Examining the Sensitivity of SST to Ocean Initial Conditions in Seasonal Forecast

Shan Sun[1], Rainer Bleck[1,2], Ben Green[1,2], Yuejian Zhu[3], Bing Fu[3,4], Philip Pegion[5], Wanqiu Wang[6]

[1]NOAA Global Systems Laboratory, [2]CIRES, University of Colorado at Boulder,
[3]NOAA NCEP Environmental Modeling Center, [4]Lynker@NOAA/NCEP/EMC,
[5]NOAA Physical Sciences Laboratory, [6]NOAA NCEP Climate Prediction Center

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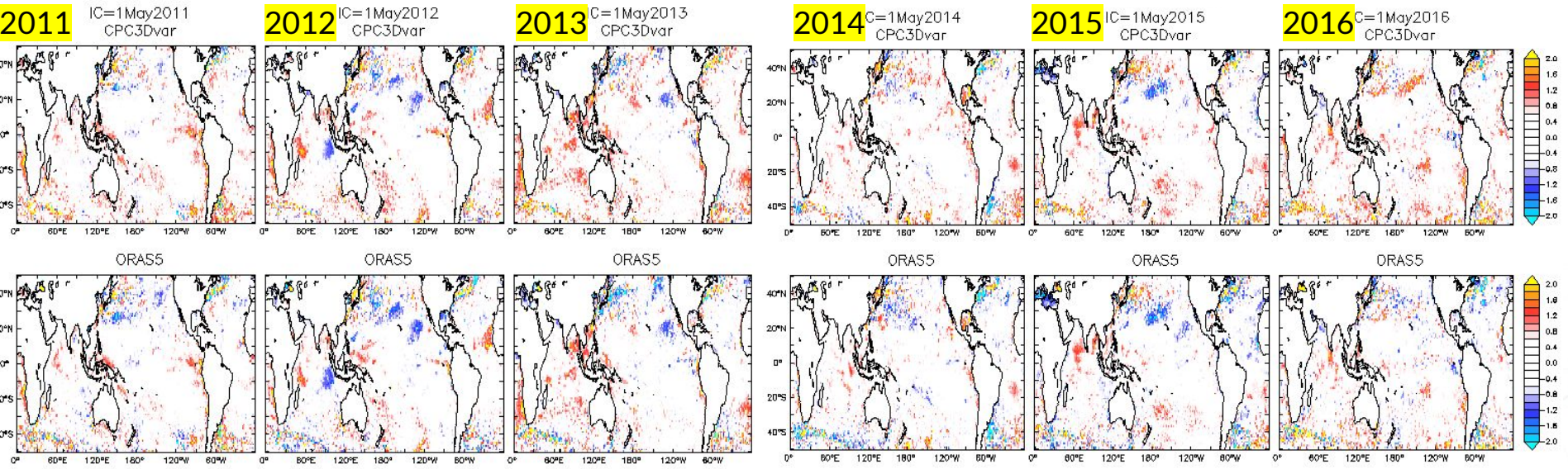
UFS Prototype 8

Components	Models	Resolution
Atmosphere	FV3+GFSv17	25km, 127 layers
Ocean	MOM6	¼°, 75 layers
Sea Ice	CICE6	¼°
Wave	WW3	½° x ½°
Aerosol	Climatology	same as atmosphere

Seasonal Forecast System Based on UFS Prototype 8, except

	Atmos hor res	Ocean Initial Conditions	NSST	Wave IC
Control	50km (C192)	CPC3Dvar	off	rest
Mod	same	ORAS5	off	rest

SST Bias from OISST May 2011-2017



SST varies by up to 2°C between these two datasets in certain regions

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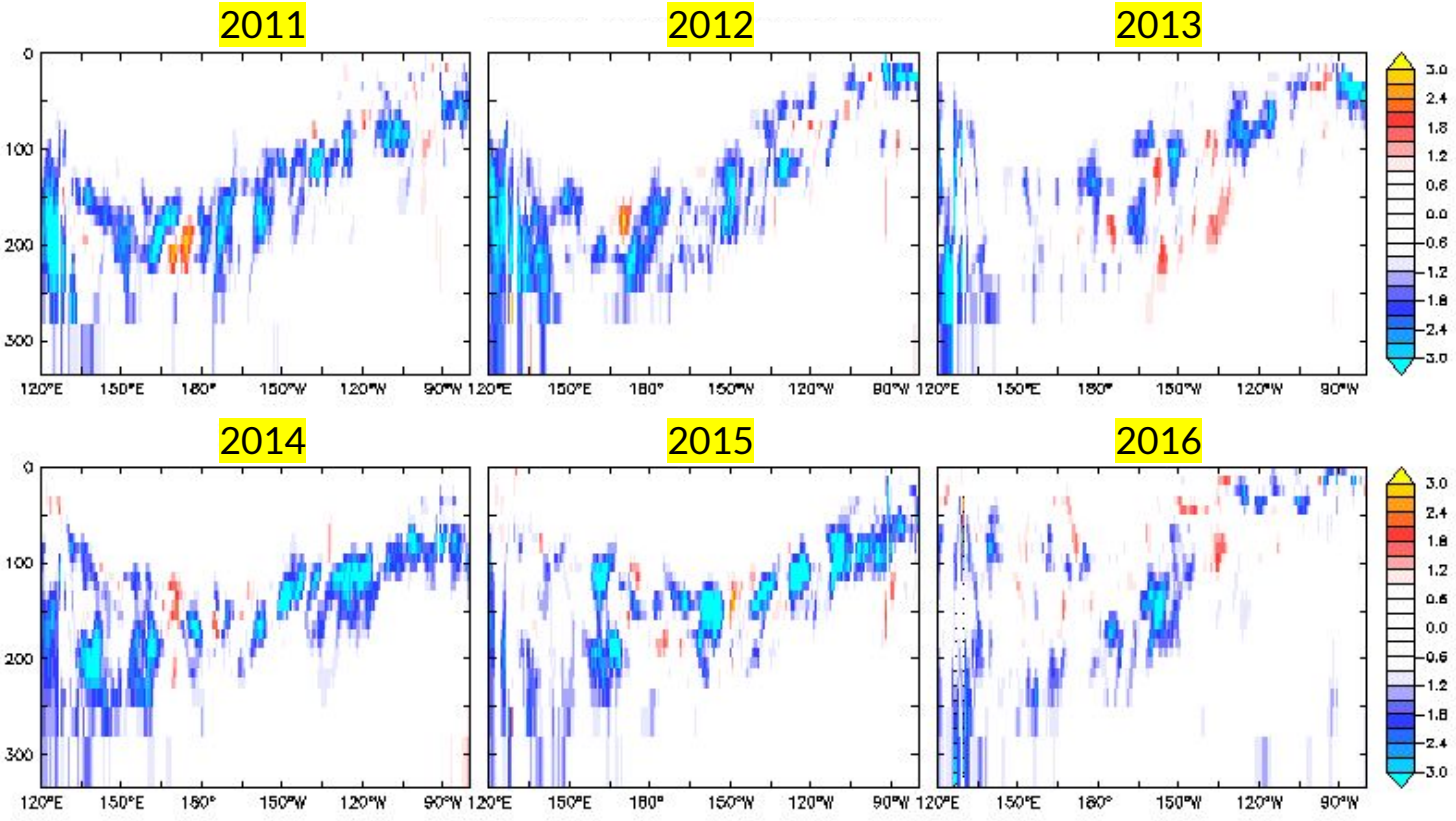
May Temp Diff at EQ PA, CPC3Dvar minus ORAS5

East

Z



A bigger temperature difference is seen at depths between these two datasets

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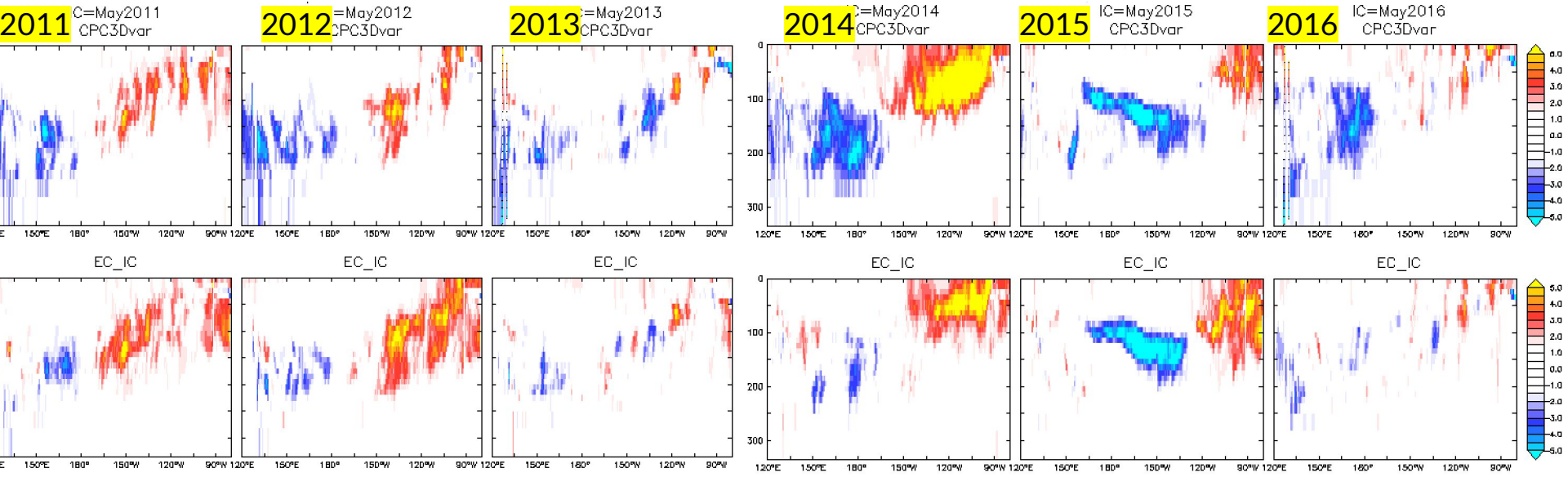
East

z

EQ PA Temp Bias from ORAS5 at 3 months



A cold temperature bias in CPC3Dvar is still there 3 months later

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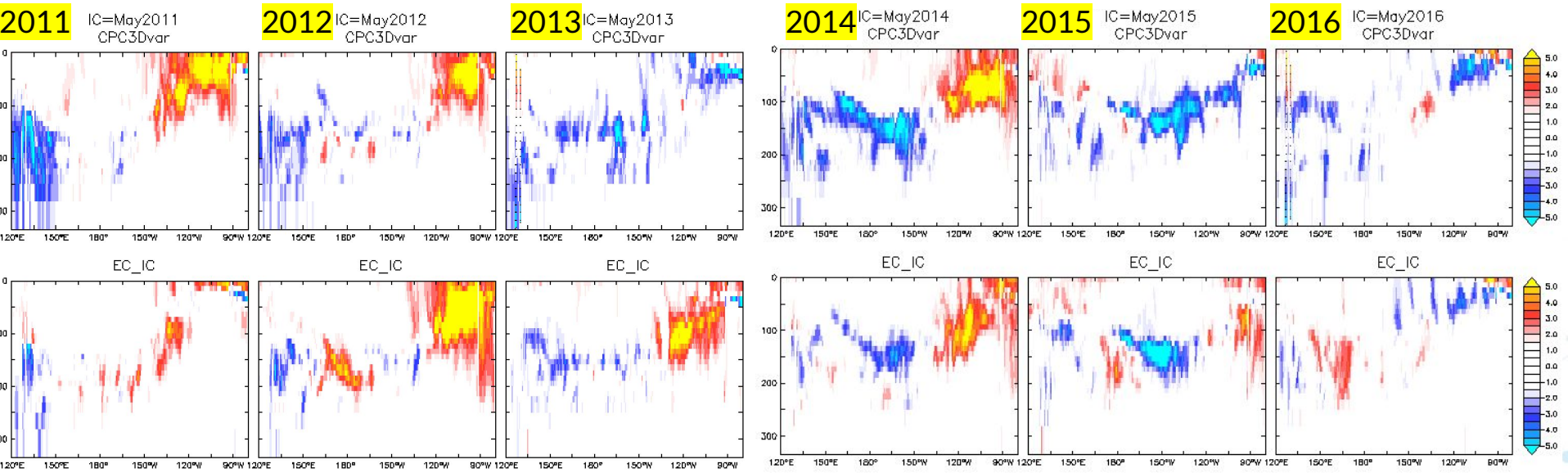
East

Z

EQ PA Temp Bias from ORAS5 at 6 months



A cold temperature bias in CPC3Dvar is still there 6 months later

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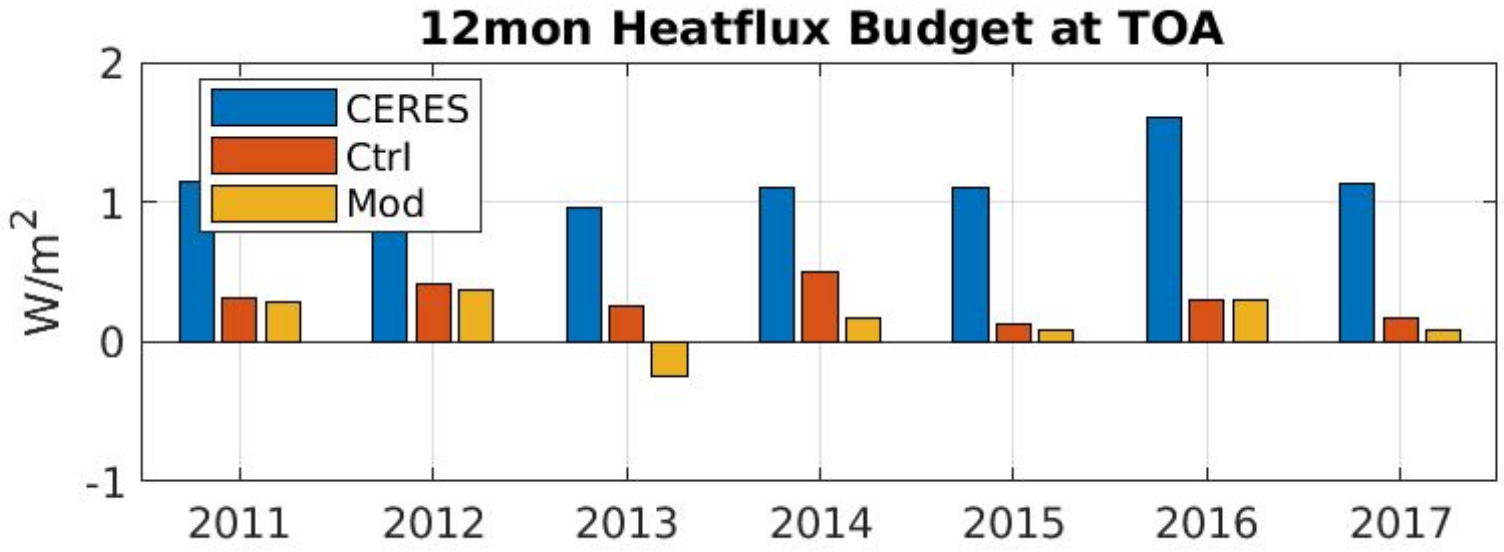
Heat Flux TOA, Modeled vs. CERES



Modeled heat flux TOA is close to but smaller than CERES (positive downward)

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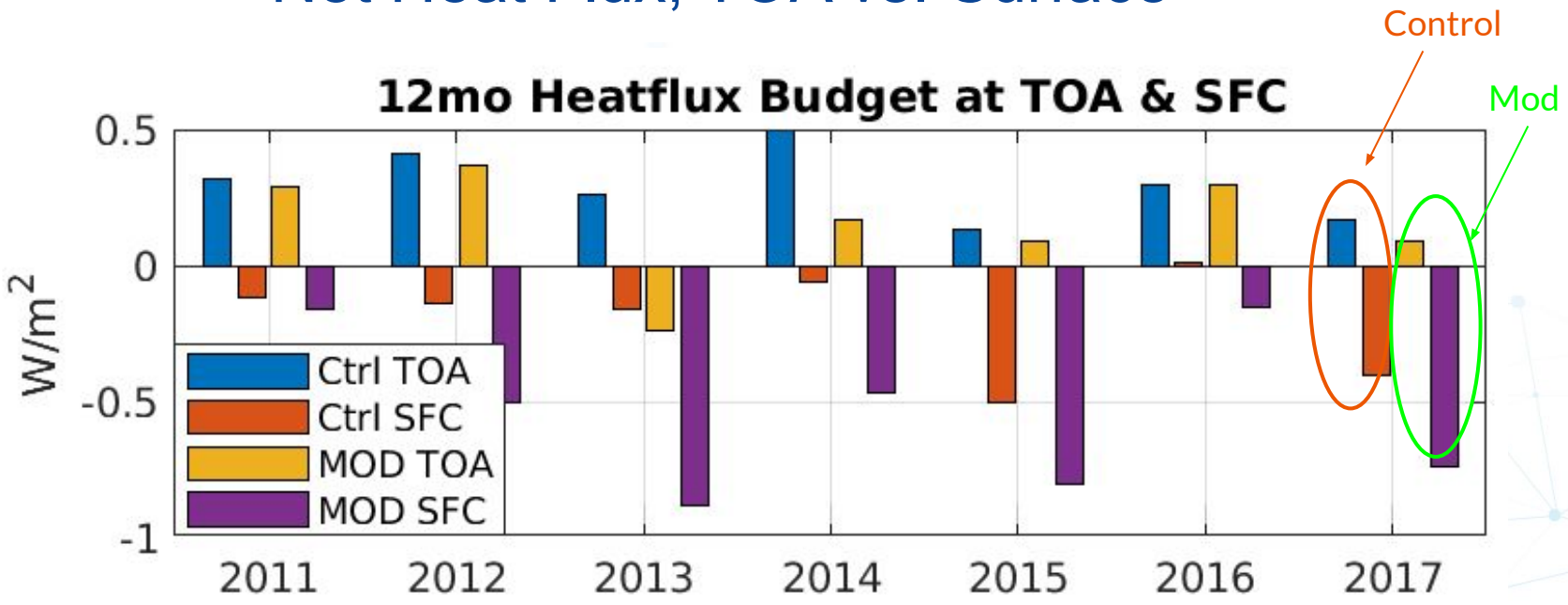
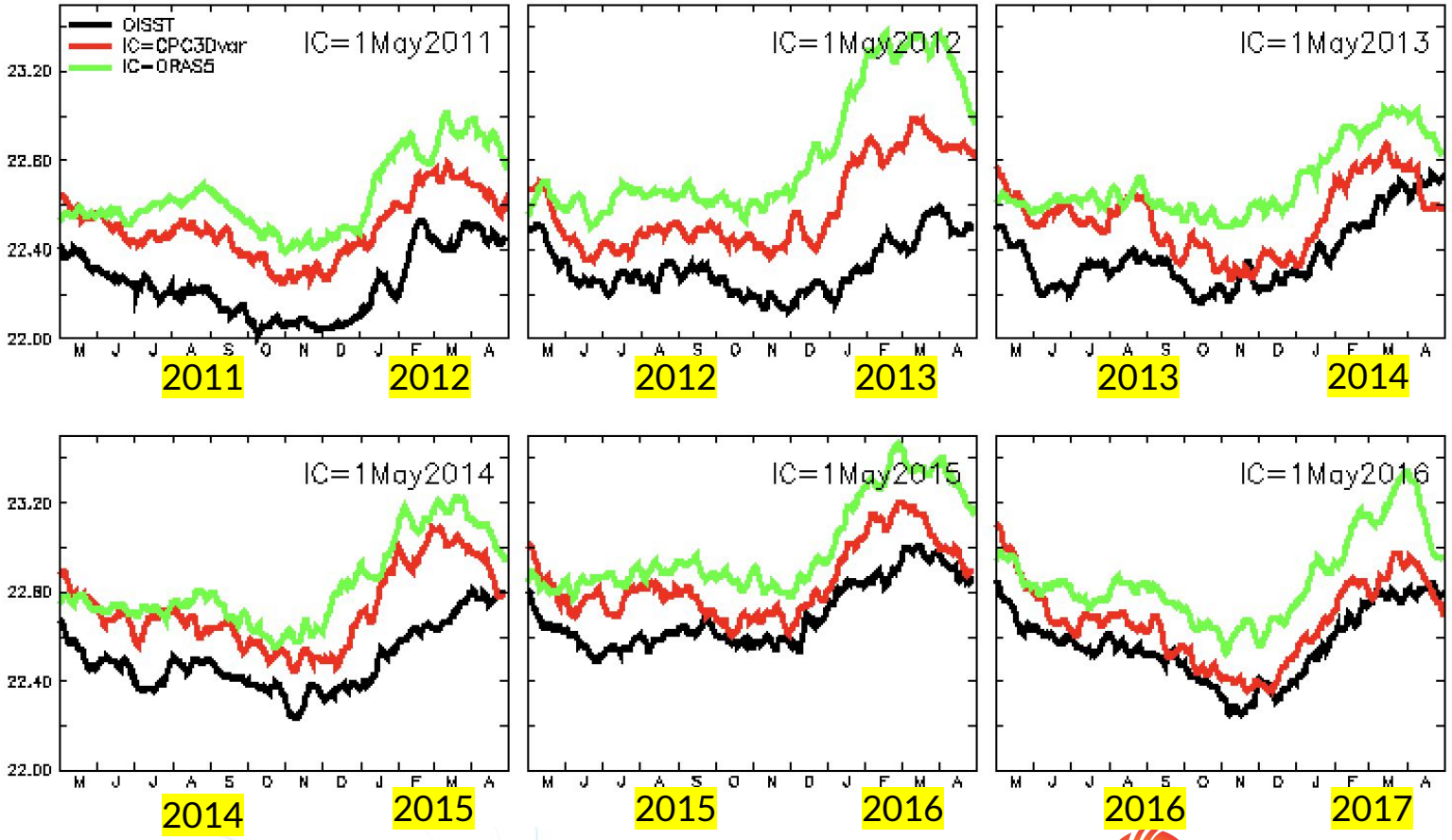
Net Heat Flux, TOA vs. Surface



The difference of net heat flux at TOA and surface can be more than 0.5 W/m^2

SST 50°S - 50°N



Modeled SST between 50°S - 50°N is mostly higher than OISST

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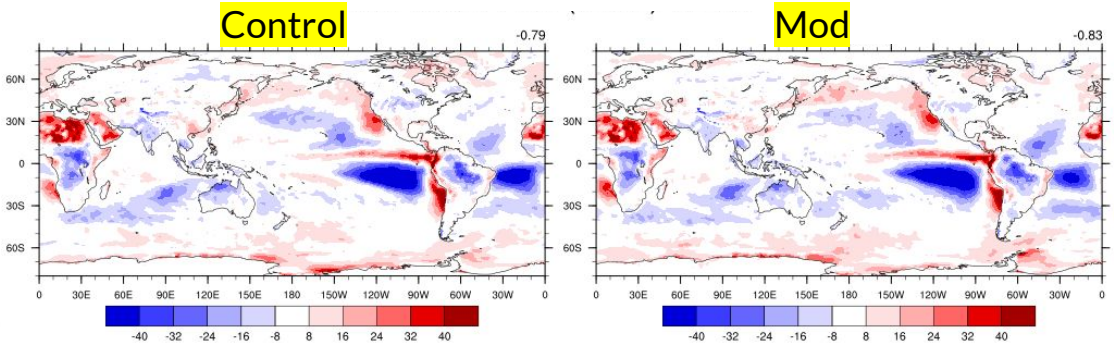
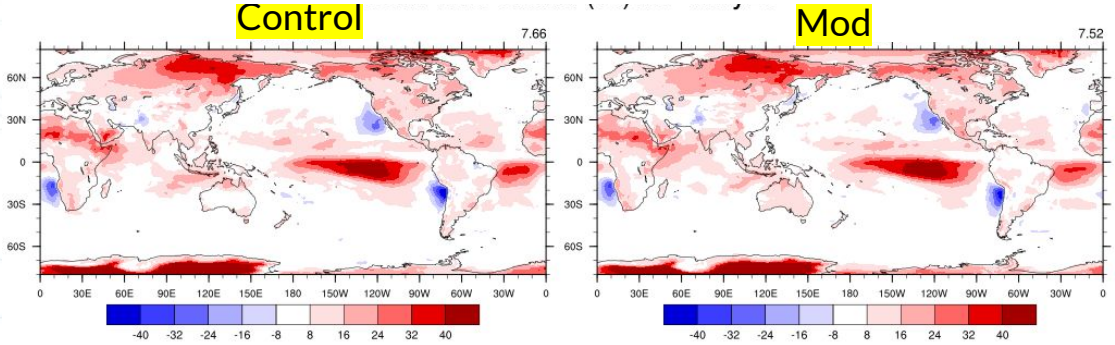
12 month Mean TOA Heat Flux Bias (W/m^2) from CERES IC=May2012



12 month Mean Total Cloud Bias (W/m^2) from CERES IC=May2012



Biases in cloud and heat flux at TOA are large in some regions

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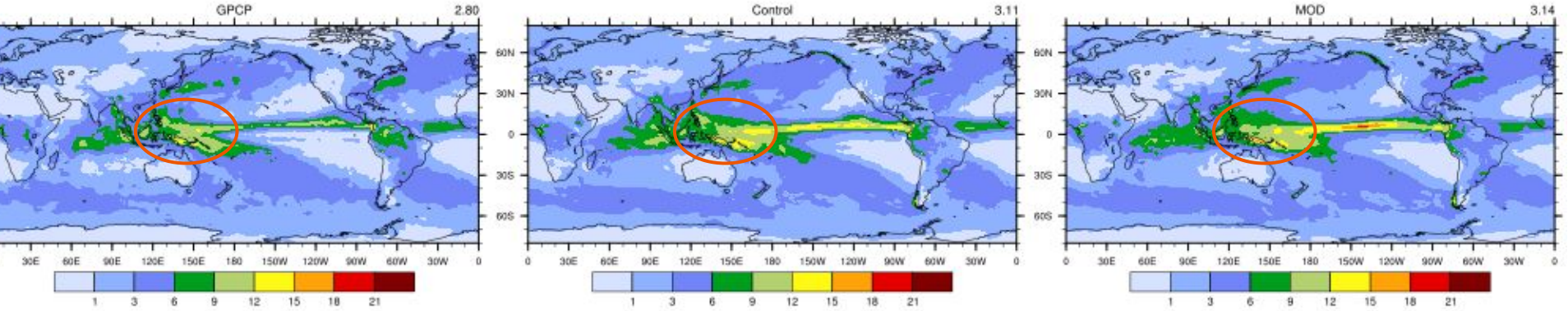
12-month mean precip (mm/day) IC=May2012



Annual mean modeled global precipitation is 10% higher than GPCP

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Summary

- Multiple 1-year long integrations are carried out, based on coupled model prototype 8
- The preliminary results compare well with observations
- It is crucial to have a realistic ocean initial condition due to the substantial memory in the ocean
- There is a persistent positive bias in SST, mostly due to the deficiency in the model physics
- Various efforts are being made to further reduce model biases