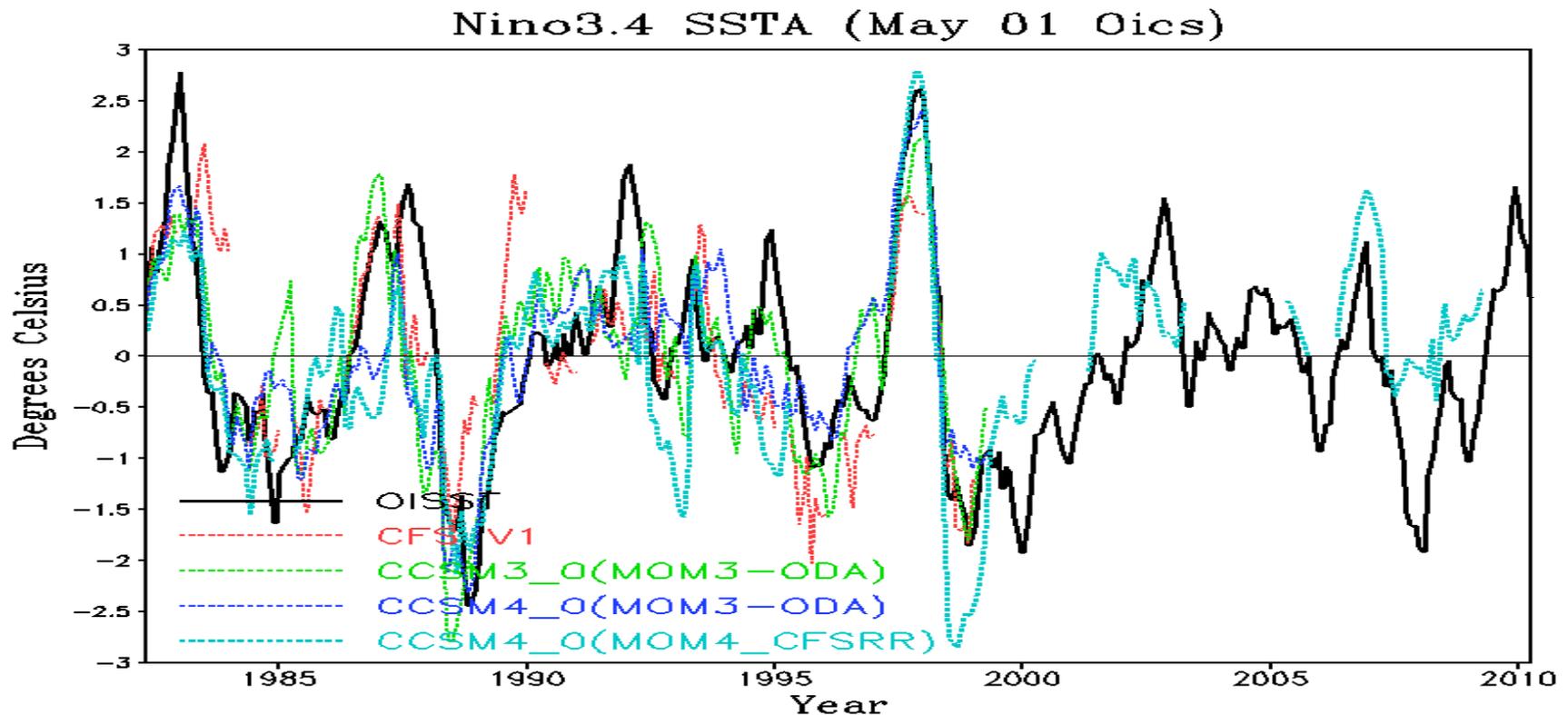




# CCSM3 and CCSM4 Seasonal-to-Interannual Prediction





# CCSM3 and CCSM4 Seasonal-to- Interannual Prediction

**University of Miami: Kirtman, Min**  
**COLA: Kinter, Paolino**  
**CIRES: Pegion**  
**NOAA/CPC: van den Dool, Peña**

# Experiments Completed

- **CCSM3.0:**

- Ocean-Only ICs, All months (1982-present), 6-member ensembles
- O-L-A ICs, 21-30 Dec., 22-31 May, 10-member ensembles
- Initial Condition Sources (GFDL-OI, GOLD, ECMWF, NCEP Reanalysis)
- Experimental Real-Time Prediction in Support of NMME

- **CCSM3.5:**

- Ocean-Only ICs, Jan, Apr, Jul, Oct, 6-member ensembles
- O-L-A ICs, 21-30 Apr., 22-31 Oct, 10-member ensembles
- Initial Condition Sources (GFDL-OI, GOLD, ECMWF, NCEP Reanalysis)

- **CCSM4.0:**

- Ocean-Only ICs
  - GFDL-OI: May 1982-1999, CFS-R: May 1982-Present
- O-L-A ICs In Preparation

# Results

- **Initial Prediction Experiments**
  - CCSM3.0, CCSM3.5, CCSM4.0
  - Ocean-Only Initialization, 6-member ensembles
  - Comparing GFDL-IO vs. CFS-R Ocean Initial States
- **Ocean-Land-Atmosphere Initialization**
  - CCSM3.0 Only
- **Sub-Seasonal Predictions**
  - CCSM3.5 Only

# CCSM3.0 Jan 1982 IC

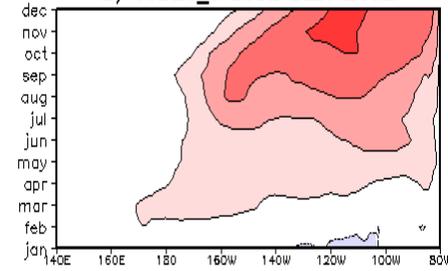
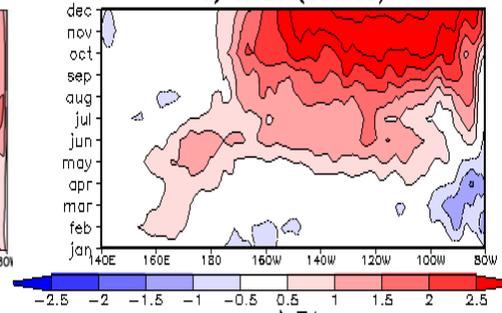
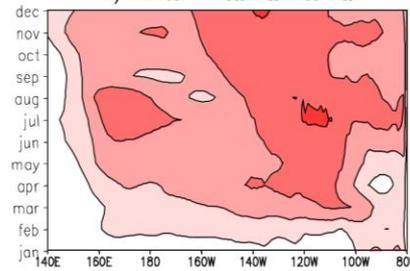
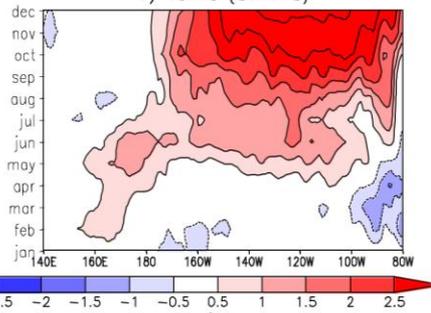
# CCSM3.5 Jan 1982 IC

a) OISST (198201)

b) CCSM3 SSTA Ens. Mean

a) OISST (198201)

b) CCSM3\_5 SSTA Ens. Mean

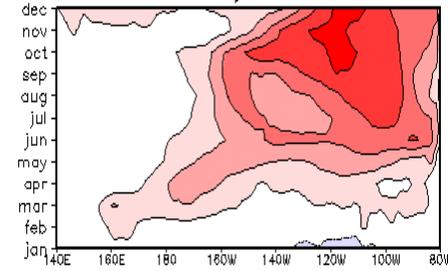
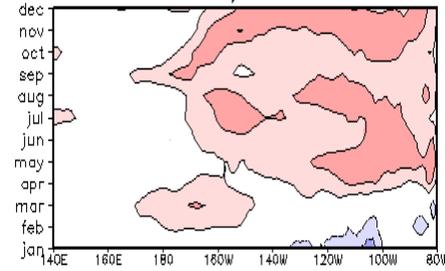
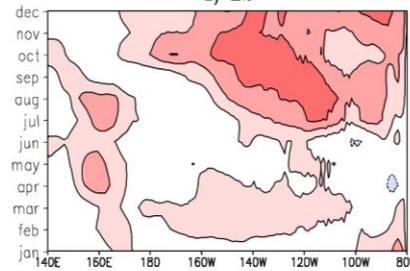
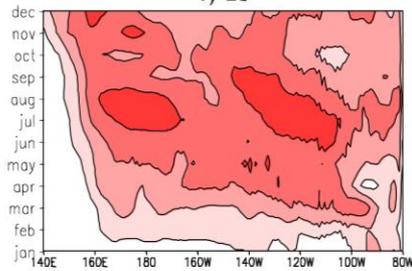


c) E1

d) E2

c) E1

d) E2

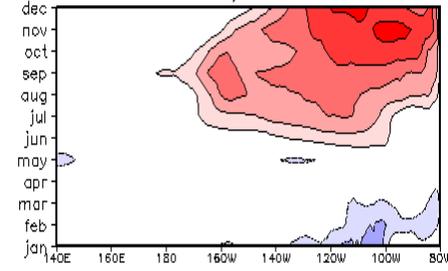
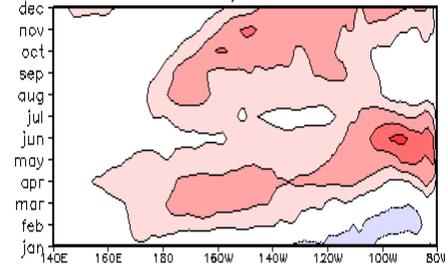
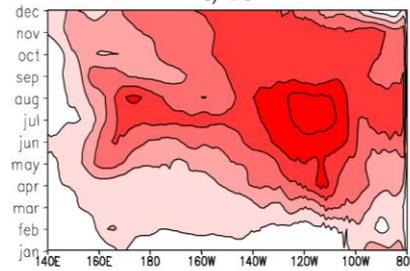
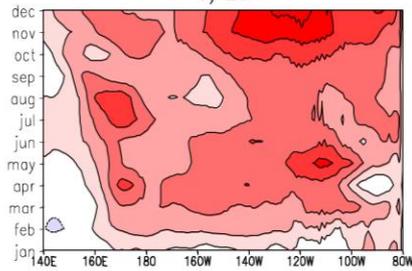


e) E3

f) E4

e) E3

f) E4

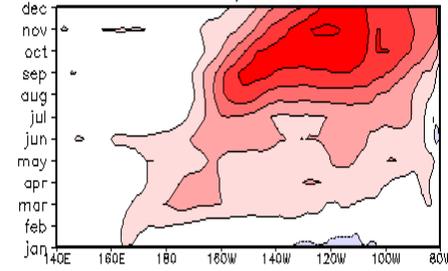
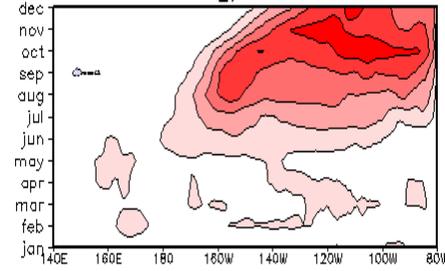
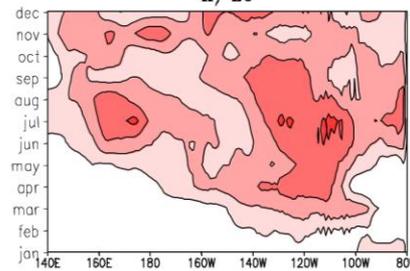
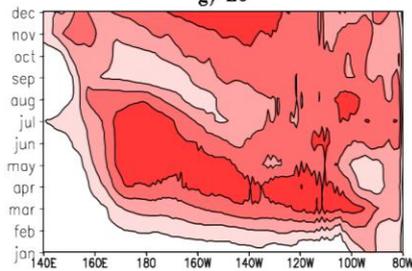


g) E5

h) E6

g) E5

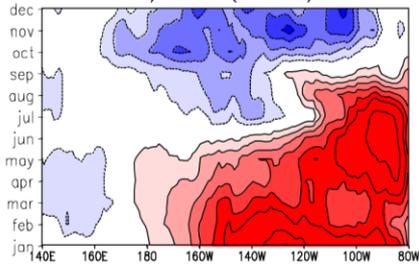
h) E6



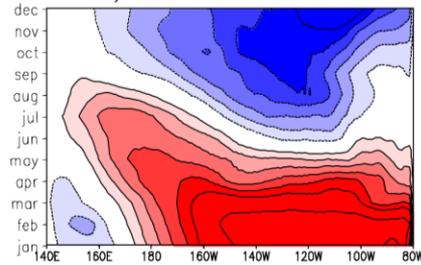
# CCSM3.0 Jan 1983 IC

# CCSM3.5 Jan 1983 IC

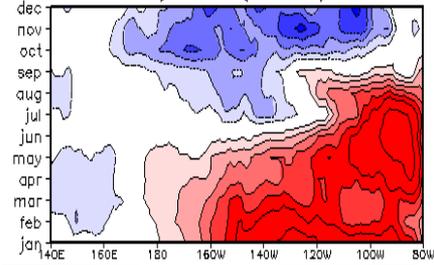
a) OISST (198301)



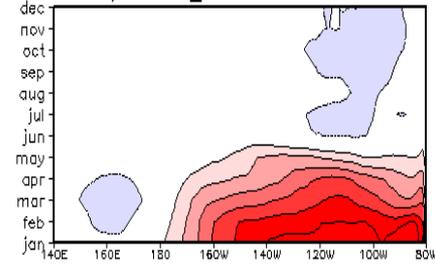
b) CCSM3 SSTA Ens. Mean



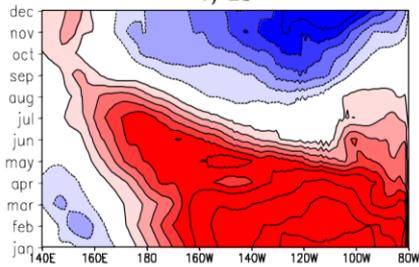
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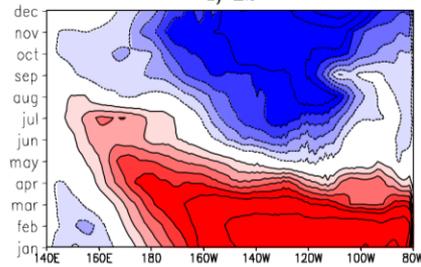
b) CCSM3\_5 SSTA Ens. Mean



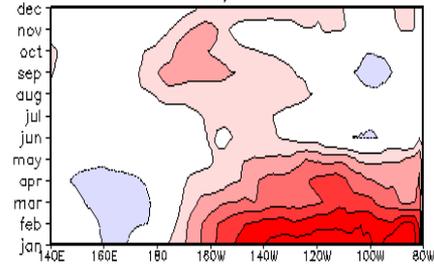
c) E1



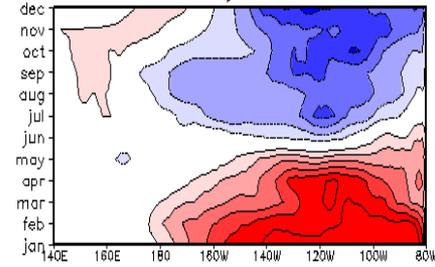
d) E2



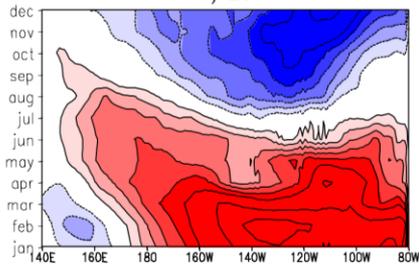
c) E1



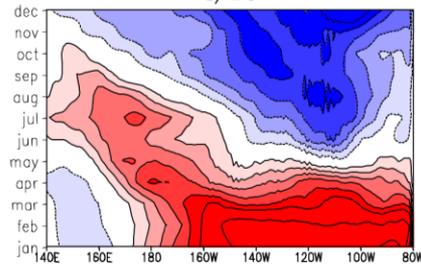
d) E2



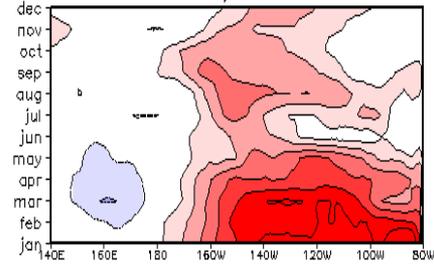
e) E3



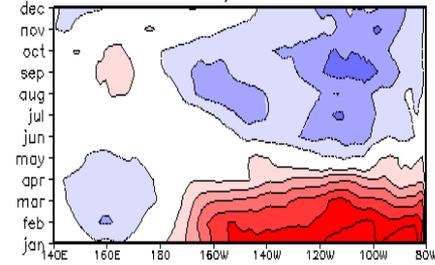
f) E4



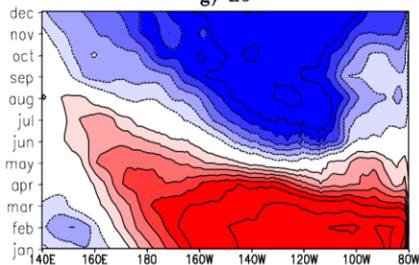
e) E3



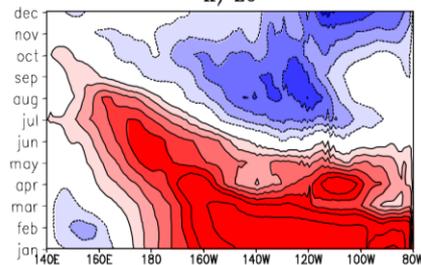
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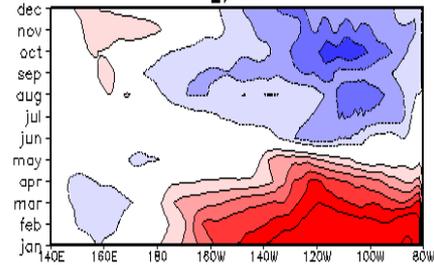
g) E5



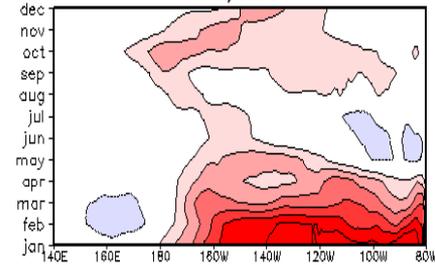
h) E6



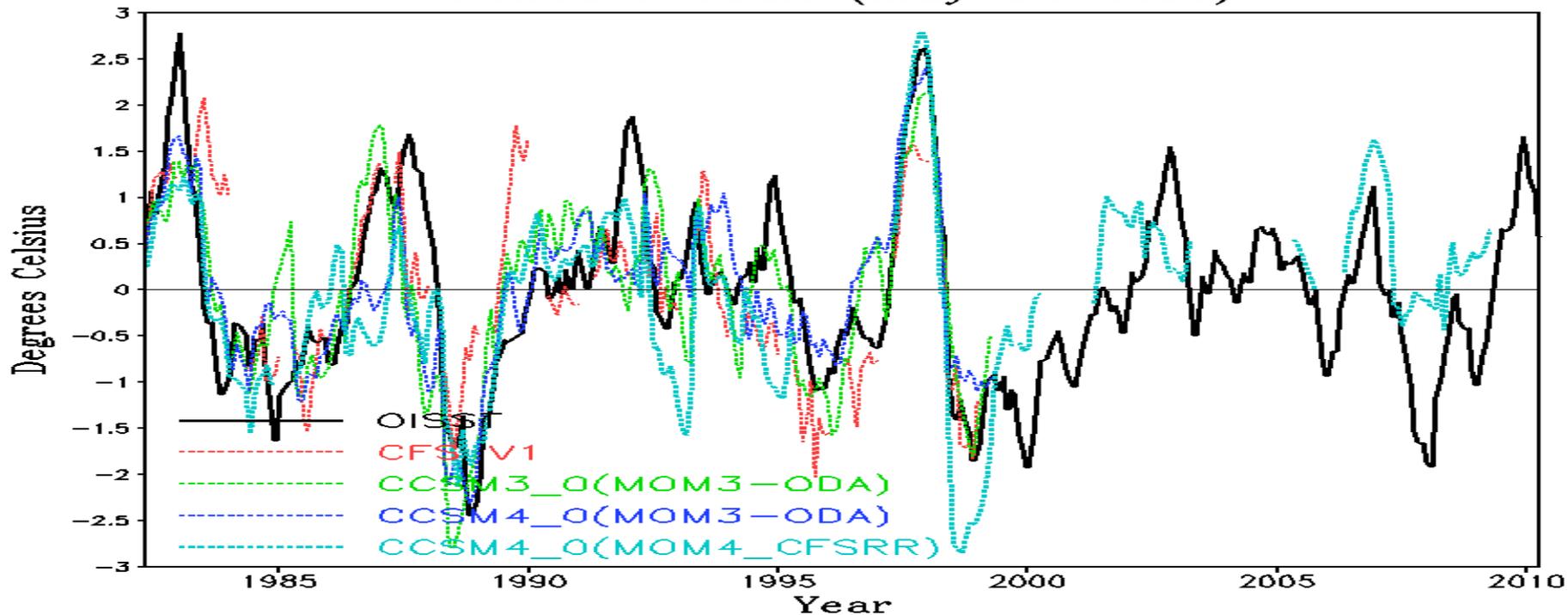
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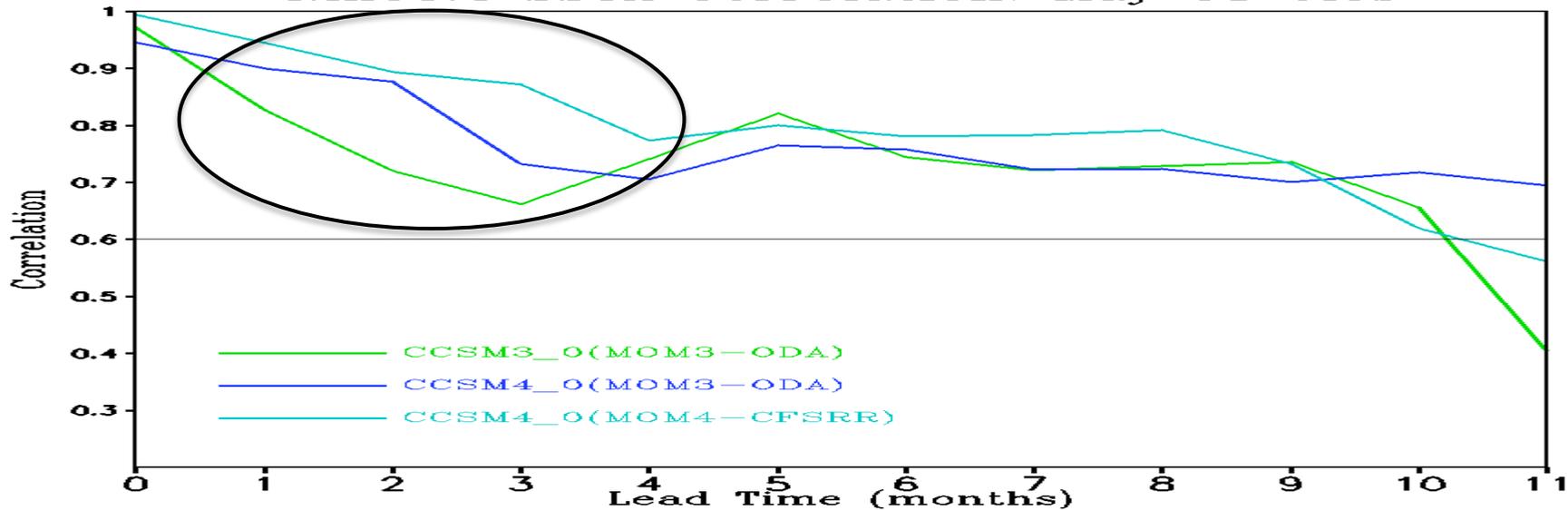
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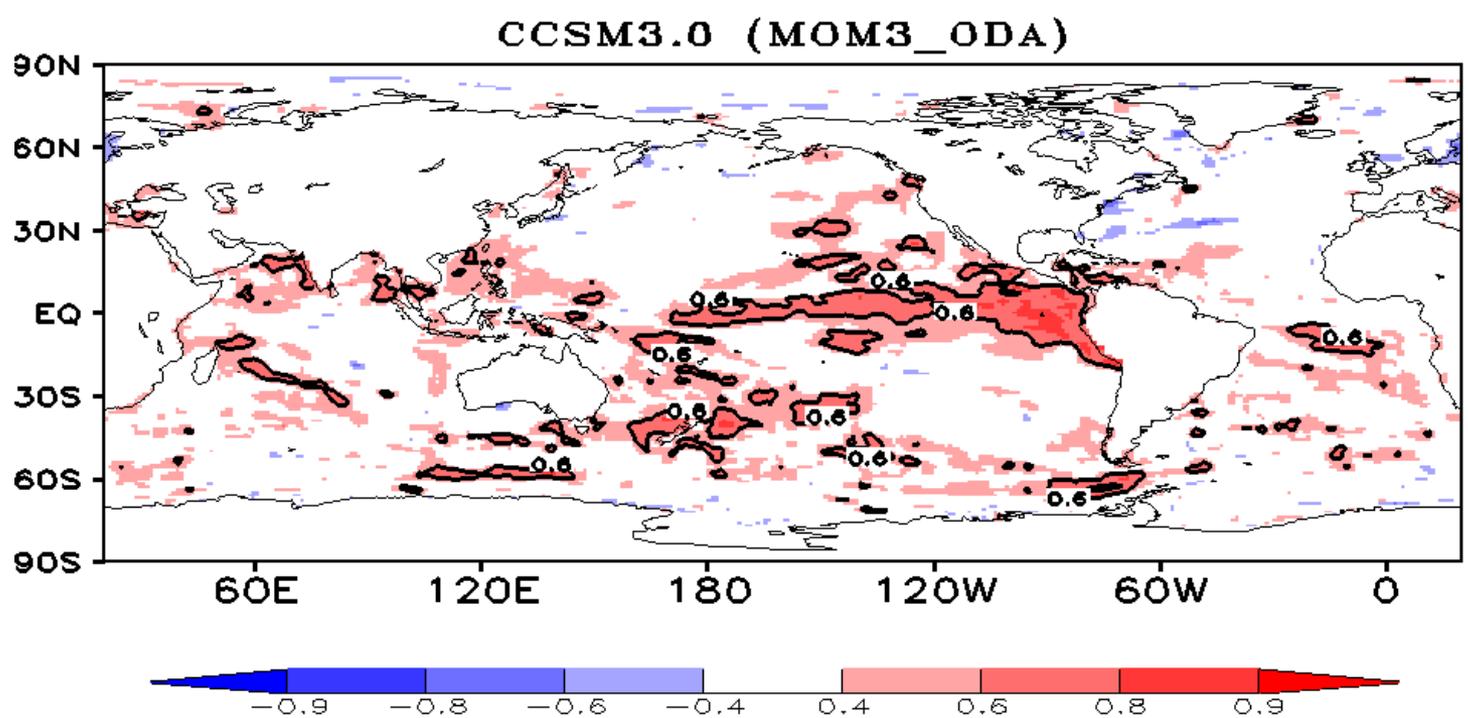
### Nino3.4 SSTA (May 01 Oics)



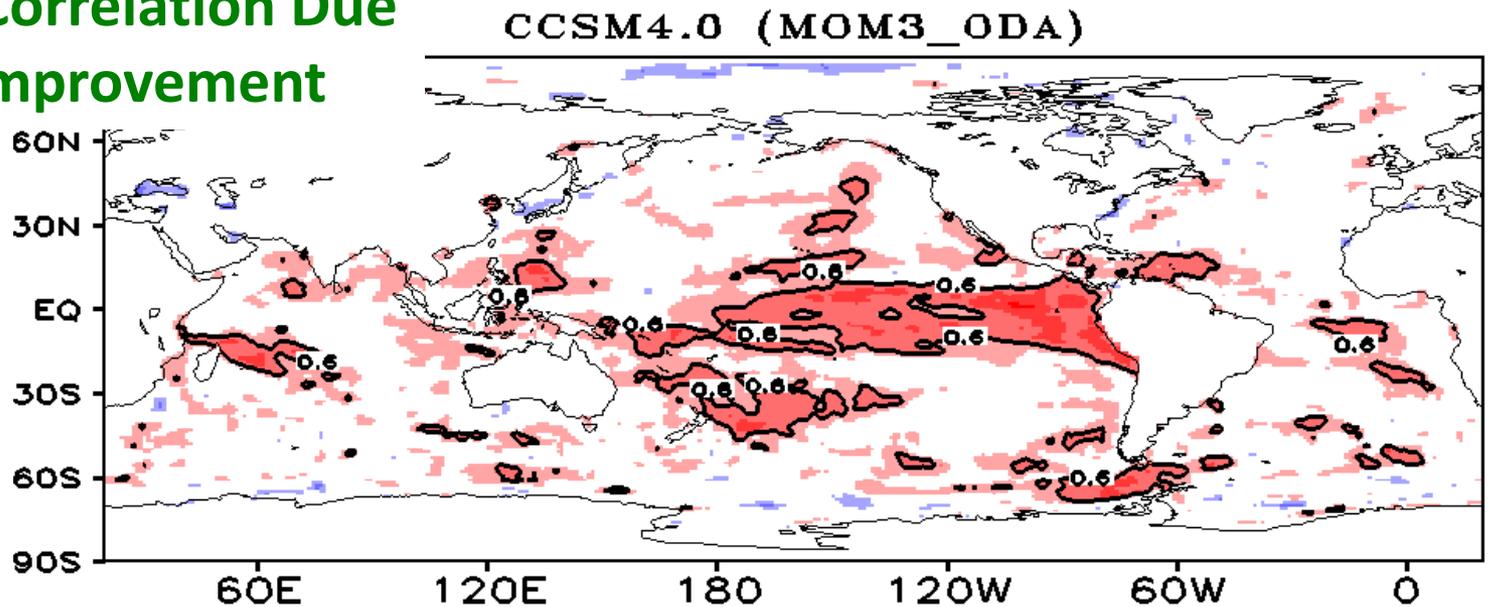
### Nino3.4 SSTA Correlation: May 01 Oics



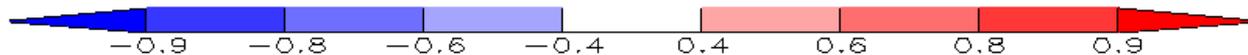
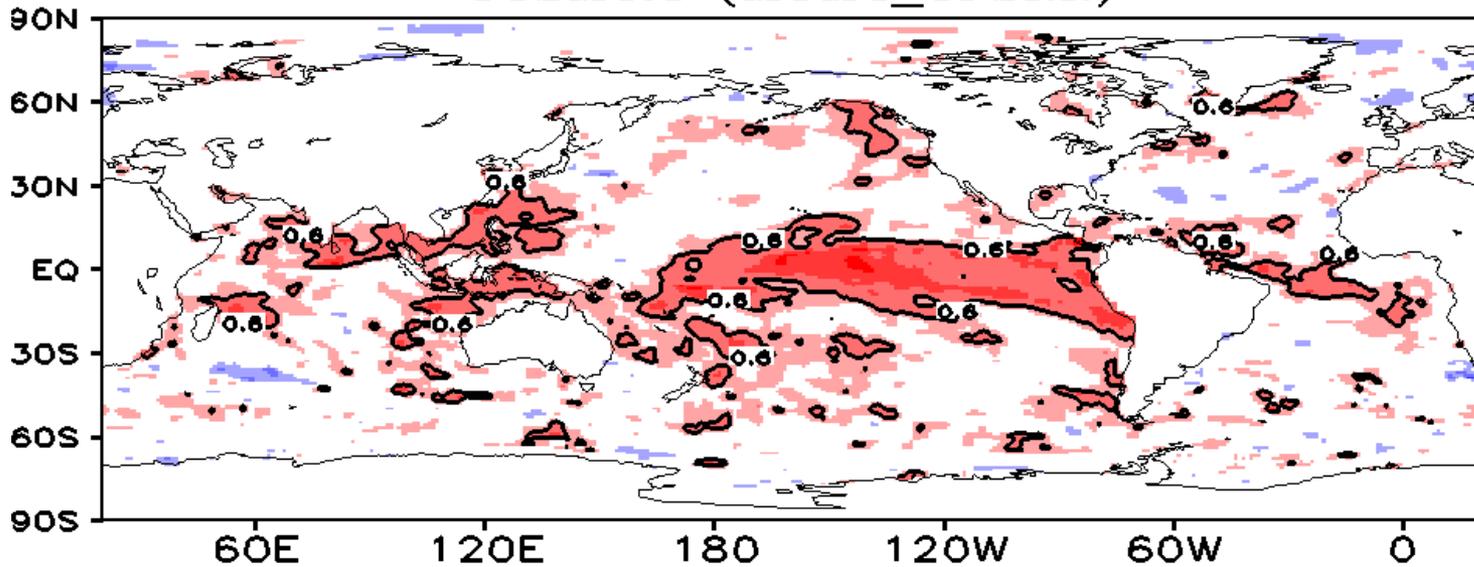
May Initial  
Conditions  
3-Months Lead



Improved Correlation Due  
to Model Improvement



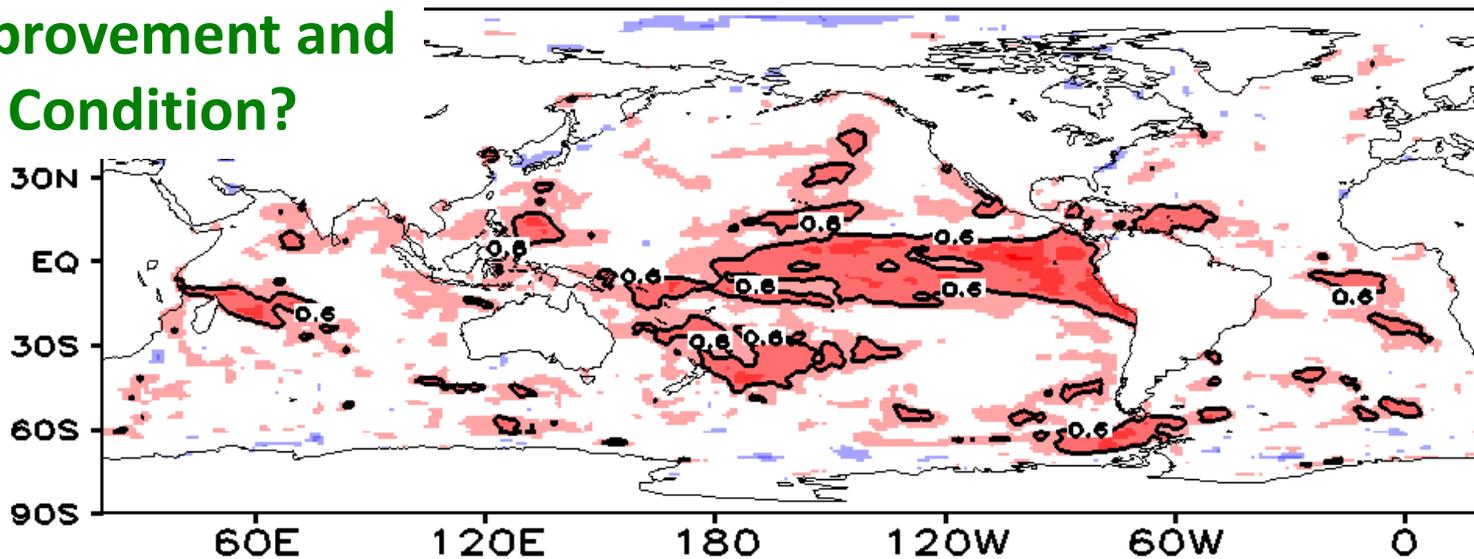
CCSM4.0 (MOM4\_CFSRR)



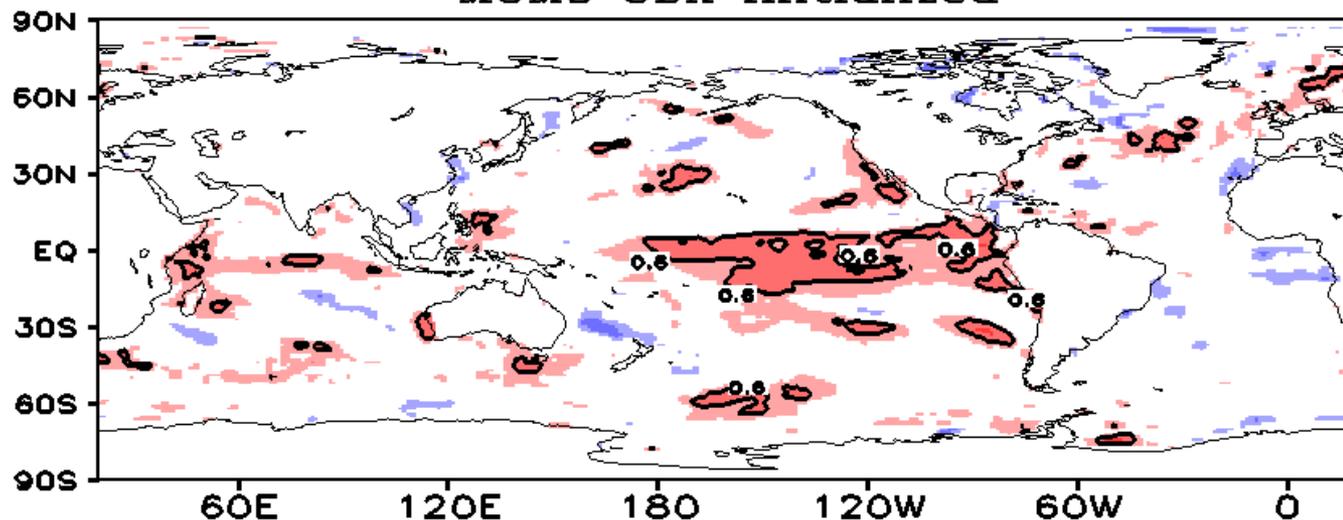
May Initial  
Conditions  
3-Months Lead

Improved Correlation Due  
to Model Improvement and  
Better Initial Condition?

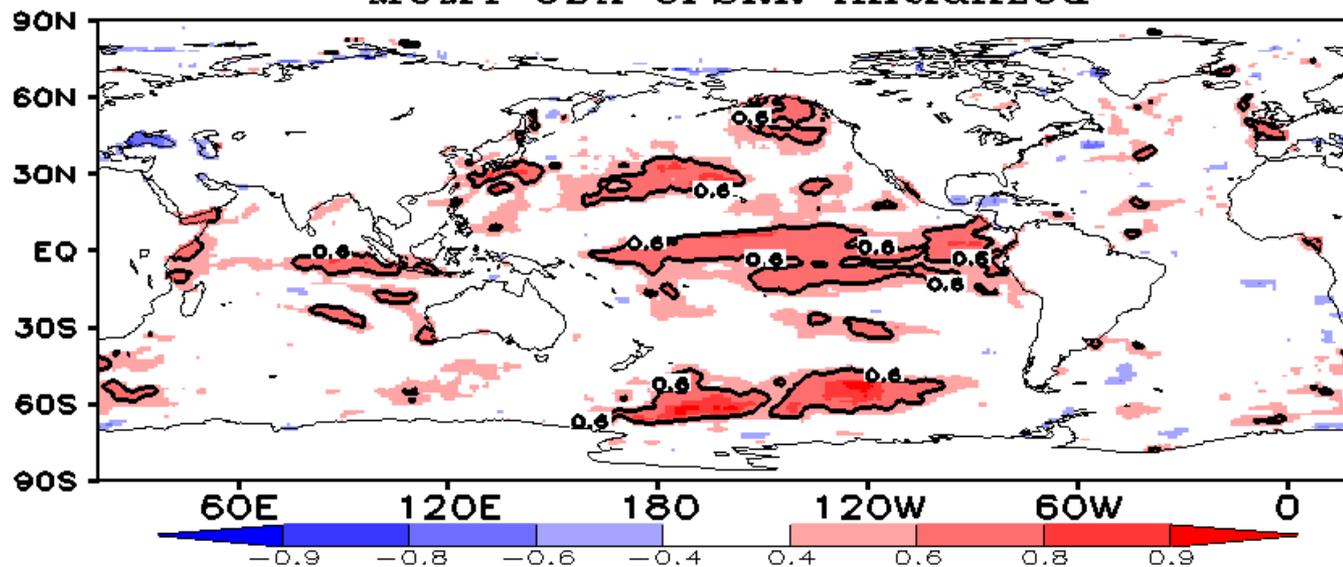
CCSM4.0 (MOM3\_ODA)



Corr. of CCSM4.0 SSTA with OISST  
Lead Month = 9 (May IC)  
MOM3 ODA Initialized



MOM4 ODA CFSRR Initialized

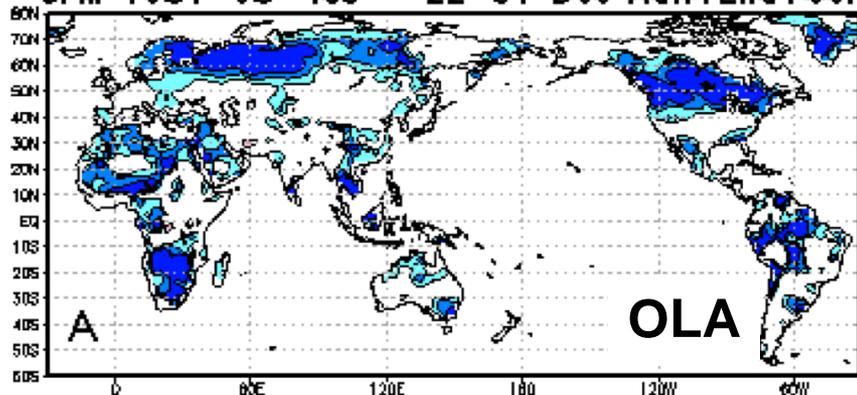


# Results

- **Initial Prediction Experiments**
  - CCSM3.0, CCSM3.5, CCSM4.0
  - Ocean-Only Initialization, 6-member ensembles
  - Comparing GFDL-IO vs. CFS-R Ocean Initial States
- **Ocean-Land-Atmosphere Initialization**
  - CCSM3.0 Only
- **Sub-Seasonal Predictions**
  - CCSM3.5 Only

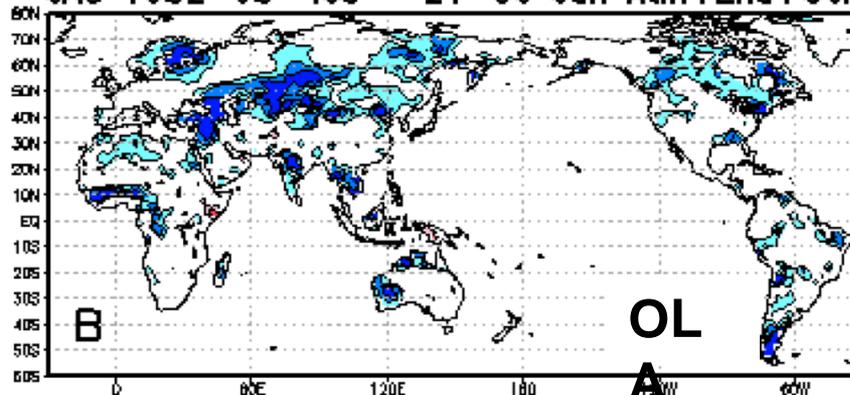
C.C. JFM CCSM3.0 T2m vs CAMS Tsfc

JFM 1981-98 ICs = 22-31 Dec Atm+Lnd+Ocn

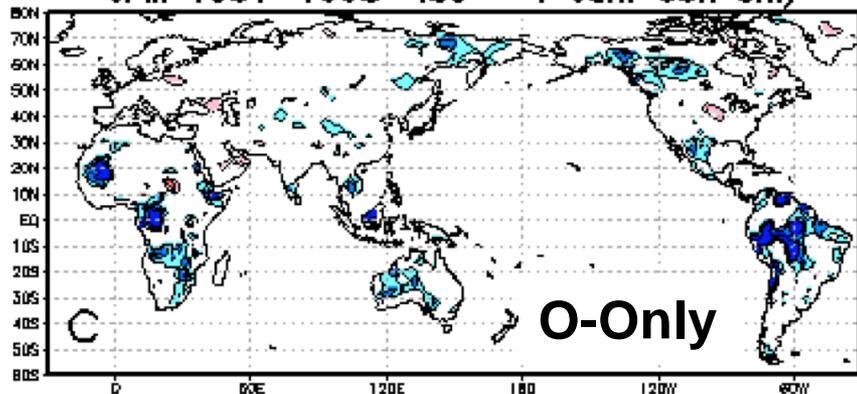


C.C. JAS CCSM3.0 T2m vs CAMS Tsfc

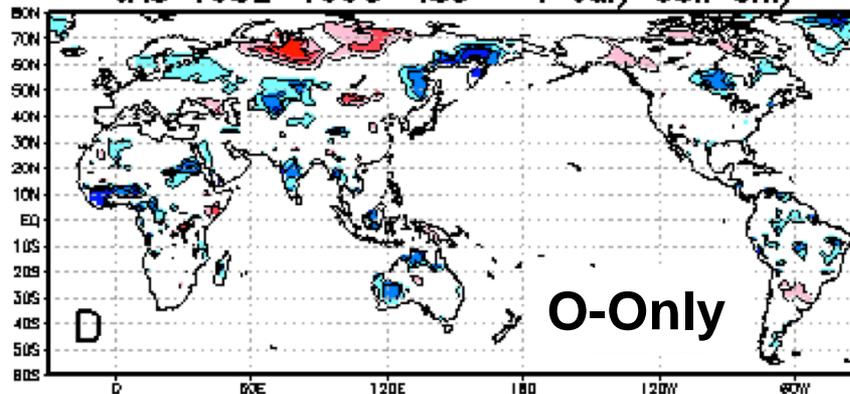
JAS 1982-98 ICs = 21-30 Jun Atm+Lnd+Ocn



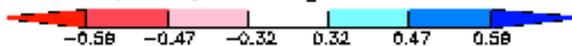
JFM 1981-1998 ICs = 1 Jan. Ocn only



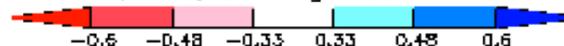
JAS 1982-1998 ICs = 1 July Ocn only



80%, 95%, 99% significance levels

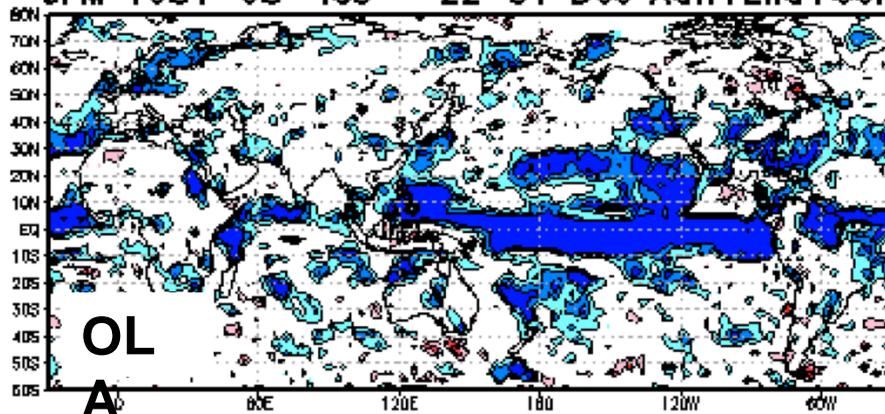


80%, 95%, 99% significance levels



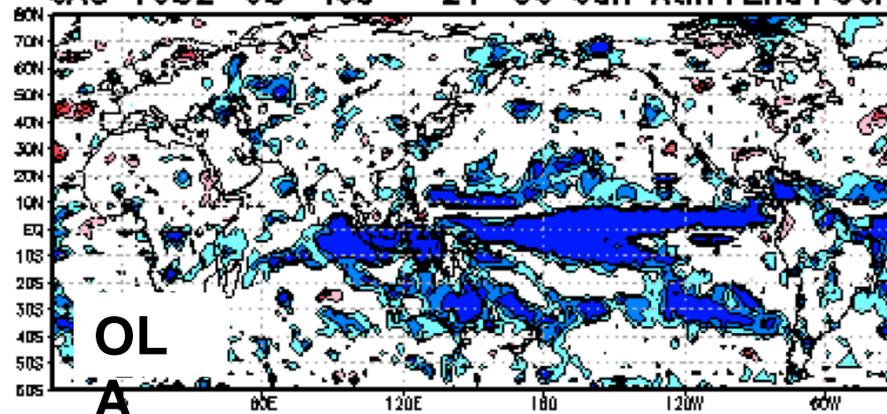
C.C. JFM CCSM3.0 Tppt vs CMAP

JFM 1981-98 ICs = 22-31 Dec Atm+Lnd+Ocn

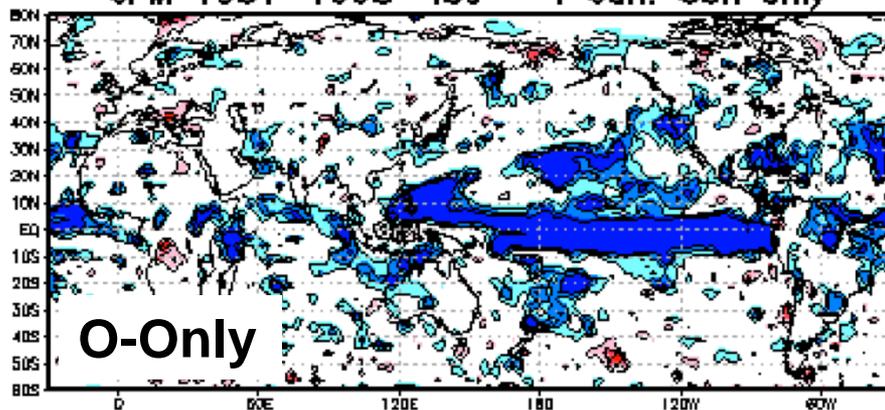


C.C. JAS CCSM3.0 Tppt vs CMAP

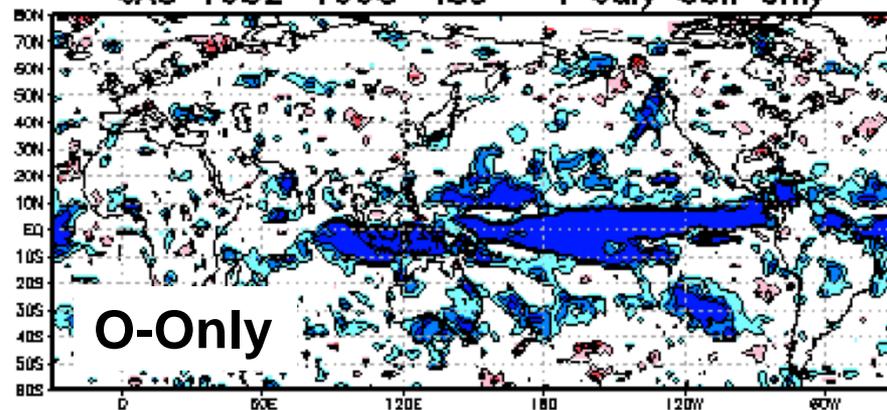
JAS 1982-98 ICs = 21-30 Jun Atm+Lnd+Ocn



JFM 1981-1998 ICs = 1 Jan. Ocn only



JAS 1982-1998 ICs = 1 July Ocn only



80%, 95%, 99% significance levels

-0.58 -0.47 -0.32 0.32 0.47 0.58

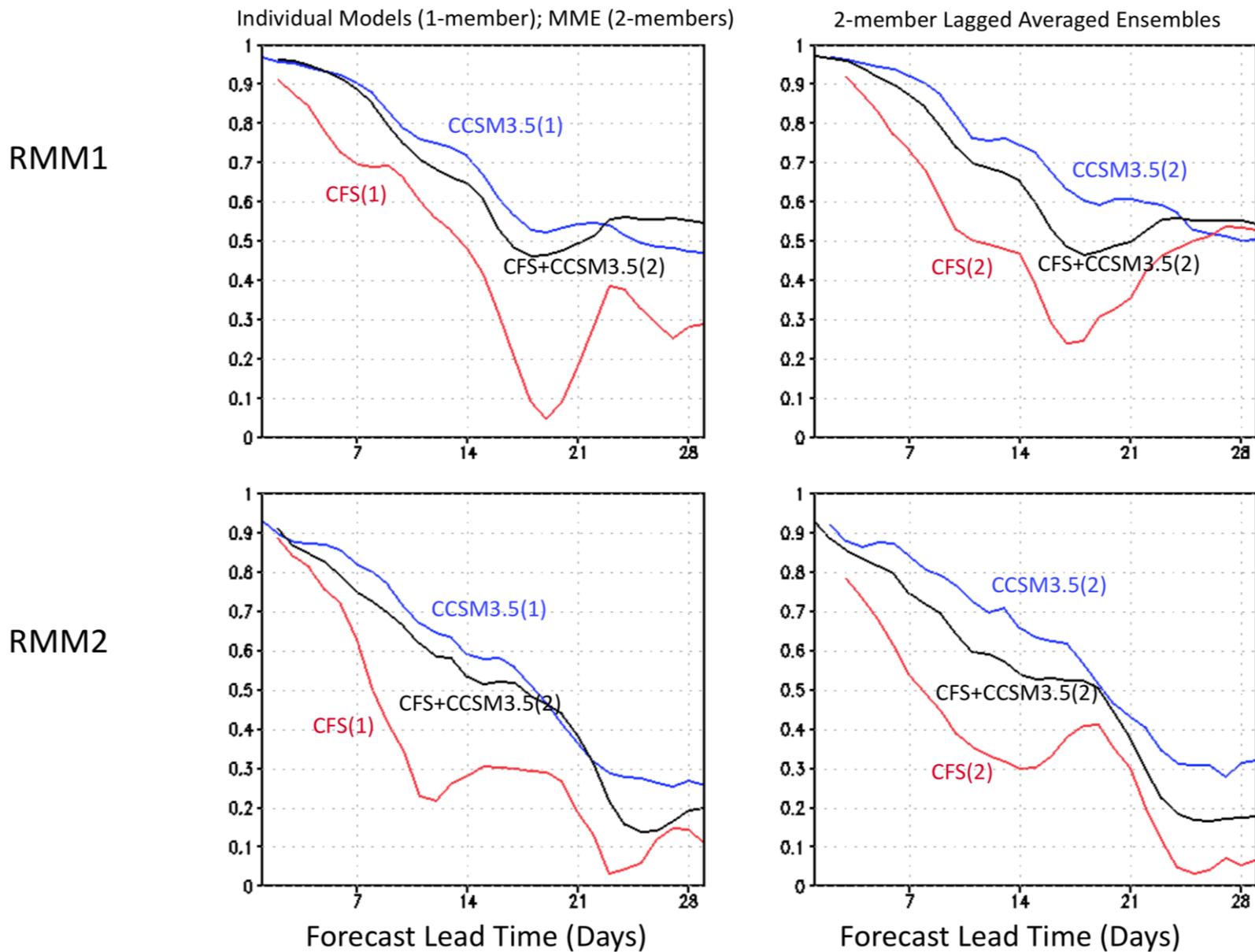
80%, 95%, 99% significance levels

-0.6 -0.48 -0.33 0.33 0.48 0.6

# Results

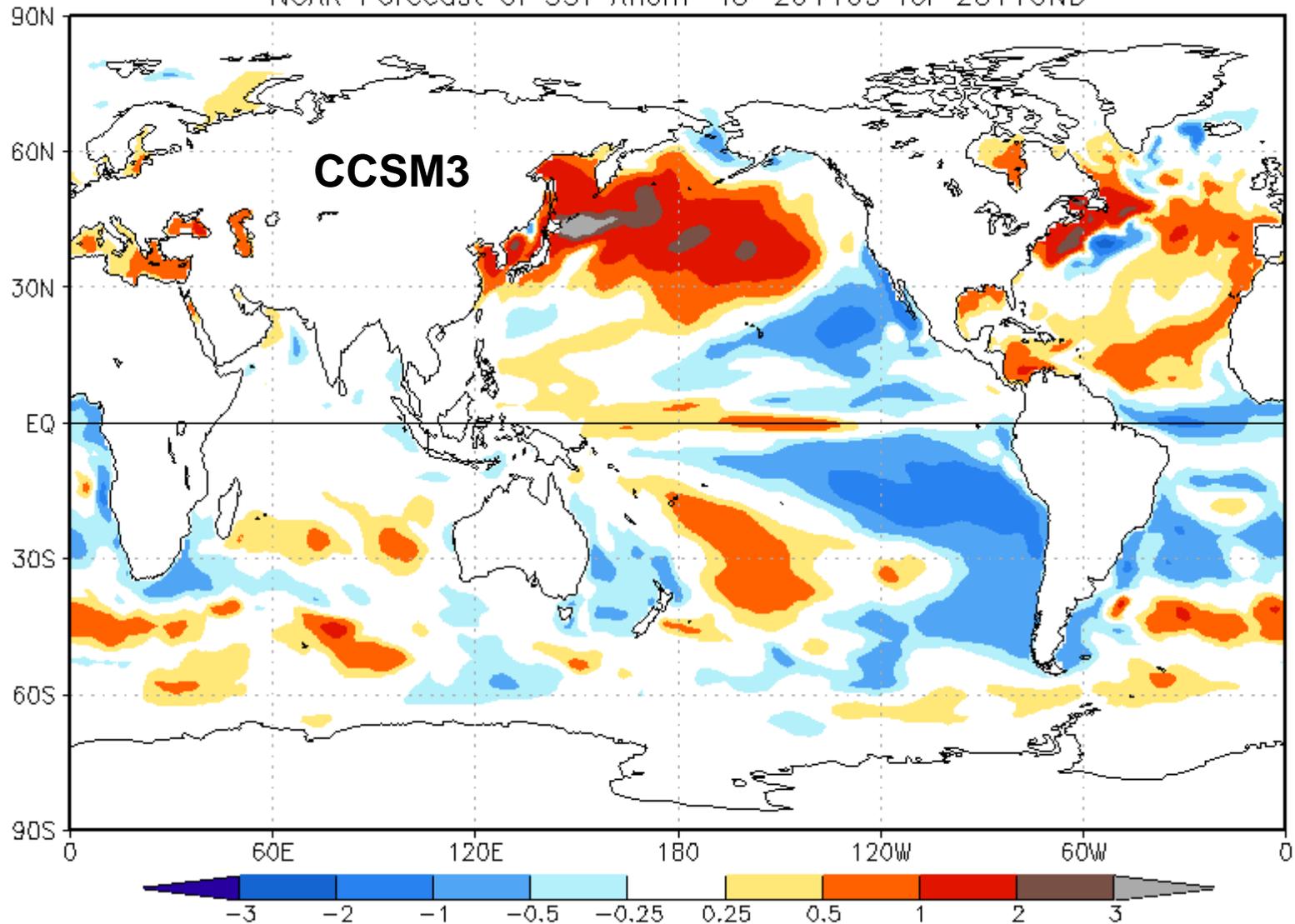
- **Initial Prediction Experiments**
  - CCSM3.0, CCSM3.5, CCSM4.0
  - Ocean-Only Initialization, 6-member ensembles
  - Comparing GFDL-IO vs. CFS-R Ocean Initial States
- **Ocean-Land-Atmosphere Initialization**
  - CCSM3.0 Only
- **Sub-Seasonal Predictions**
  - CCSM3.5 Only

### Average Anomaly Correlation Skill of MJO Index (RMM12) Apr and Oct Initial Conditions (1981-1999) with CCSM3.5



# Experimental Real-Time

NCAR Forecast of SST Anom IC=201109 for 2011OND



# Results

- **Initial Prediction Experiments**
  - Isolate Model Improvements Leading to Improved Forecast SSTA Correlation
  - CFS-R Ocean ICs Improve Correlations?
- **Ocean-Land-Atmosphere Initialization**
  - CCSM3.0: First Season Land T2m and Precip Improve Correlations
- **Sub-Seasonal Predictions**
  - CCSM3.5+CFSv1: Multi-Model RMM1 and RMM2 Improved Correlation
- **No Substitute for Real Prediction**