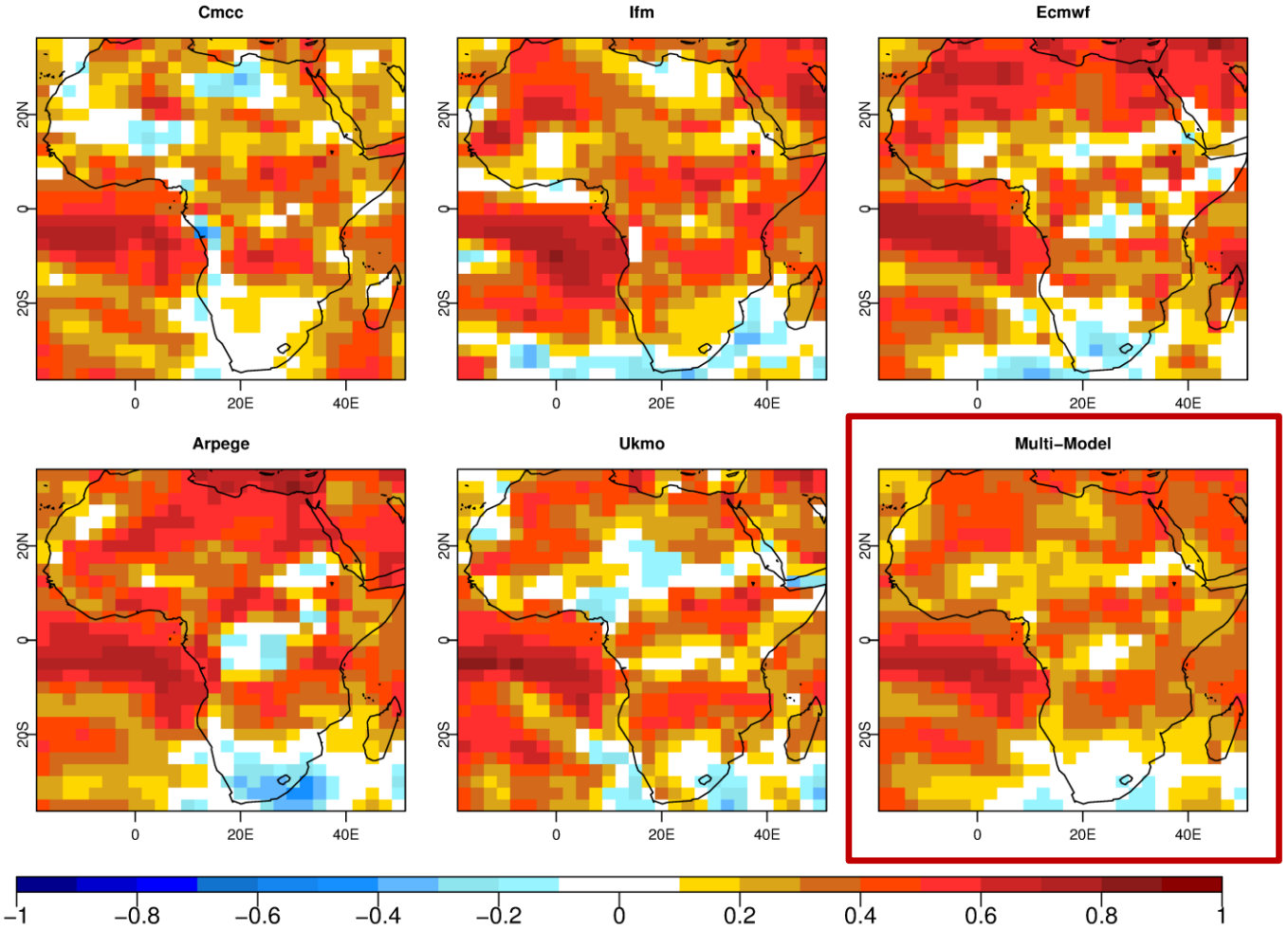
Percent Consistent



Brier Skill Score



- ENSEMBLES – 5 models with a 9-member ensemble
- *Ensemble mean* is better than any individual model



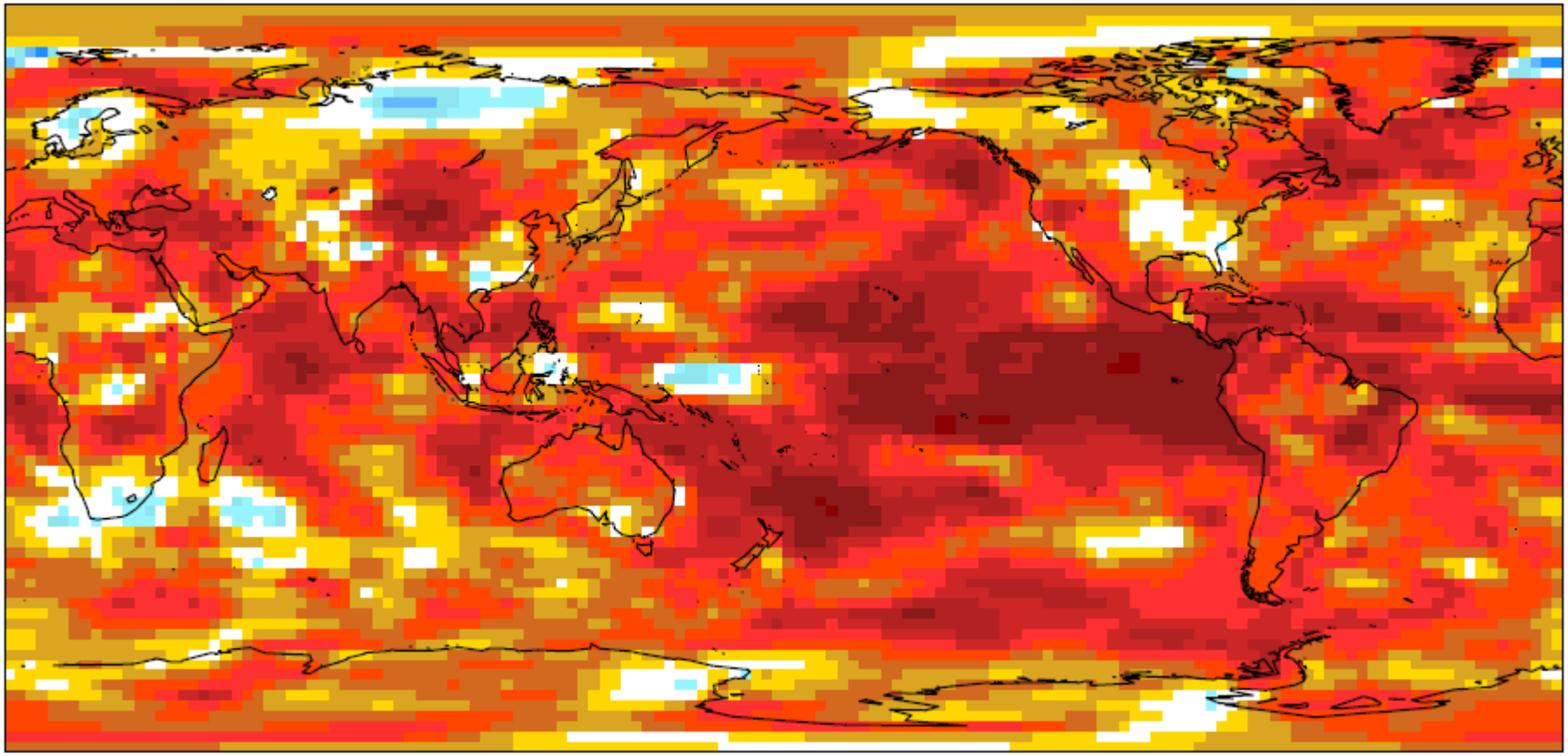
Questions

- Does the multimodel ensemble have skill at forecasting mean temperature and rainfall?
- Is there any relationship between the skill in means and the skill for extremes?

- We will use JJA as an example season
- We will use Multi Model solutions
- Time period is 1979 to 2005

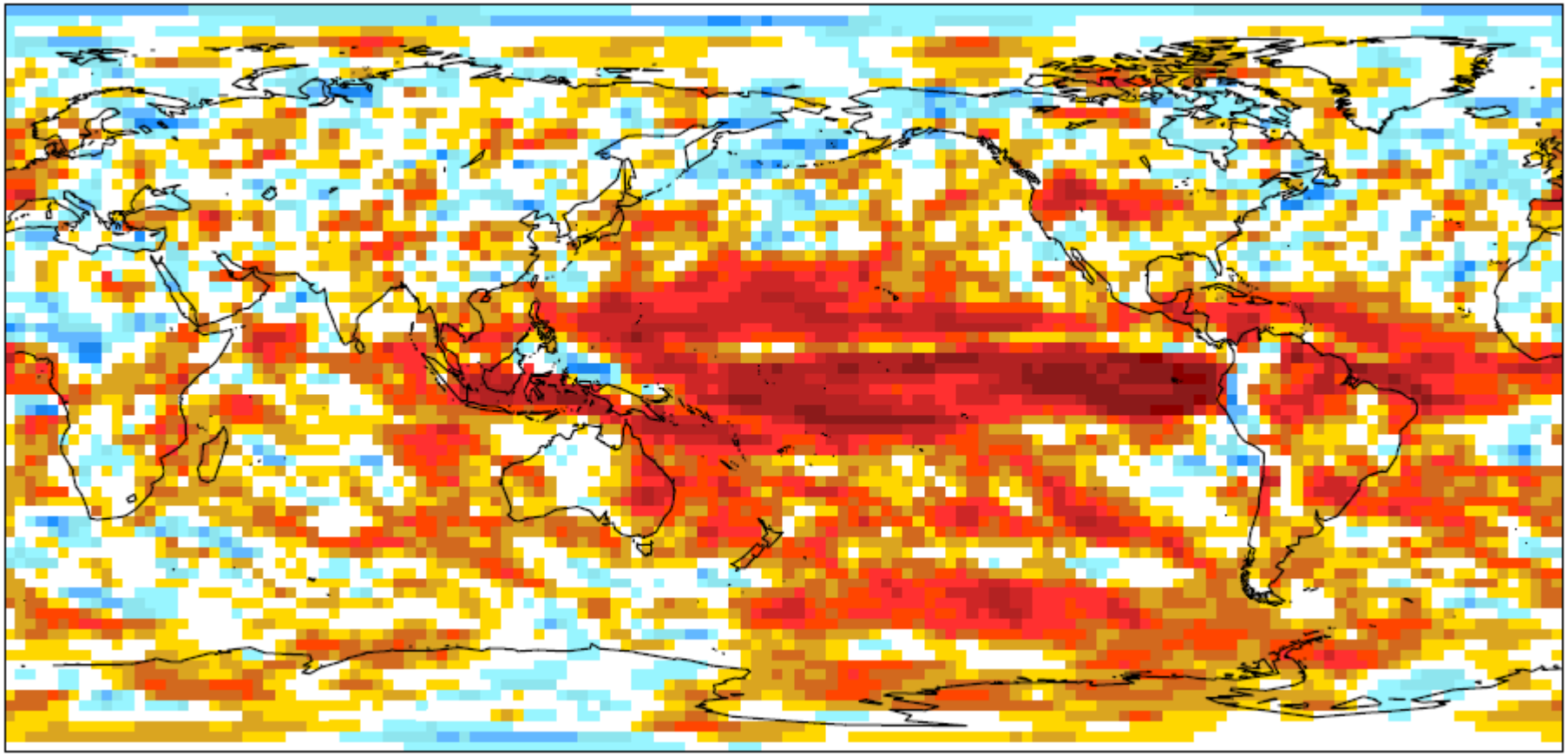
Example: Skill for mean temperature (JJA)

- Good skill, best in tropics



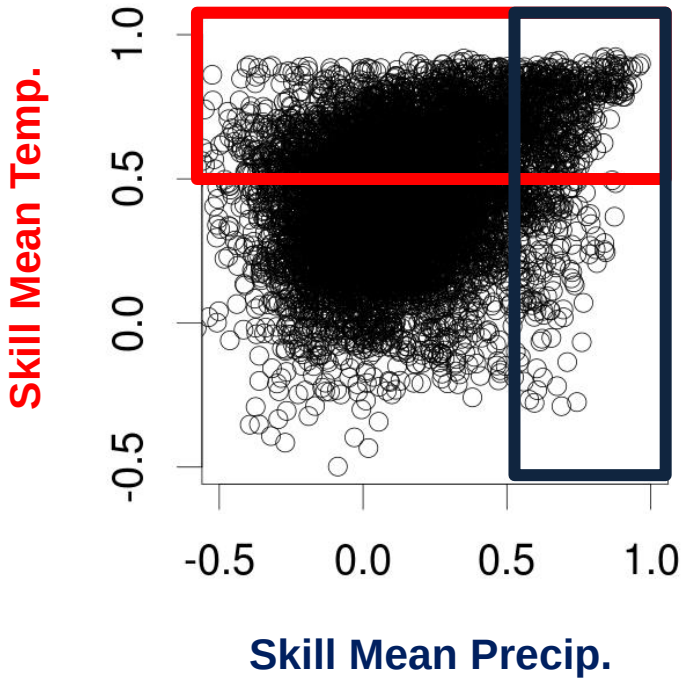
Skill for mean rainfall (JJA)

- Generally low skill in mid-high latitudes



How do skills of different parameters compare?

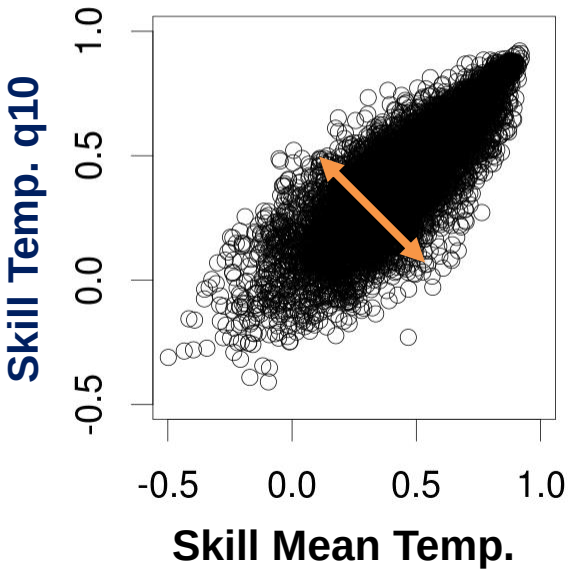
Each point is one pixel

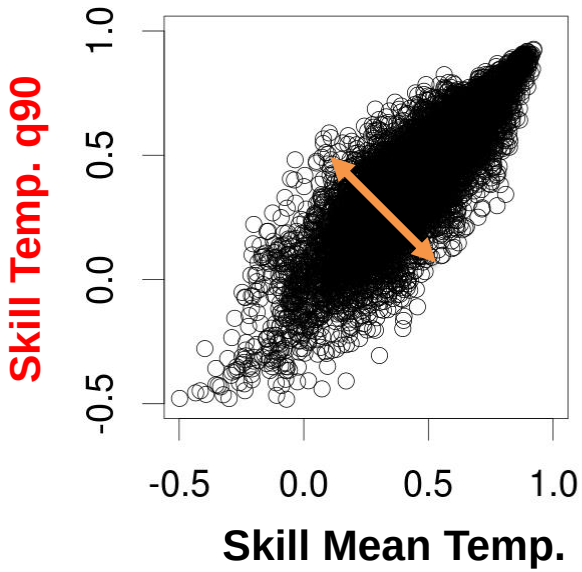


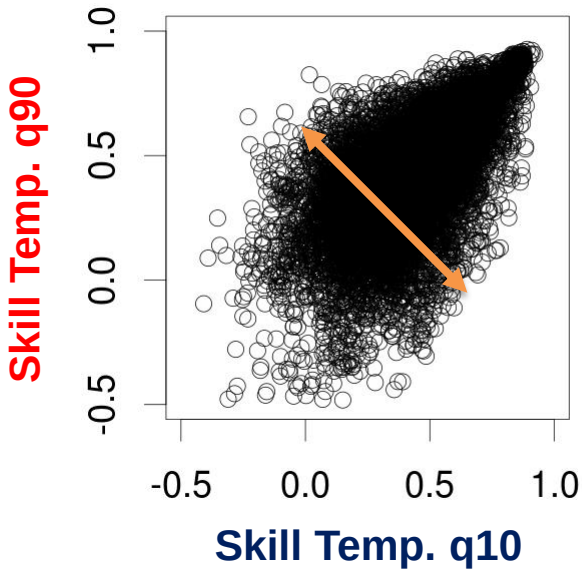
Focusing on the globe:

- Skill for mean temperature is larger than skill for mean precipitation
- Many pixels have low skill
- There is no clear relationship between the two skills

How do skills of means and extremes compare?





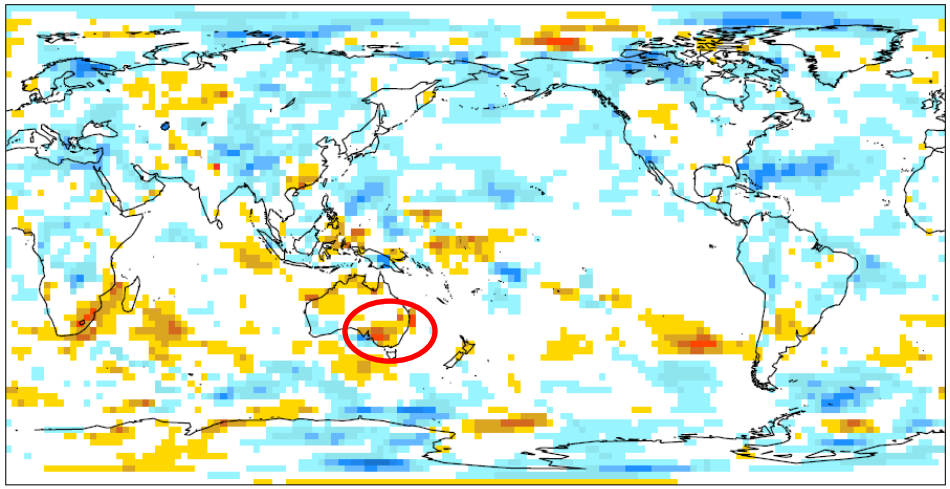


Focusing on the globe:

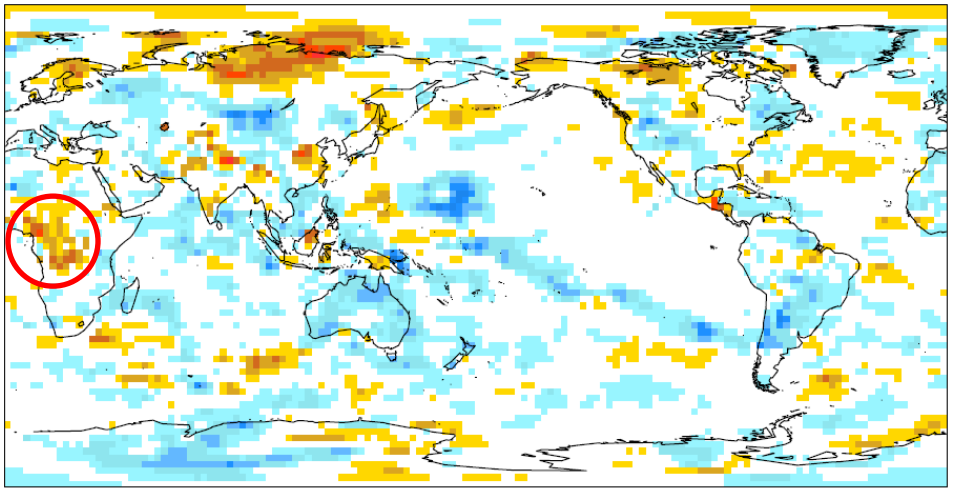
- Skill for extremes is comparable as the skill for means
- Skill for extremes is strongly related to skill in mean
- Skill for q10 and q90 extremes are not that strongly related

Seasonal forecasting of extreme events

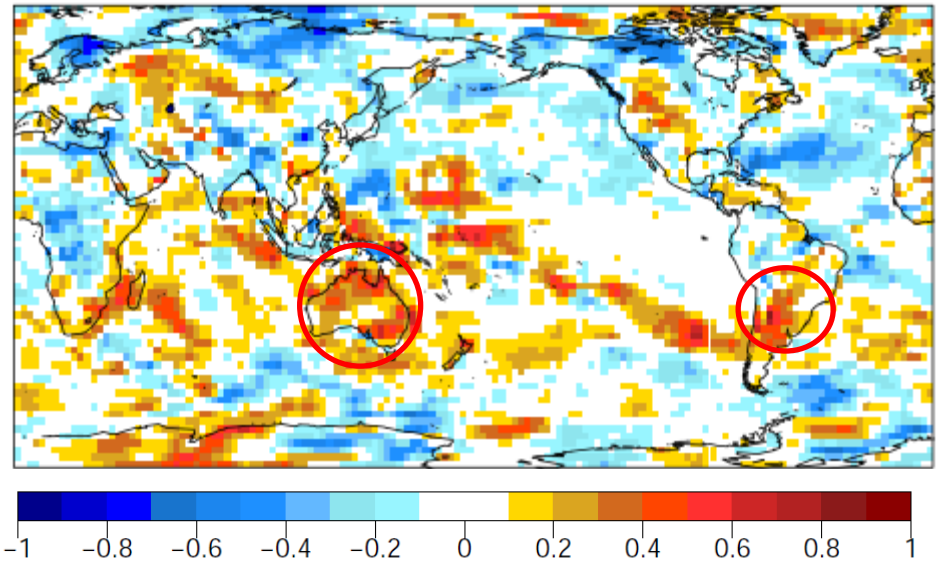
Skill Temp q90 – Skill Mean Temp



Skill Temp q10 – Skill Mean Temp



Skill Temp. q90 – Skill Temp q10

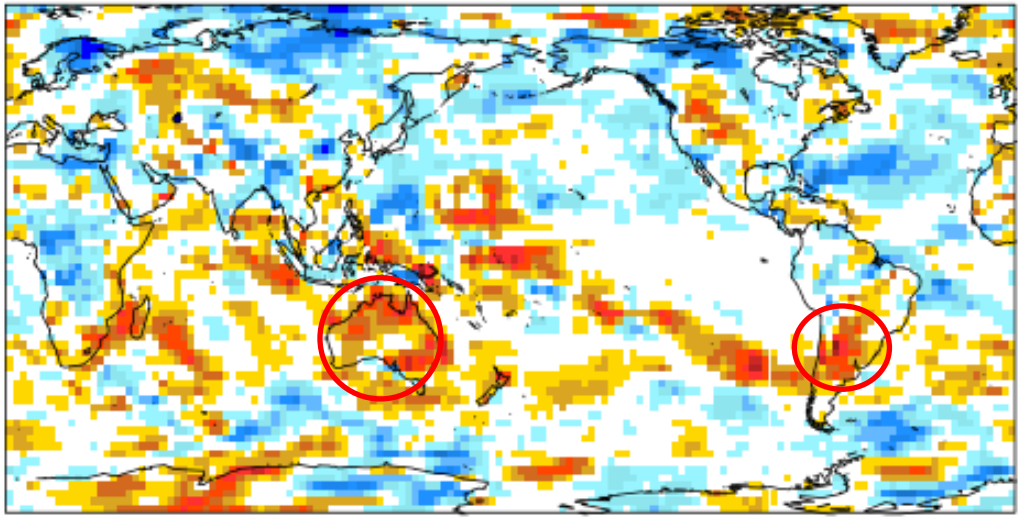


Caution:
We don‘t get any information about the absolute skill!

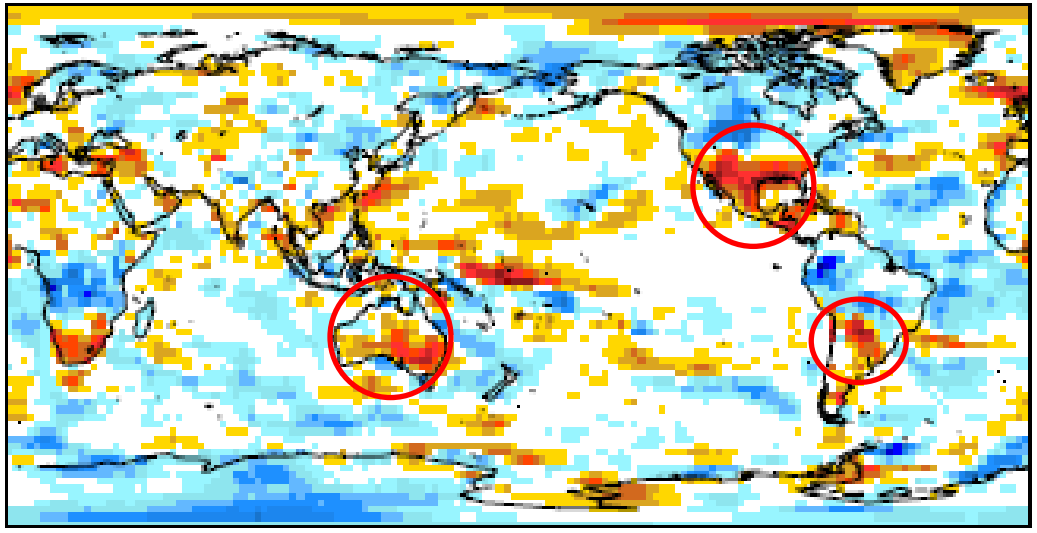
Seasonal forecasting of extreme events

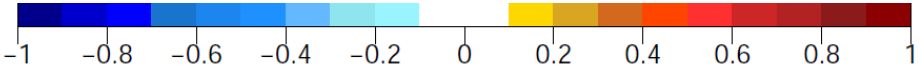
Skill Temp. q90 – Skill Temp q10

JJA



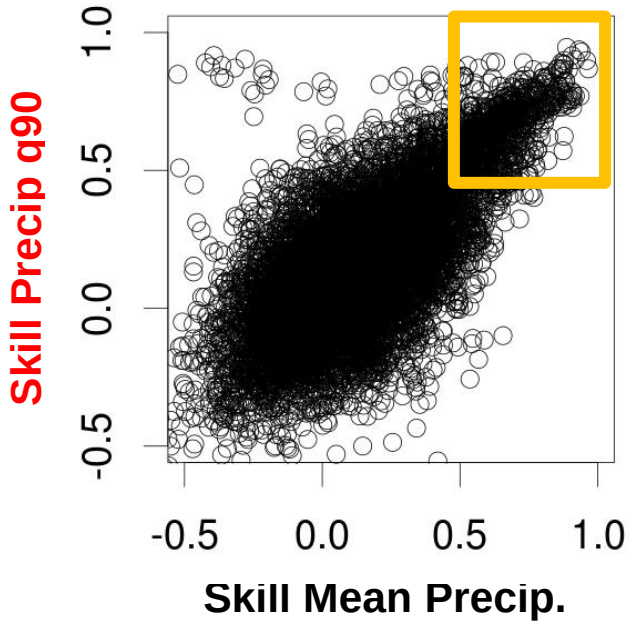
DJF



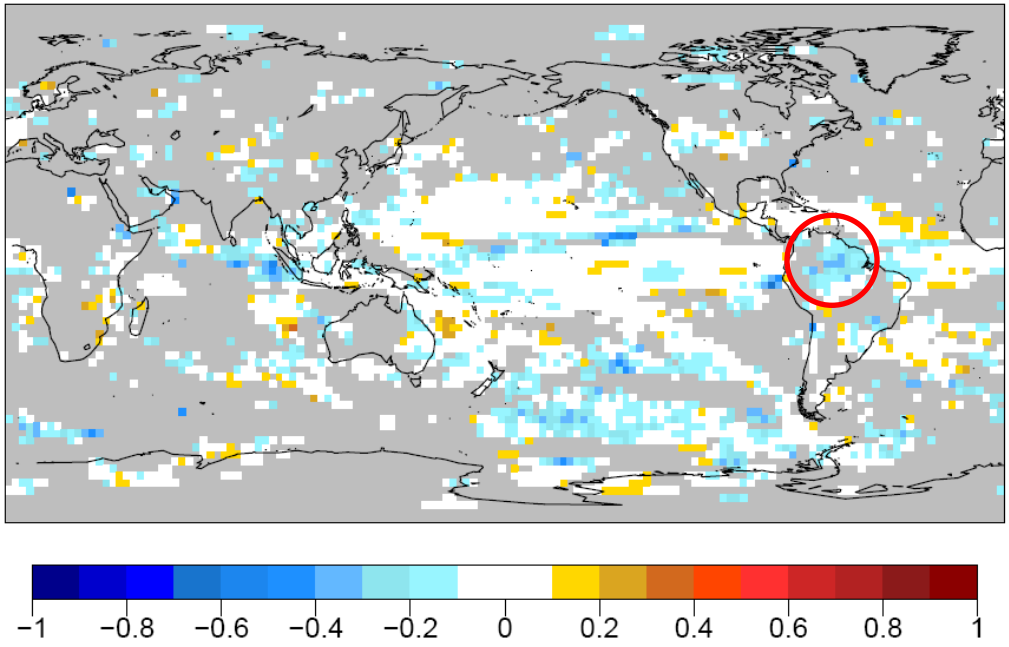


Skill for extremes for precip?

- Skill patterns are more patchy



Skill Precip. q90 – Skill Precip q10



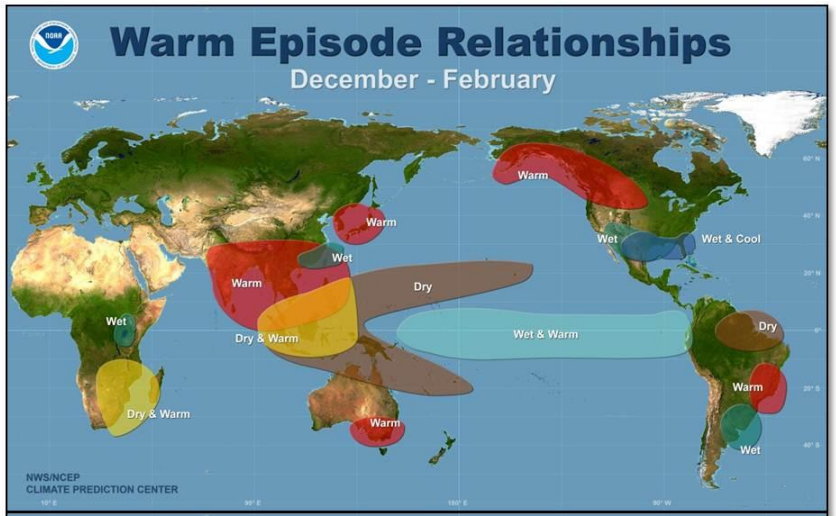
How does ENSO influence model skill?

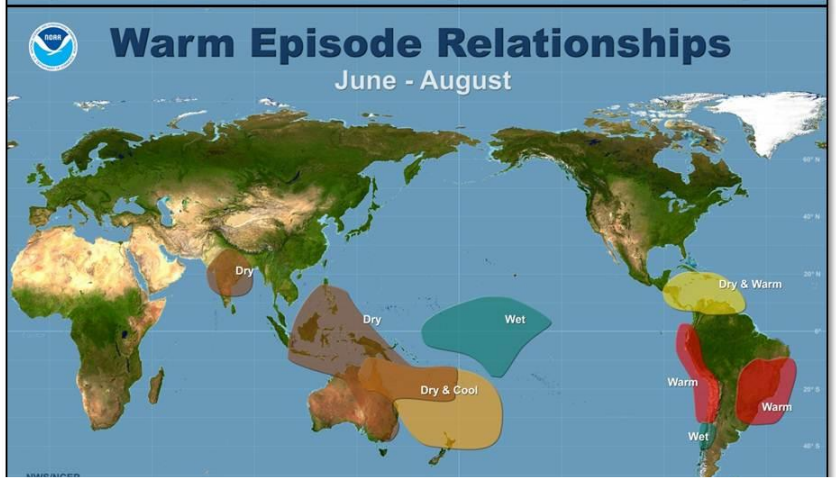
Questions:

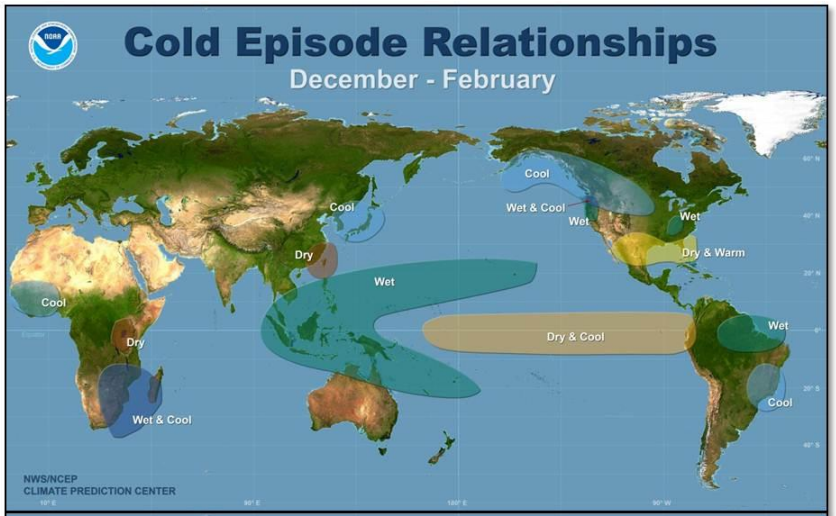
- Is forecast skill better during ENSO years?
- Is this different between El Nino and La Nina?
- Do these relationships change for climate extremes?

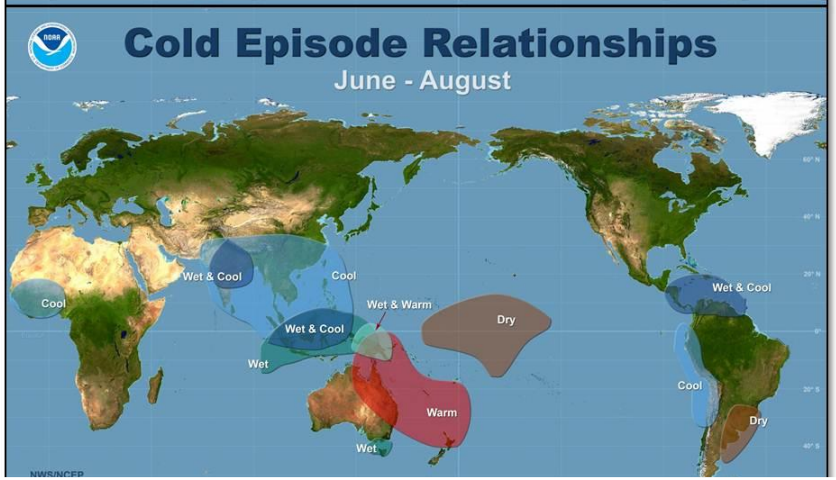
- We focus on DJF & JJA and three key regions: South America, Africa, Southern US
- ENSO events defined per the US CPC

How ENSO drives forecast skill?







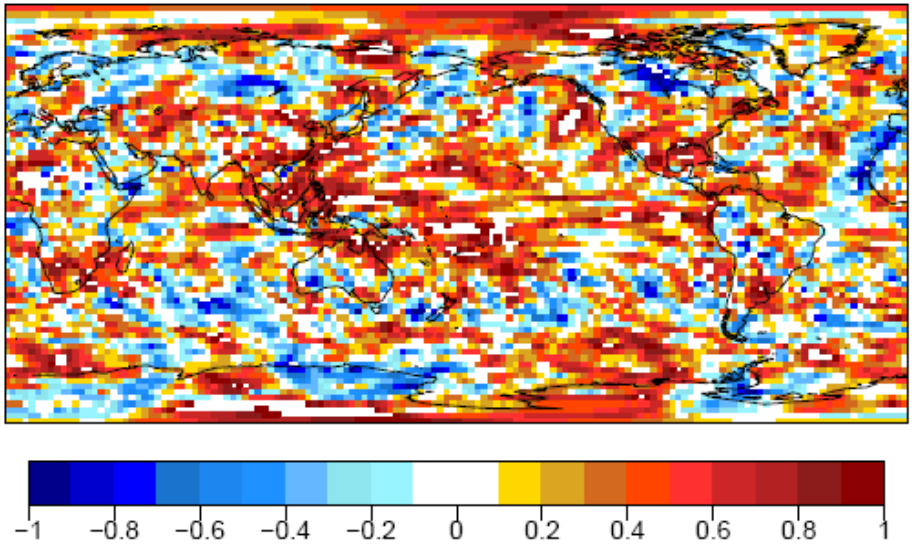


Source:CPC/NOAA

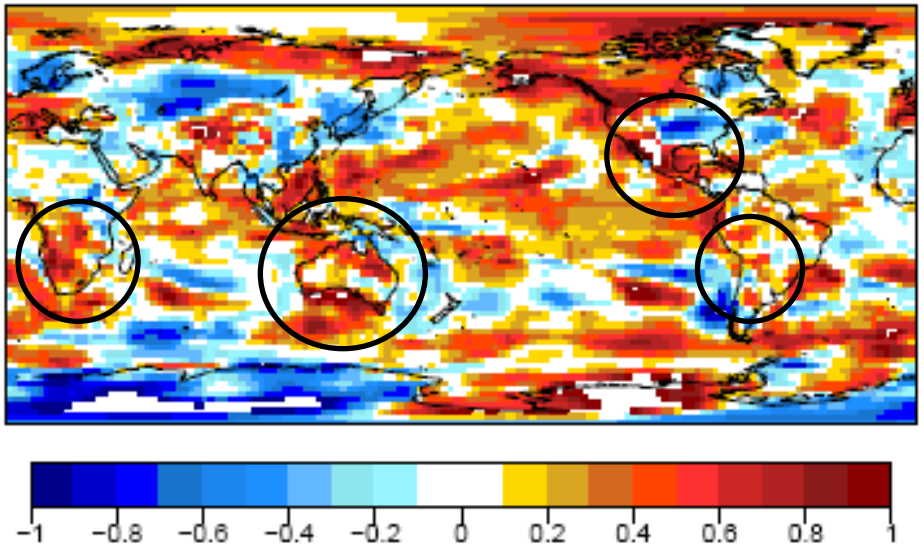
ENSO and forecast skill (DJF)

- CPC ENSO classifications
- Difference in skill between ENSO & neutral years

Rain



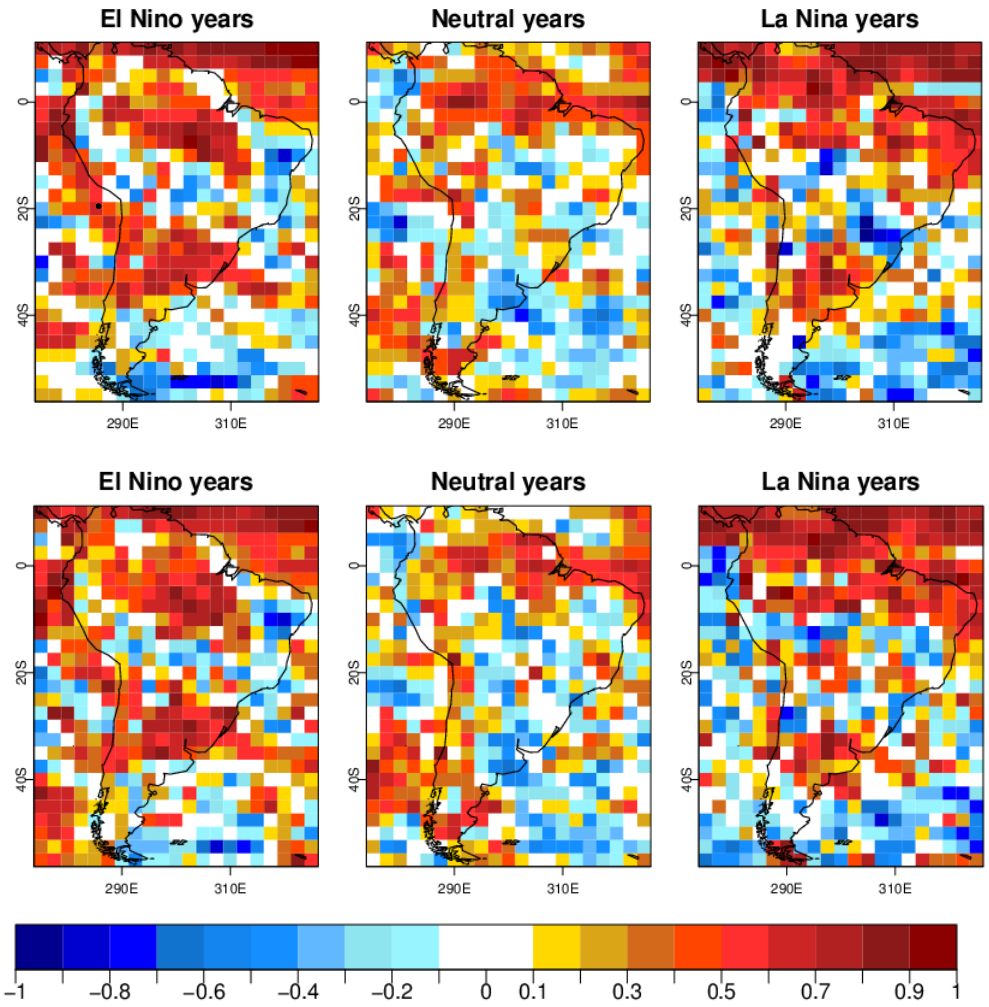
Temp



Influences of La Nina and El Nino DJF

Mean Precip.

q90 Precip.

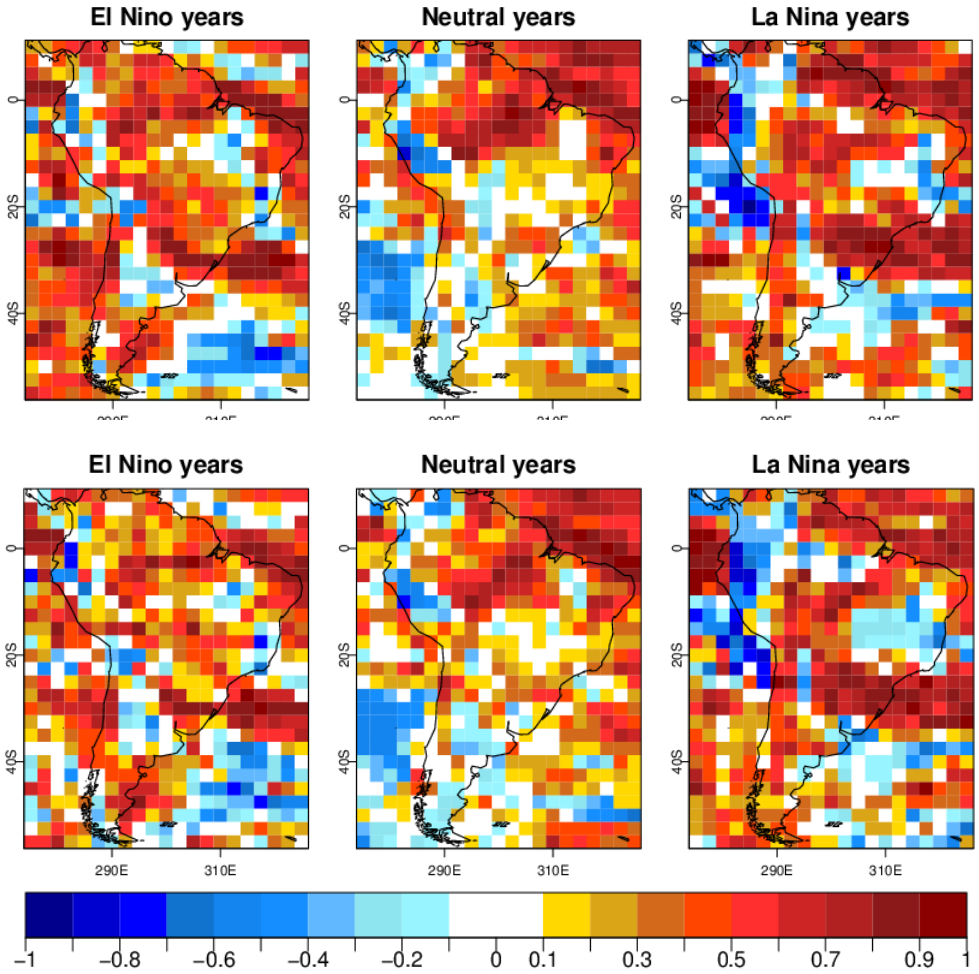


Improvement in skill during ENSO years for Northeastern Brazil and Southeastern South America

Influences of La Nina and El Nino JJA

Mean Precip.

q90 Precip.



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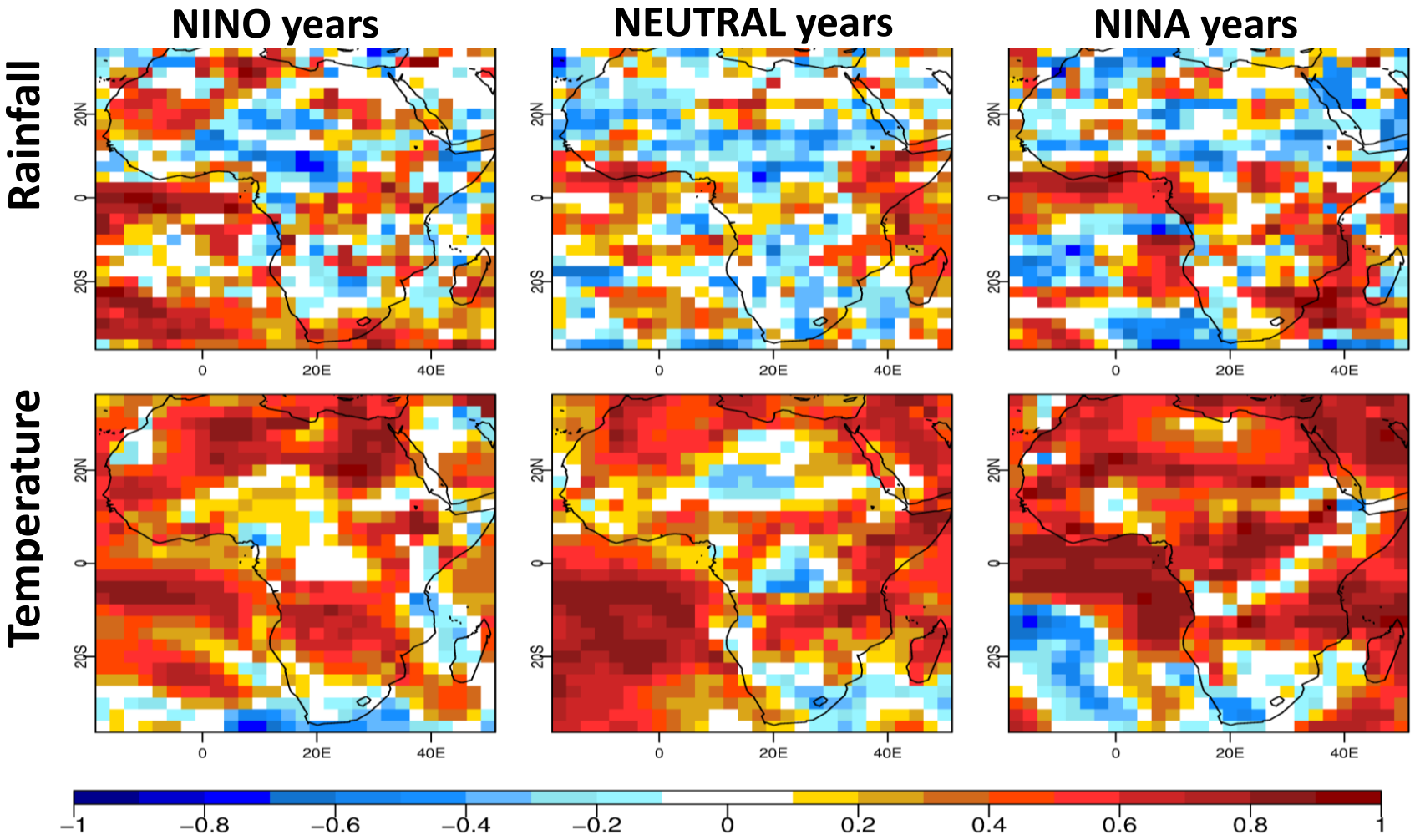
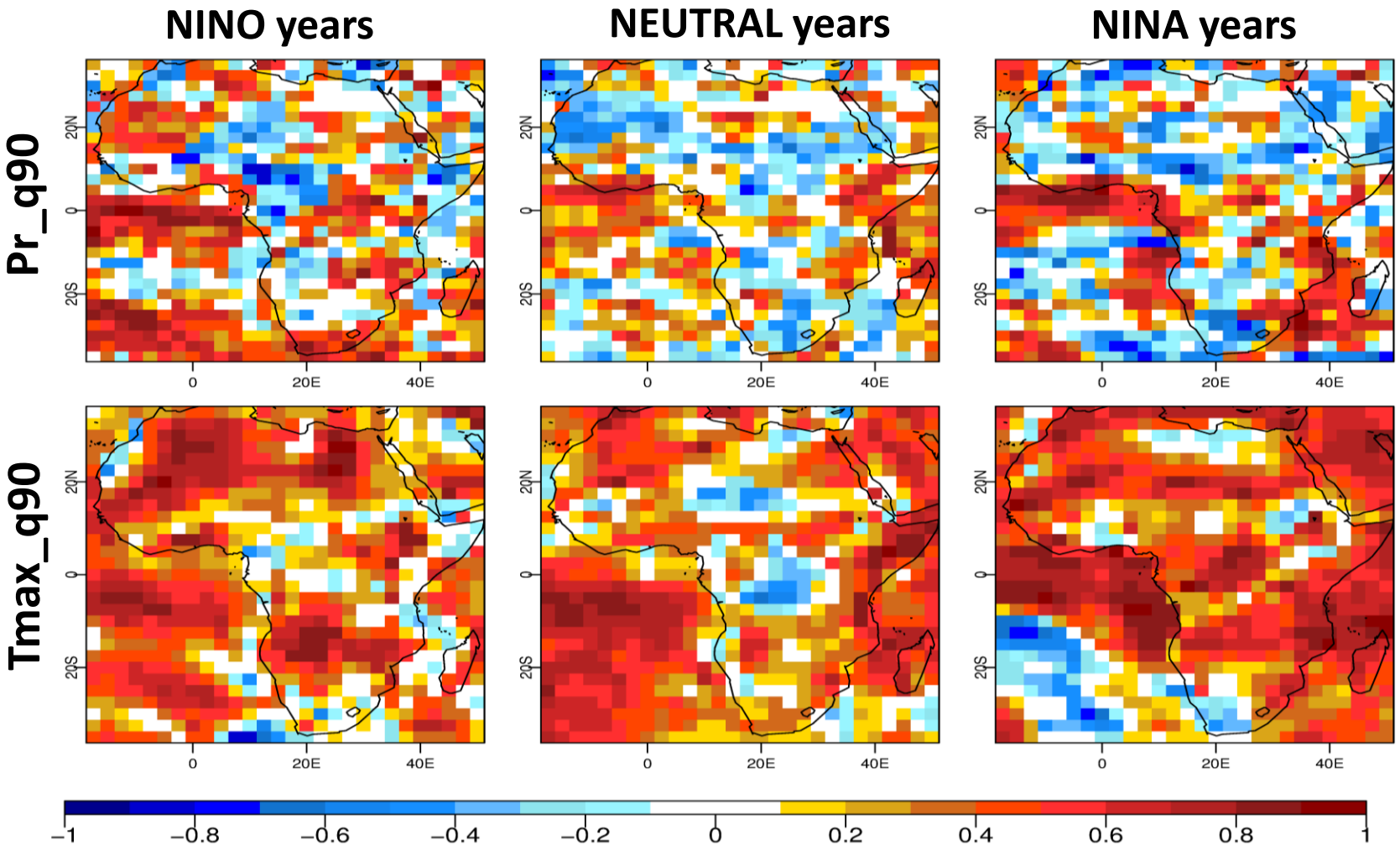


Influences of La Nina and El Nino JJA



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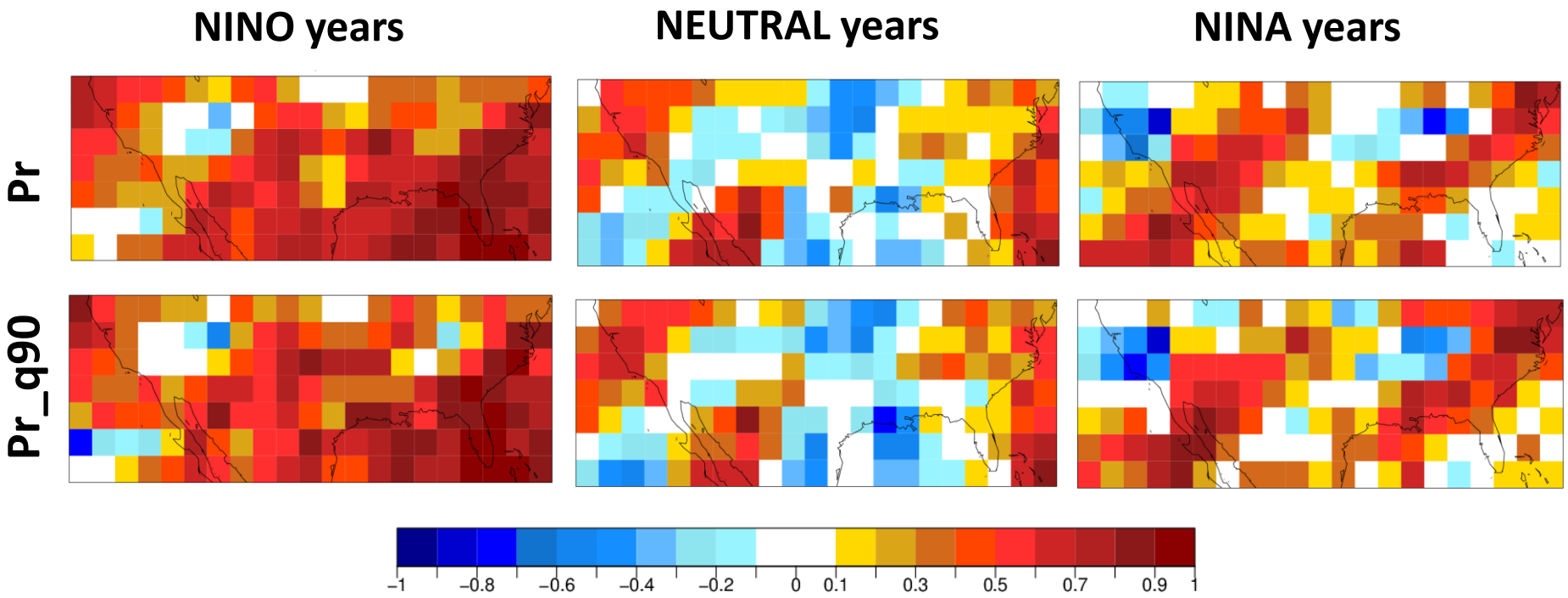

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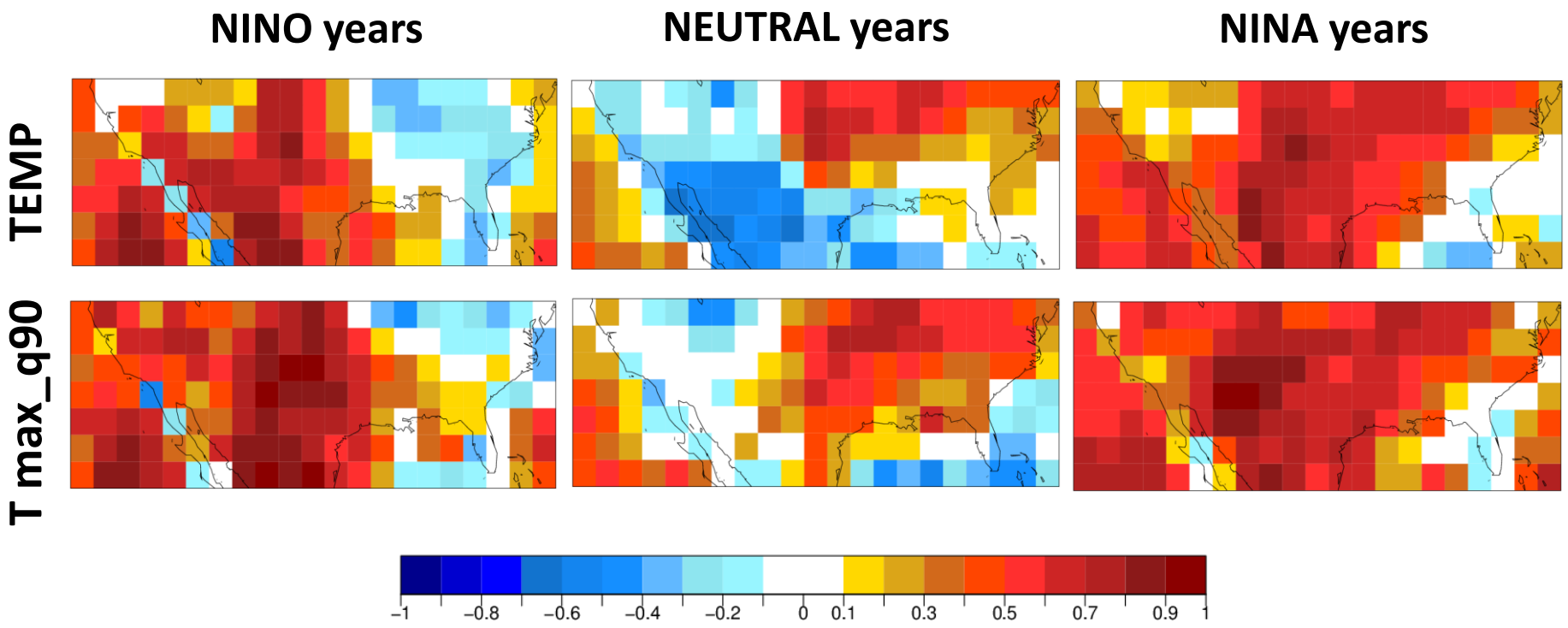
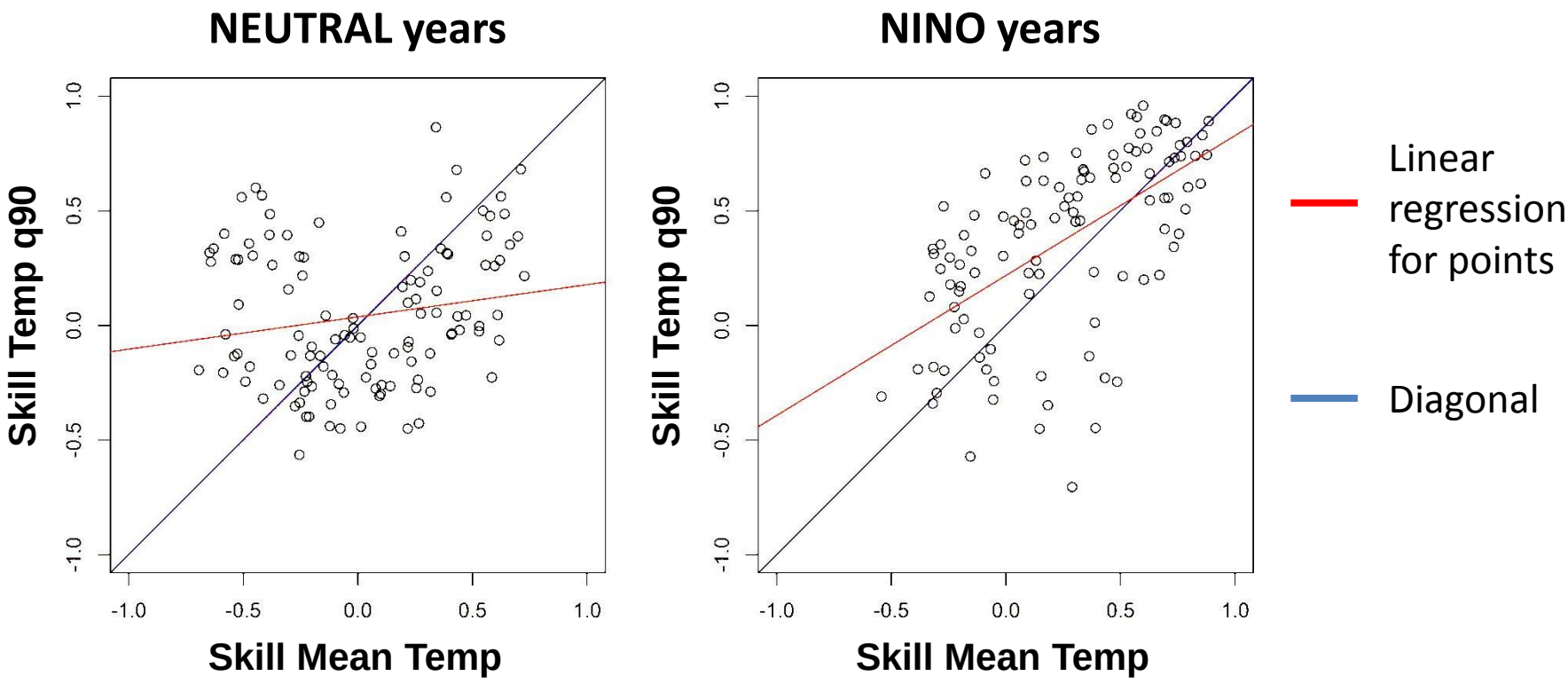
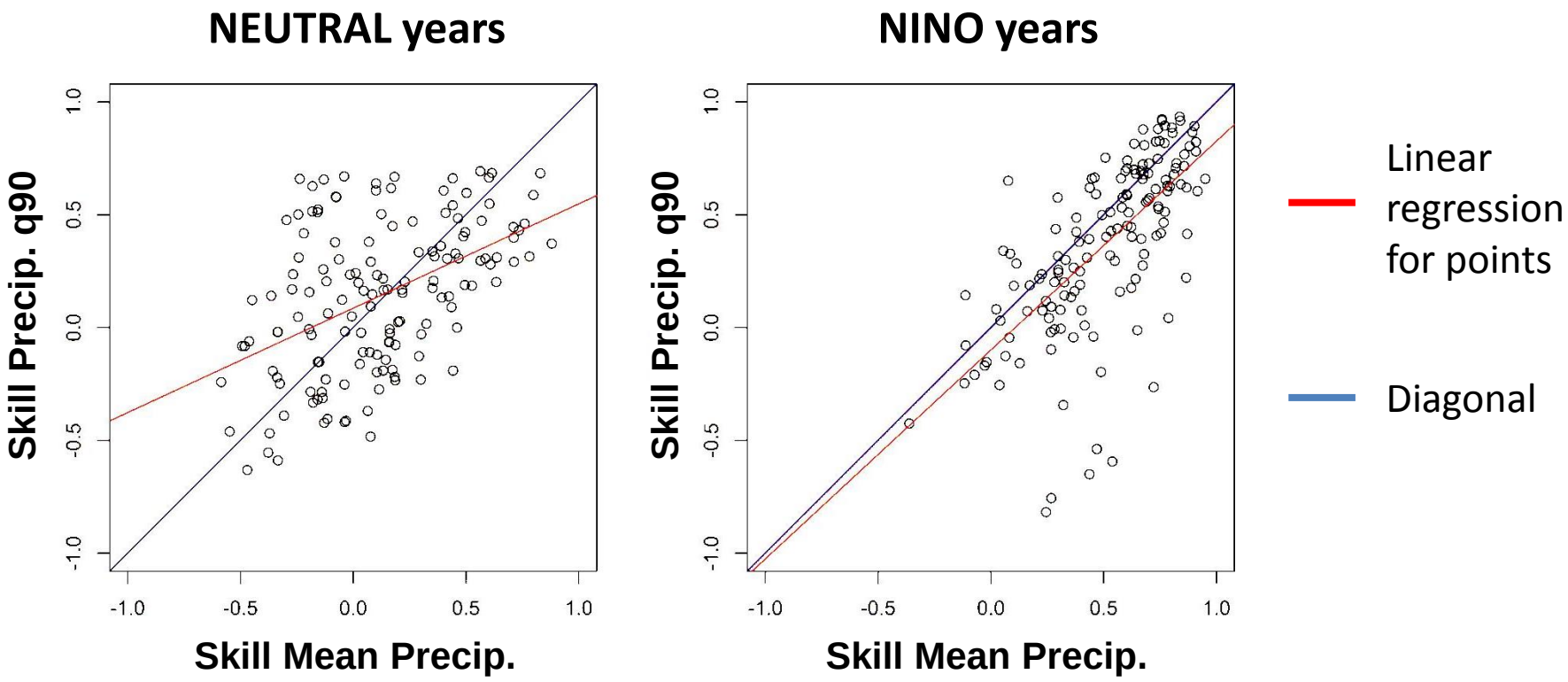


USA improved skill for DJF temp. extremes during ENSO



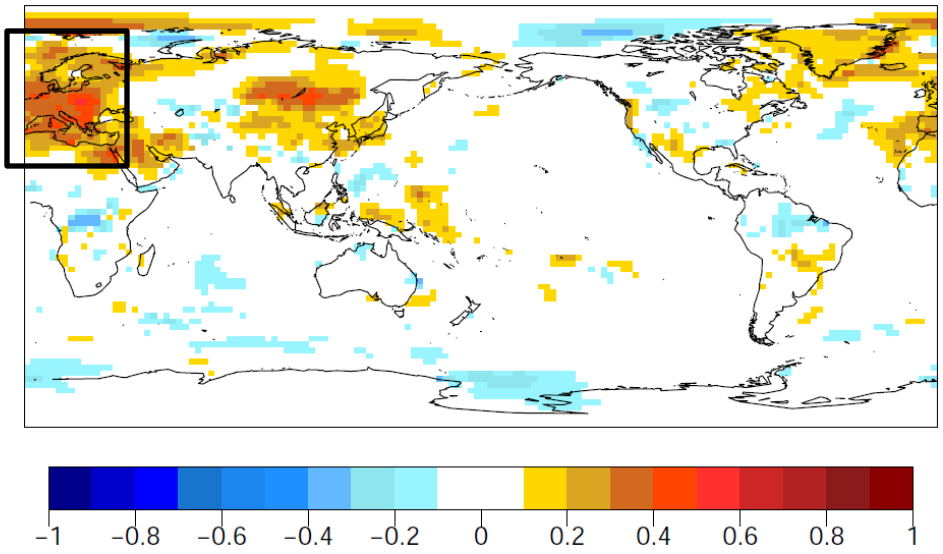
USA improved skill for DJF precip. extremes during ENSO

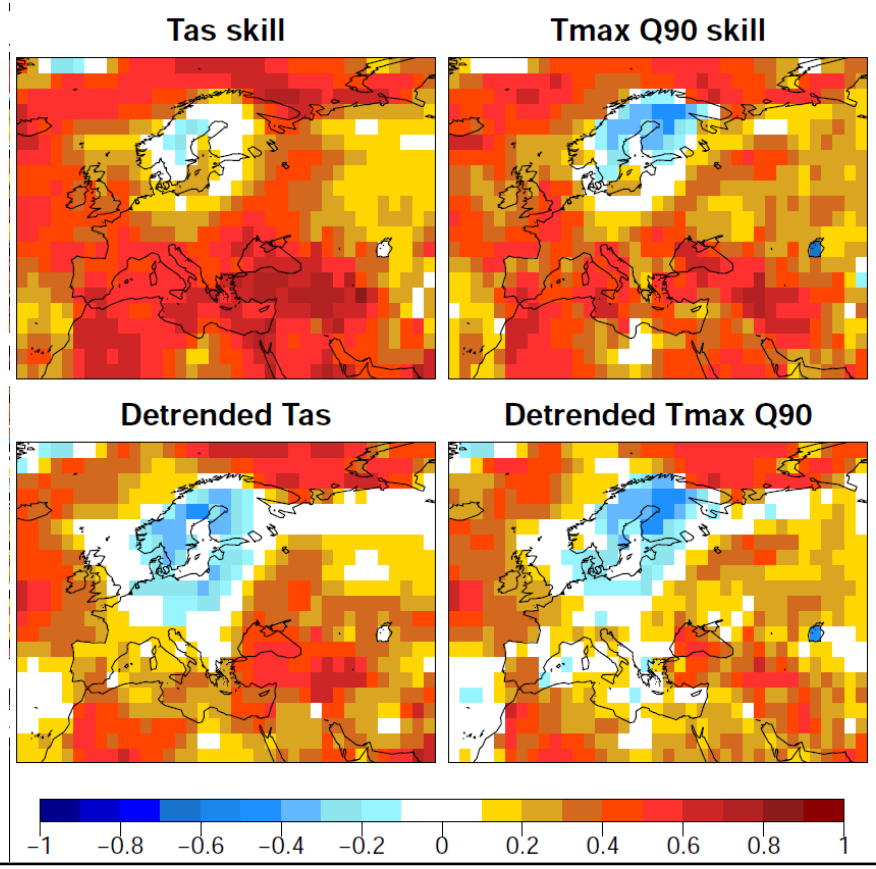


Is the skill in temperature due to the trend?

- Linearly detrended forecasts & observations

JJA mean temperature skill – detrended skill





Conclusion

- Seasonal outlooks have some skill, best for temperature and tropical precipitation
- Much of the skill in the midlatitudes is related to ENSO
- Skill for climate extremes is similar to means, with some exceptions
- Better skill for US extremes during ENSO years

Future work

- Seasonal percentiles
- Significance testing
- Why is there better skill in the warm tail?
- Detailed investigation of interesting regions
- More on ENSO/other indices and extremes
- Influence of trend on prediction skill

Seasonal forecasting of extreme events