Simulation of Ocean Fields in CESM1.5

- A few fields of climatic interest, focusing on the 20th century simulations
- Brief summary of trends in the pre-industrial control simulations

CESM1.5 solutions are compared to those of CCSM4 and Large Ensemble (LE) simulations

Means for the last 20- / 25-years and only one ensemble member are used

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Ocean Initial Conditions

CCSM4: PHC2* + 130 years

LE: PHC2

#28: Unknown

+ 150 years of a known coupled simulation w/ CLUBB
+ 34 years of #14
+ 16 years of #18
+ 41 years of #25

for a total integration length of > 750 years

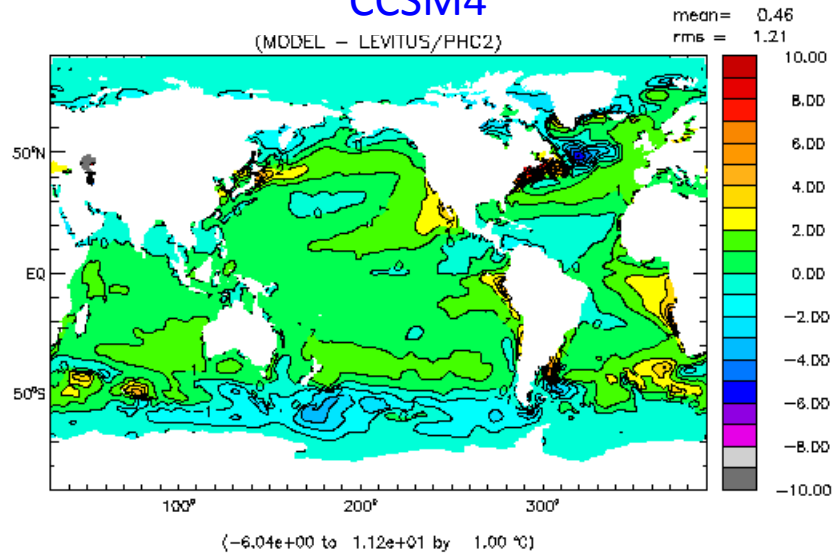
#31: same as #28 w/ new land surface data and tuning

#32: same as #31, but w/ PHC2 (no 20C simulation)

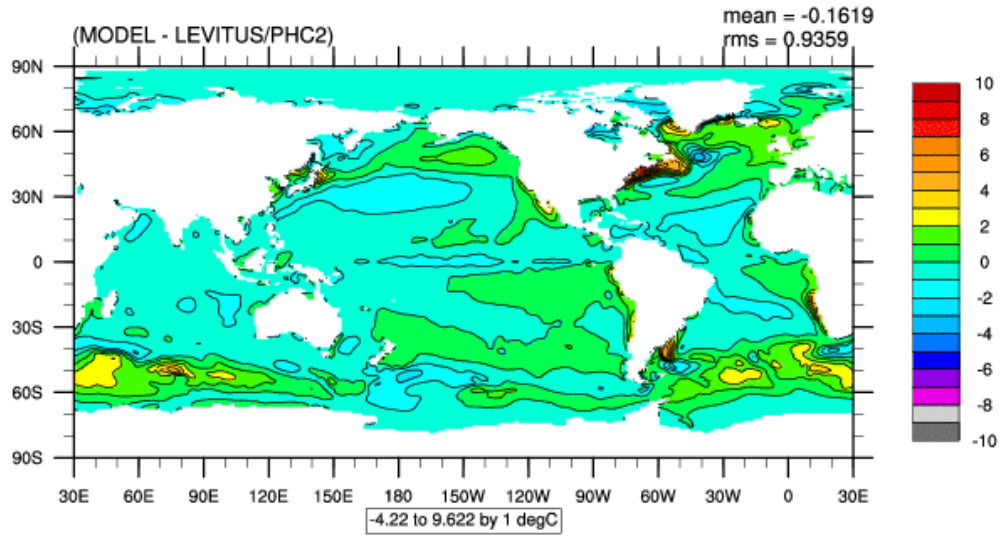
*PHC2: A blending of Levitus World Ocean Atlas data w/ better Arctic data

Model Sea Surface Temperature (SST) Differences from Observations

CCSM4



LE



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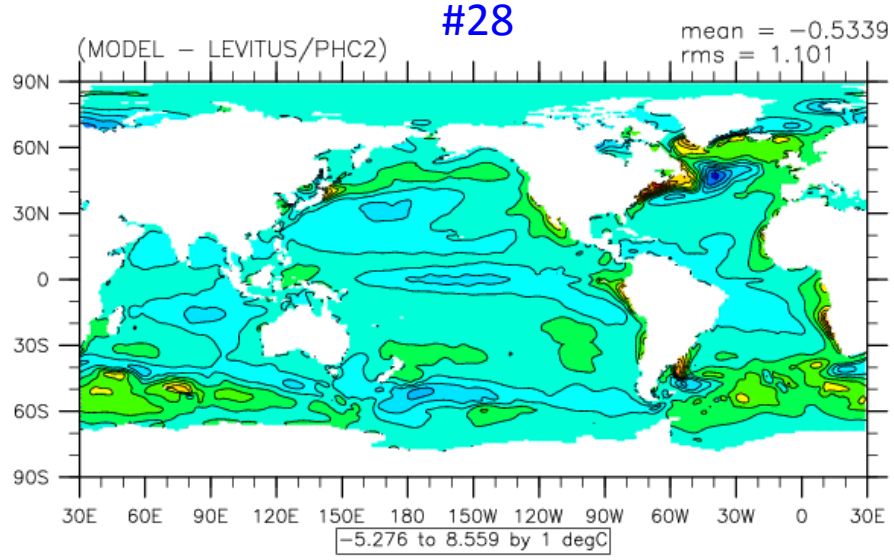

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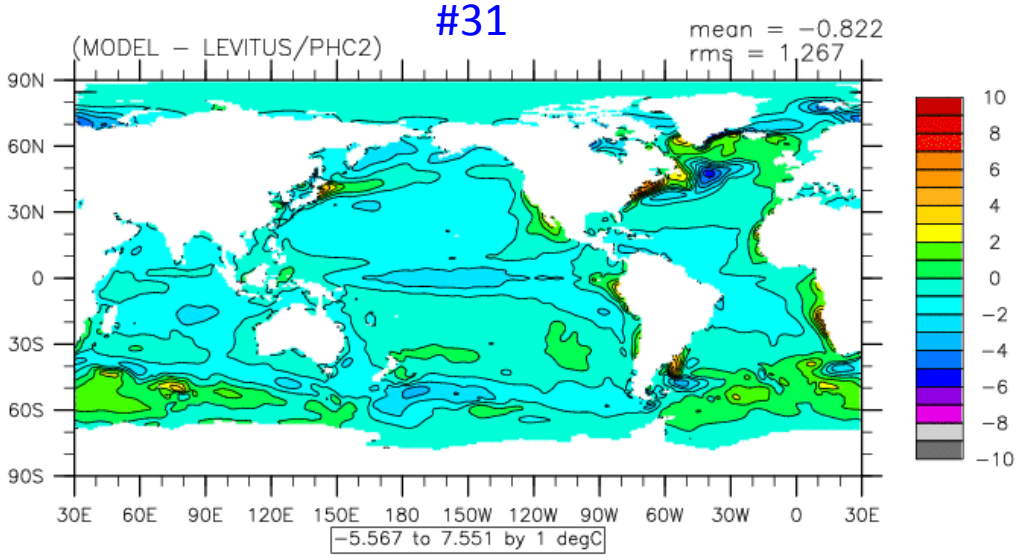
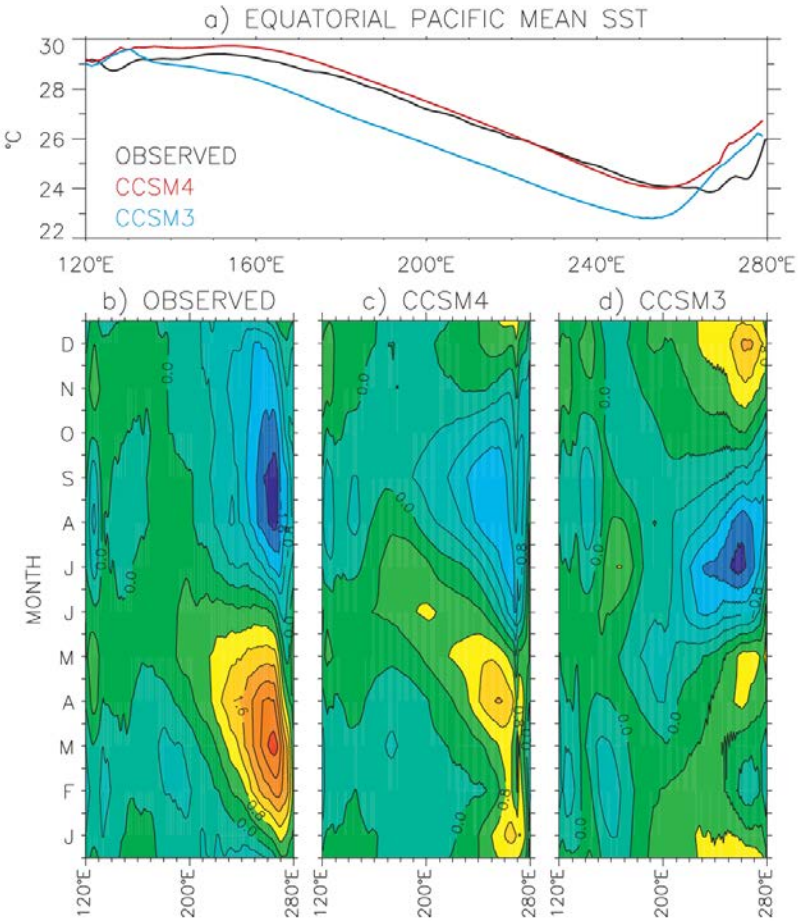
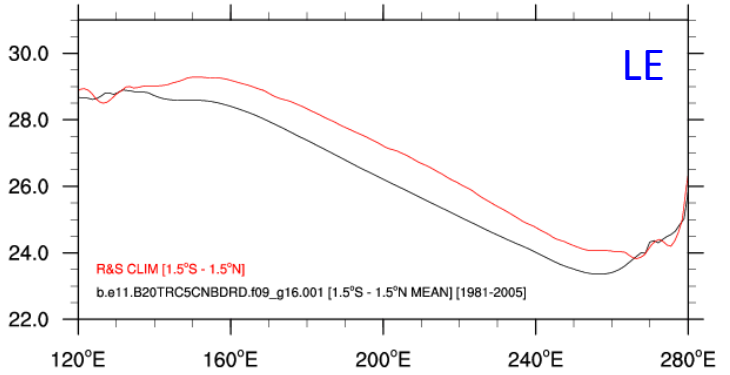
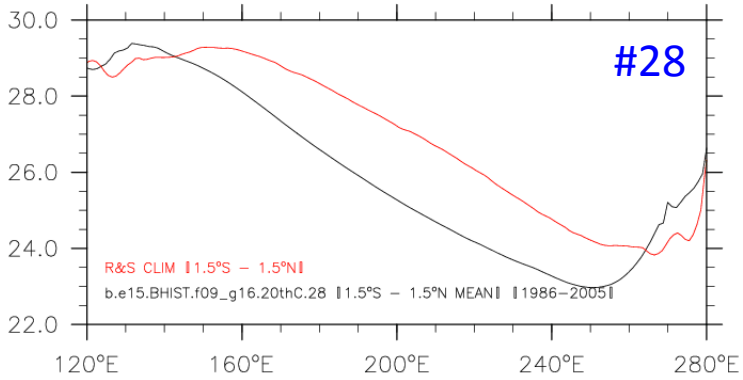
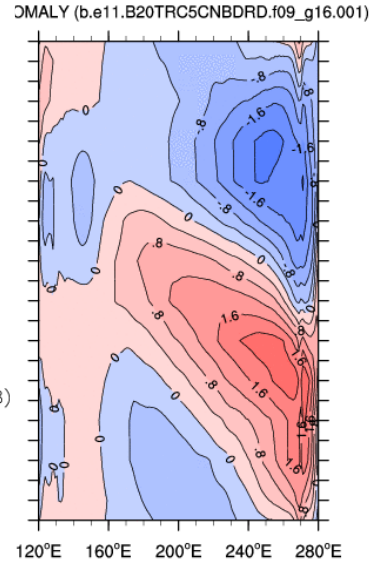


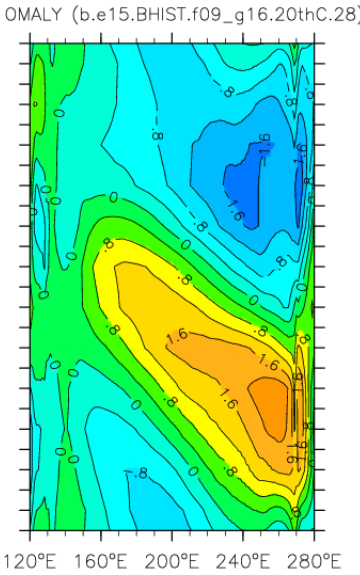
Equatorial Pacific Mean SST and its Seasonal Cycle





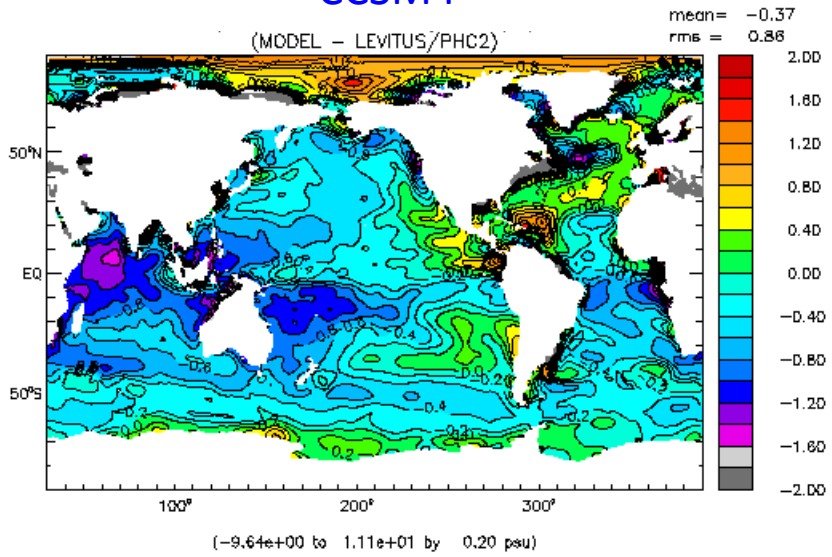






Model Sea Surface Salinity Differences from Observations

CCSM4



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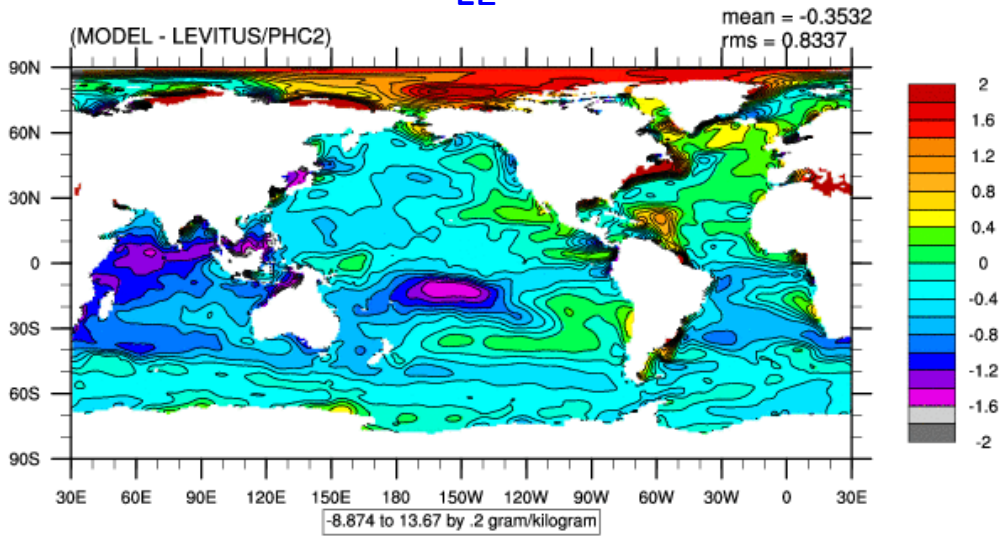

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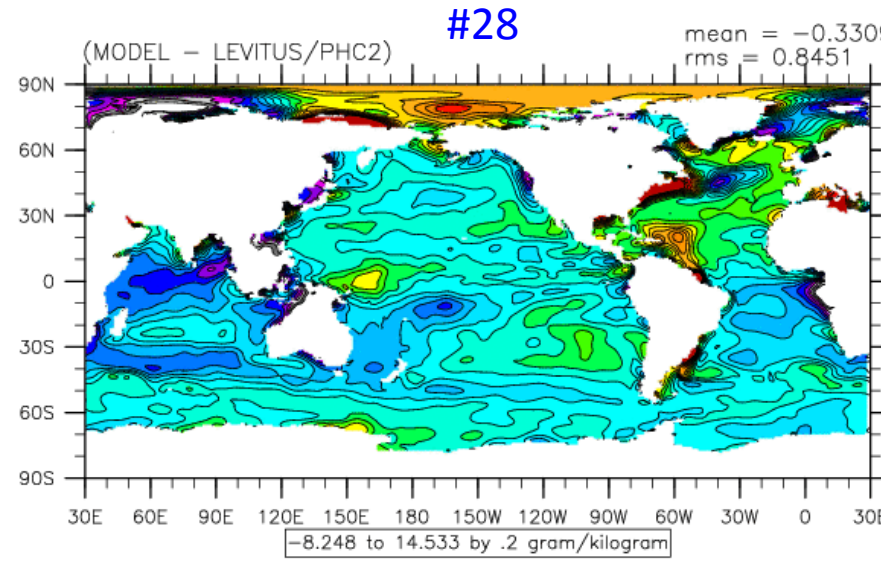

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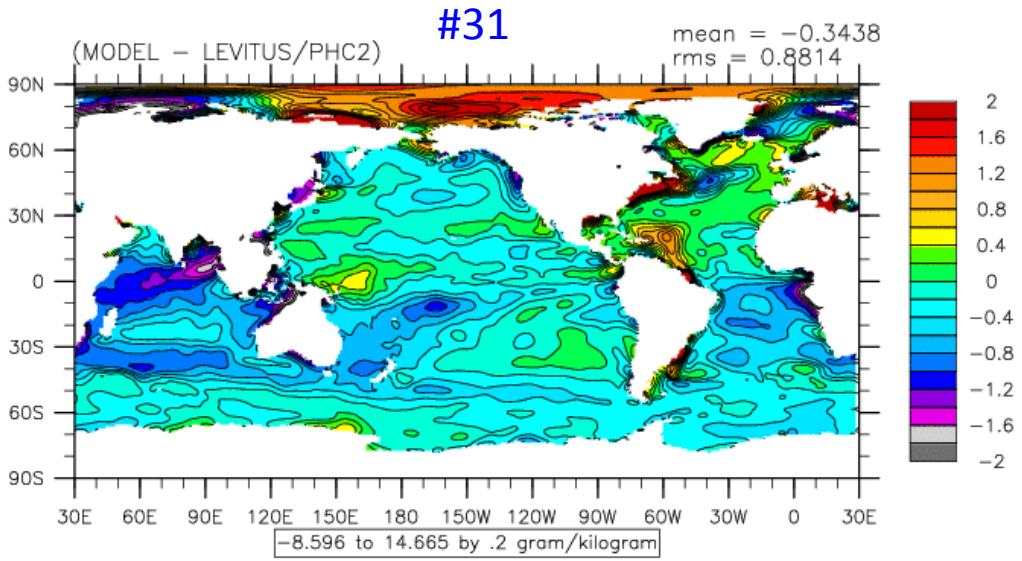
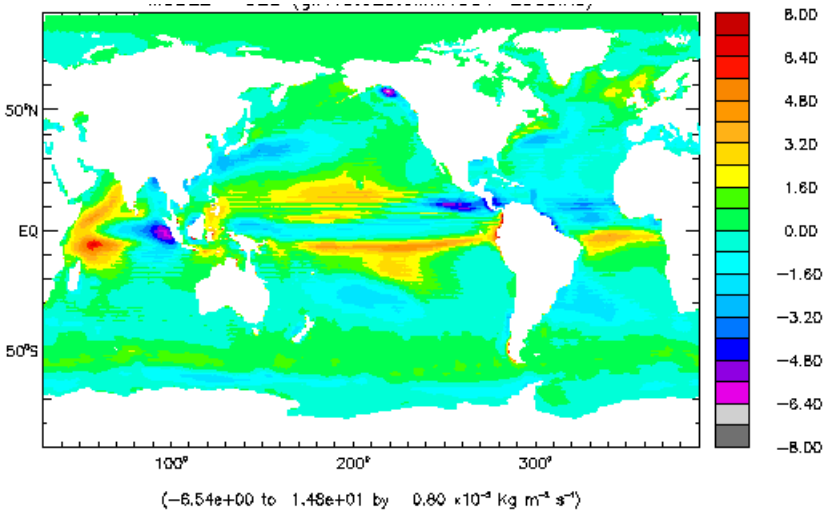


Model Precipitation Differences from Observations*

CCSM4



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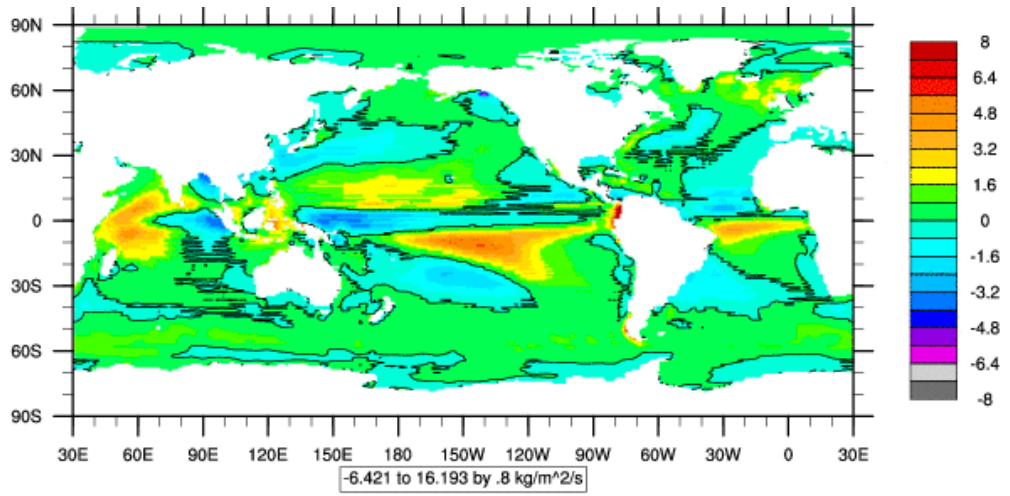

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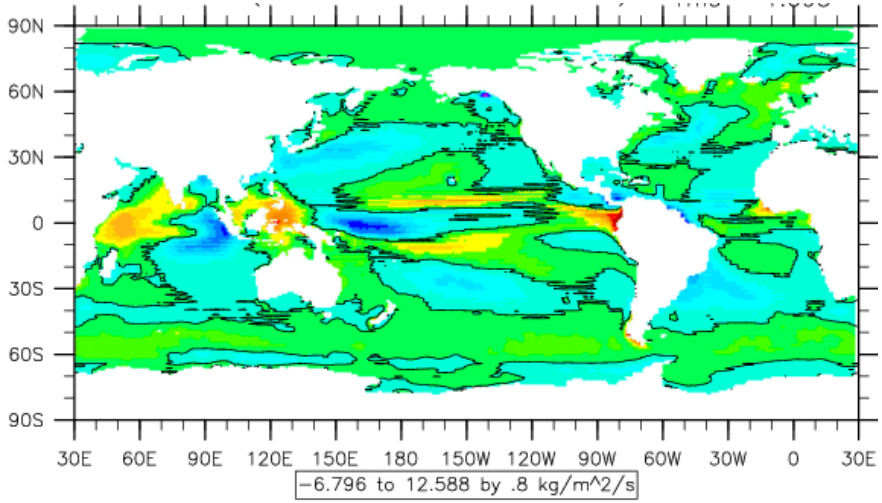

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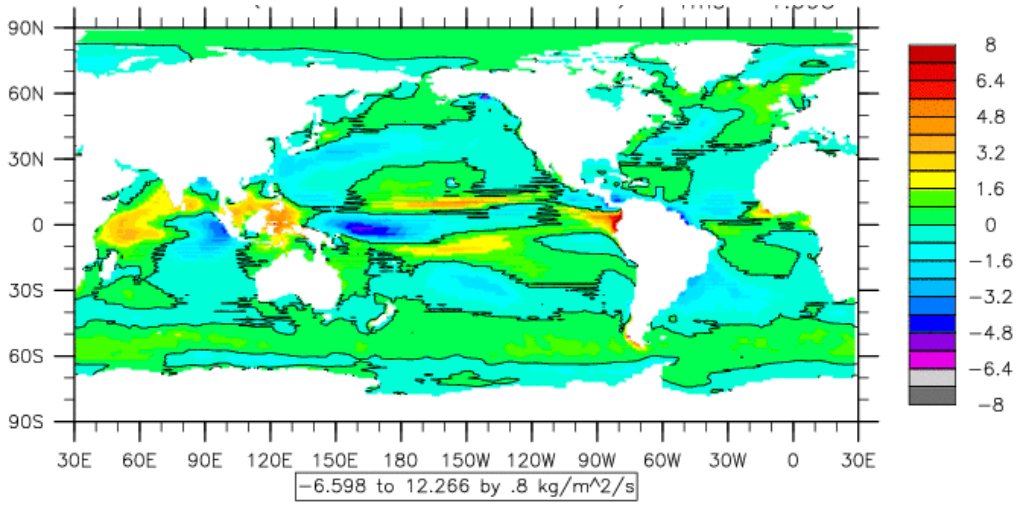
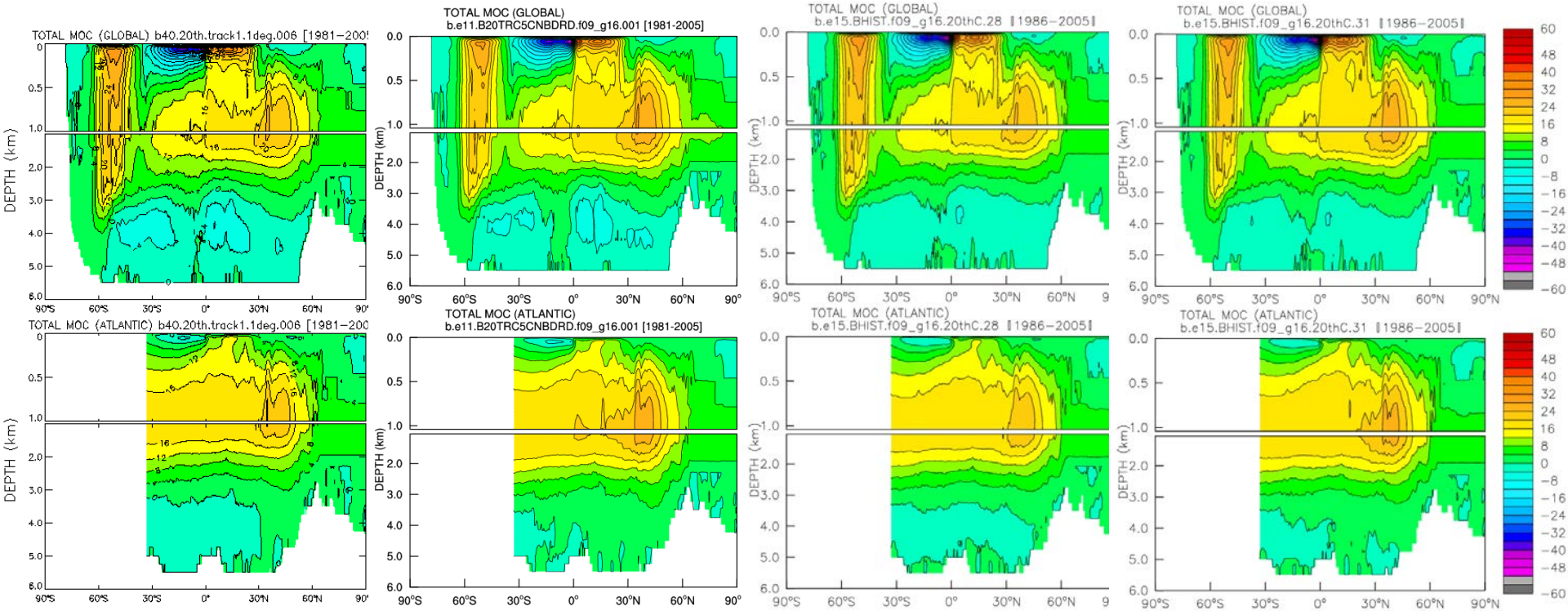


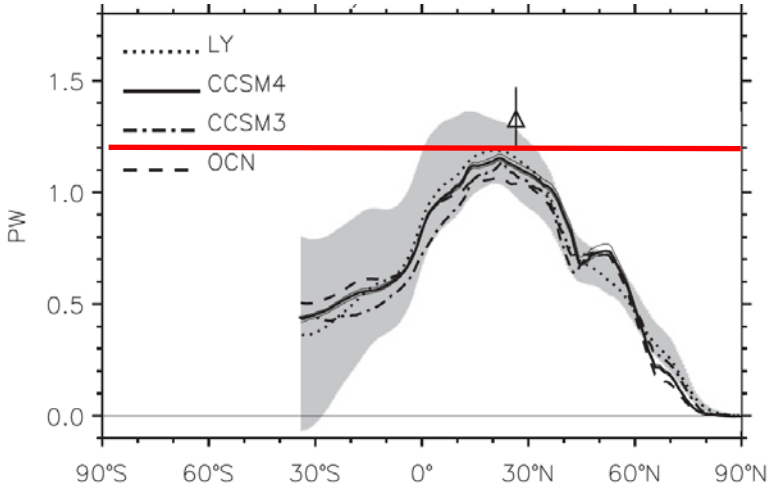
* CORE-II: Blending primarily of GPCP and CMAP

Global (top) and Atlantic (bottom) Meridional Overturning Circulations (Sv)

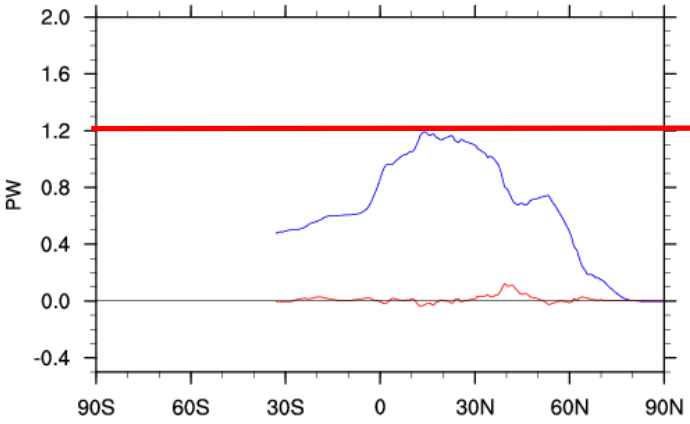
CCSM4 LE #28 #31



Atlantic Northward Heat Transport



LE



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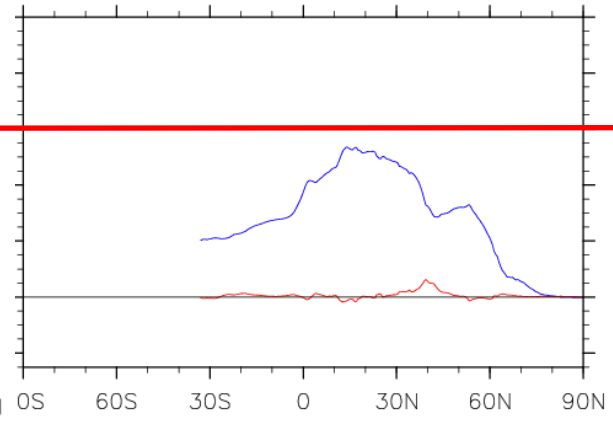

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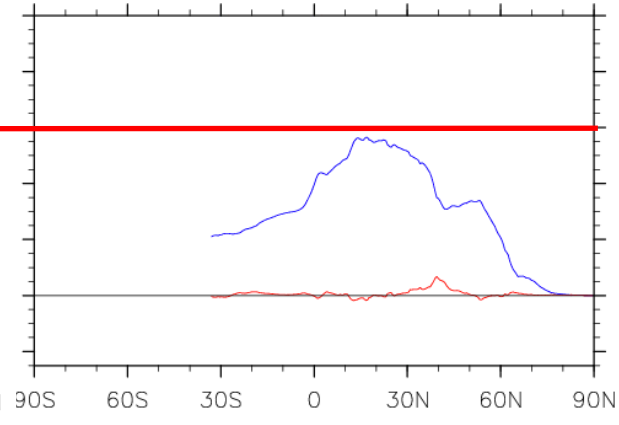
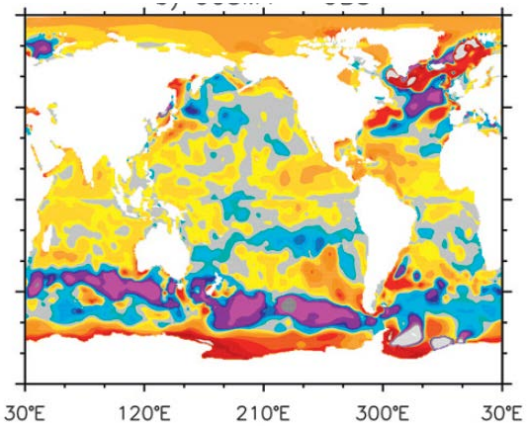


Winter-Mean Mixed Layer Depth (Model – Observations)

CCSM4



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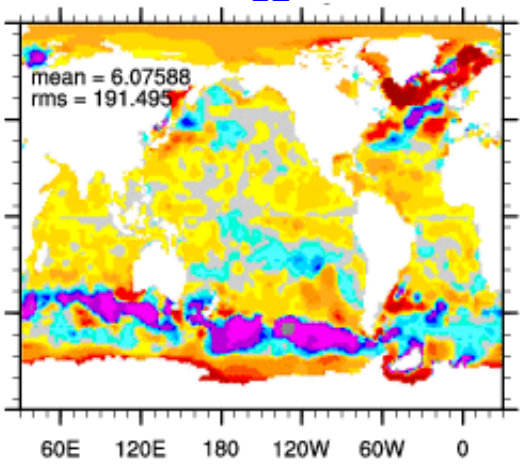

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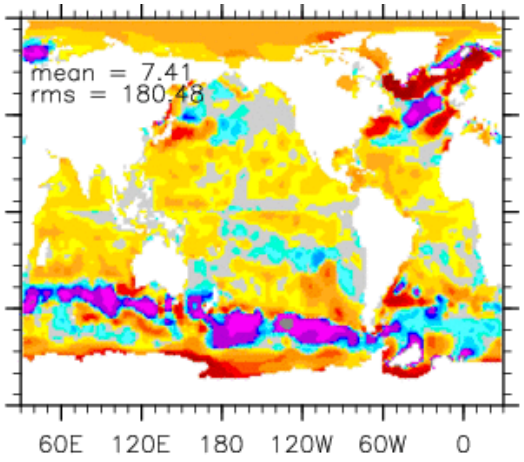

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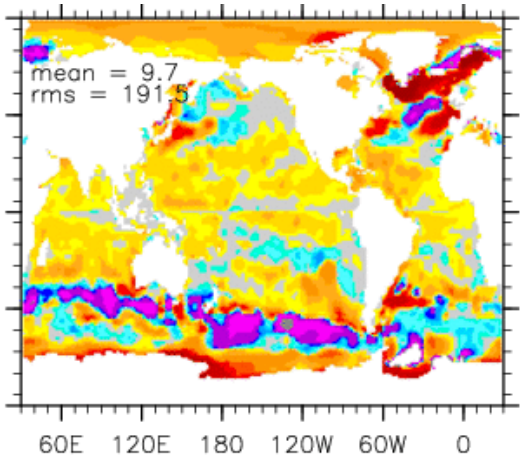
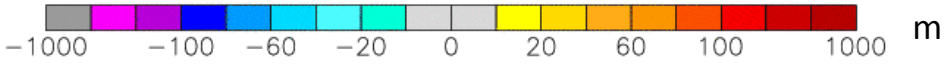
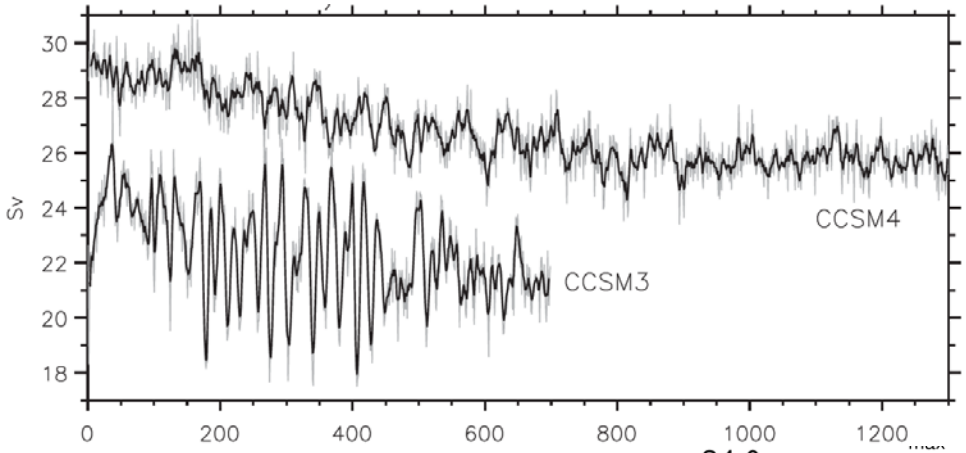




AMOC Maximum Transport Time Series



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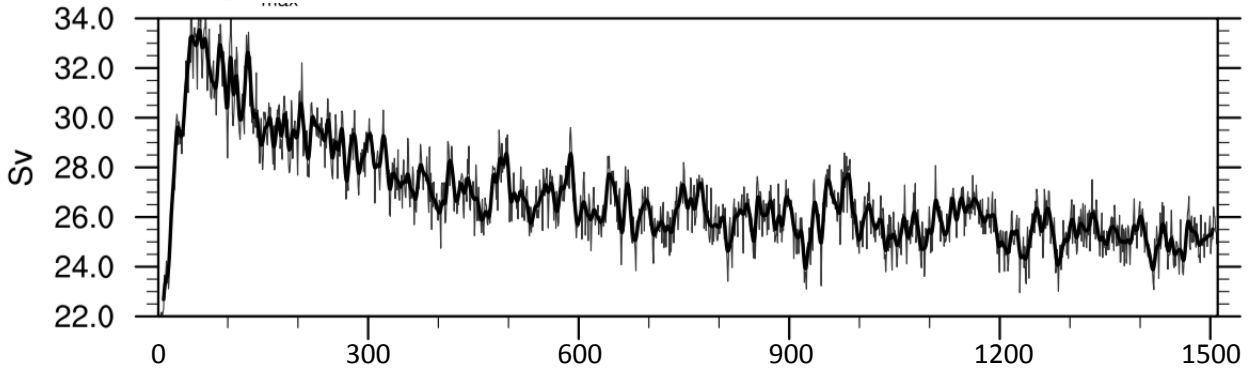

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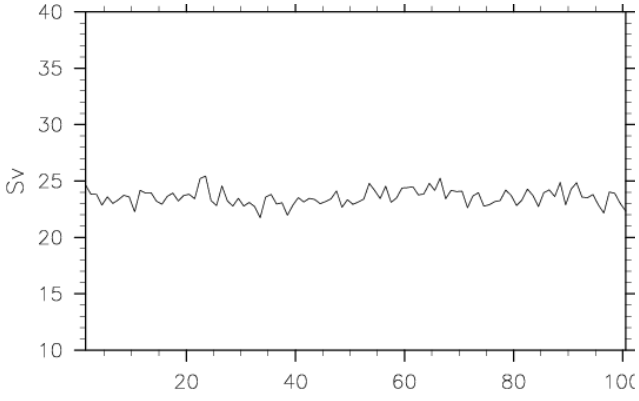

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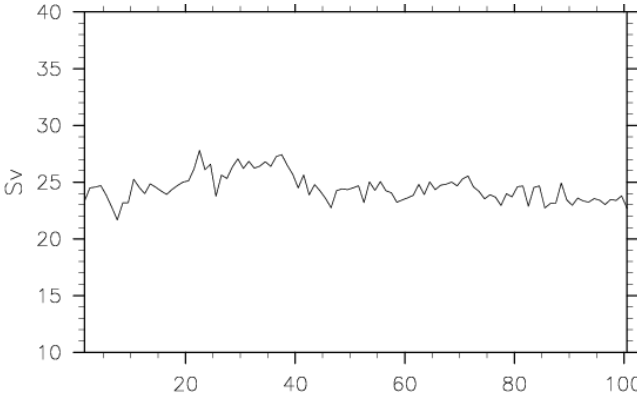

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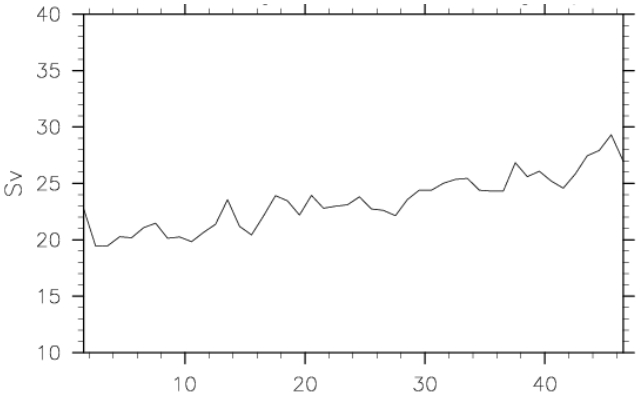
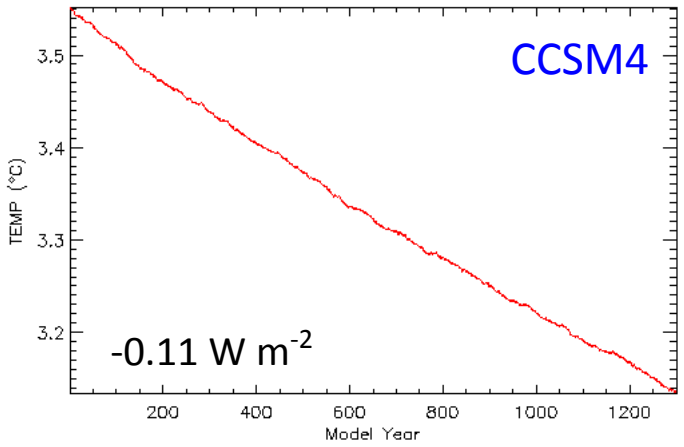
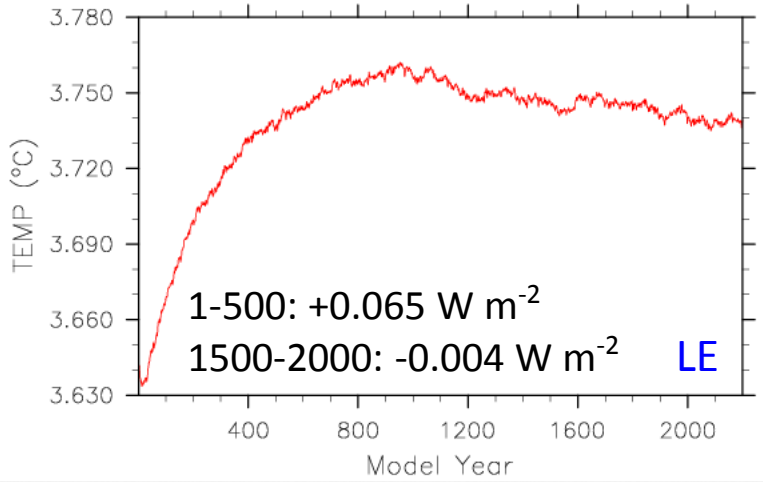
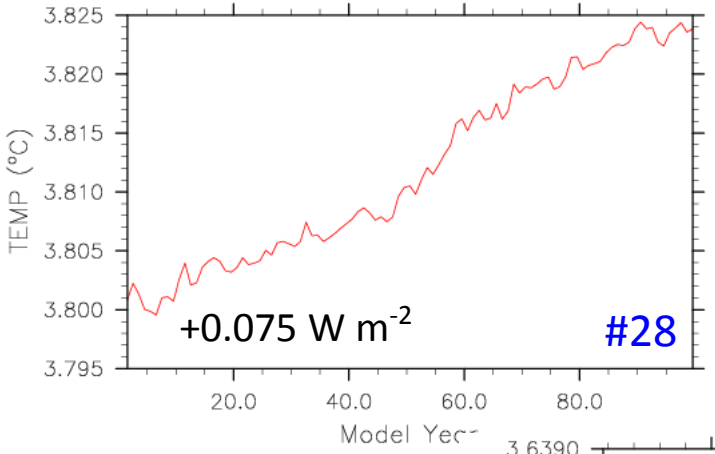
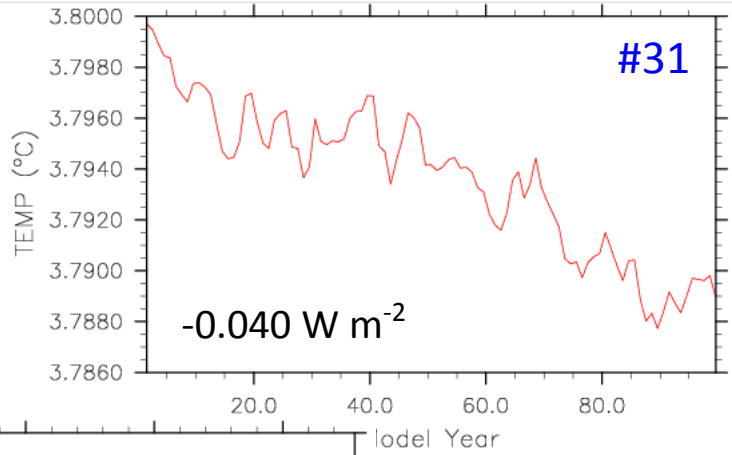


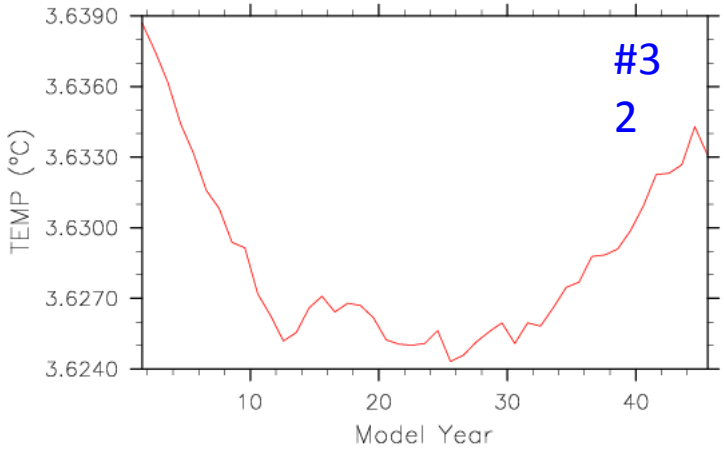
Global-Mean Temperature Trends in Pre-Industrial Control Simulations







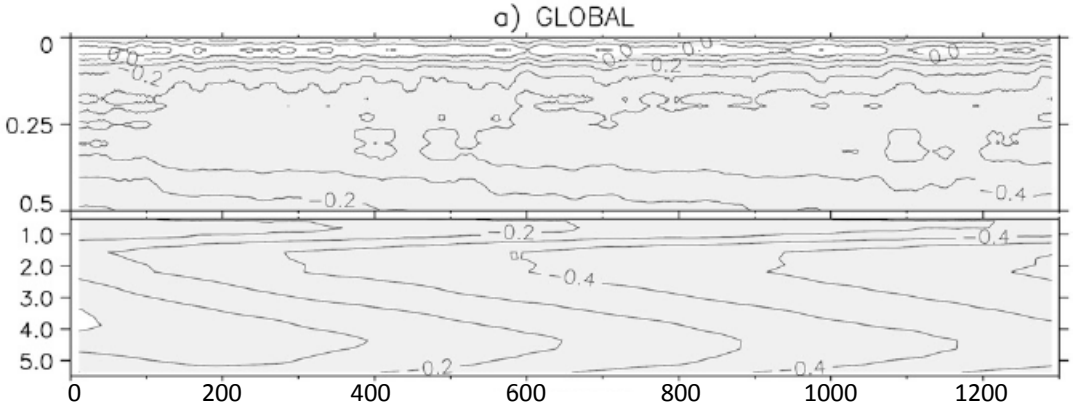




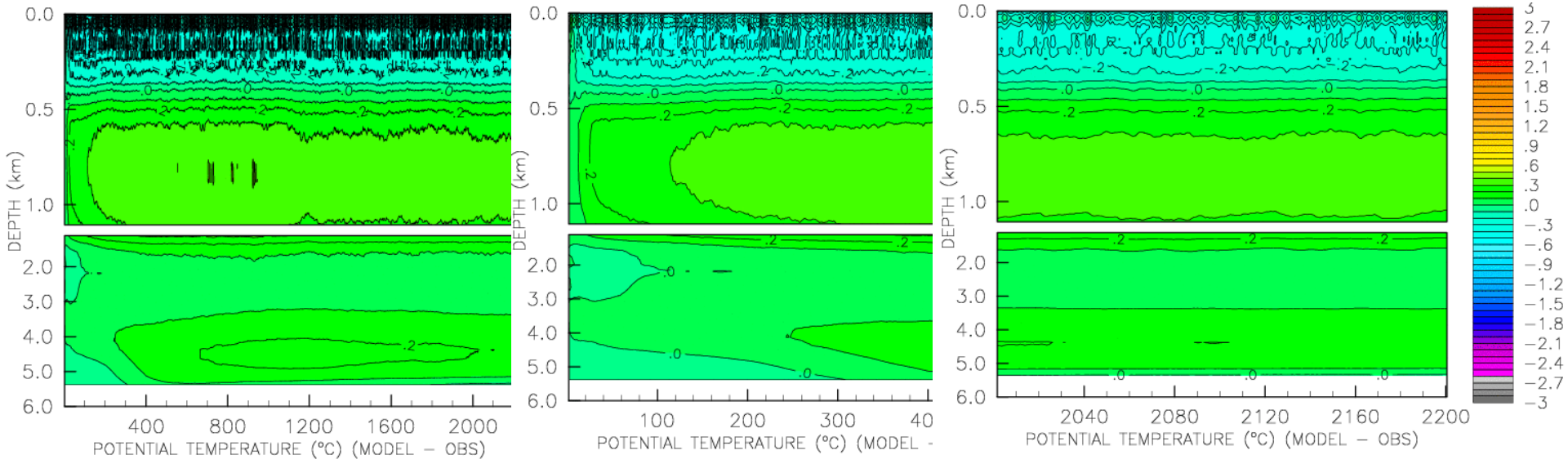
Global Horizontal-Mean Temperature Trends in Pre-Industrial Control Simulations

CCSM4

PHC2 + 130 years

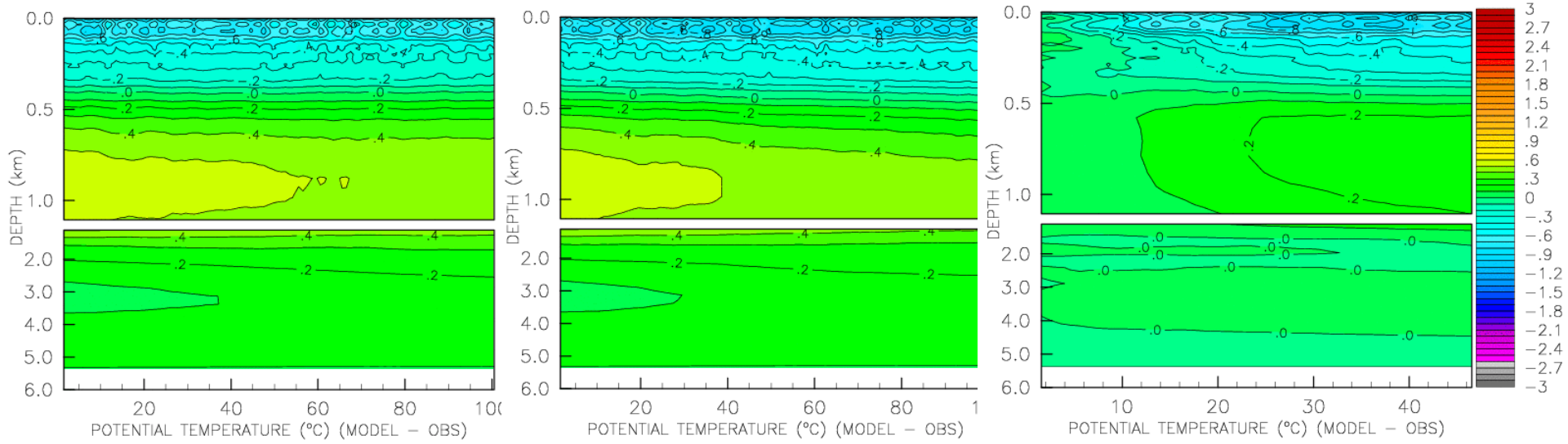


LE PHC2



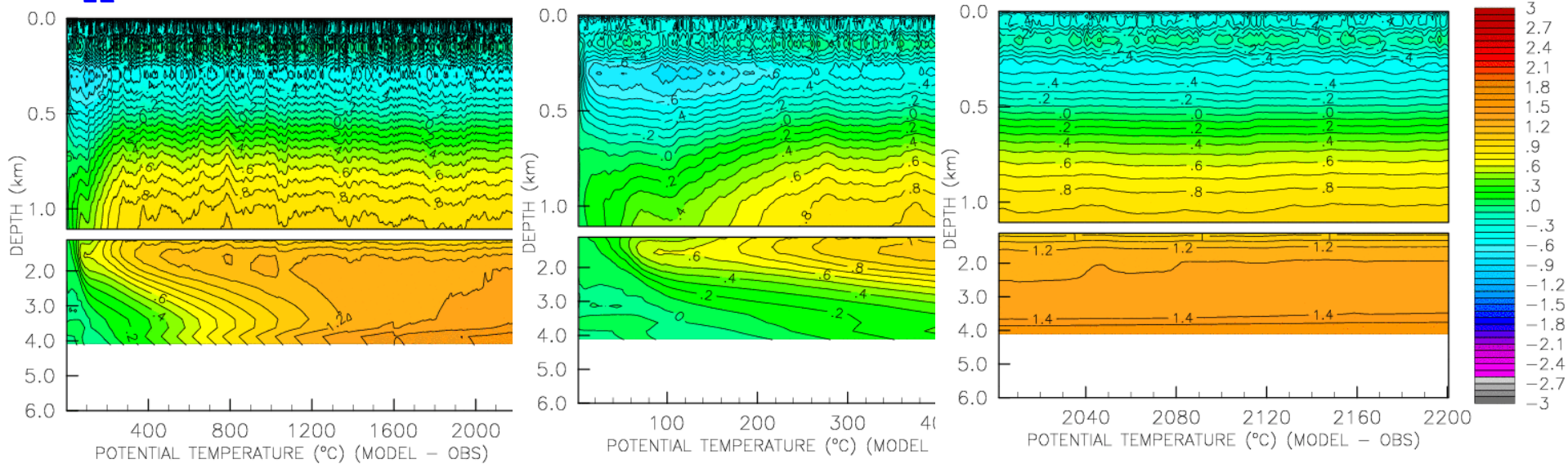
Global Horizontal-Mean Temperature Trends in Pre-Industrial Control Simulations

#28 #31 #32

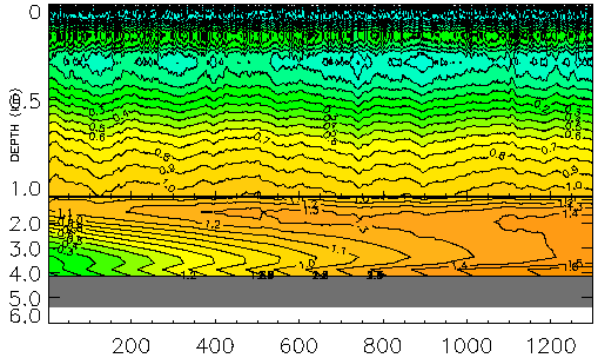


Arctic Horizontal-Mean Temperature Trends in Pre-Industrial Control Simulations

LE



CCSM4



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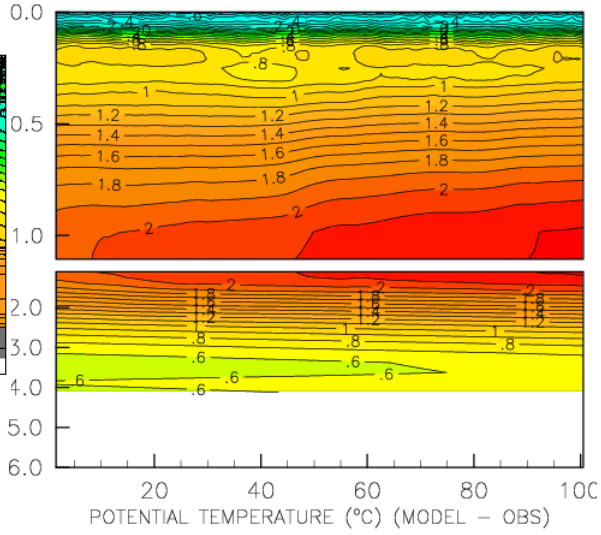

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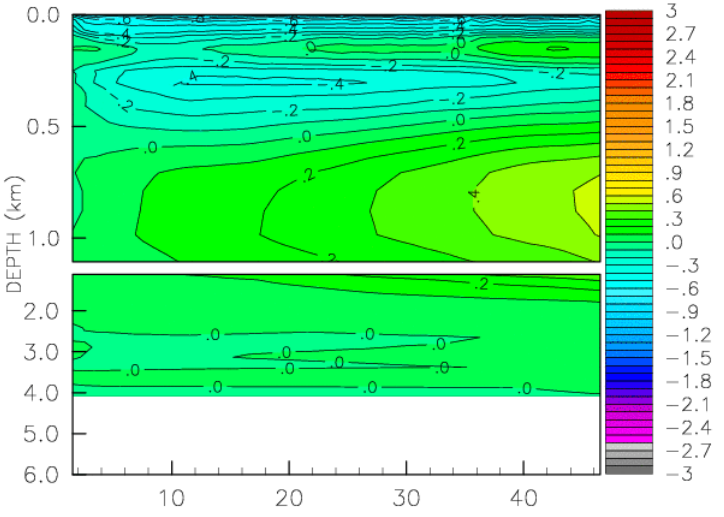
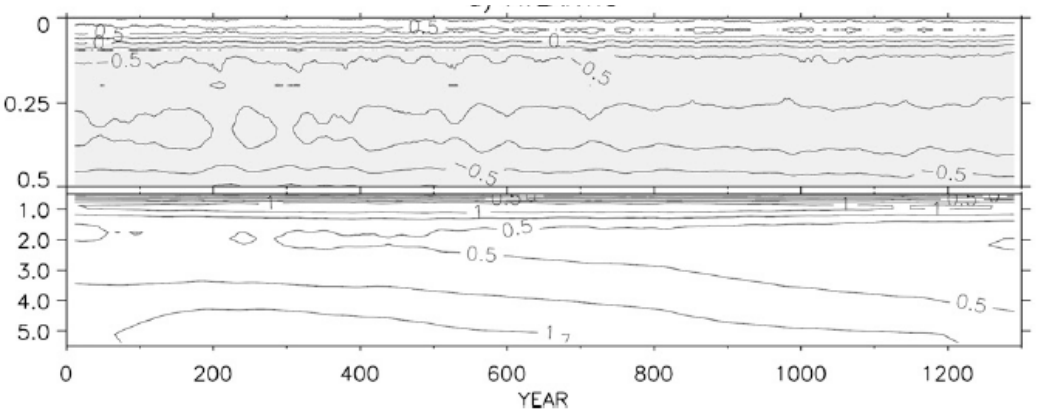
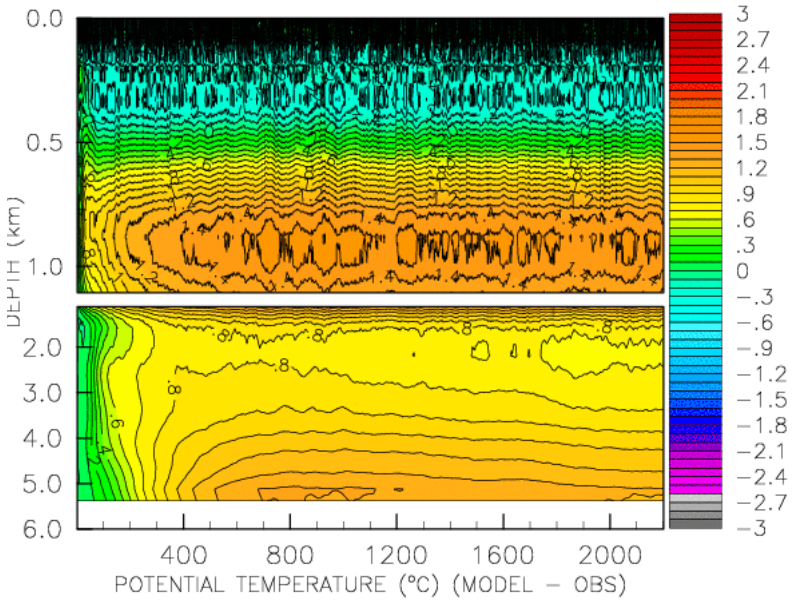


Atlantic Horizontal-Mean Temperature Trends in Pre-Industrial Control Simulations

CCSM4



LE



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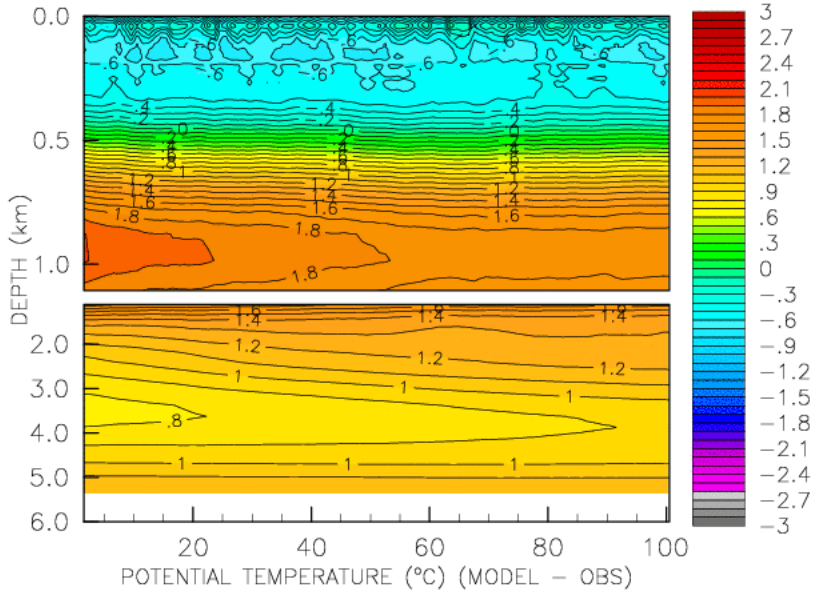

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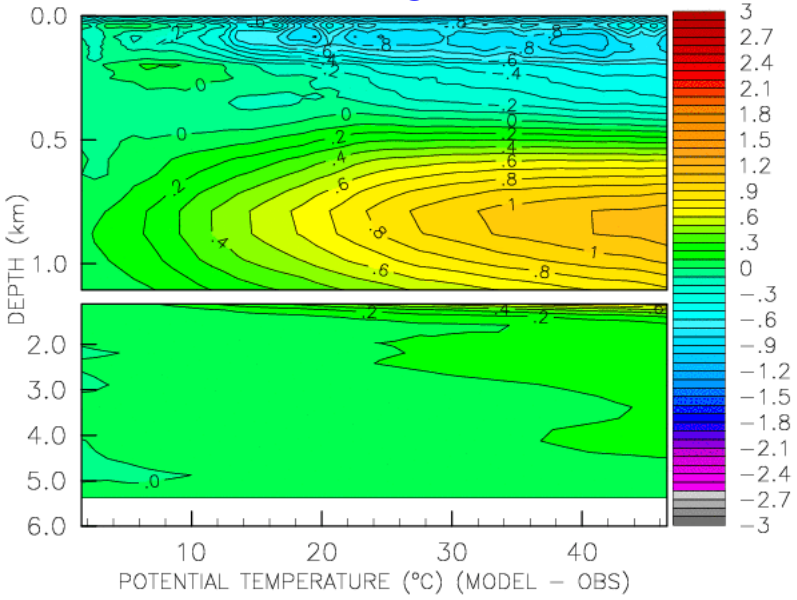

Summary

- Large surface / upper-ocean cooling in CESM1.5 compared to CCSM4 and LE is a serious concern
- In general, CESM1.5 ocean solutions are similar to those of CCSM4 and LE
- Integrations are too short to assess longer term trends and behavior, but there are some similarities between CESM1.5, CCSM4, and LE
- *"Best practice"* initialization method for the ocean remains a research topic