Regionalization and Prediction of Seasonal Precipitation in Ethiopia

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NASA IDS 2nd Workshop

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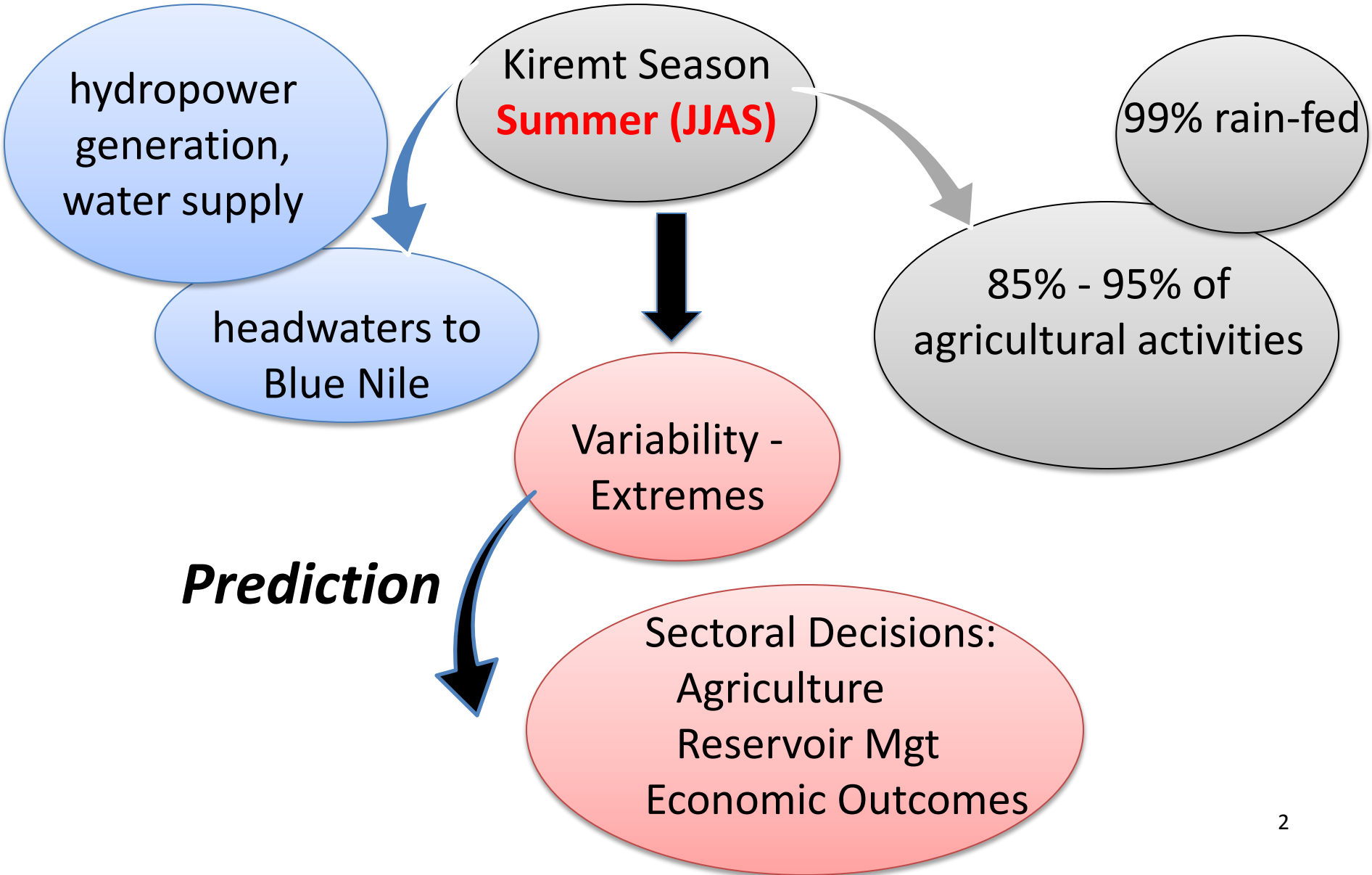
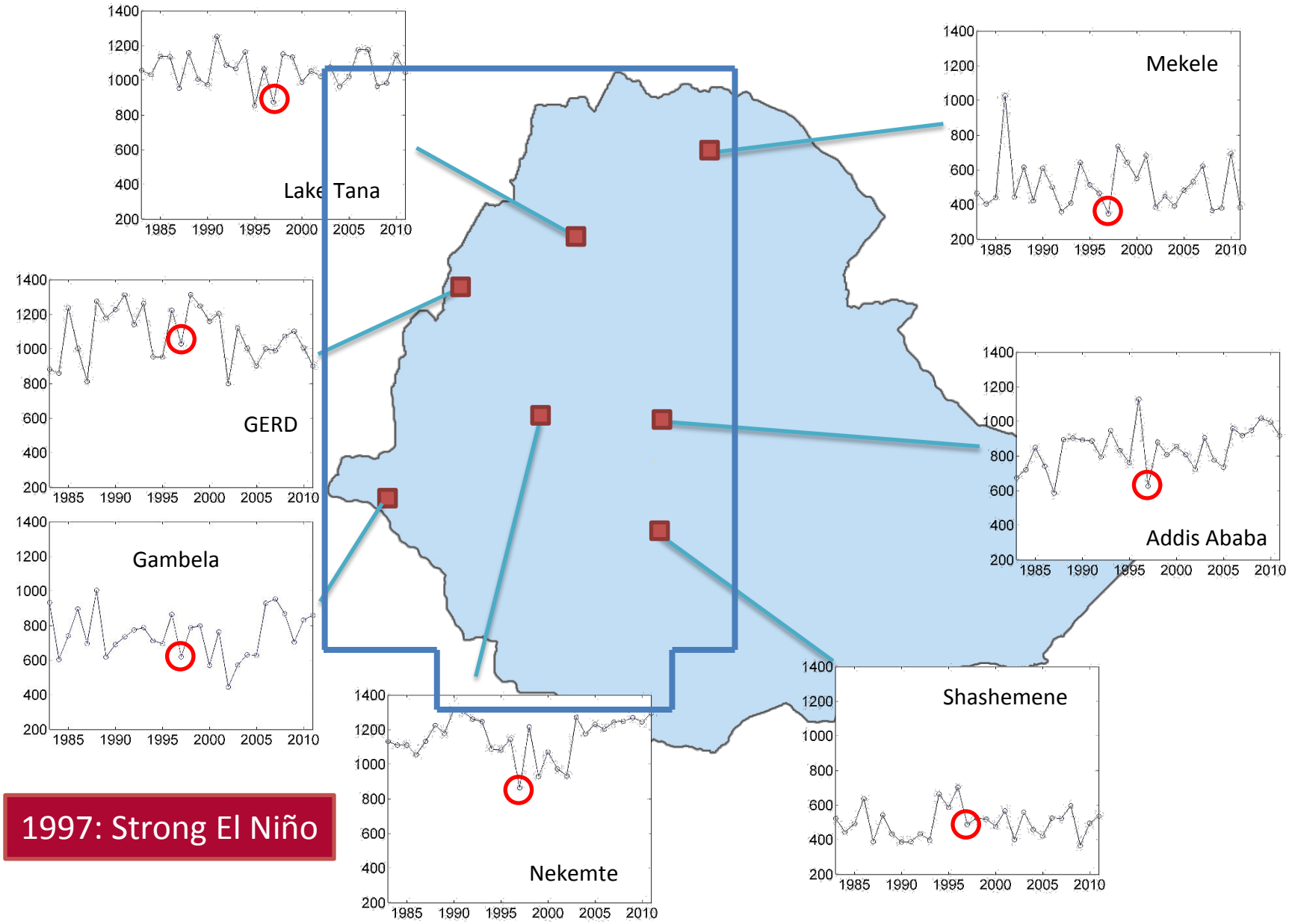
Precipitation in Western Ethiopia



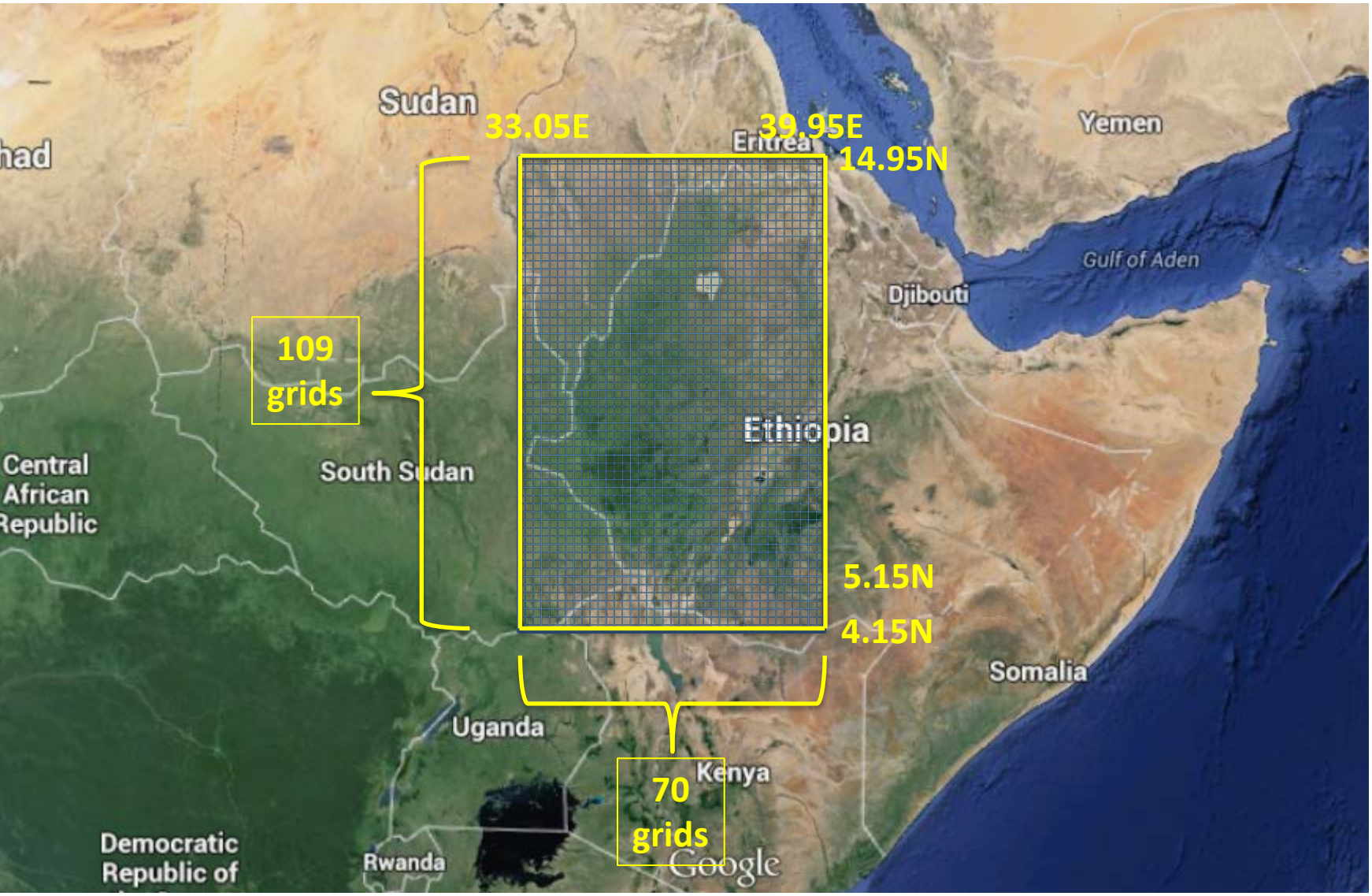
Seasonal Total Precipitation (mm) Jun-Sep 1983-2011



1997: Strong El Niño

Gridded precipitation data (NMA); JJAS total

(Dinku et al., 2014)



Compare clustering techniques; objectively select # clusters

Selection of *k*

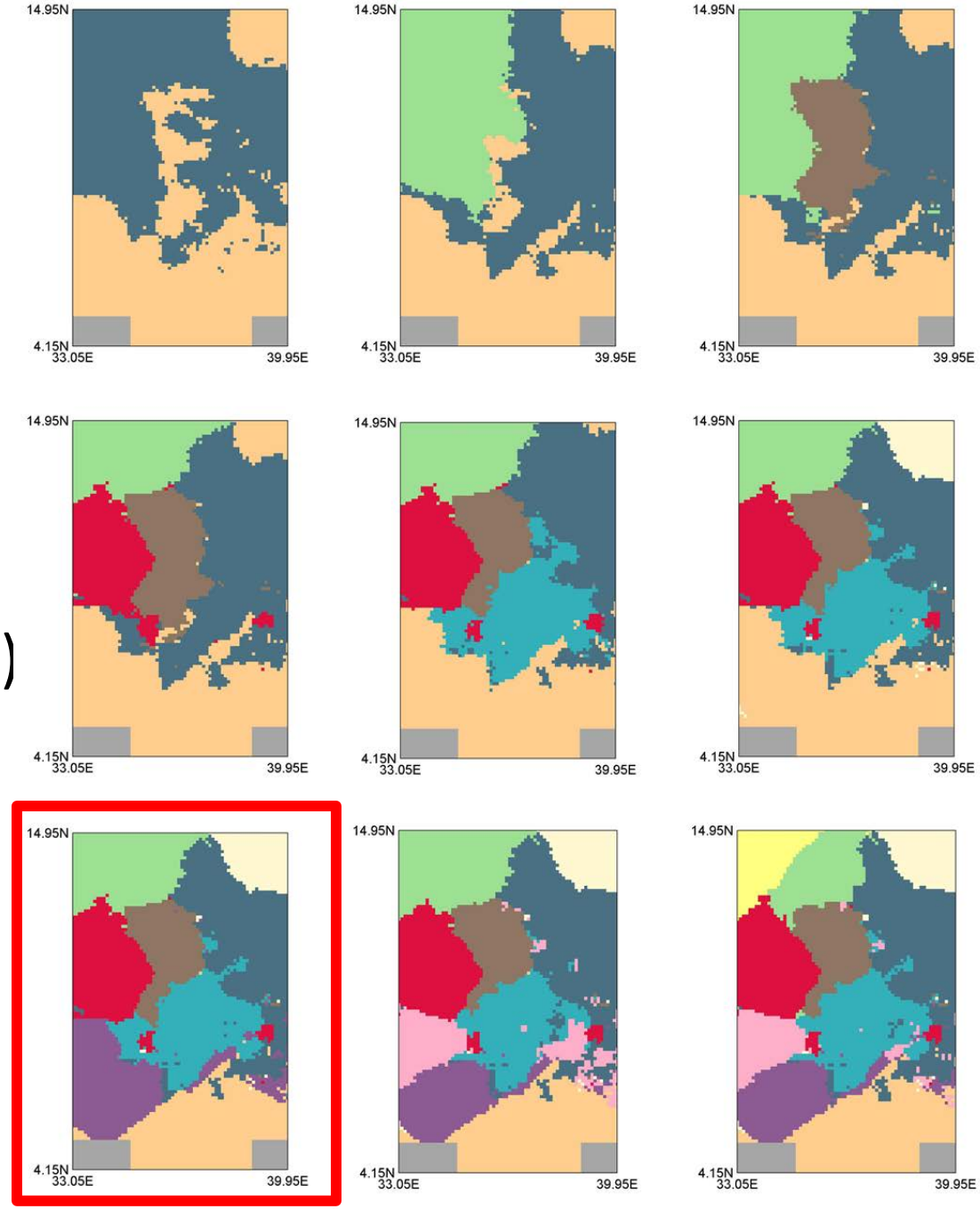
Clusters based on correlation matrix

Compare:

Σe^2 within cluster

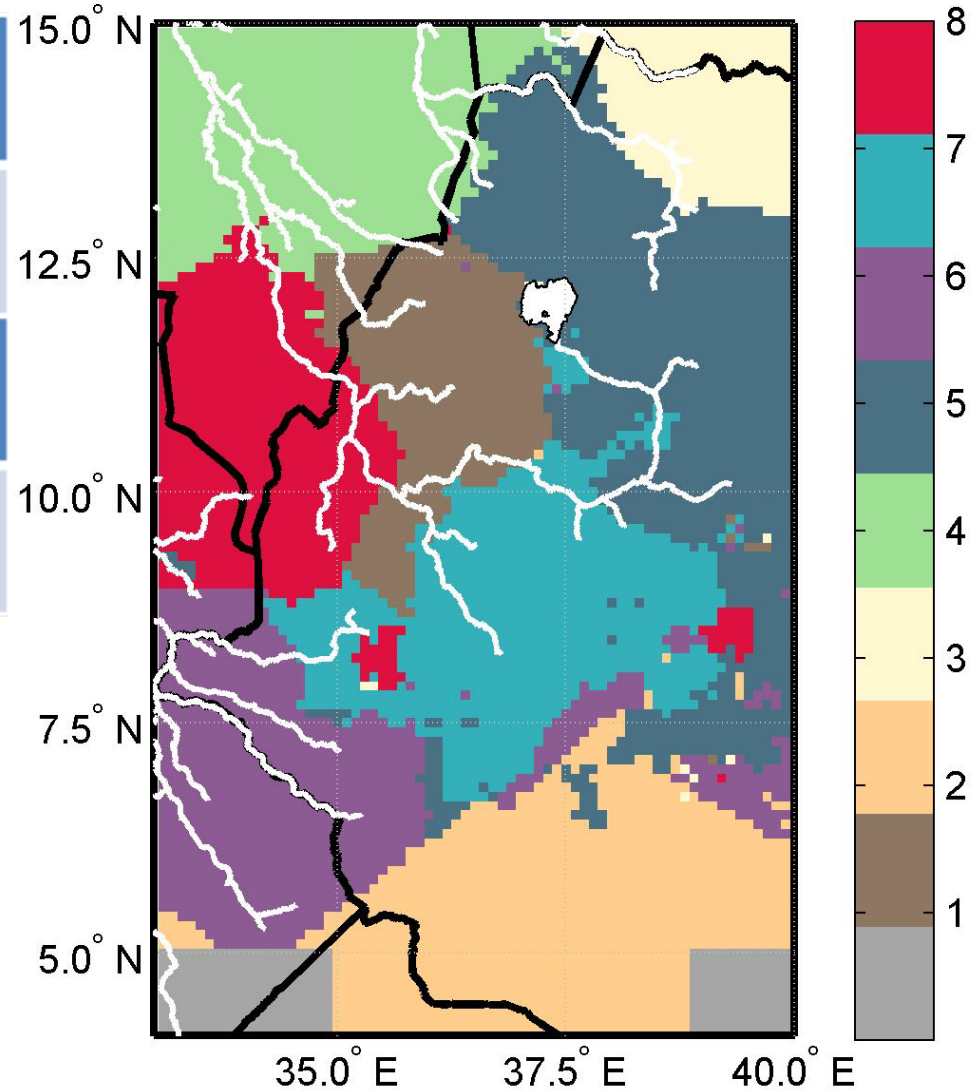
e = (grid – cluster avg)

k = 8



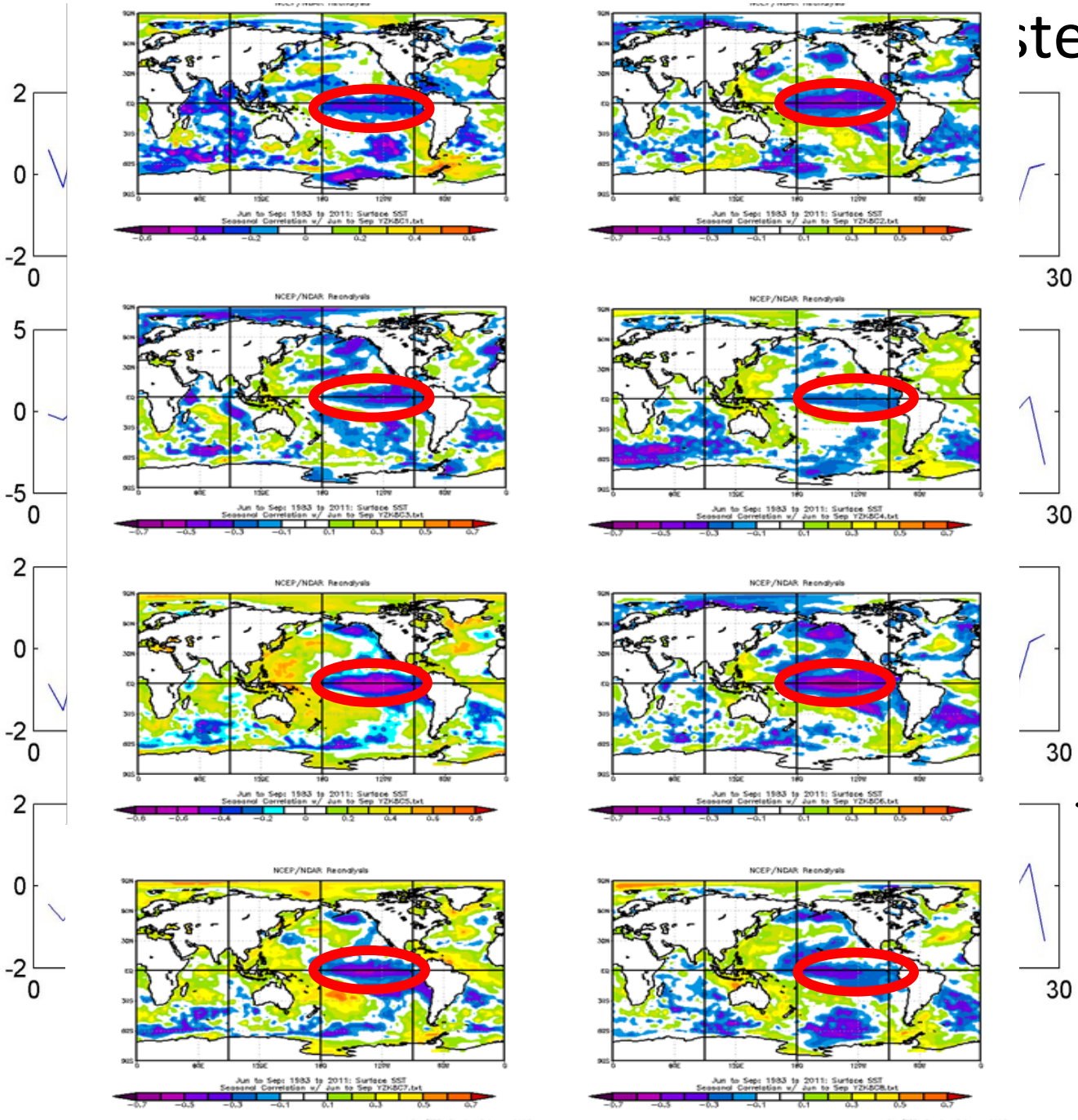
Intra-correlation for *k* clusters

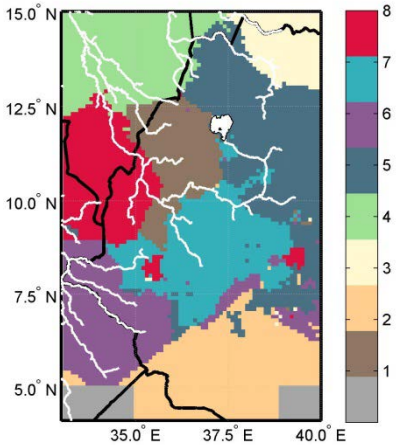
Cluster Index	1	2	3	4
Intra-correlation	0.74	0.79	0.91	0.85
Cluster Index	5	6	7	8
Intra-correlation	0.77	0.78	0.64	0.85



- High intra-correlation, indicating strong coherency within each cluster
- All intra-correlation > inter-correlation

ster Average





Justification of clusters

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concurrent climate variables

season ahead climate variables

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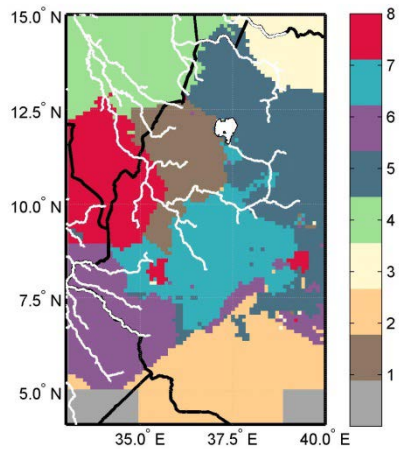
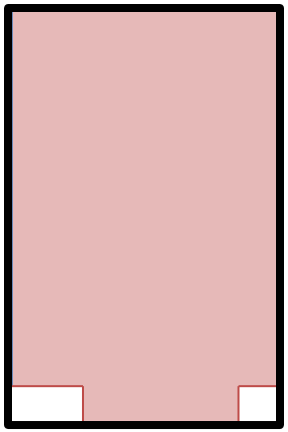
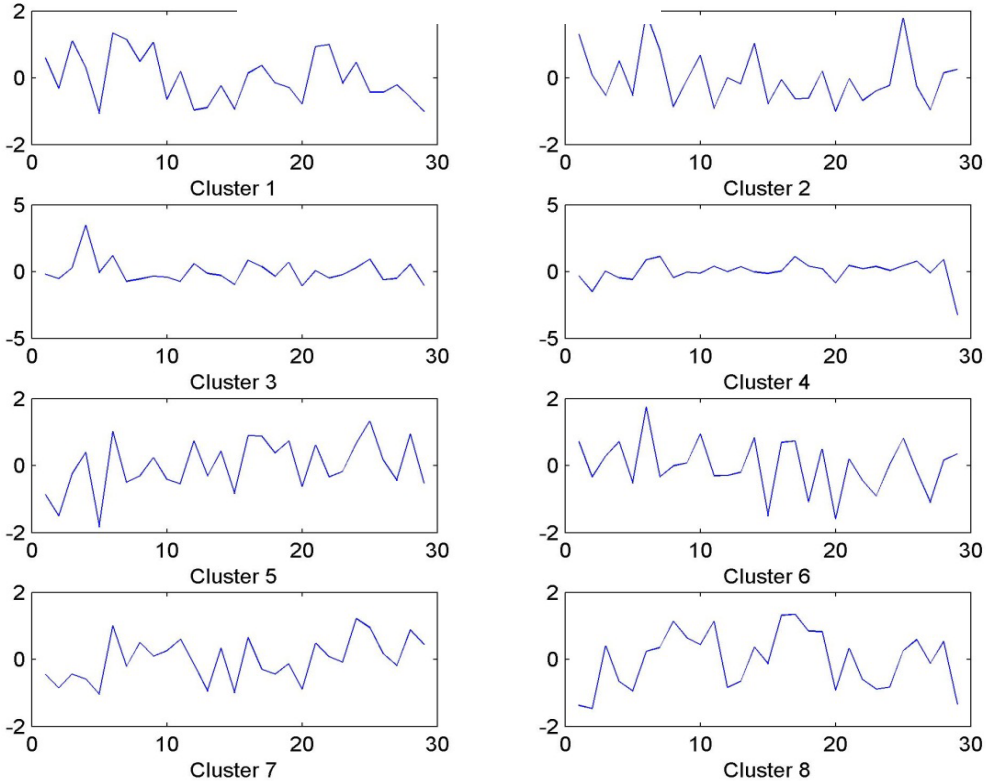
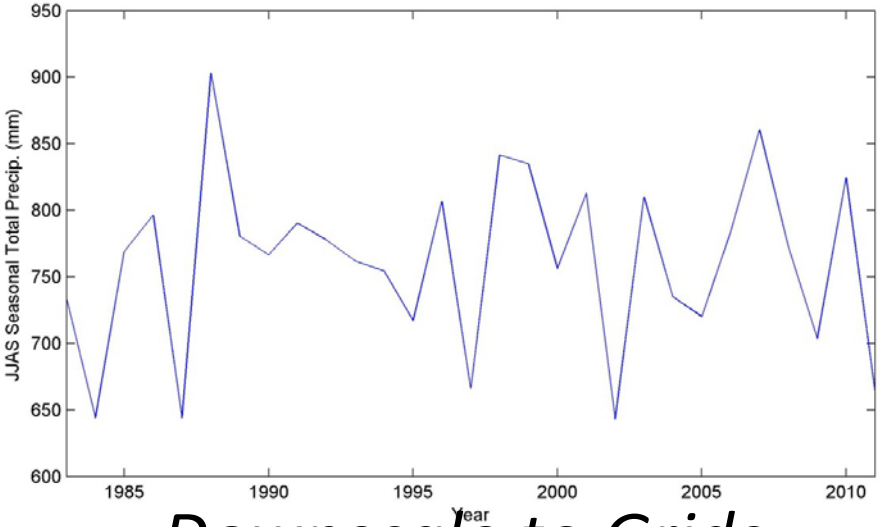
Predictors

Precipitation Prediction- Clusters vs unClustered



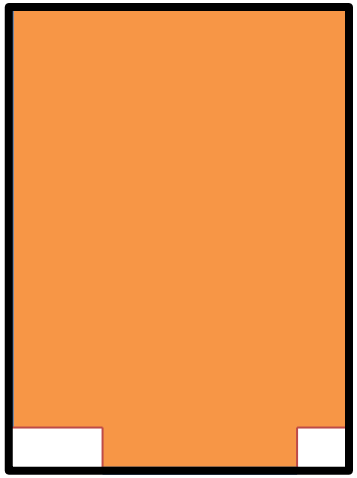


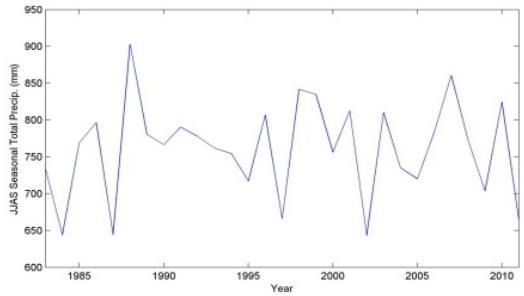




Downscale to Grids (Hydro, Econ models)

unClustered Prediction (PCA + panel regression)



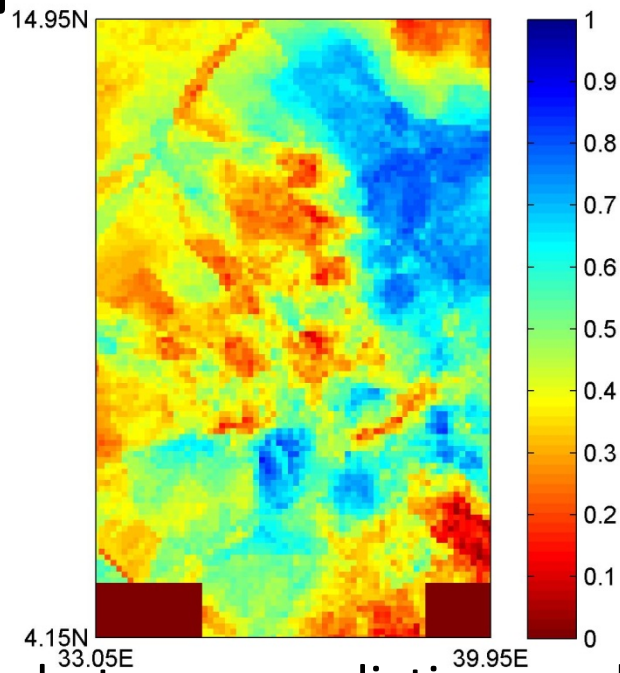


Same Predictors for Full Region

$$Y_{i,t} = \tilde{\alpha}_i + \tilde{\beta}_i X_t + \varepsilon_{i,t}$$

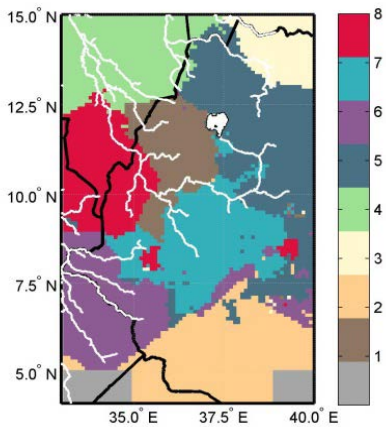
$$\tilde{Y}_{i,t} = \tilde{\alpha}_i + \tilde{\beta}_i X_t$$

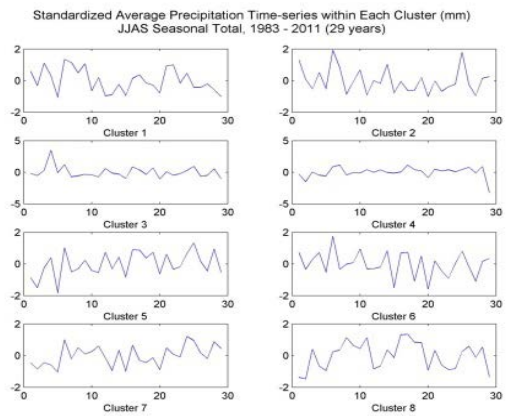
Y = seasonal precipitation
X = predictors
i = grid index



Correlation map between predictions and observations of grid-level Jun-Sep seasonal precip

Clustered Prediction (PCA + panel regression)



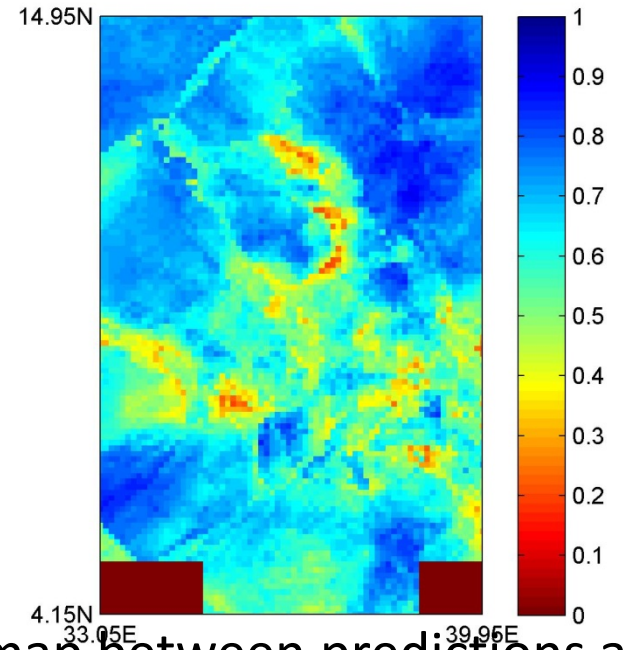


Unique Predictors by Cluster

$$Y_{i \in j,t} = \tilde{\alpha}_i + \tilde{\beta}_i X_{j,t} + e_{i,t}$$

$$\tilde{Y}_{i \in j,t} = \tilde{\alpha}_i + \tilde{\beta}_i X_{j,t}$$

Y = seasonal precipitation
X = predictors
j = cluster index
i = grid index

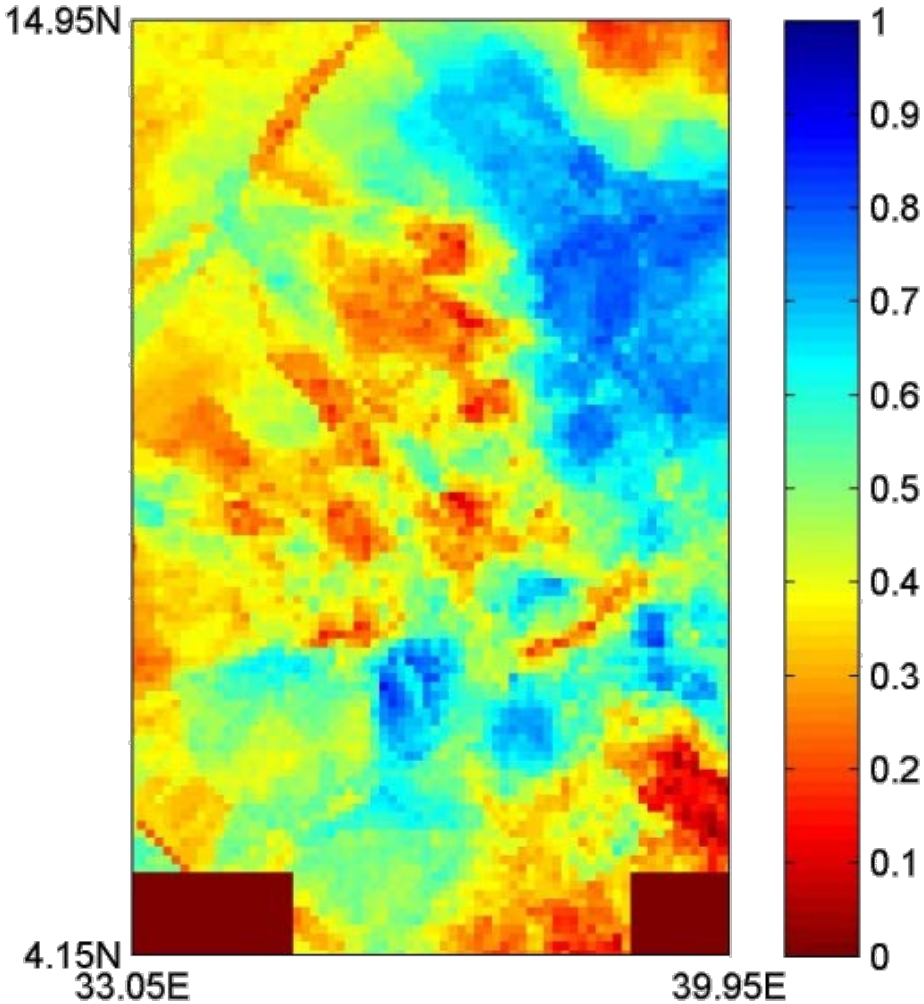


Correlation map between predictions and observations of grid-level Jun-Sep seasonal precip

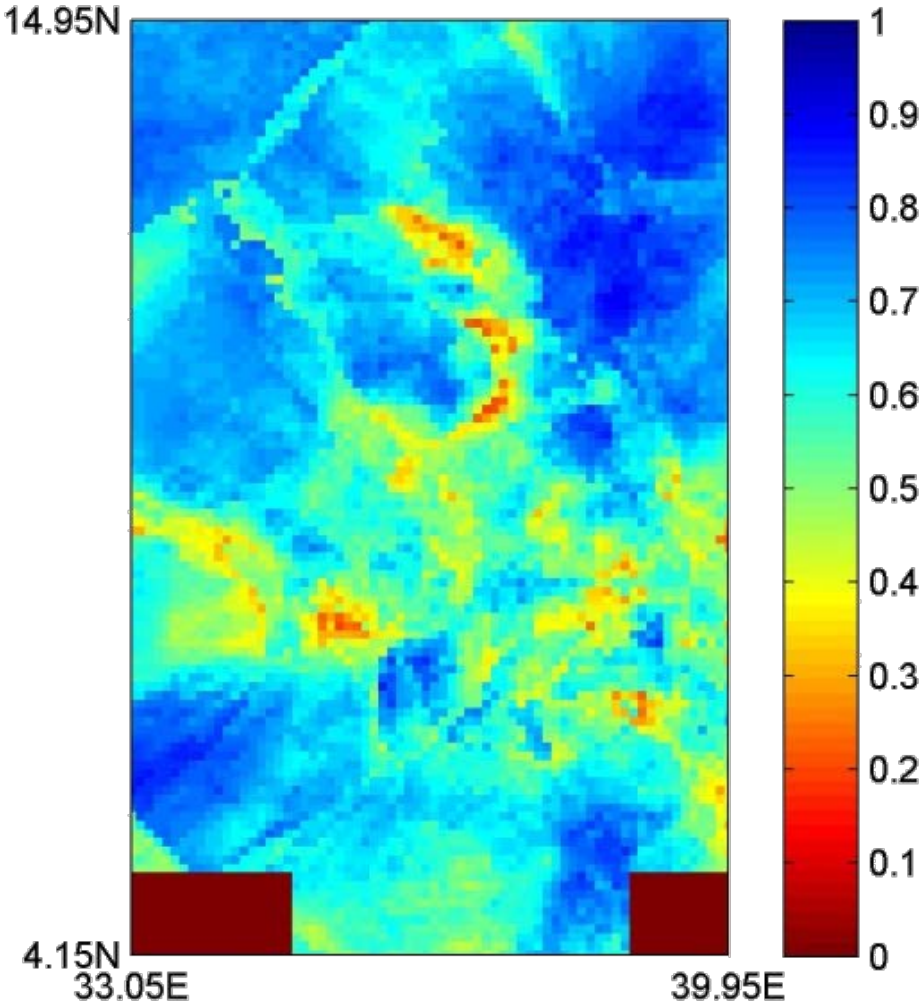
Correlation Maps: Observations and Predictions

JJAS Seasonal Total

unClustered



Clustered



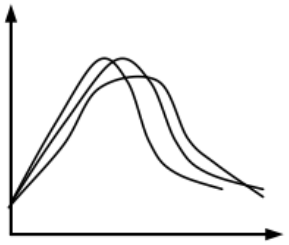
% grids significant at α=0.95: 82% 95%

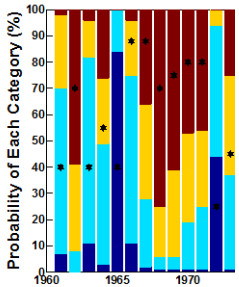
Next Steps

- Consider additional predictors, targets
- Use forecast ensembles
- Evaluate lead time vs skill
- Compare against other modeling approaches
- Integrate forecasts into Sectoral Models

  →Reservoir Operations (e.g. GERD)

  →Ag-Economic Model (GDP, poverty rates, etc)





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