

CVCWG winter meeting

Drift/Shock in the Decadal Prediction Experiments

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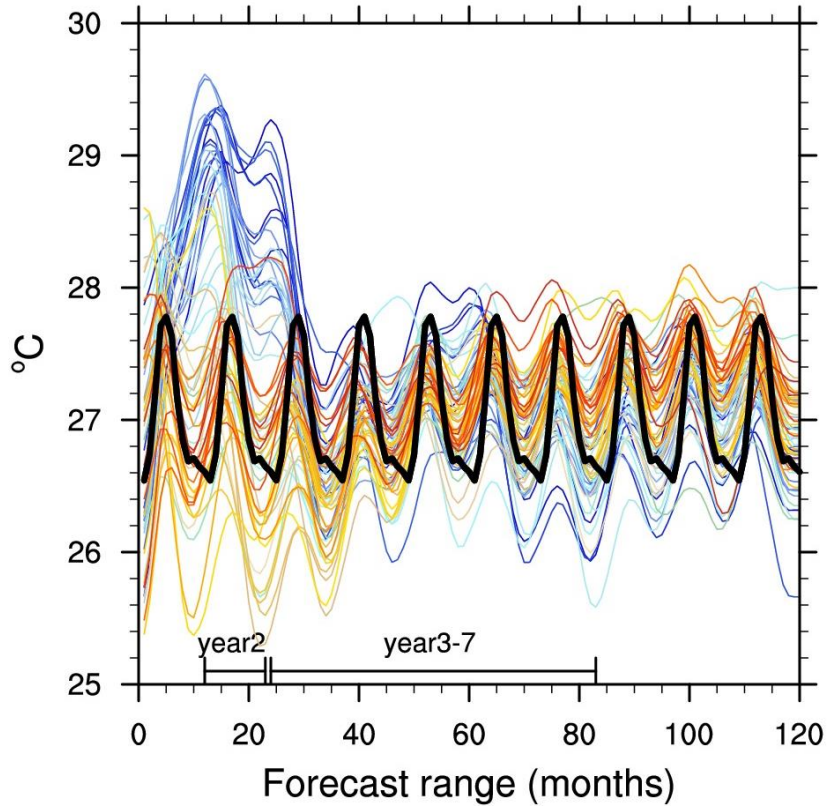
NCAR/CGD

02/27/2019

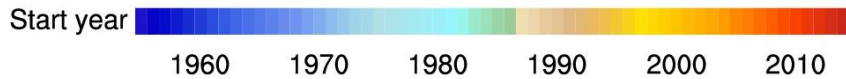
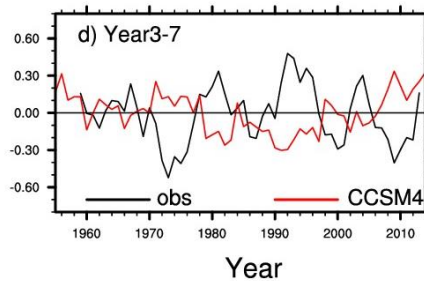
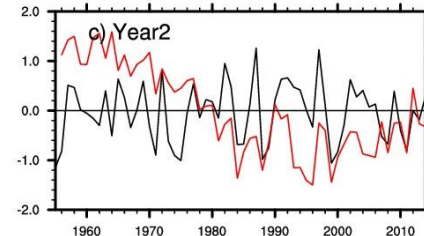
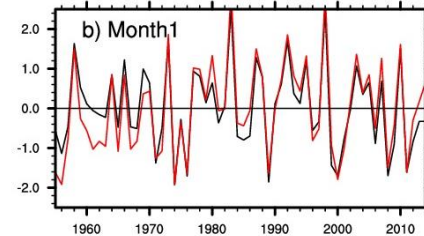
I'll focus on some technical issues in the initialized decadal prediction experiments without worrying about predictability

Initialization Shock in CCSM4 DP

a) CCSM4 Nino34 hindcasts

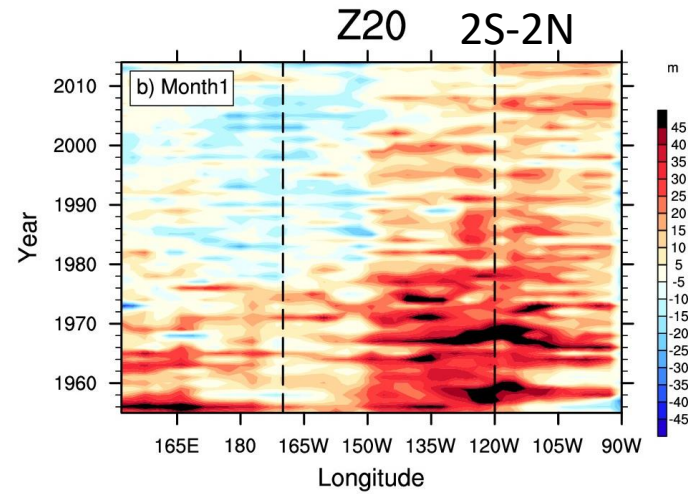
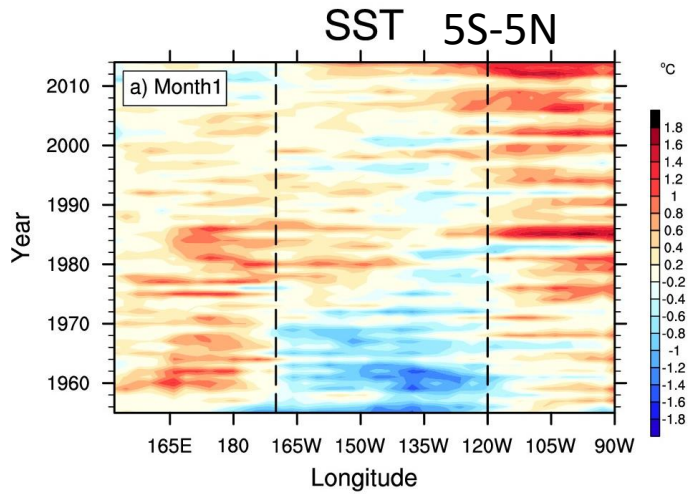


Interannual anomalies

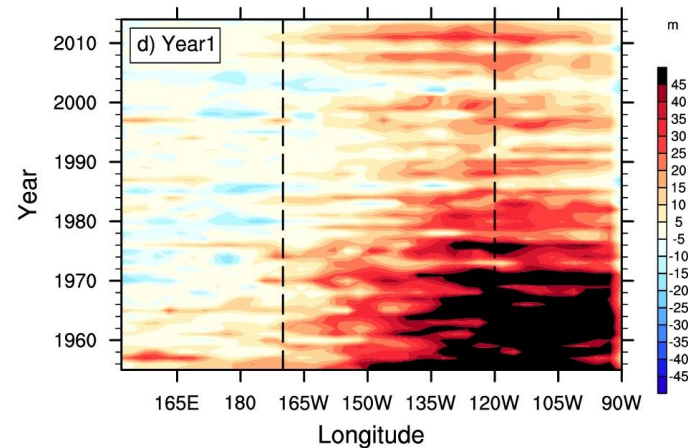
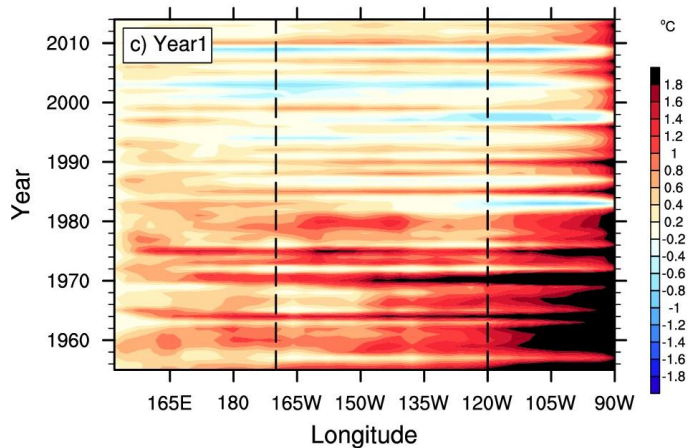


Biases in Month1 and Year1

Month1



Yr1



Heat budget analyzed in Teng et al. 2017 CLIVAR Exchanges

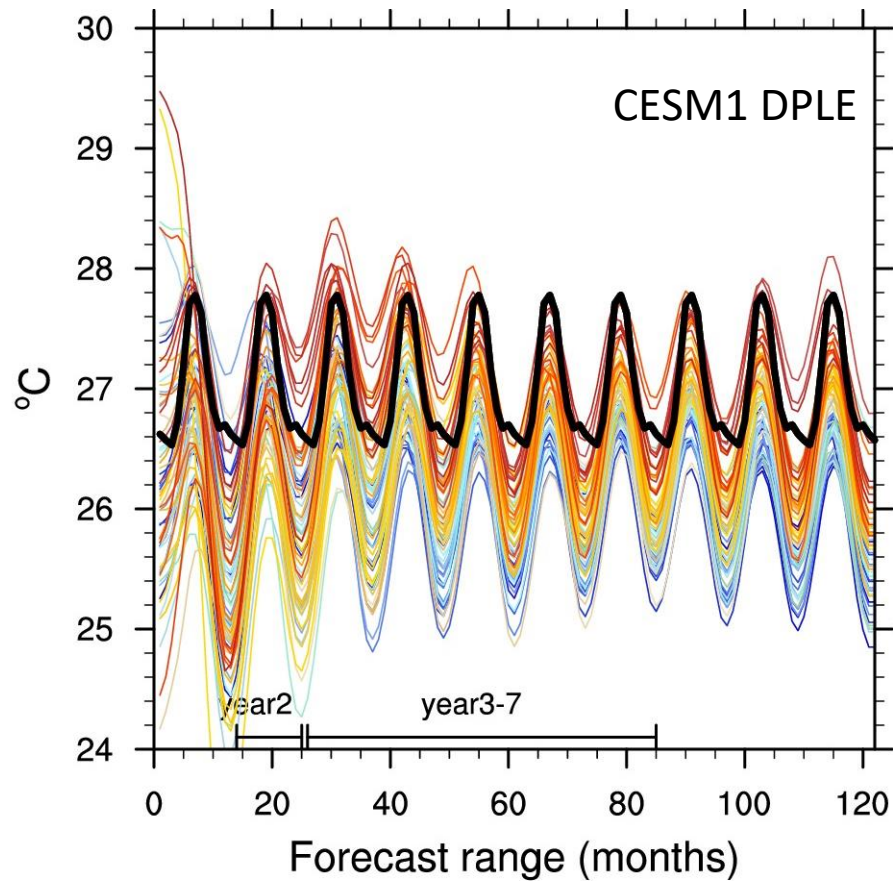
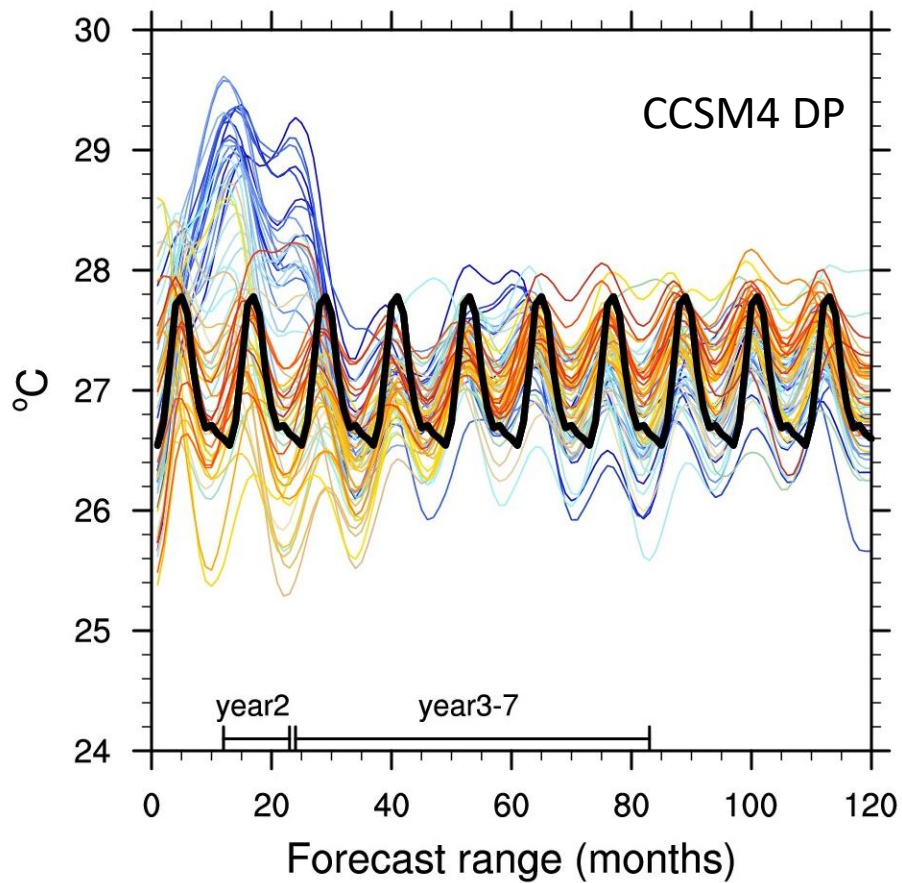
Setup of CCSM4 & CESM1 DP

Yeager et al. 2018 BAMS

	CCSM4-DP	CESM-DPLE
Model	CCSM4	CESM1.1
atm	CAM4 (FV 1°, 26 levels)	CAM5 (FV 1°, 30 levels)
ocn	POP2 (1°, 60 levels)	POP2 (1°, 60 levels) with BGC
ice	CICE4 (1°)	CICE4 (1°)
Ind	CLM4	CLM4
UI ensemble	6-member CCSM4 twentieth-century ensemble (Meehl et al. 2012)	40-member CESM twentieth-century Large Ensemble (Kay et al. 2015)
Forcing		
through 2005	CMIP5 historical	CMIP5 historical
from 2006 onward	CMIP5 representative concentration pathway (RCP) 4.5	CMIP5 RCP 8.5
Initialization		
method	Full field	Full field
atm	UI	UI
ocn	CORE-forced FOSI	CORE*-forced FOSI
ice	CORE-forced FOSI	CORE*-forced FOSI
Ind	UI	UI
Ensembles		
Ensemble size	10	40
Start dates	Annual; 1 Jan 1955–2014 (<i>N</i> = 60)	Annual; 1 Nov 1954–2015 (<i>N</i> = 62)
Ensemble generation	Variable Jan start days and round-off perturbation of atm initial conditions	Round-off perturbation of atm initial conditions
Simulation length	120 months	122 months

CORE winds (based on NCEP/NCAR Reanalysis) were replaced by 20CRv2 (1948-2010) and JRA55 (2011-2017) at 30S-30N

Nino34 SST



Start years



1959

1969

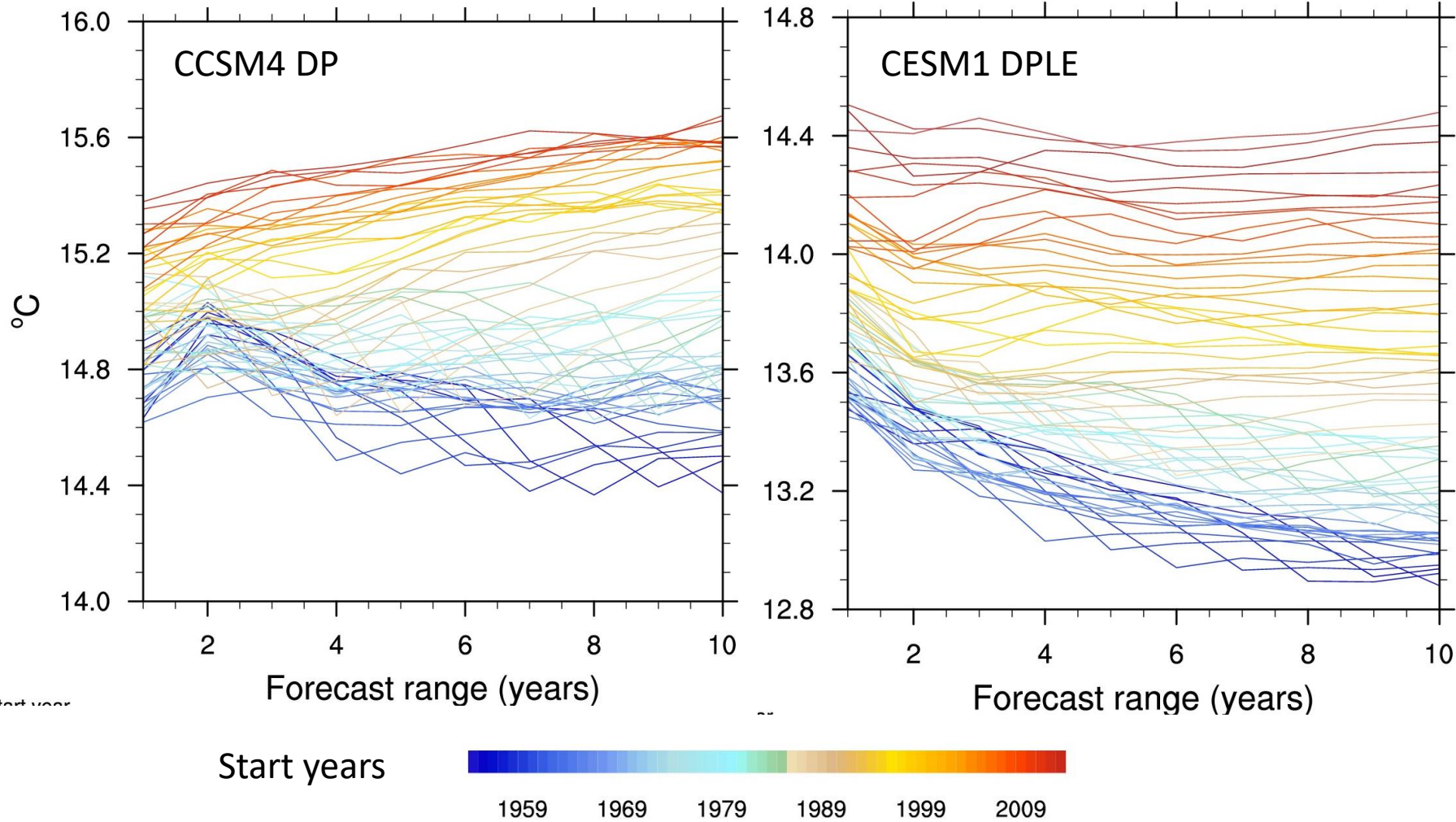
1979

1989

1999

2009

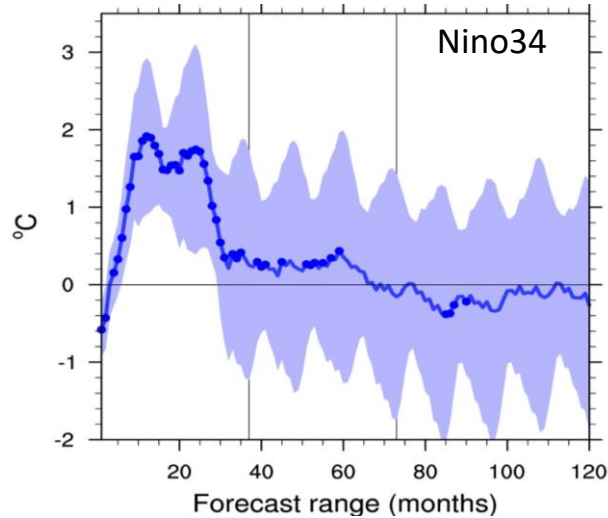
Global Annual Mean TAS



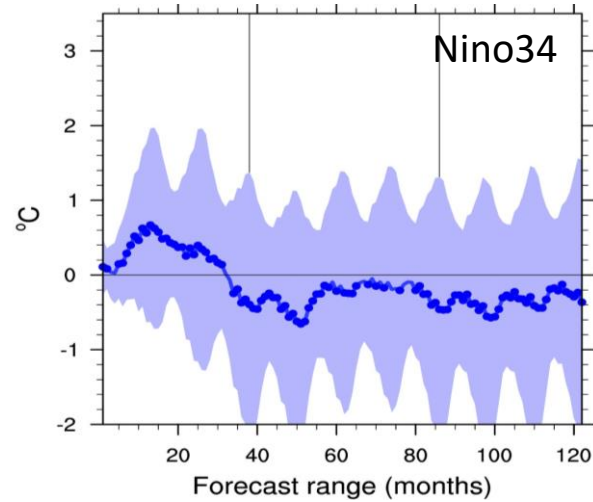
H_0 : Invariance of bias
under climate change

Non-stationary Biases
1955-1975 vs. 1980-2010

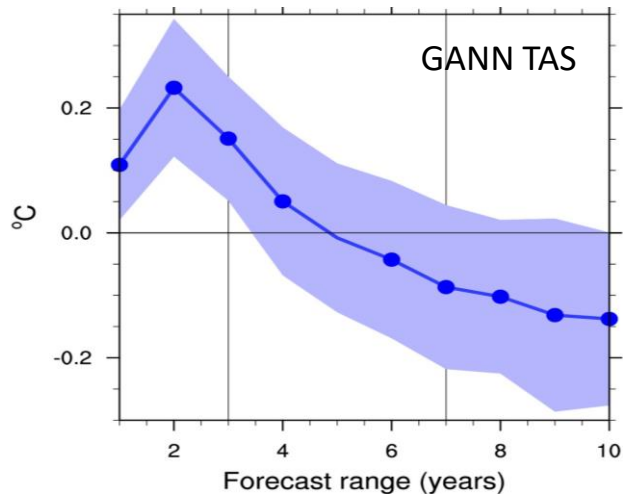
CCSM4 DP



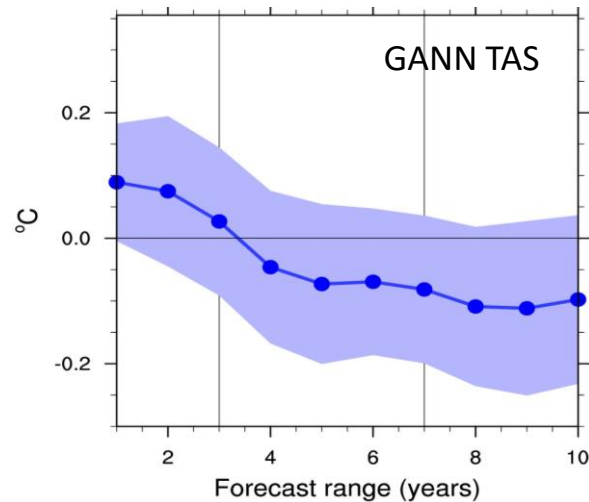
CESM1 DPLE



GANN TAS

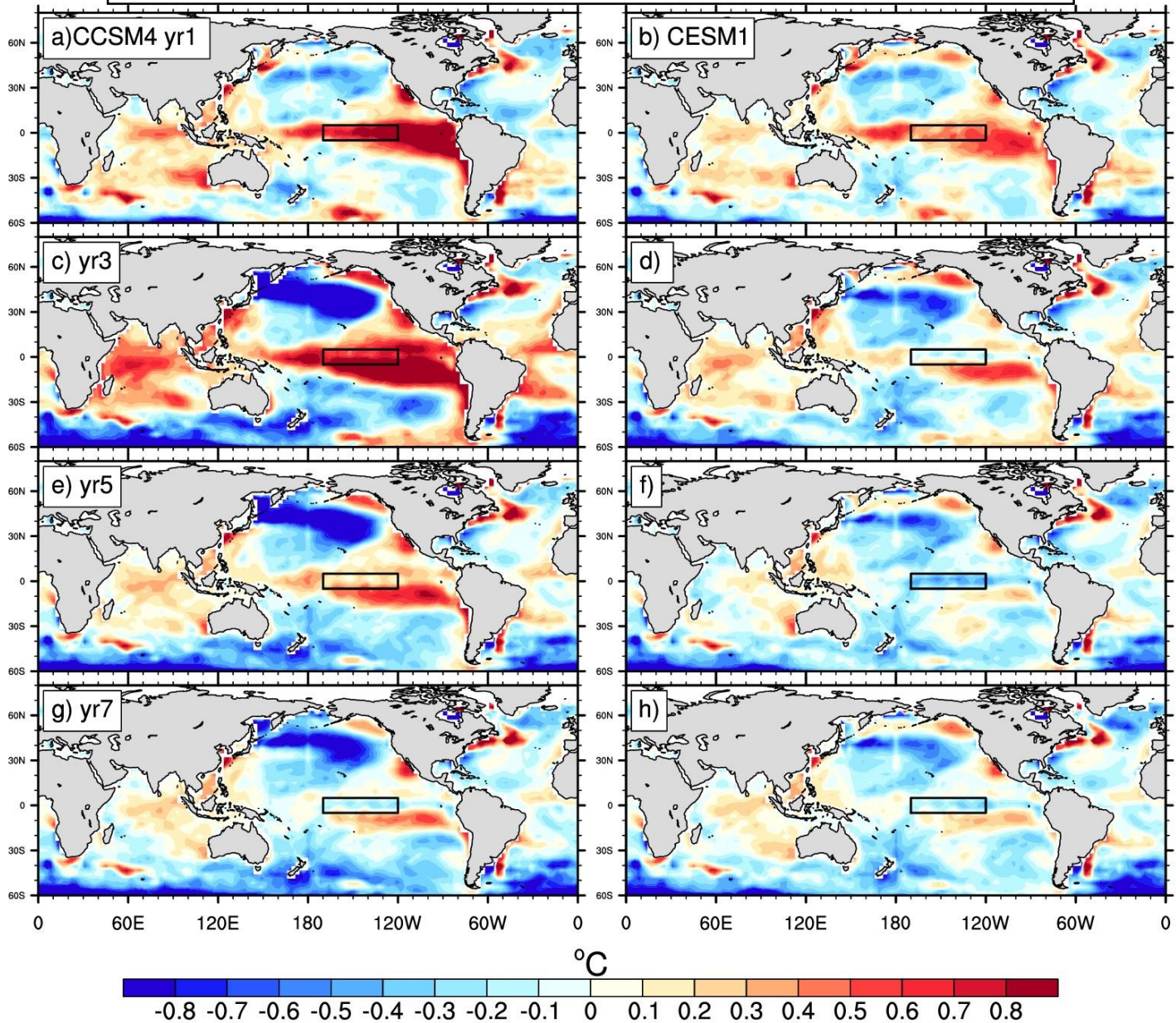


GANN TAS



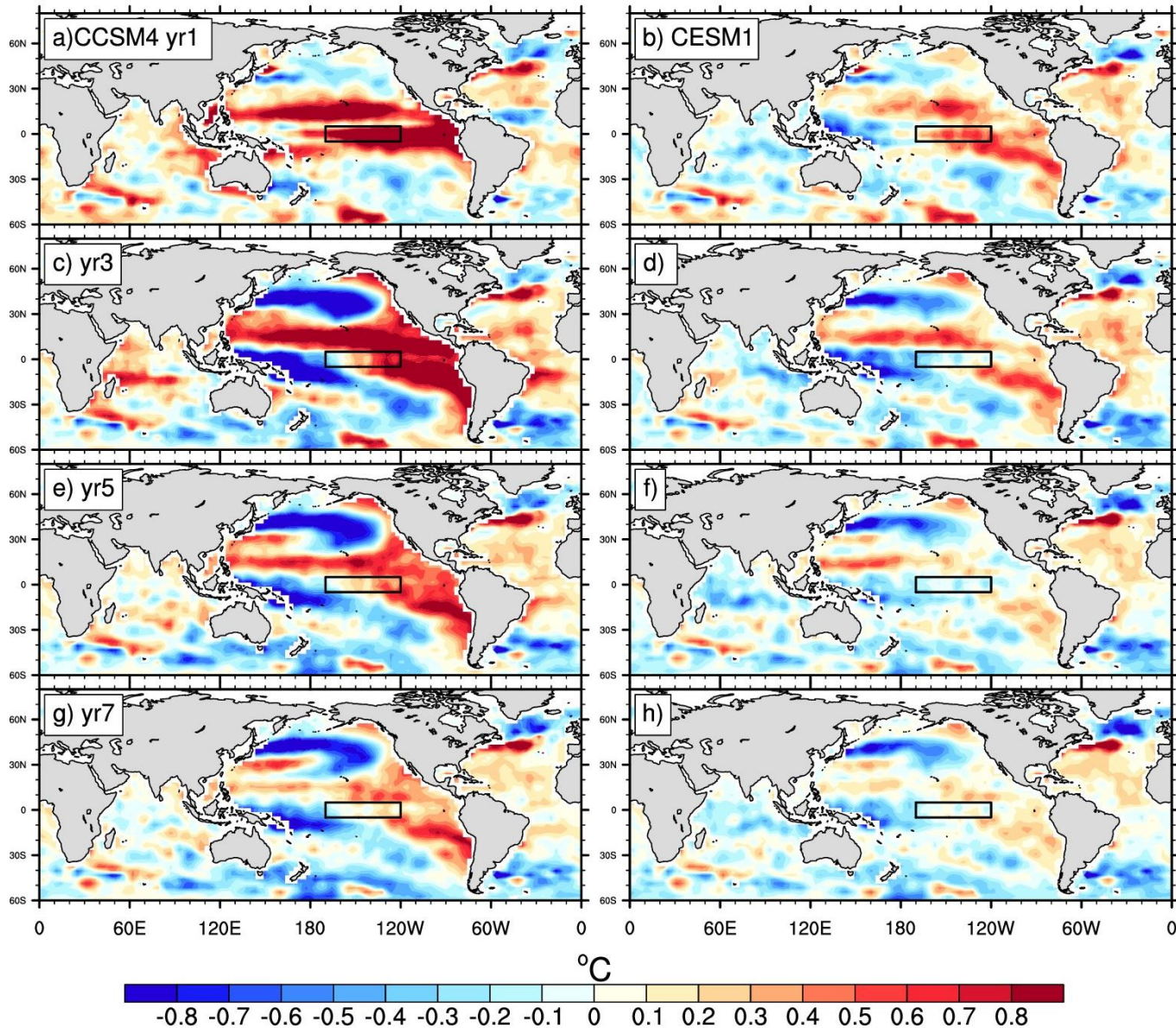
Non-stationary Biases in SST

1955-1975 vs. 1980-2010

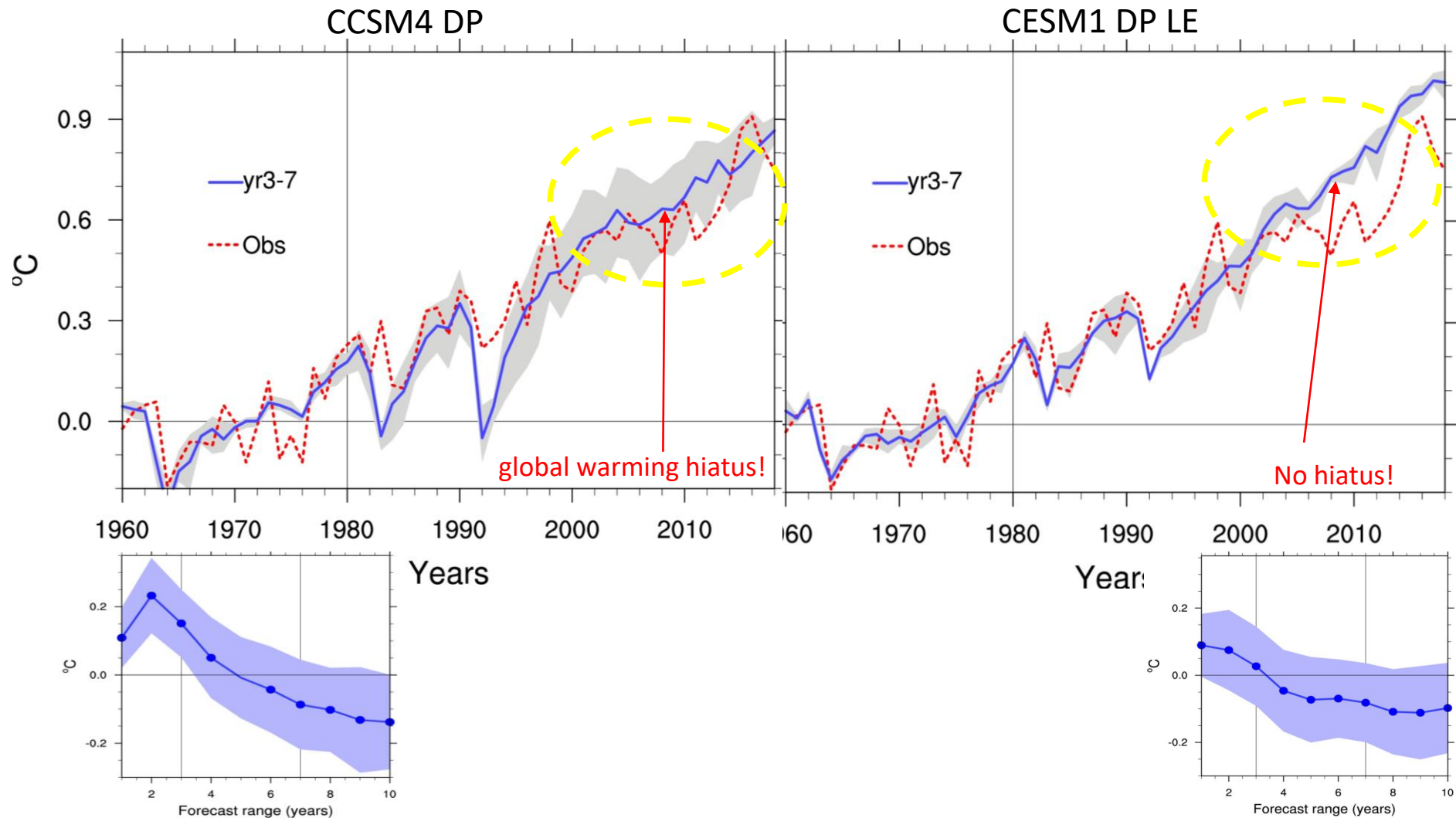


Non-stationary Biases in TEMP0-300

1955-1975 vs. 1980-2010

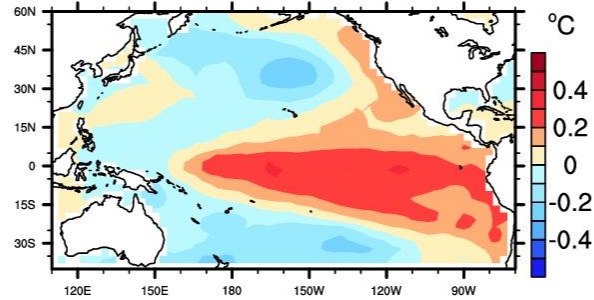


Year3-7 Hindcast Global ANN TAS anomalies wrt 1960-1980

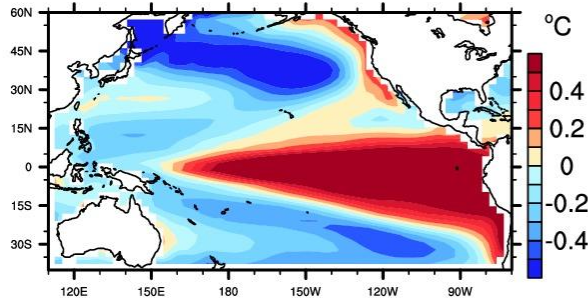


Impacts on the IPO Hindcast: CCSM4 DP

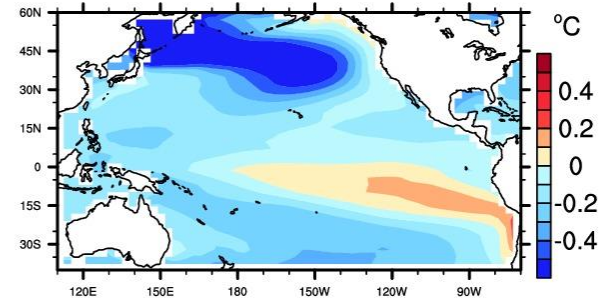
a) IPO observations



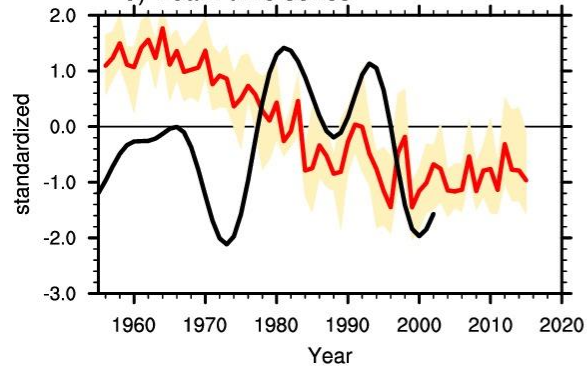
b) CCSM4 yr2 hindcast EOF1



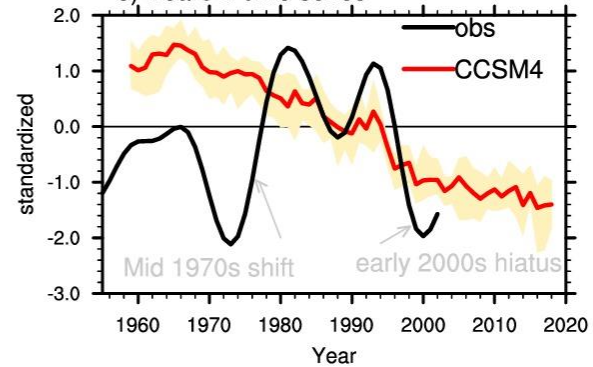
c) CCSM4 yr3-7 hindcast EOF1



d) Year2 time series

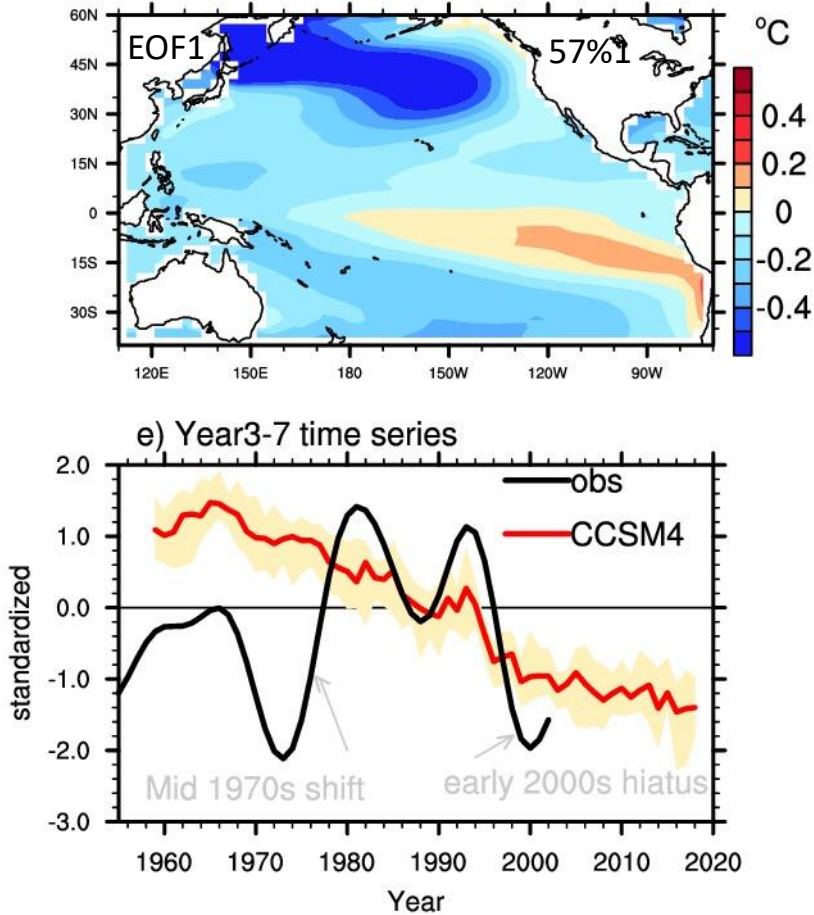


e) Year3-7 time series

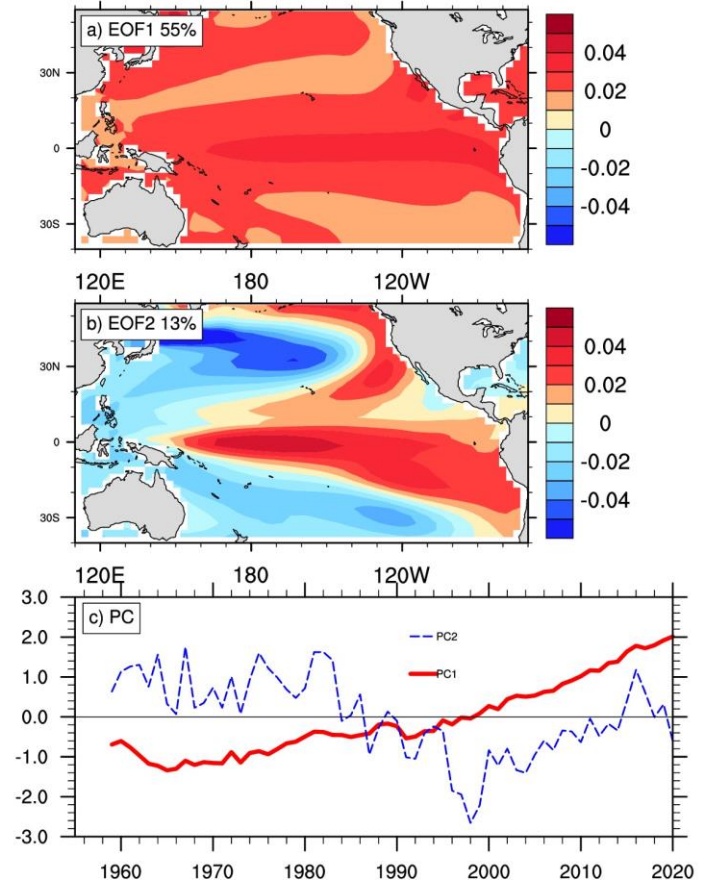


Impacts on the Yr3-7 IPO Hindcast

CCSM4 DP



CESM1 DPLE



Summary

- **Much reduced** initialization shock in the equatorial Pacific in the CESM1 DPLE, but there are some **similar shock/drift behaviors** in both the CCSM4 DP and the CESM1 DPLE
- **Non-stationary biases violate** the working **hypothesis** of the common bias correction method , challenging initialization of **the pre-satellite era**
- Better **understanding** of the **CORE-FOSI** initialization method is needed
- Raise the interests to explore **alternative** initialization method (e.g. from reanalysis)

*Challenges for decadal prediction: predictability,
much longer forecast range, pre-satellite era, much smaller signals*