Seasonal prediction of extreme weather: lesson from attribution

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Seasonal forecasting
Event Attribution

- Very similar: compute probabilities of events now vs probabilities in a reference climate.

- Seasonal forecasts are made before the event, attribution is done after the event.

- Attribution increases the skill due to the trends by moving the reference period back to "pre-industrial"

- Event attribution is usually done for extremes.

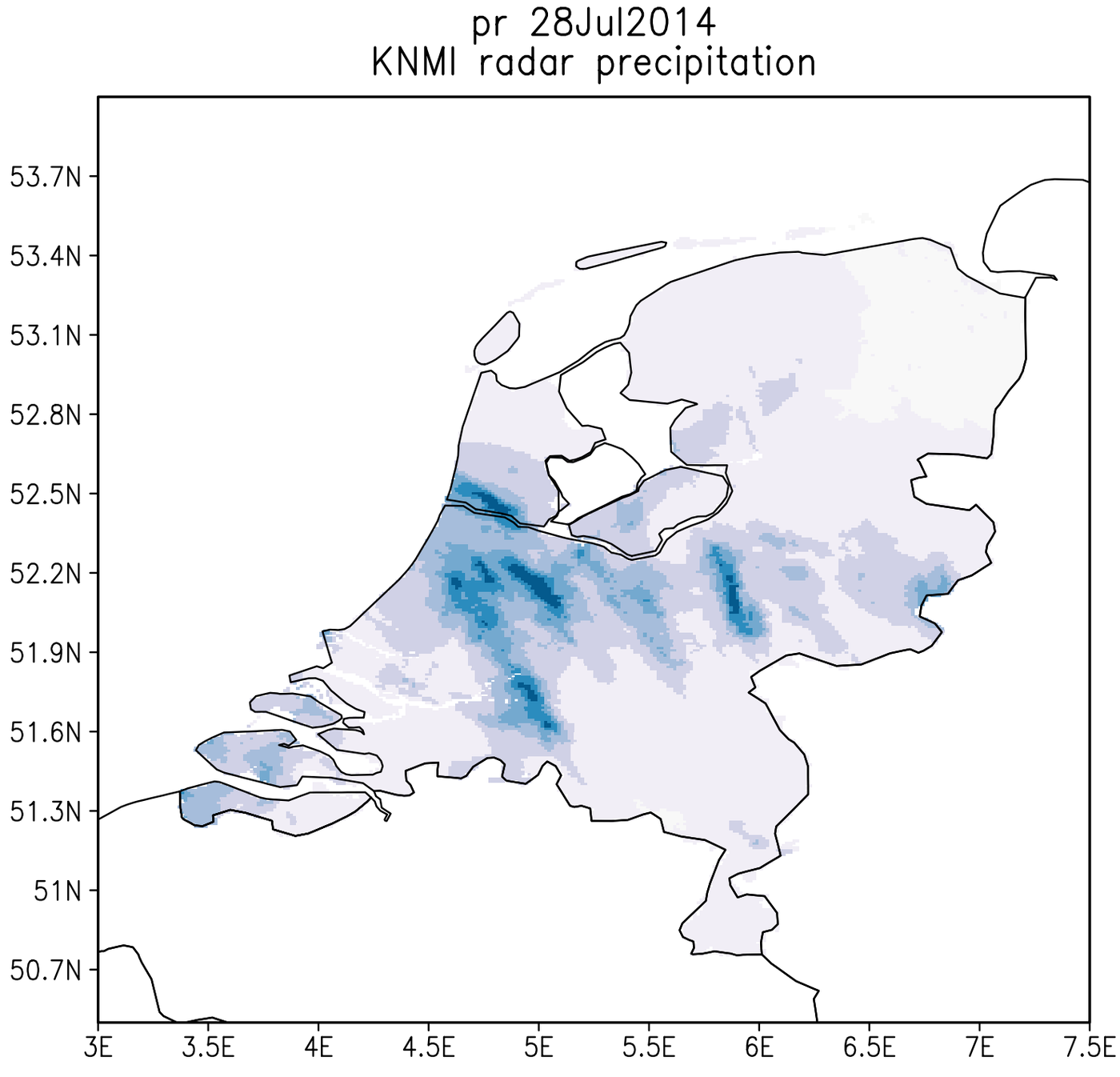
Event definition

- Much harder than we thought.
- ETCCDI has a standard list: Txx, TXn, Tnx Tnn; Rx1day, Rx5day (in practice Rx3day is often useful)
- Weather forecasters also have very relevant lists.
- Drought has many faces: P, P-E, snow.
- Often users are interested in impact-related parameters: flood level, heat stress, water availability.

Event definition

Watch difference between points (stations) and area averages (grid boxes) for variables with small scales.

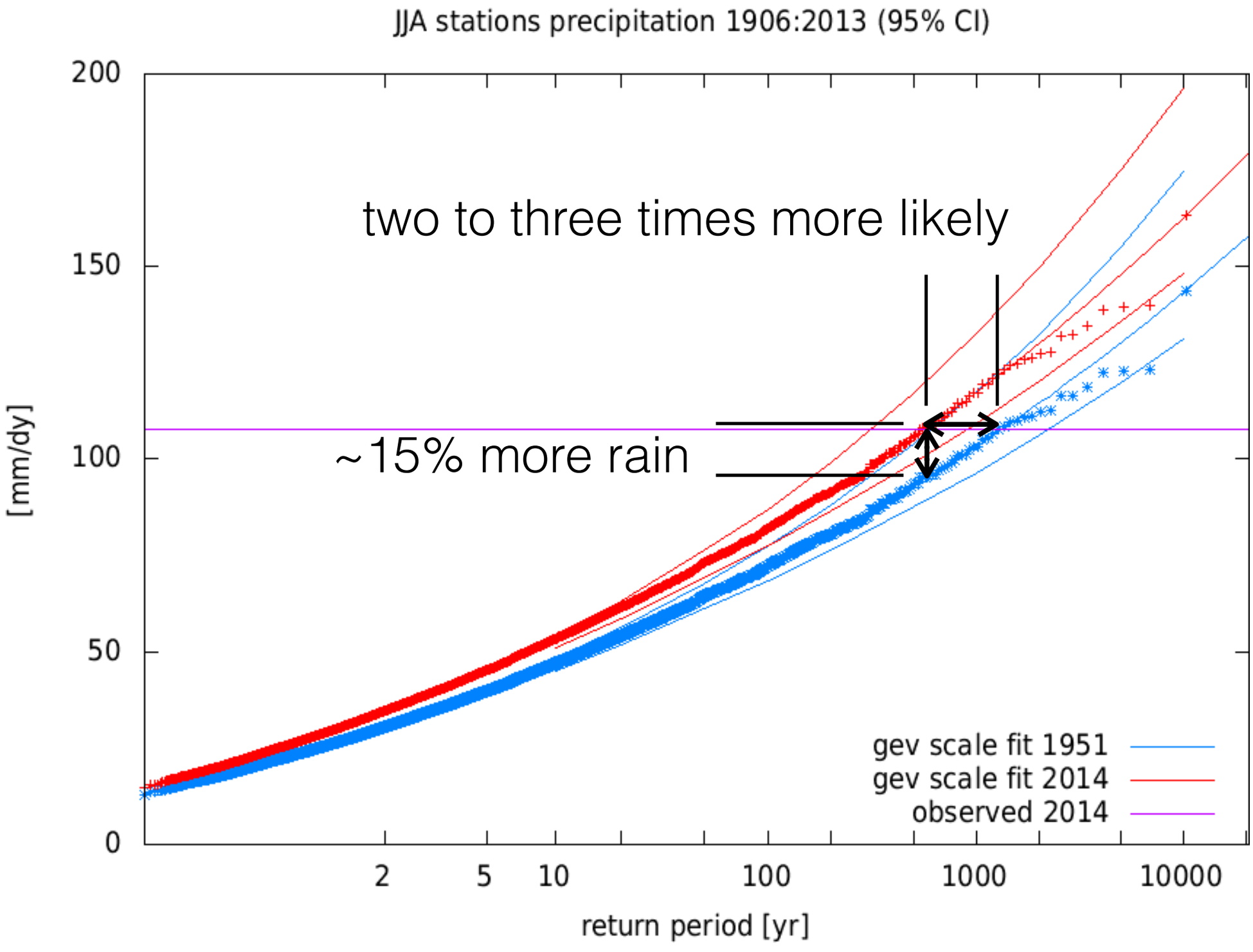
Also, the extreme value of a grid box average is in general not equal to the average of the extremes.



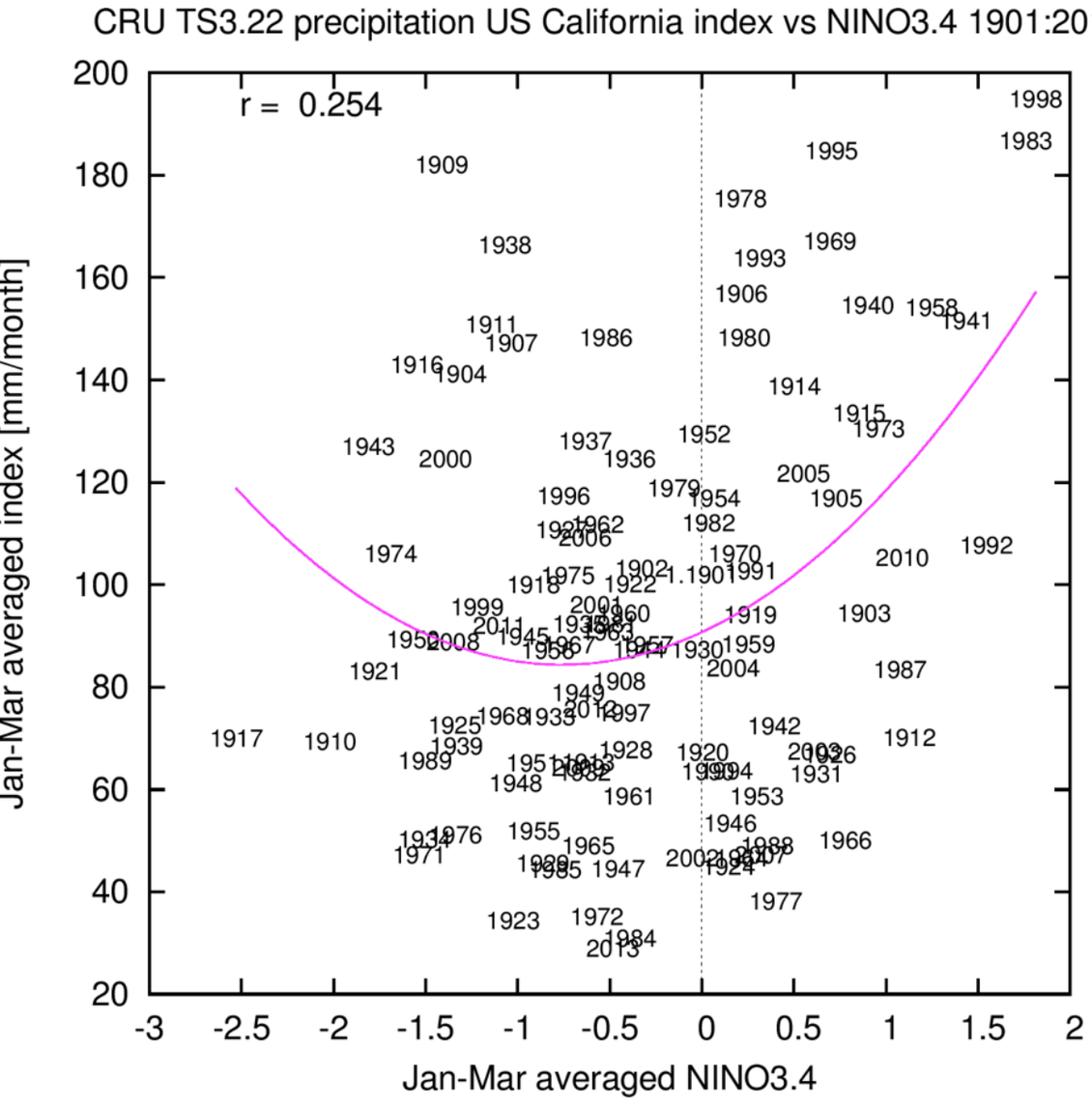
Communicate change

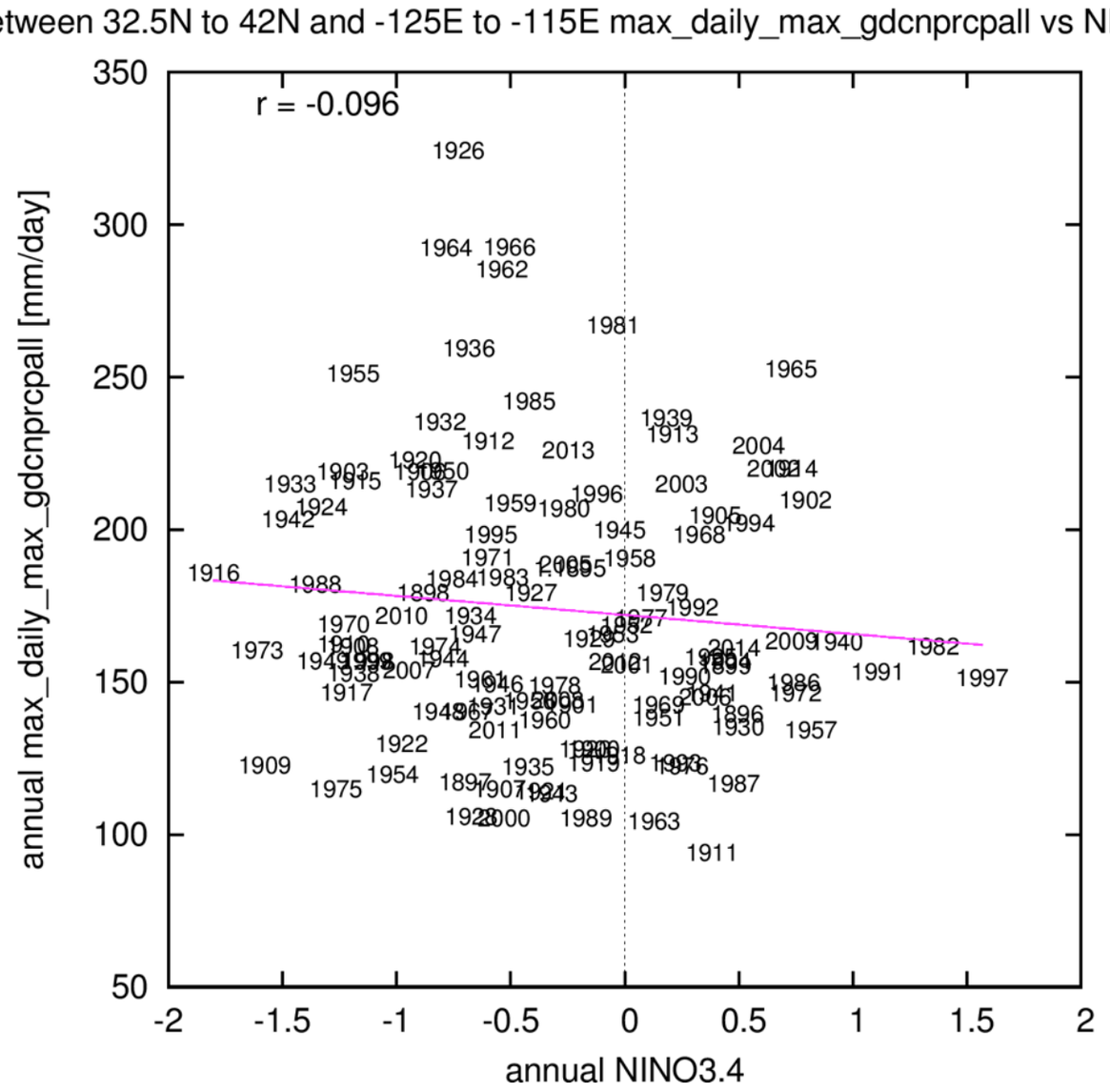
- Change in amplitude (K, mm/dy. %, ..)
- Change in probability p(now)/p(cliim)
- Change in return times T = 1/p
- (FAR = 1 – p(clim)/p(now))

How to describe a change

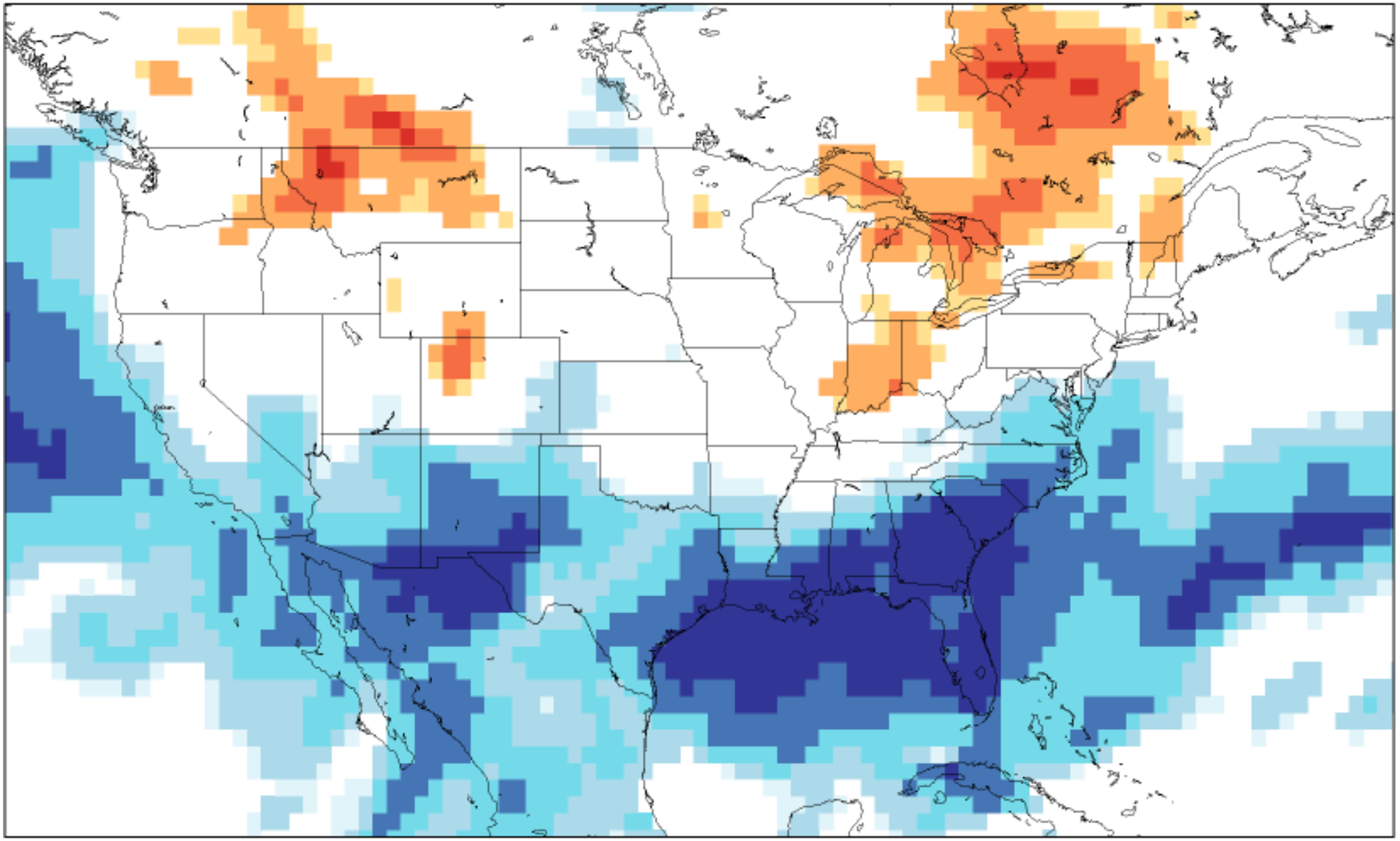


Mean vs extremes

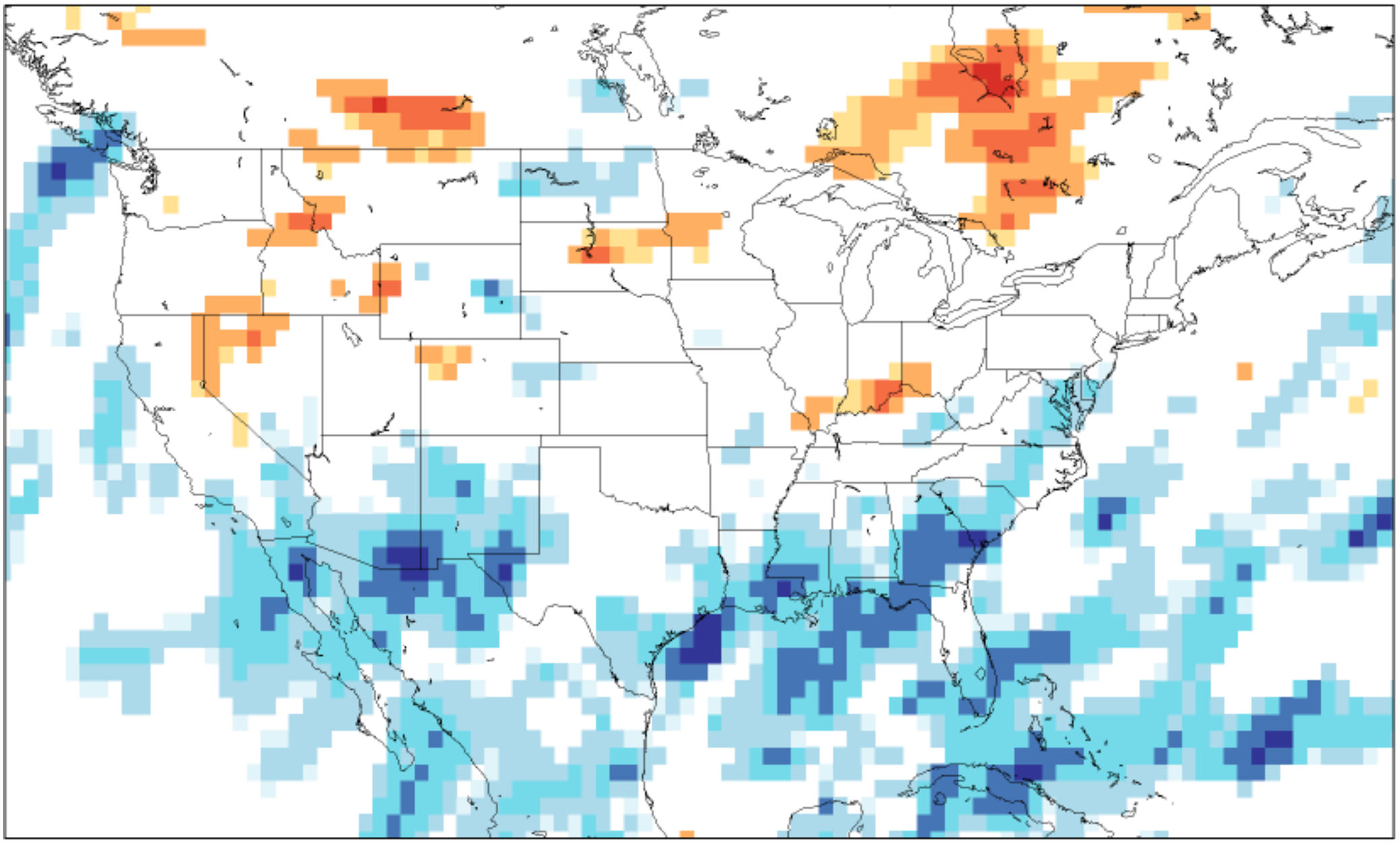




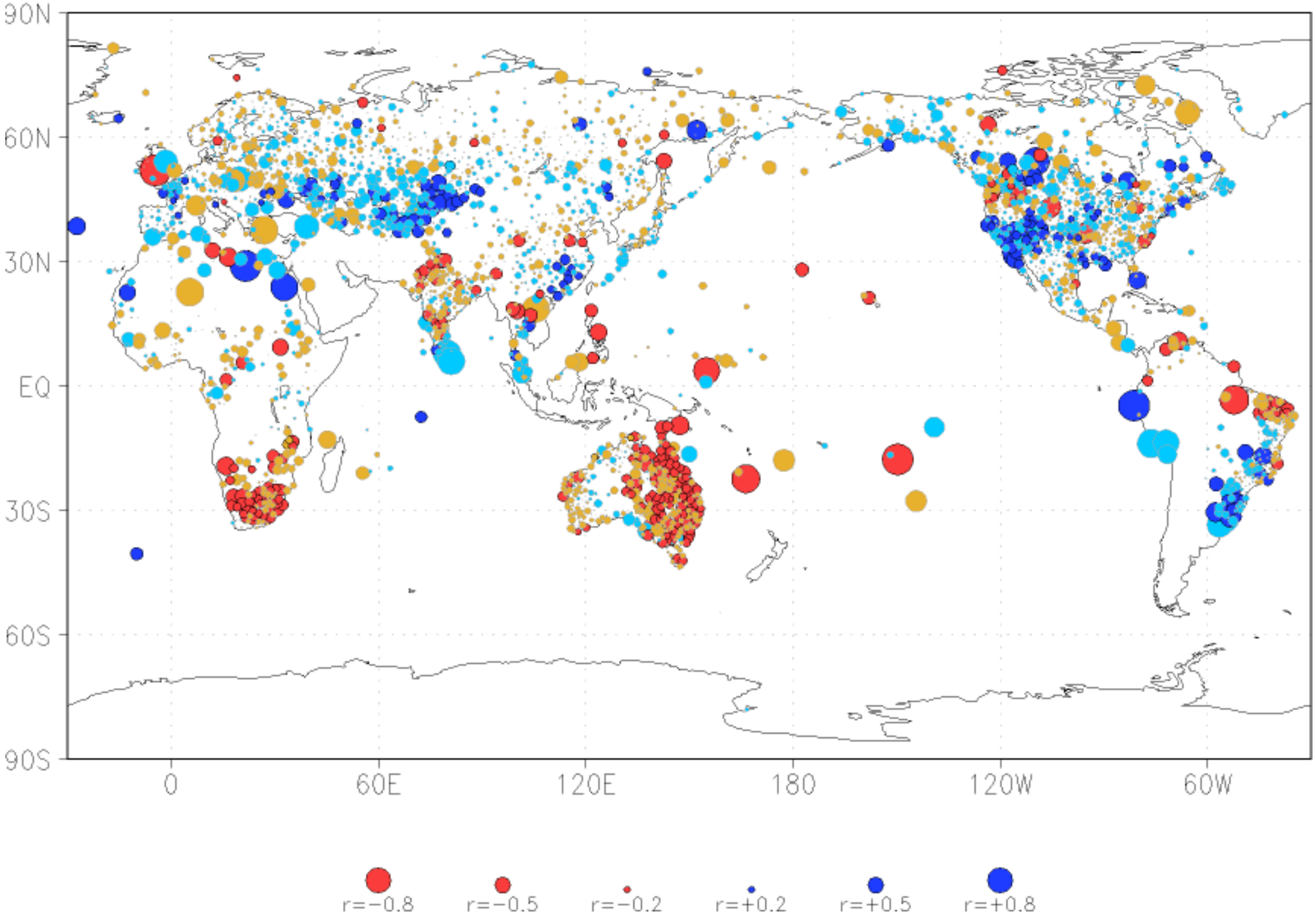
corr Dec–Feb averaged NINO3.4 index
with Dec–Feb averaged ERA–int precipitation 1979:2014 p<10%



corr DJF NINO3.4 index
with DJF ERA-int seasonal max of daily pr 1980:2015 p<10%

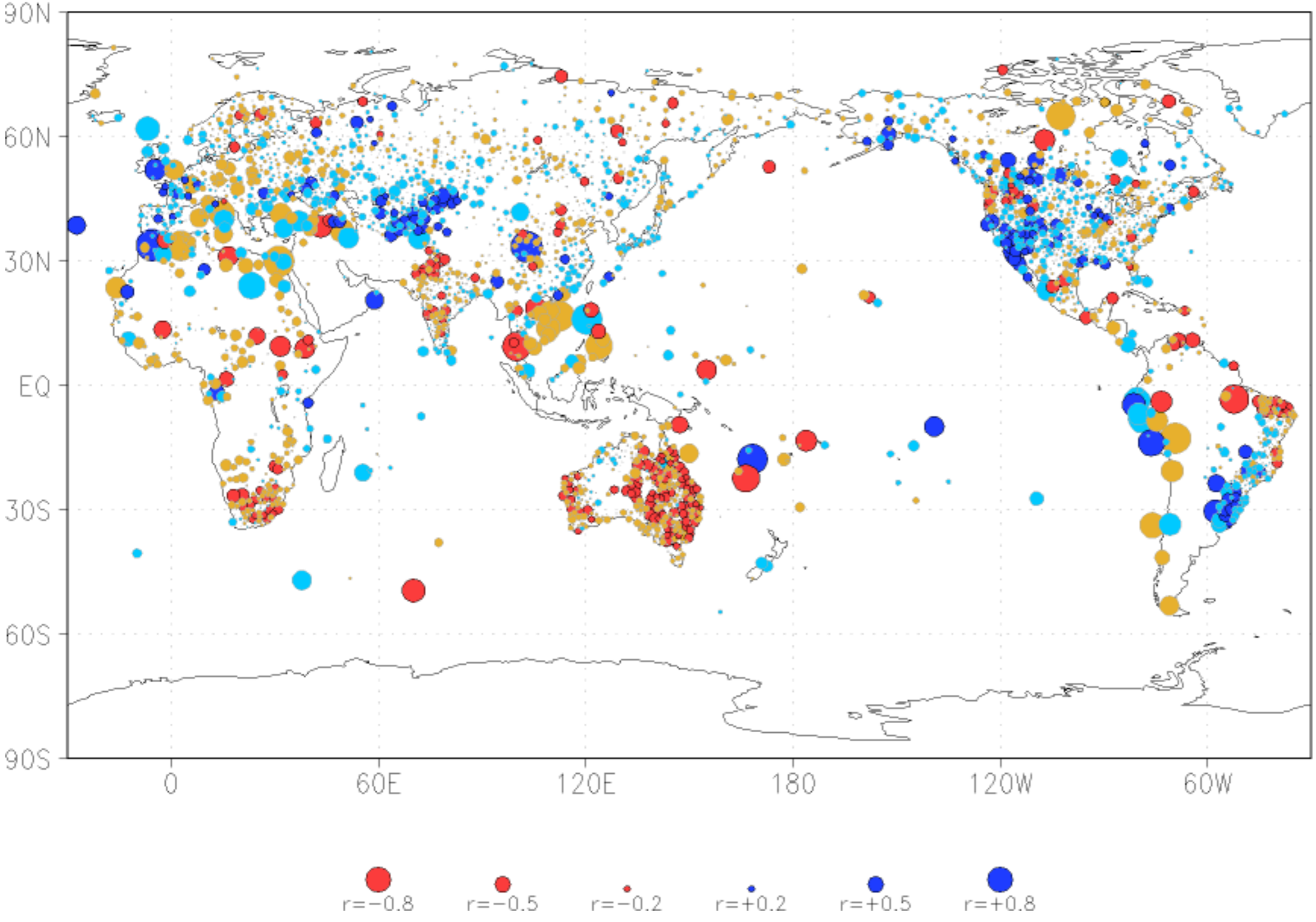


corr period station max ave 90 gdcnprcpall
with NINO3.4 index

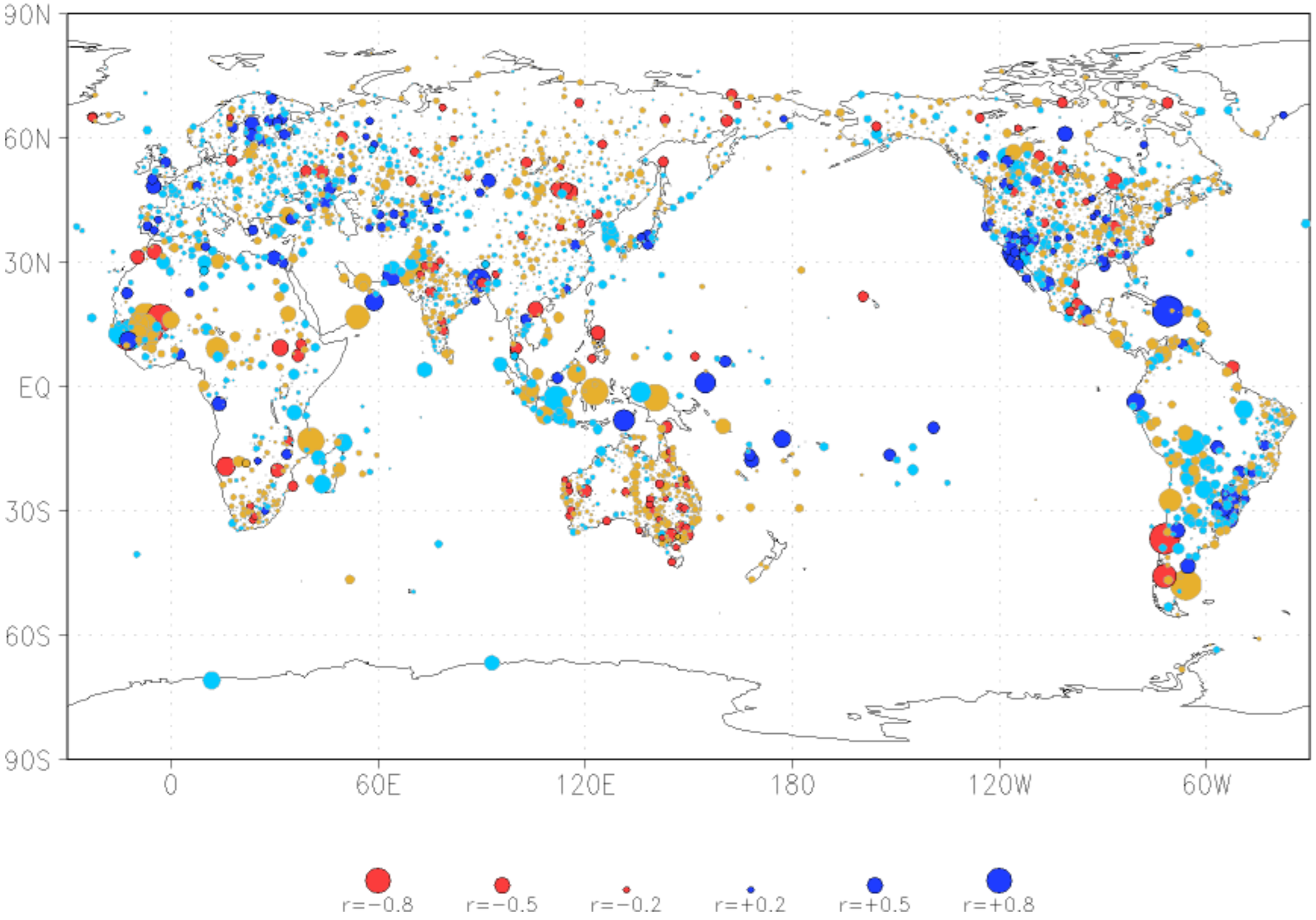


There are 620/ 3052 (17.22%) stations with P < 10.00%
There are 394/ 3052 (10.94%) stations with P < 5.00%
There are 153/ 3052 (4.25%) stations with P < 1.00%

corr period station max ave 30 gdcnprcpall
with NINO3.4 index



There are 572/ 3173 (15.88%) stations with P < 10.00%
There are 349/ 3173 (9.69%) stations with P < 5.00%
There are 118/ 3173 (3.28%) stations with P < 1.00%



There are 437/ 3556 (12.14%) stations with P < 10.00%
There are 244/ 3556 (6.78%) stations with P < 5.00%
There are 63/ 3556 (1.75%) stations with P < 1.00%

To do

- Look at other extremes: heat and cold waves, droughts, storms, fog. ...

- Analyse daily output of seasonal forecast models, verify against observations.

- How to do bias corrections on extremes?