

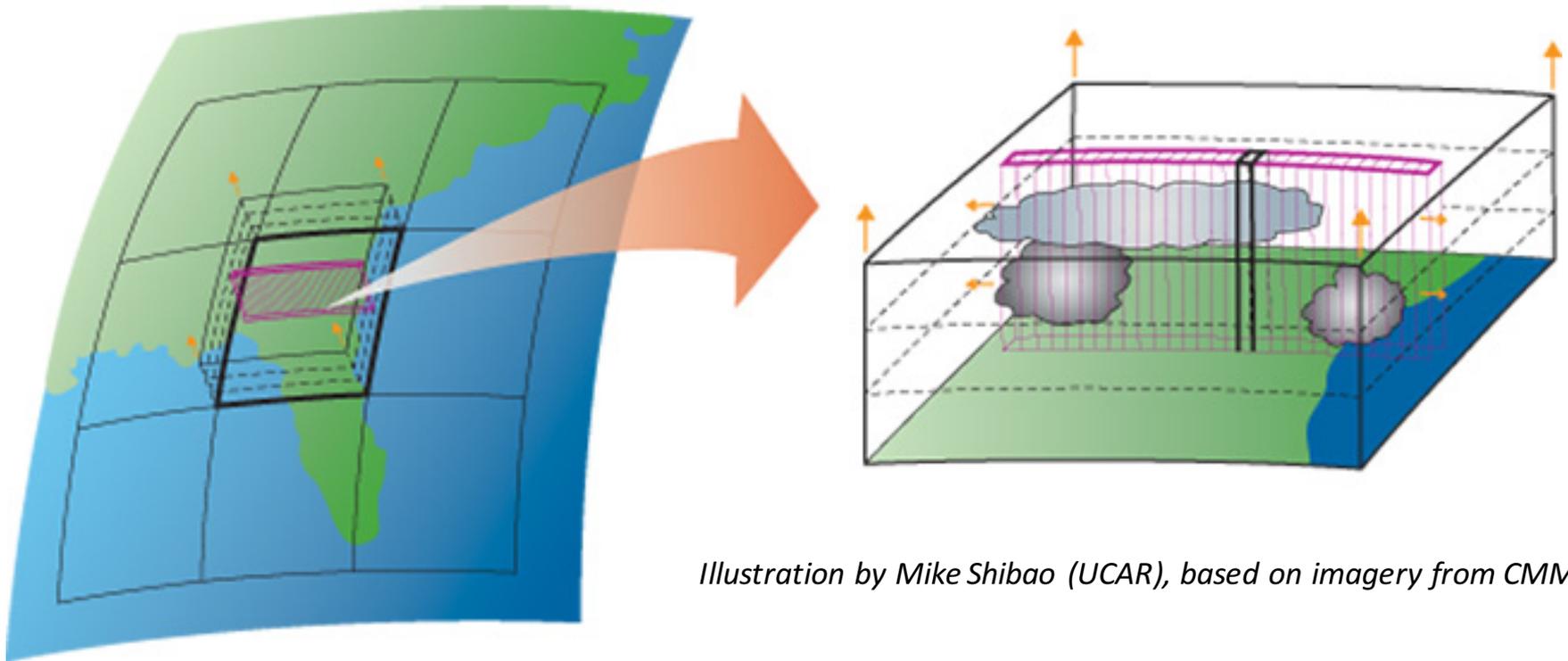
# The impact of super-parameterization on the S2S forecast skill

Cristiana Stan, David Straus, Michael  
Fennessy and Dan Paolino

George Mason University, USA

# What is Super-Parameterization (SP)?

Proposed by Grabowski (2001) and Khairoutdinov and Randall (2001)



*Illustration by Mike Shibao (UCAR), based on imagery from CMMAP*

# Models and Experiments

	CCSM4	SP-CCSM4
Atm/Res	CAM4/FV09	SP-CAM/F09 CRM/3 km
Land/Res	CLM4/1 deg	CLM4 1 deg
Ocean/Res	POP/1 deg	POP/1 deg
Se-ice/Res	CICE4/ 1deg	CICE4/1 deg
Levels	26	30

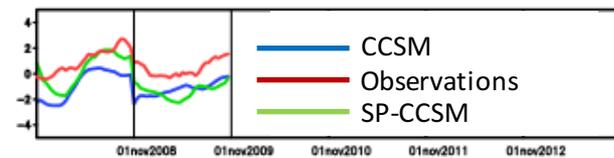
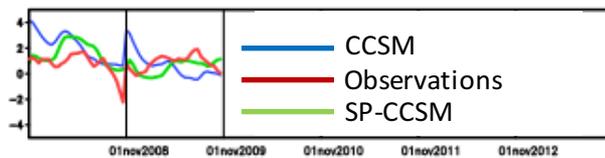
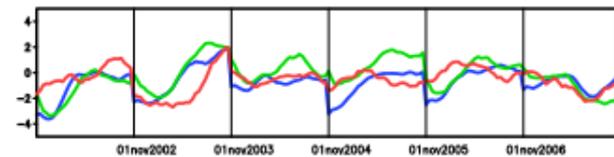
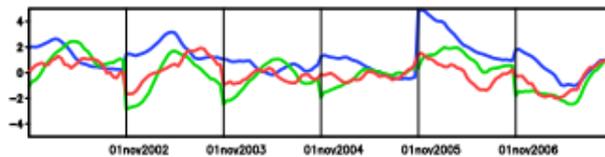
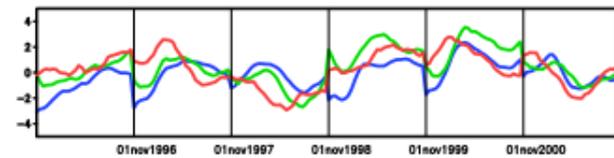
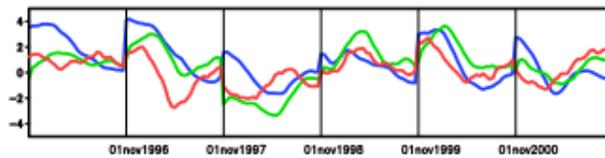
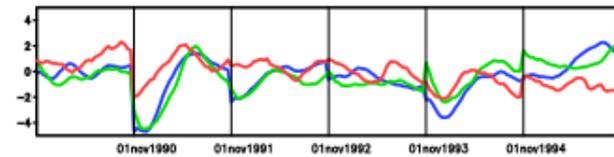
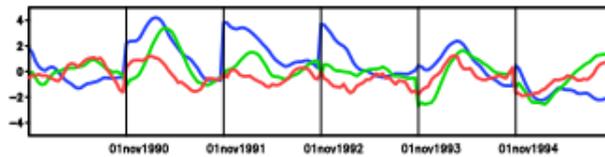
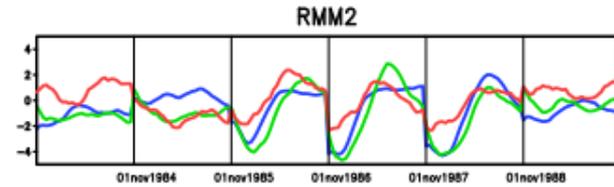
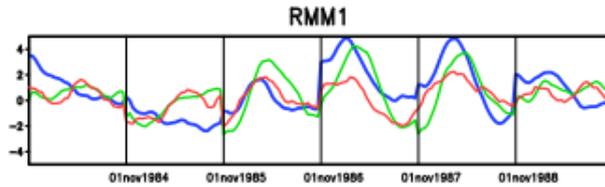
## NMME Hindcasts 1982 - 2008

Ocean and Sea Ice	Atm. and Land
November 1	October 27 00Z
	October 28 00Z
	October 29 00Z
	October 30 00Z
	October 31 00Z

Initial conditions: CFSR

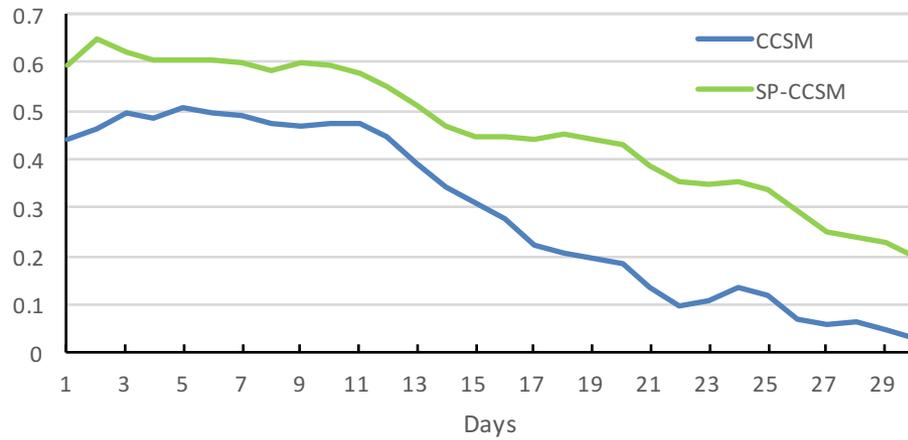
Hindcast length: 12 months

# MJO Forecast Skill

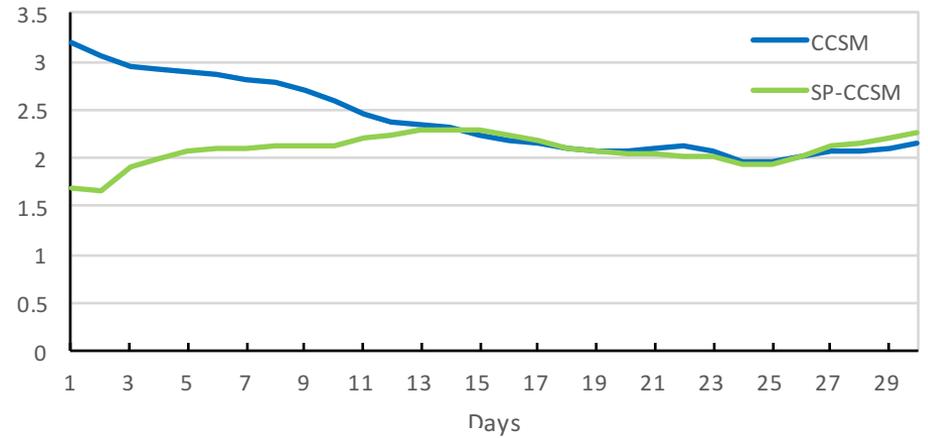


# MJO Forecast Skill

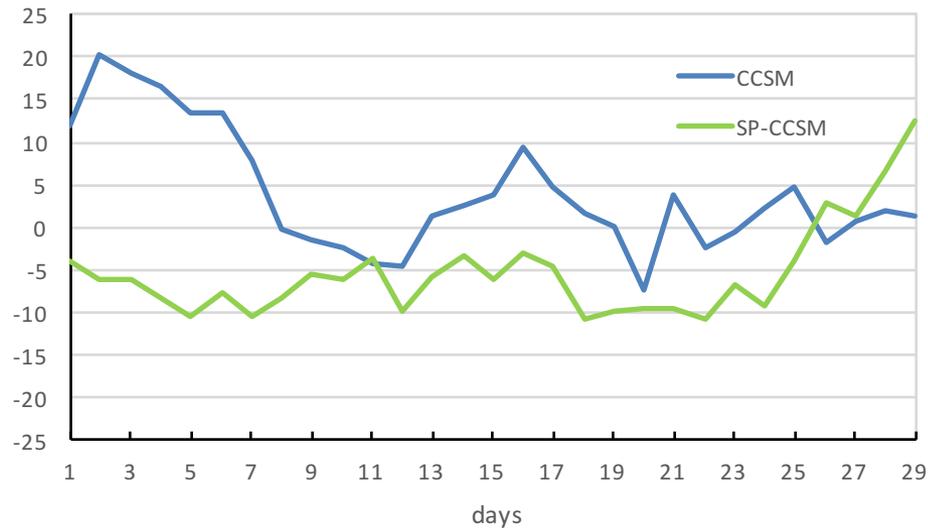
## Correlation



## RMSE



## Phase Error



# November 1984

CCSM

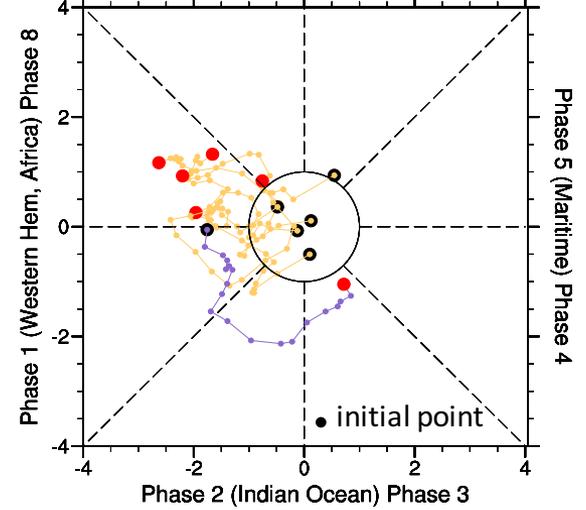
OBS

SP-CCSM

CCSM

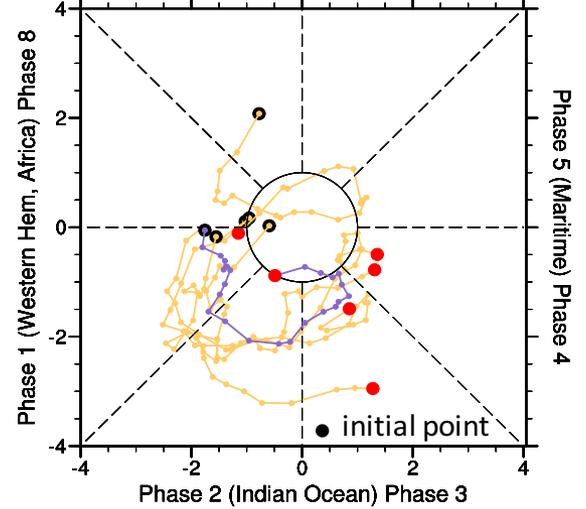
U850

Phase 7 (Western Pacific) Phase 6

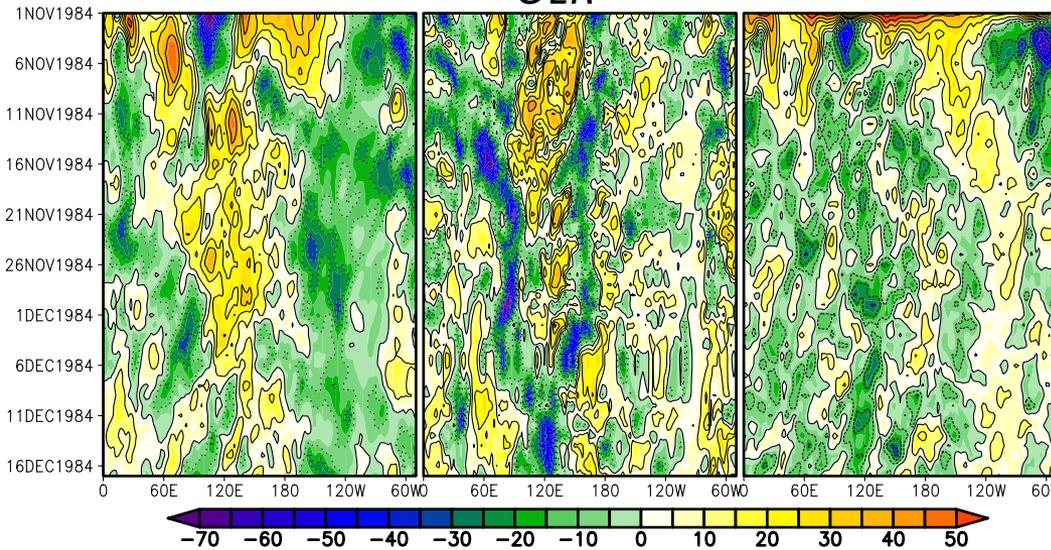
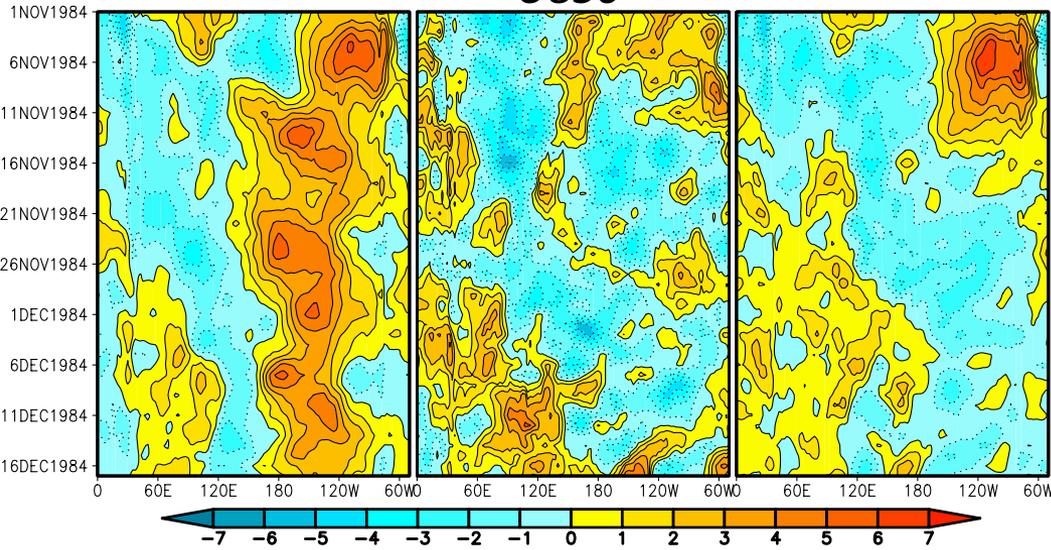


SP-CCSM

Phase 7 (Western Pacific) Phase 6



OLR



# November 1996

CCSM

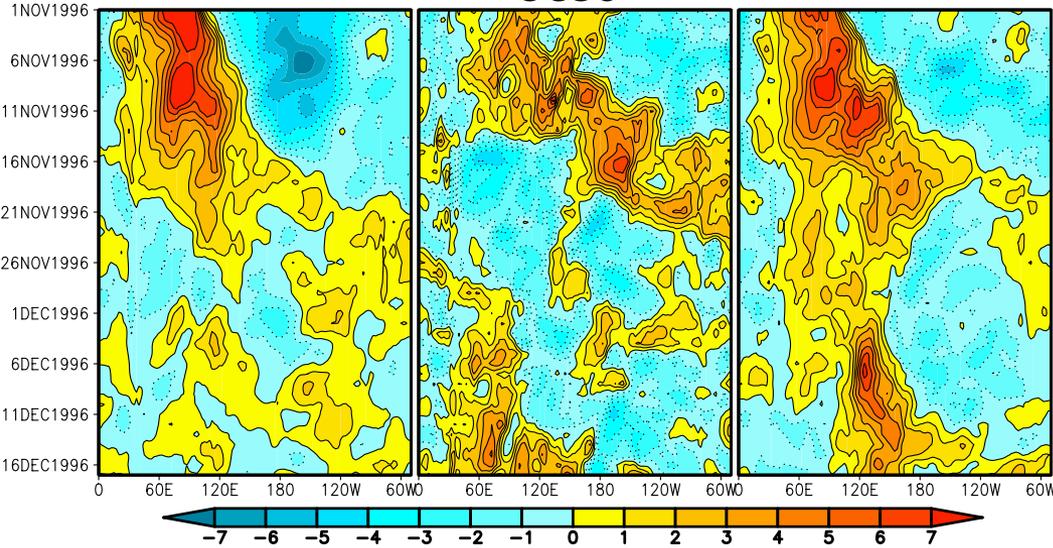
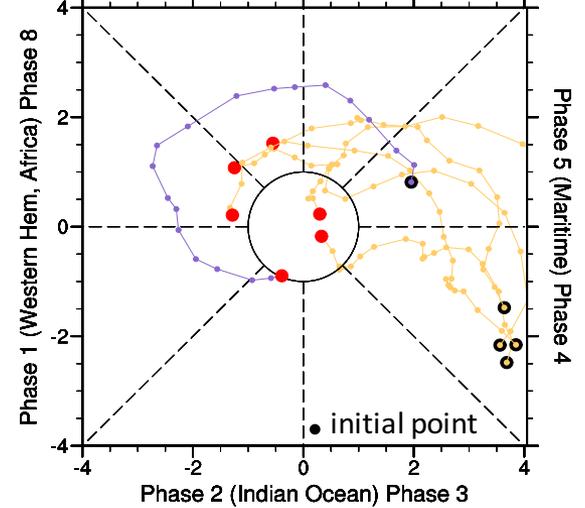
OBS

SP-CCSM

U850

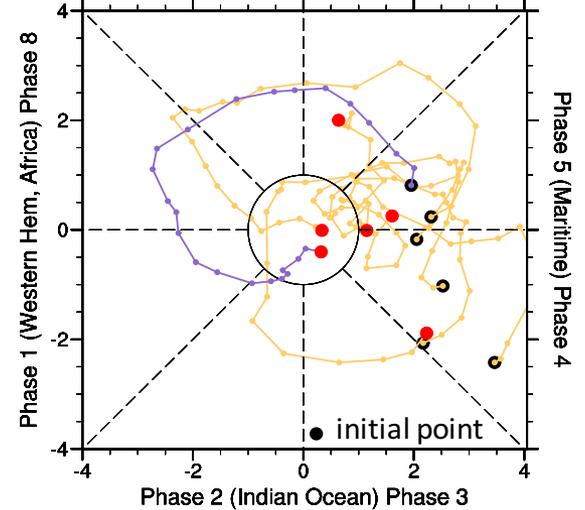
CCSM

Phase 7 (Western Pacific) Phase 6

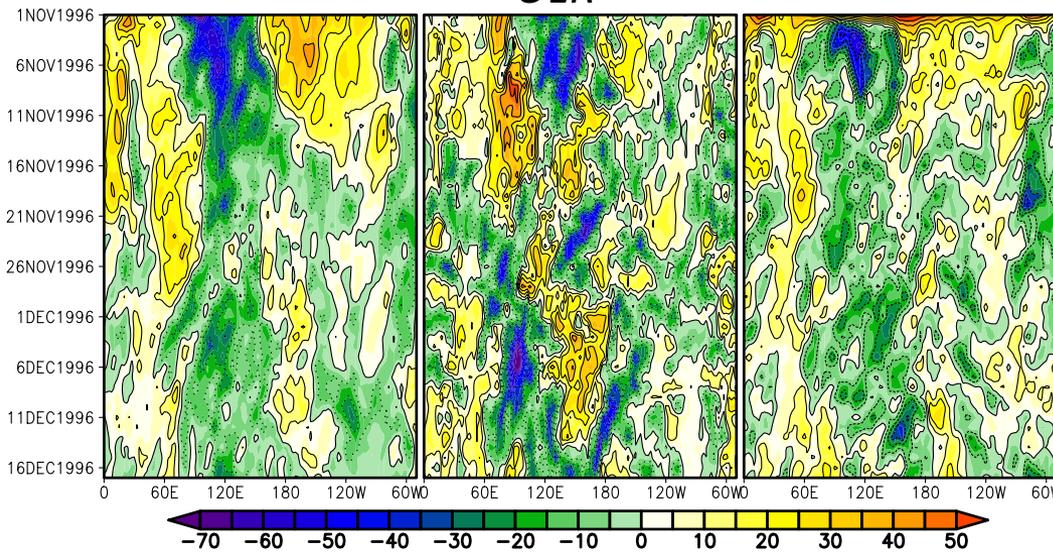


SP-CCSM

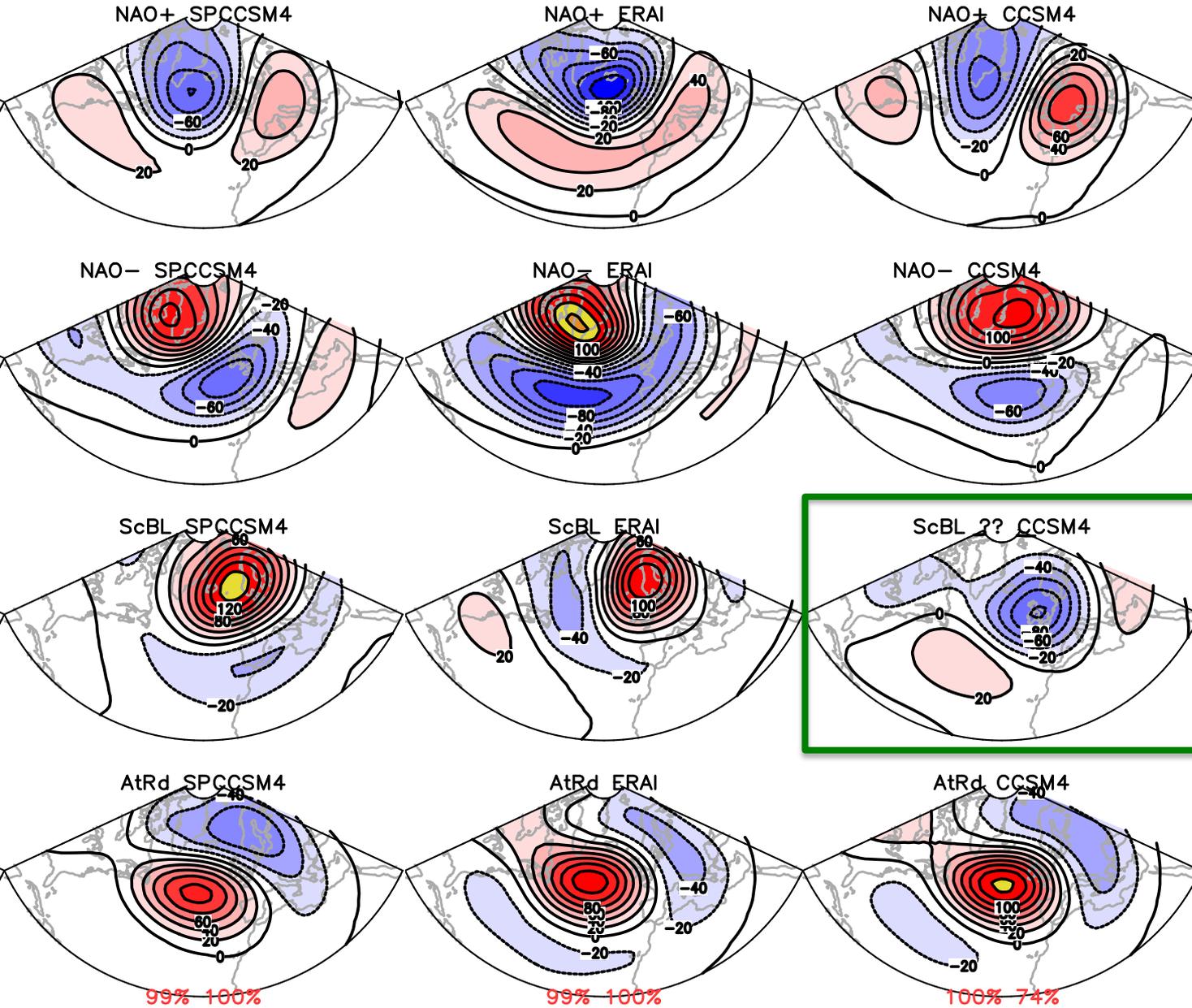
Phase 7 (Western Pacific) Phase 6



OLR



# Euro-Atlantic Sector Clusters



The sign reversal is not a coding error

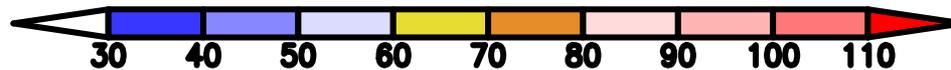
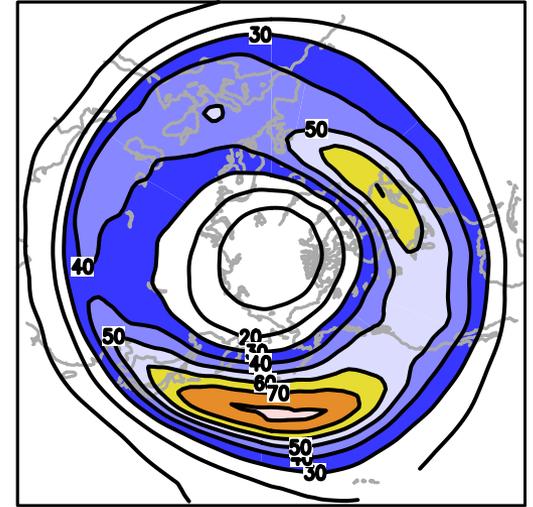
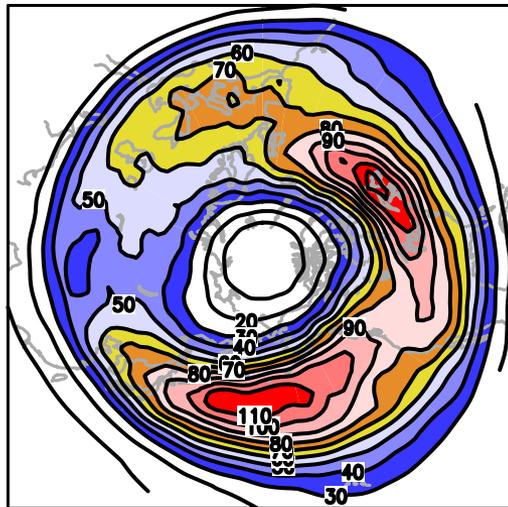
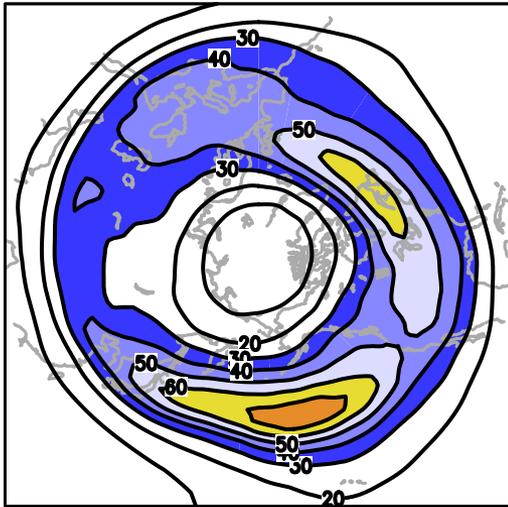


# Variance of zonal wind at 300-mb

CCSM

ERA-I

SP-CCSM



zonal wavenumbers  $> 3$  and periods  $< 10$  days

# Summary

- The explicit representation of cloud processes through super-parameterization has an impact on the forecast skill of the intraseasonal variability predicted by an ocean-atmosphere climate model
- The anomaly correlation in the super-parameterized model is higher and the loss of skill is slower than in the conventionally-parameterized model
- The forecast error of the MJO phase is smaller in the super-parameterized model
- The uncertainties in initial conditions are important for the MJO forecast skill
- The pattern and significance of the weather regimes in the Euro-Atlantic and North Pacific sectors are sensitive to the cloud parameterization