The Missing CFSv2 Skill for Rainfall in the Sahel

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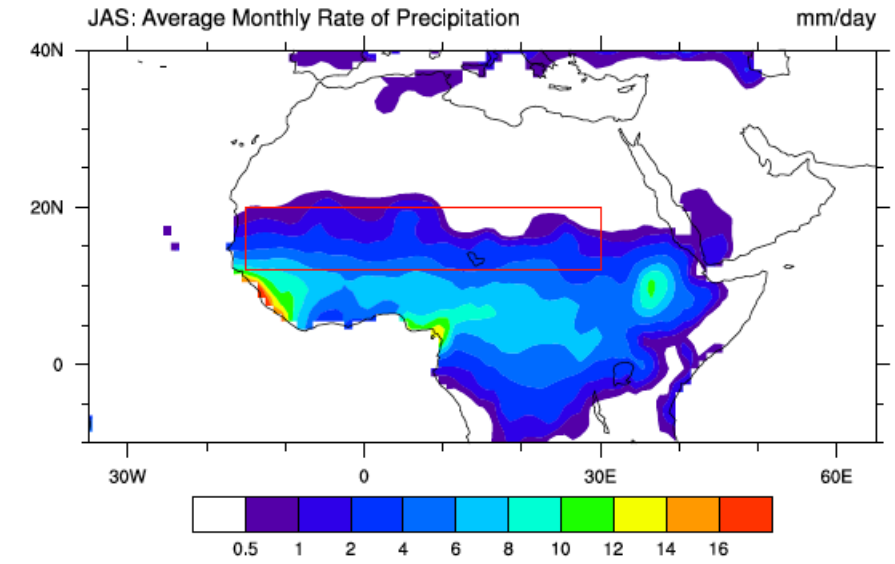
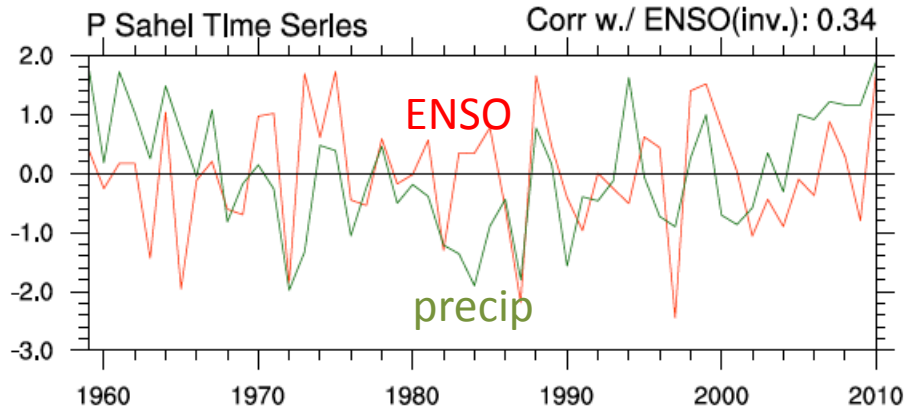
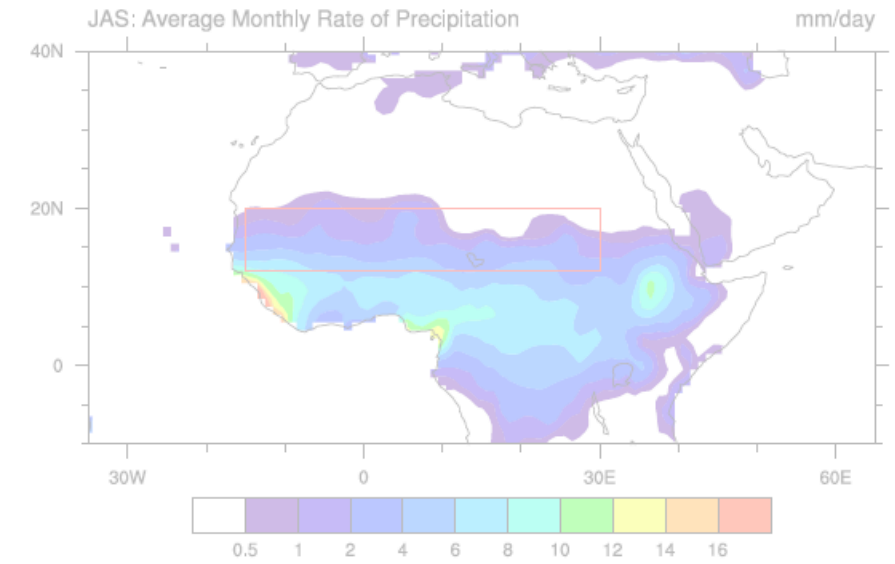
Sahel African climate: Review

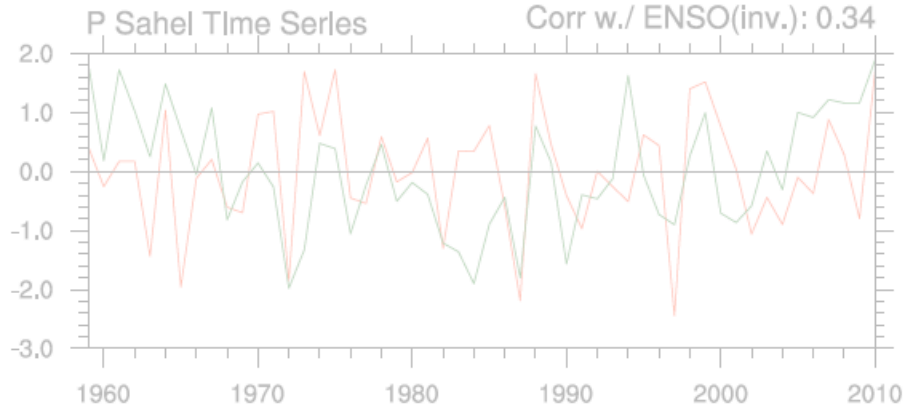




←Known ENSO effect
on Sahel rainfall *r*=0.34

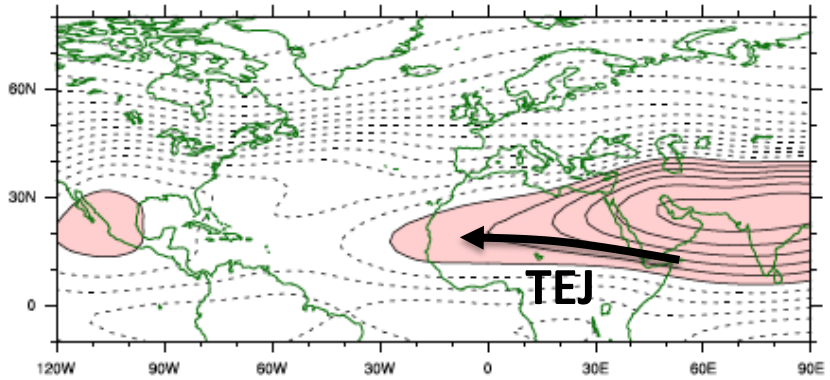
Sahel African climate: Review



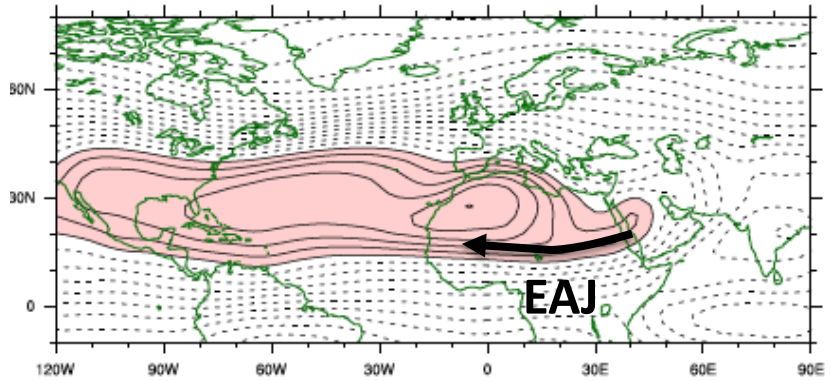


JAS Streamfunction

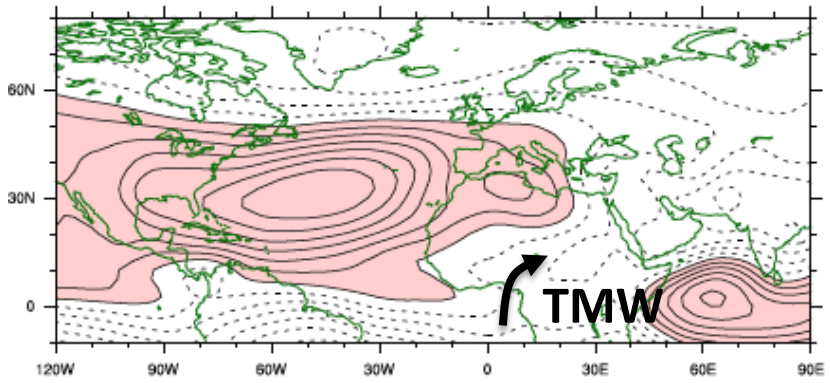
200mb



600mb



850mb



Geopotential Height Anomalies 1959-2010

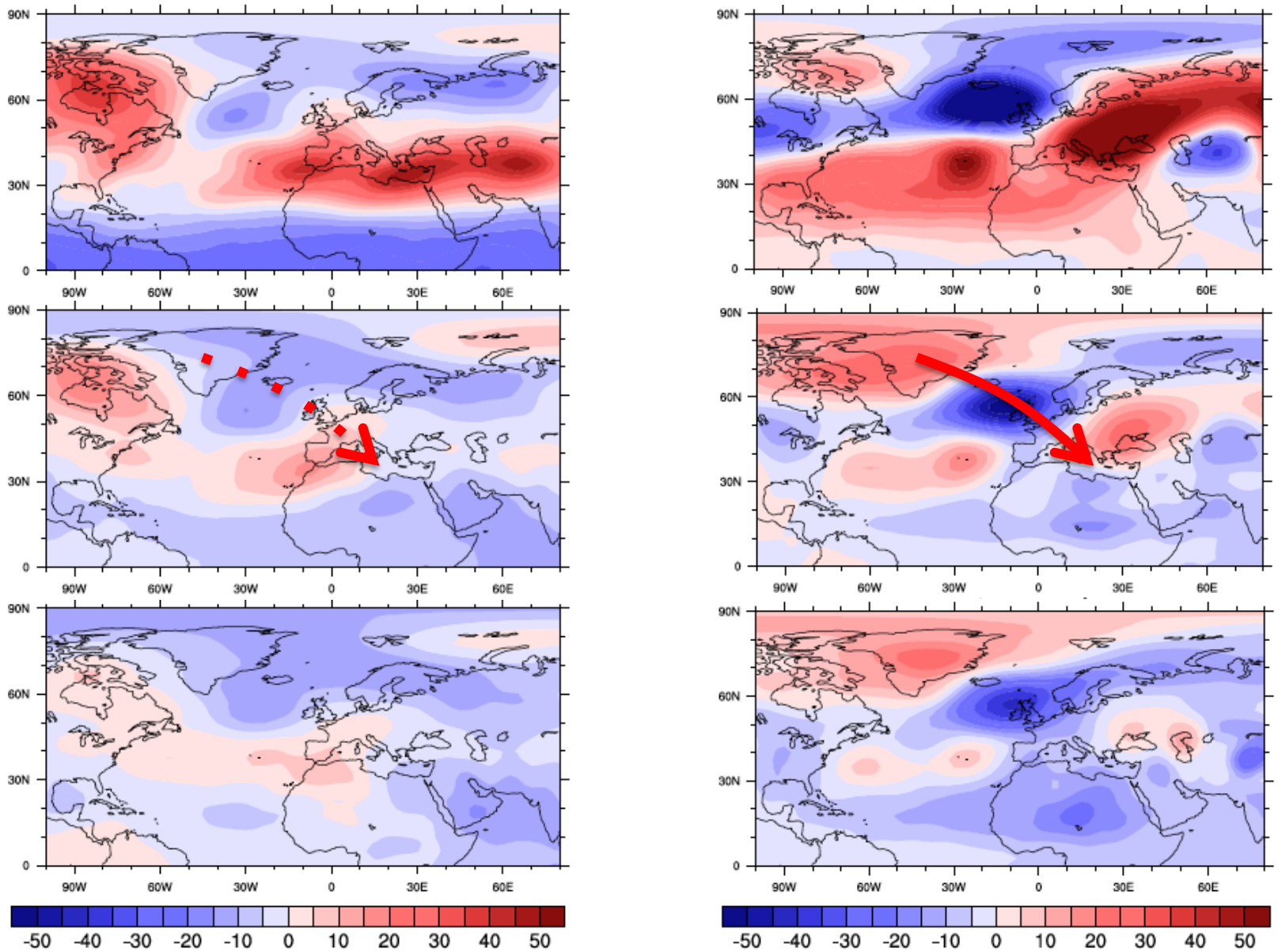
La Nina Years – El Nino Years

ENSO Neutral: Wet Years – Dry Years

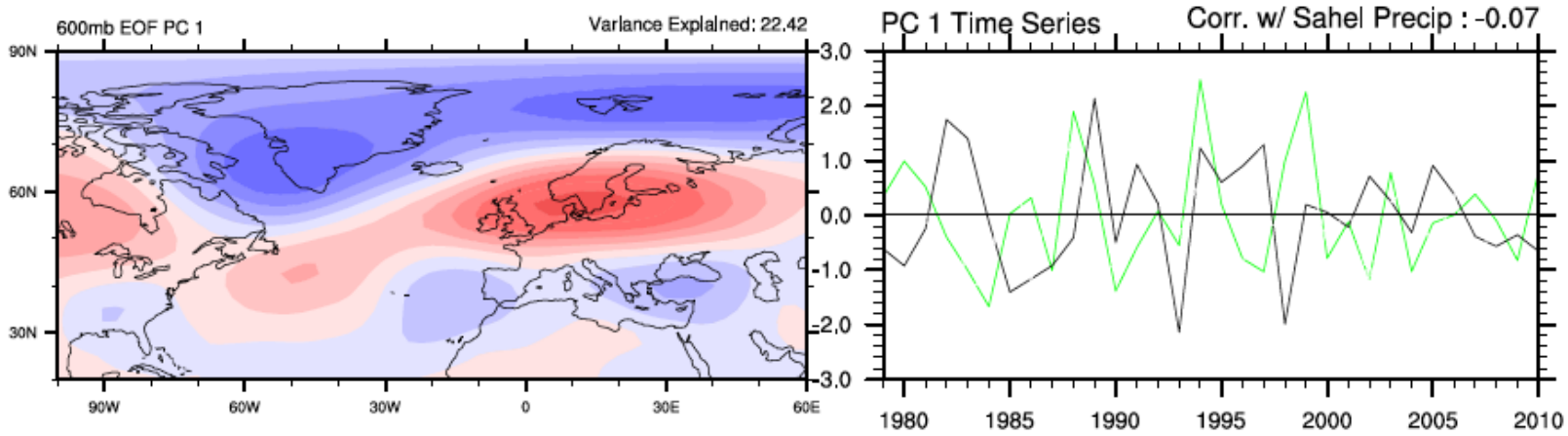
200mb

600mb

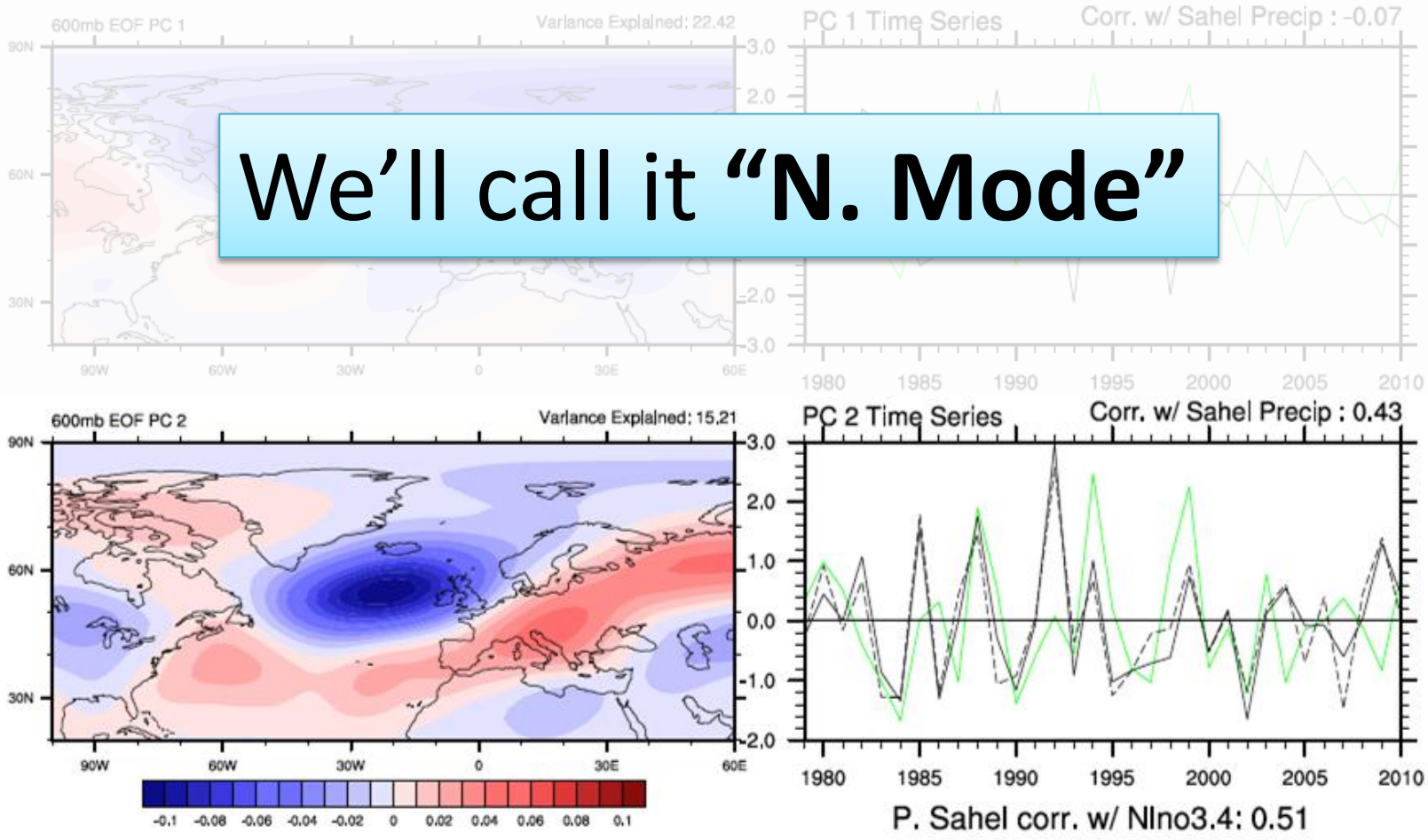
850mb



NCEP Geo. Hgt. Analysis: 1979 - 2010



NCEP Geo. Hgt. Analysis: 1979 - 2010



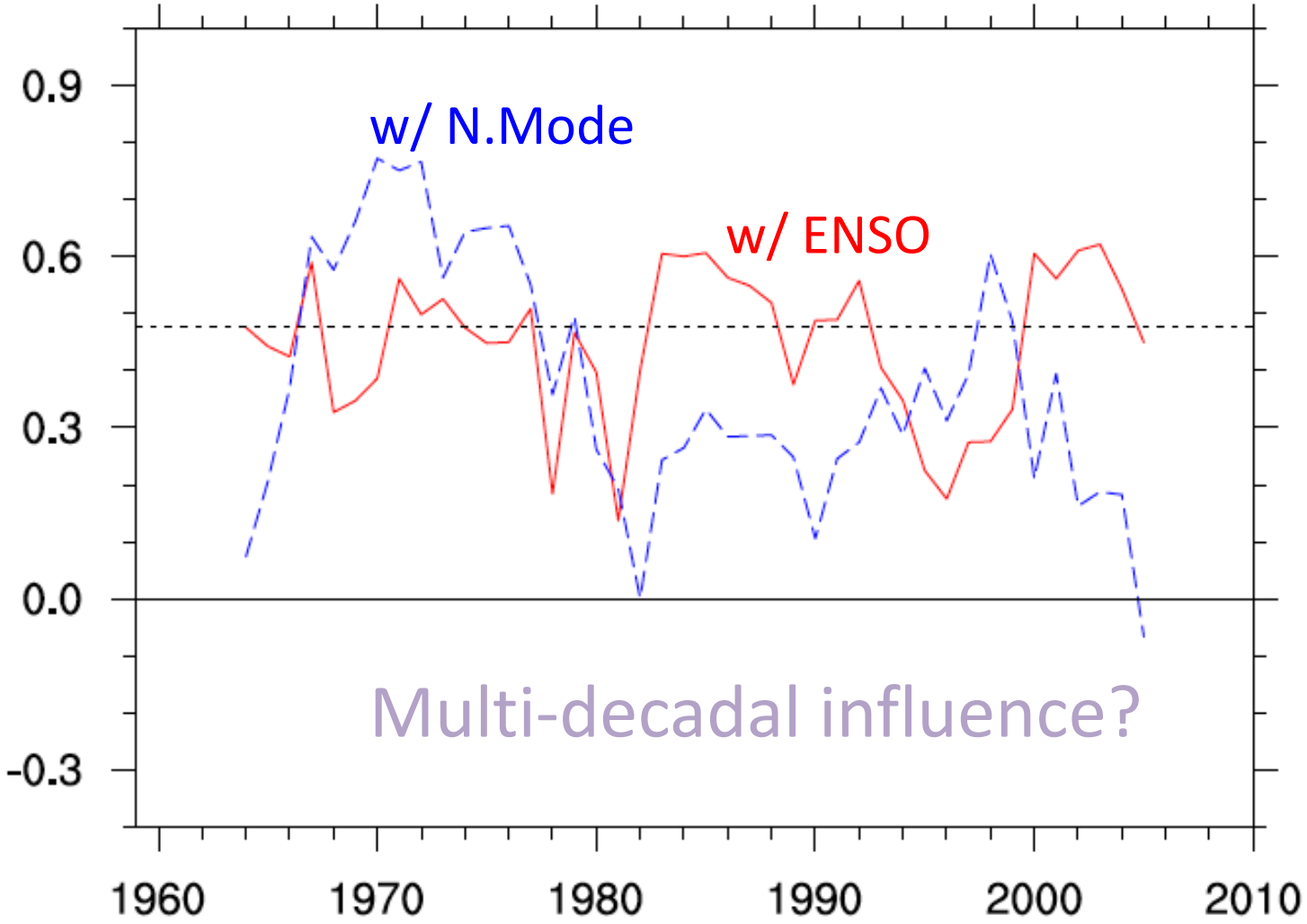
We'll call it **"N. Mode"**

N. Mode correlation analysis With various climate indices: 1979-2010

	Corr. w/ N. Mode	Corr. w/ P Sahel	P Sahel Variance Expl.
N. Mode	——	**0.44**	**0.19**
Nino 3.4	-0.13	**-0.51**	**0.25**
NAO	-0.03	-0.26	0.07
AO	0.19	0.15	0.02
PNA	0.01	0.05	0.00
AMO	-0.17	0.08	0.01

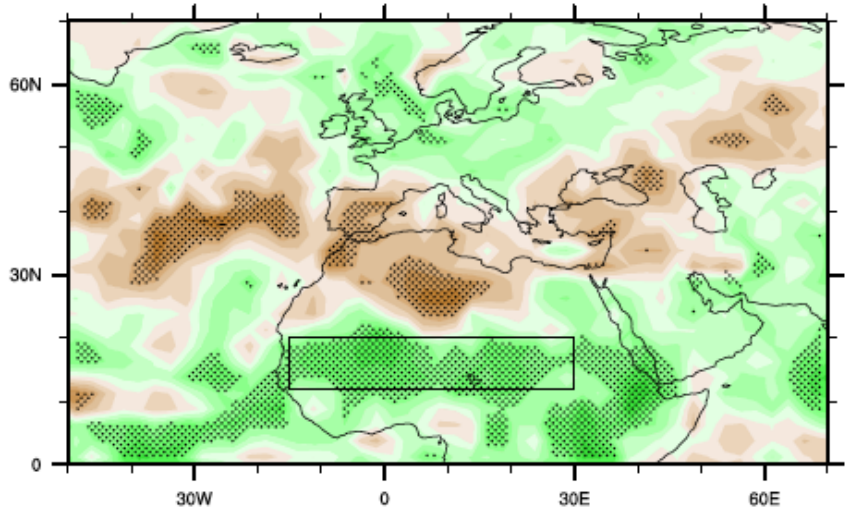
Shaded boxes are significant at 90% confidence

11 year sliding correlation with Sahel Precip

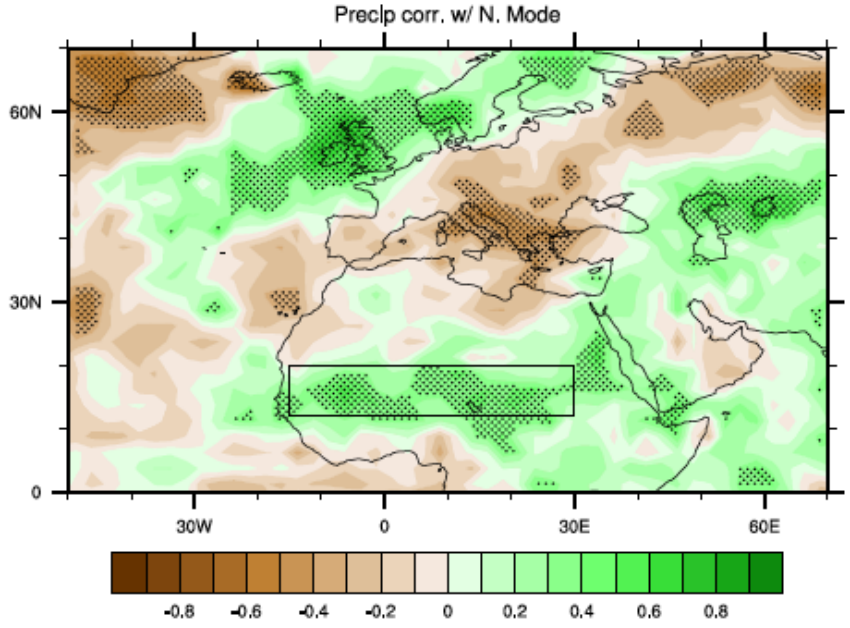


Spatial Correlation Maps

Precipitation



ENSO



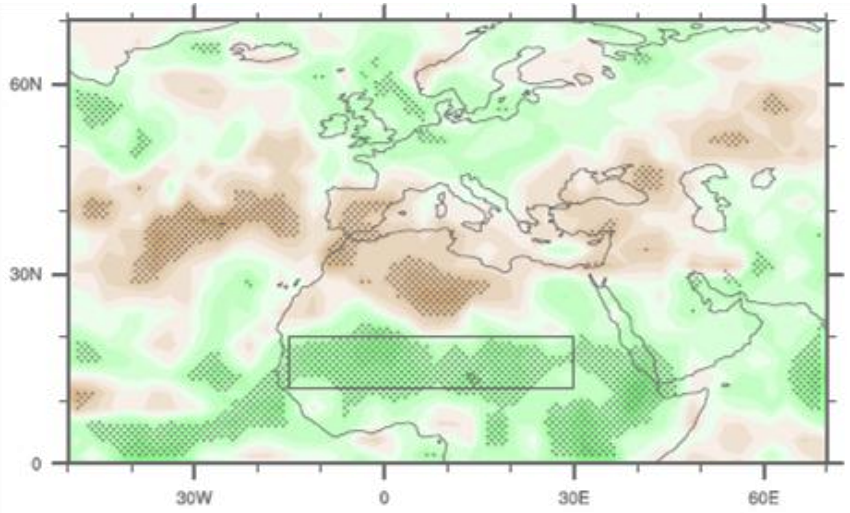
N. Mode

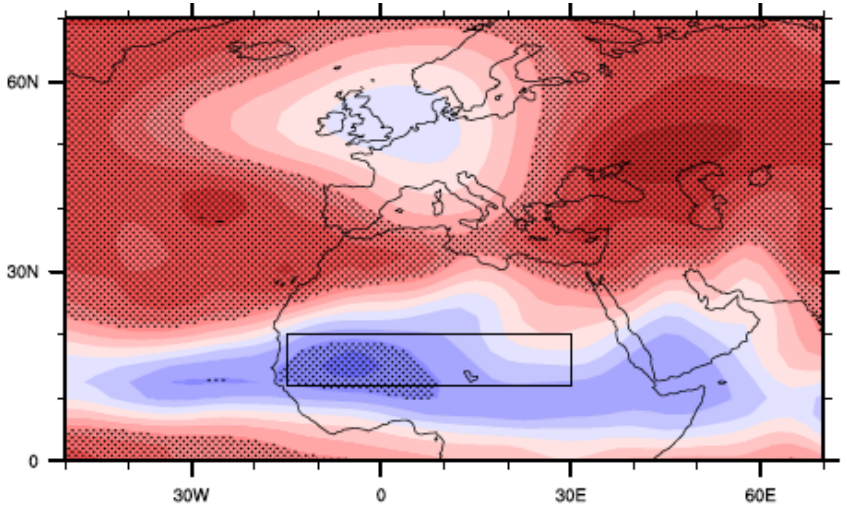
Spatial Correlation Maps

Precipitation

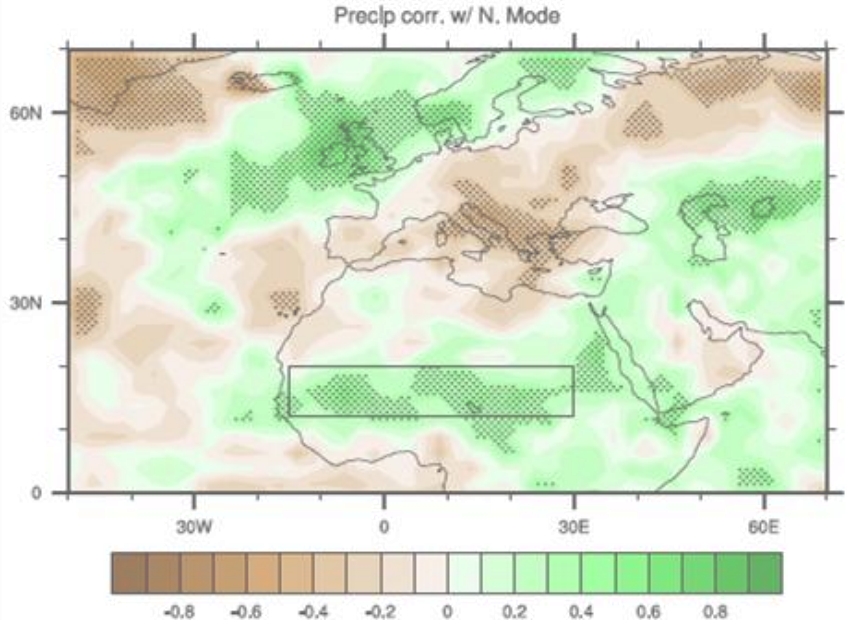
Streamfunction

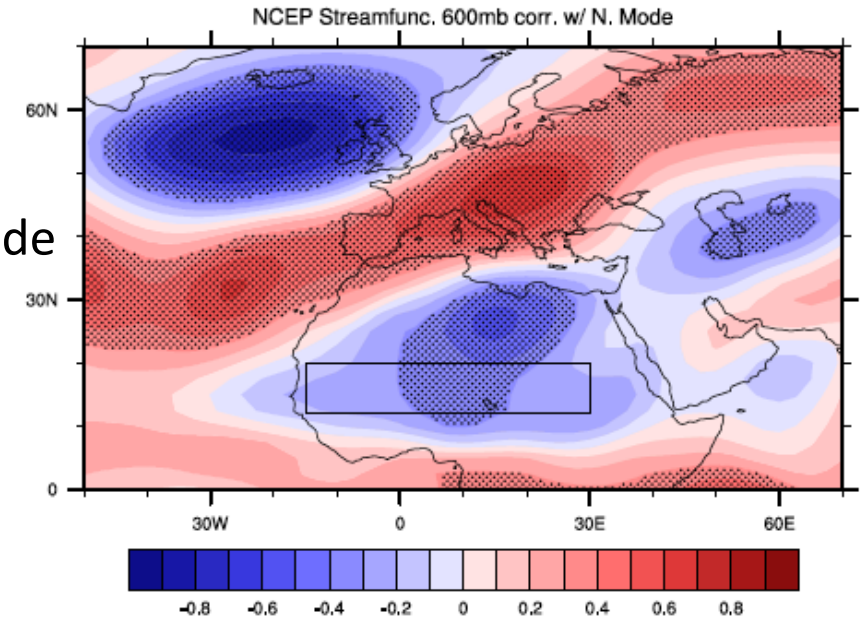
ENSO



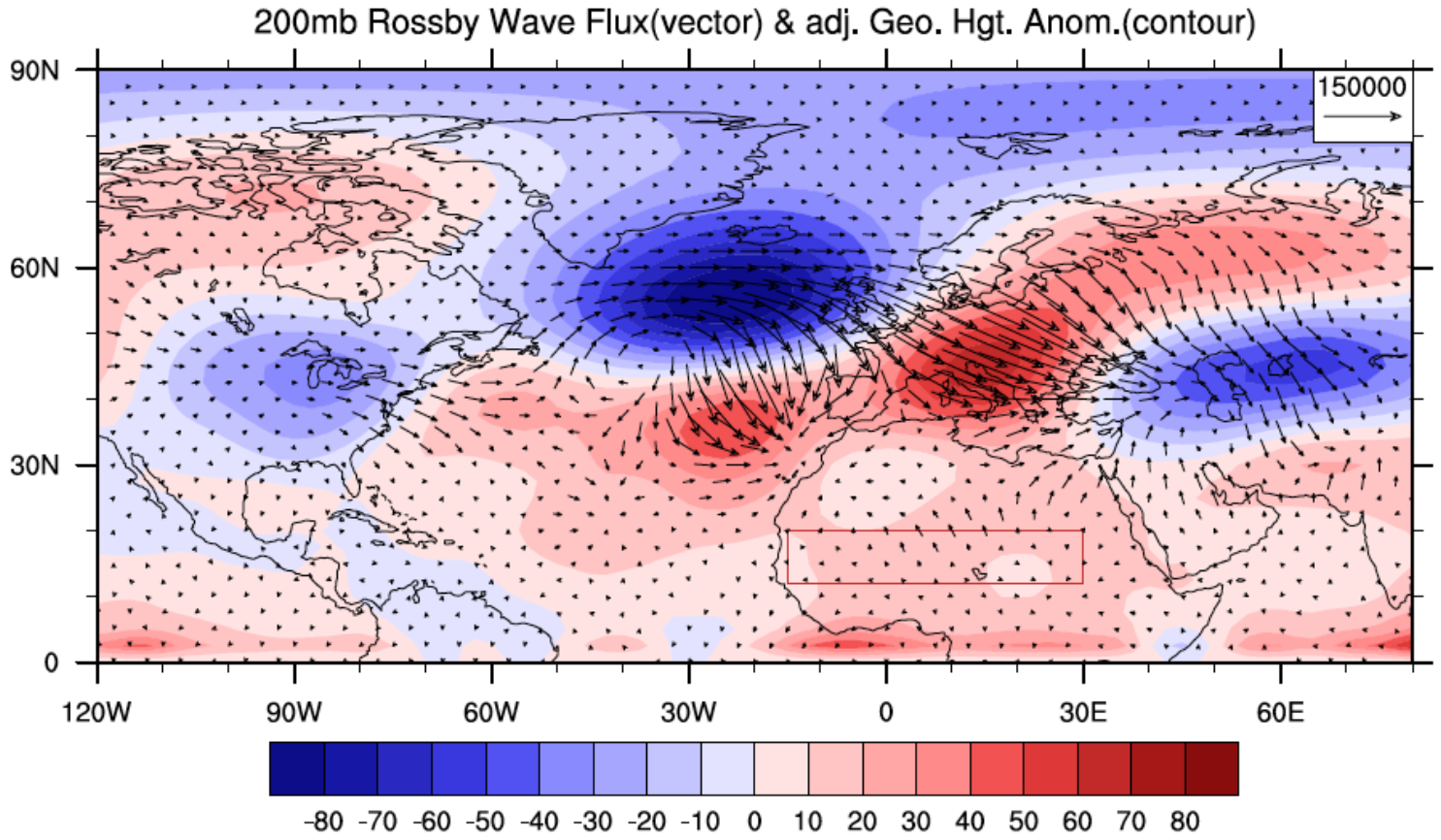


N. Mode





Streamfunction-derived Rossby Wave Flux Activity



$$\mathbf{W} = \frac{1}{2|\mathbf{U}|}\begin{pmatrix} U(\psi_x'^2 - \psi'\psi'_{xx}) + V(\psi'_x\psi'_y - \psi'\psi'_{xy}) \\ U(\psi'_x\psi'_y - \psi'\psi'_{xy}) + V(\psi'^2_y - \psi'\psi'_{yy}) \\ \frac{f_0^2}{S^2}[U(\psi'_x\psi'_p - \psi'\psi'_{xp}) + V(\psi'_y\psi'_p - \psi'\psi'_{yp})] \end{pmatrix} + \mathbf{C}_U M. \quad \text{(C5)}$$

Takaya, K., and H. Nakamura, 2001: A Formulation of a Phase-Independent Wave-Activity Flux for Stationary and Migratory Quasigeostrophic Eddies on a Zonally Varying Basic Flow. J. Atmos. Sci., 58, 608-627.

CFSv2 Performance

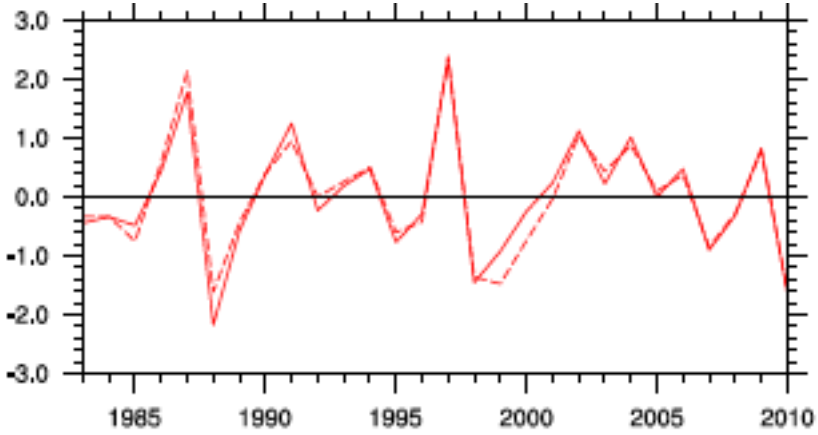
Does the model capture
the N. Mode?

How the model performs for known variability

Forecast Month 0

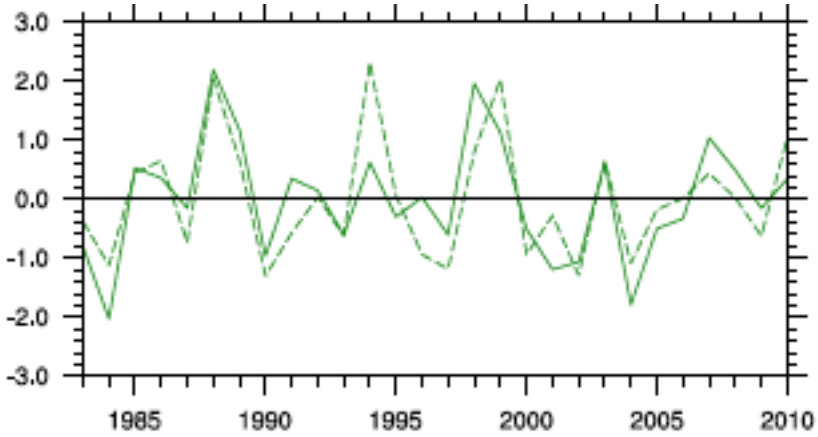
Solid Lines: Model Output
Dashed Lines: Observational Data

ENSO 3.4 SST



R = 0.97

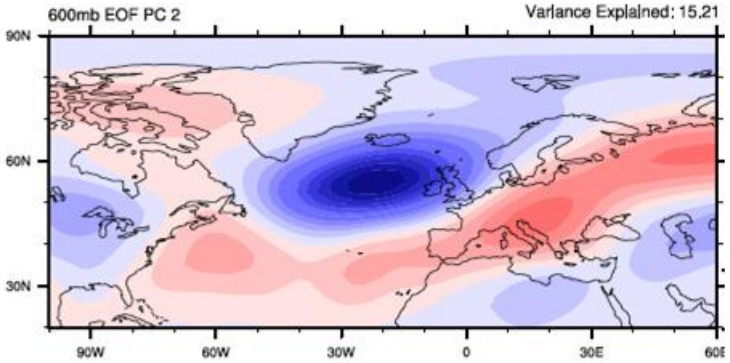
Sahel Precip



R = 0.78

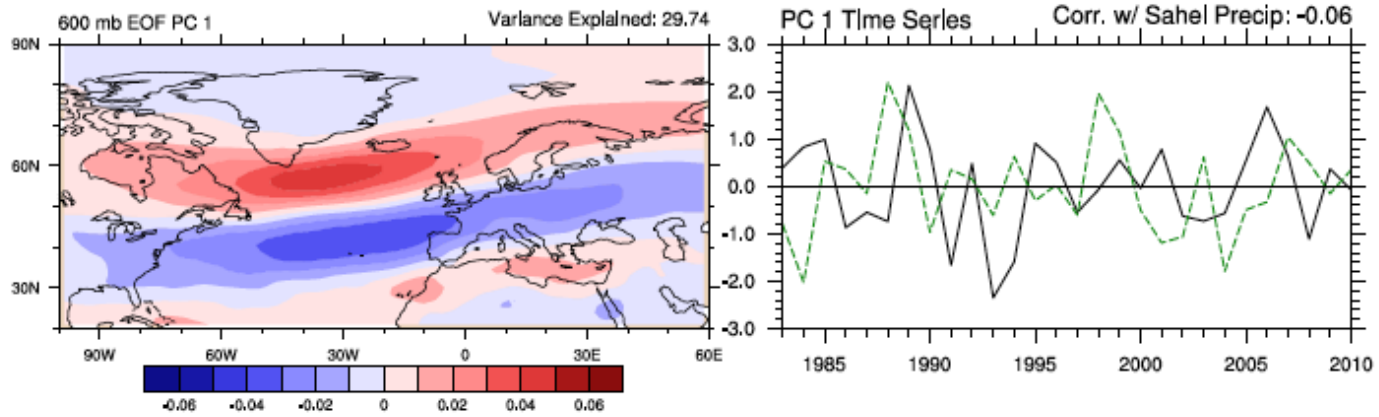
CFSv2 600mb Geo. Hgt EOF Analysis

Obs

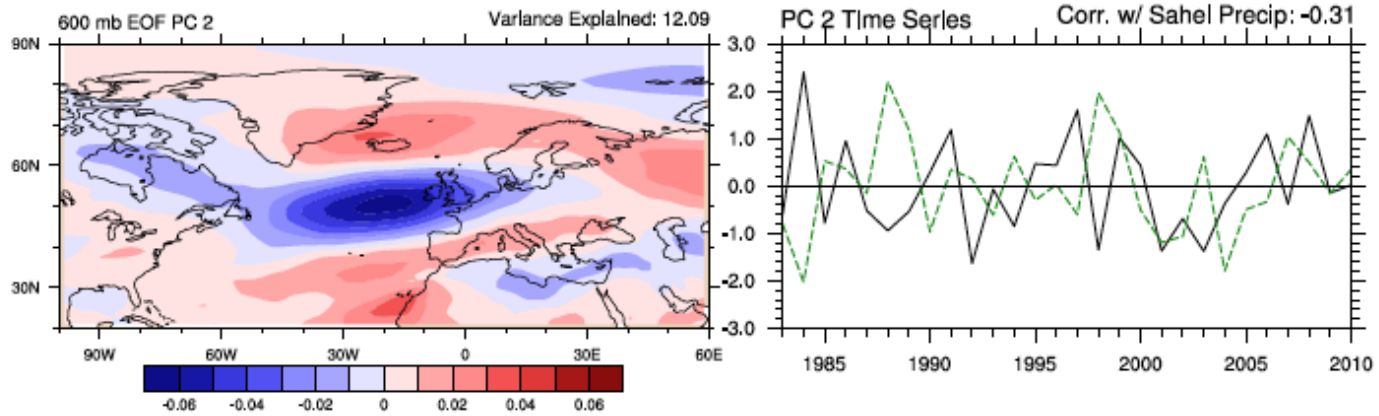


CFS

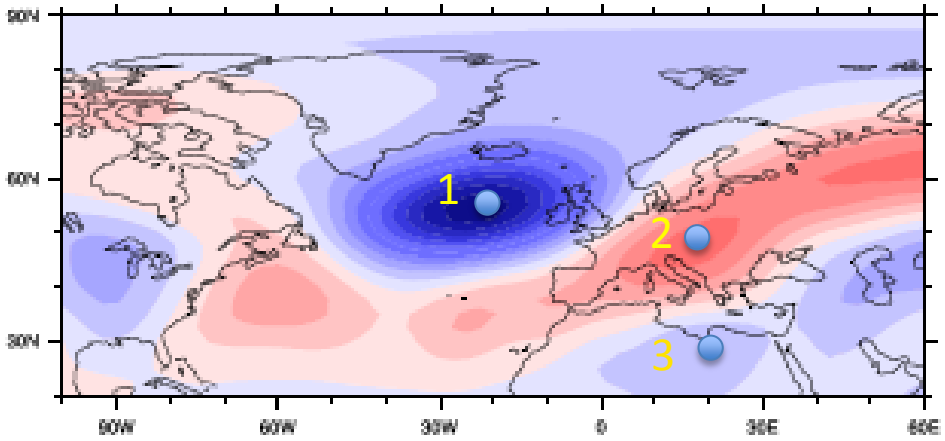
PC 1



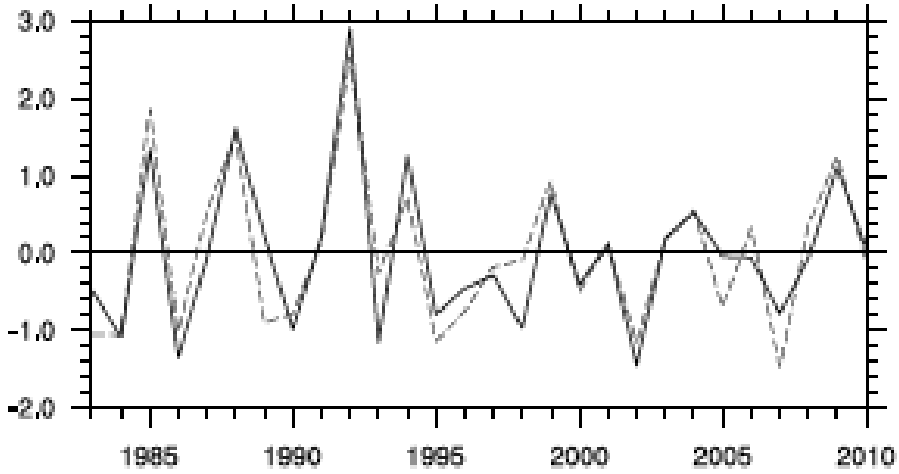
PC 2



Creating an index to approximate N. Mode



N.Index = Pt.1 – 3(Pt.2) + 2(Pt.3)



EOF T. Series: Solid

N. Mode Index: Dashed

R = 0.89

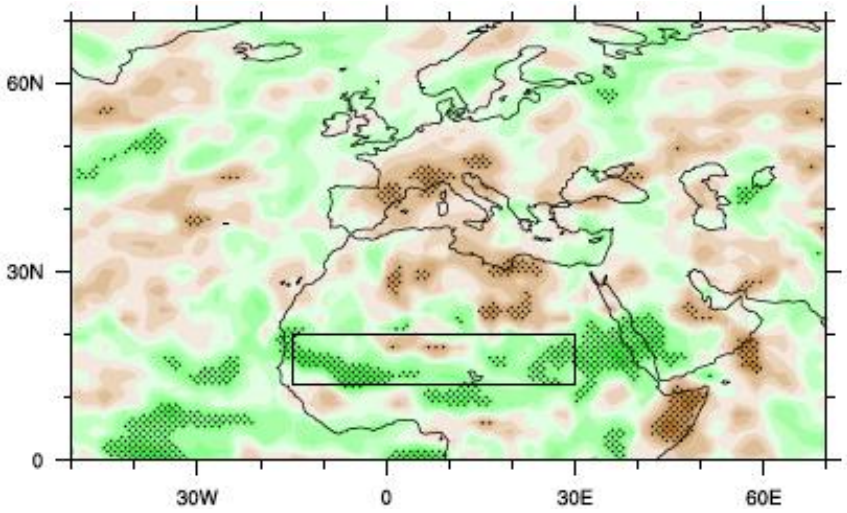
Index prediction: CFSv2 Performance

	Precip	ENSO		N. Mode	
Forecast Month	Pre.S Obs v/ Pre.S CFS	Nino Obs v/ Nino CFS	Nino CFS v/ Pre.S CFS	N. Mode Obs v/ N. Mode CFS	N. Mode CFS v/ Pre.S CFS
0	0.78	0.97	-0.54	-0.16	-0.14
1	0.32	0.88	-0.52	-0.28	-0.19
2	0.48	0.84	-0.28	-0.09	0.35
3	0.33	0.81	-0.14	-0.01	-0.07
4	0.31	0.75	0.01	-0.33	0.01
5	-0.06	0.62	-0.12	-0.10	0.15

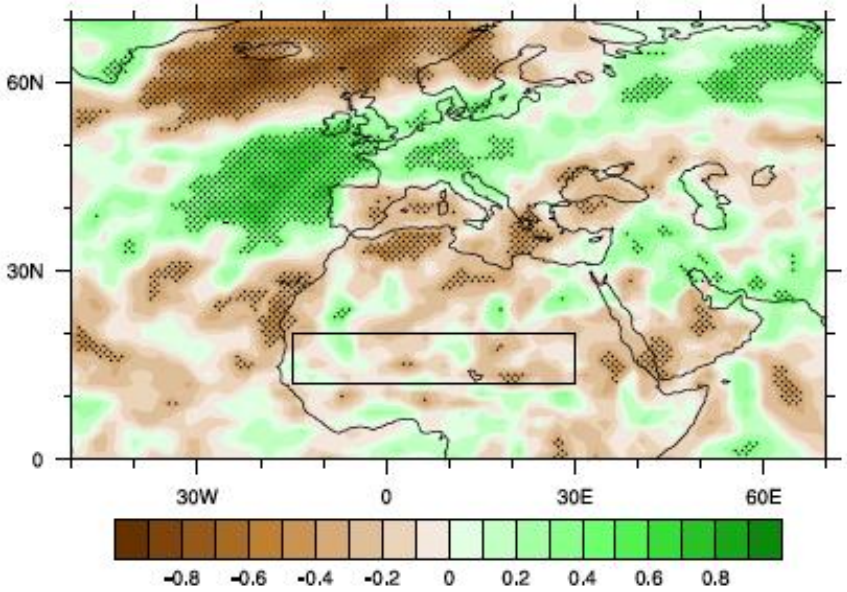
Shaded boxes are significant at 90% confidence

Precipitation Spatial Correlation

CFSv2 Month 0



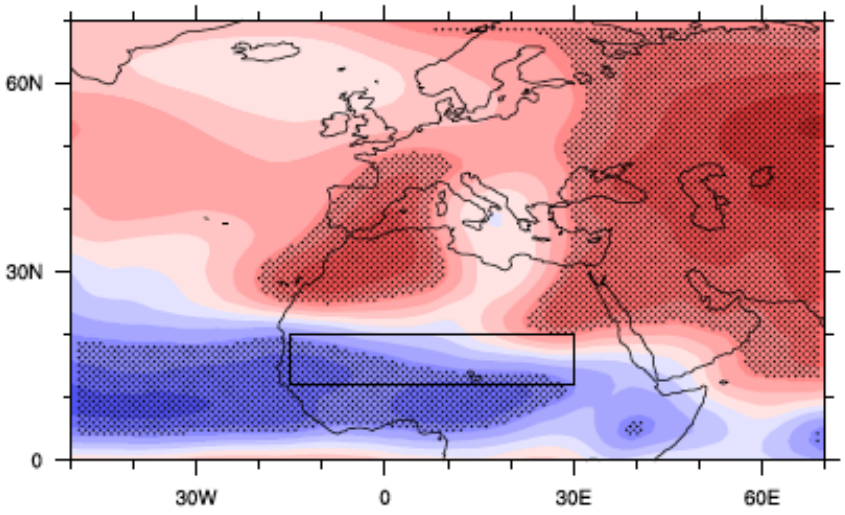
ENSO



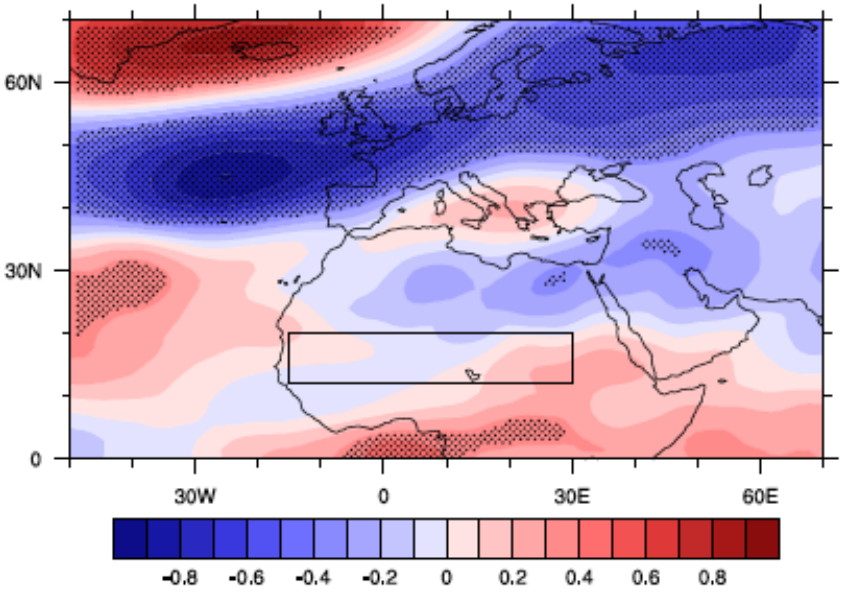
N. Mode

Streamfunction Spatial Correlation

CFSv2 Month 0



ENSO



N. Mode

Future Work

- Dynamical mechanisms of N. Mode.
- Multidecadal variability of N. Mode.