

A Global HYCOM-CICE Coupled System within the CSM Framework

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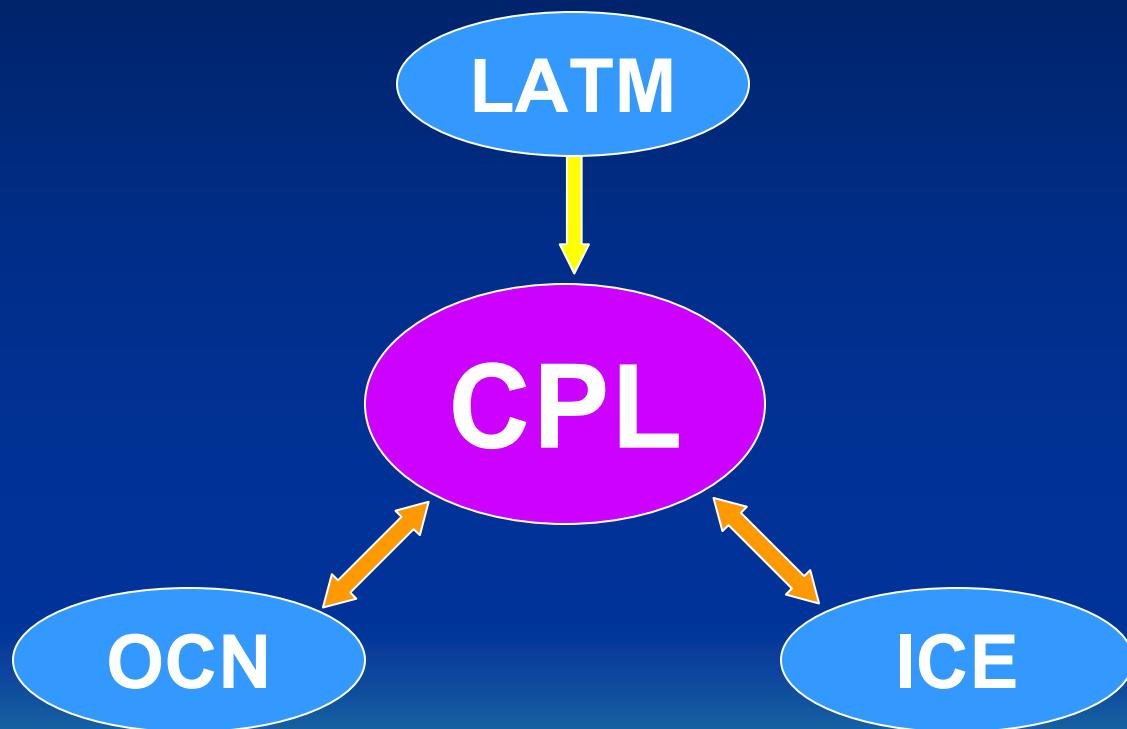
Oct. 27 - 29, 2004, Miami, Florida

OBJECTIVES

- Development of a coupled ocean-ice model
- Study of the interaction between ocean and sea ice
- Participation in COREs (Coordinated Ocean-ice Reference Experiments)
- Fully coupled ocean-atmosphere-ice model



Coupled Ocean-Ice Models within the CSM Framework

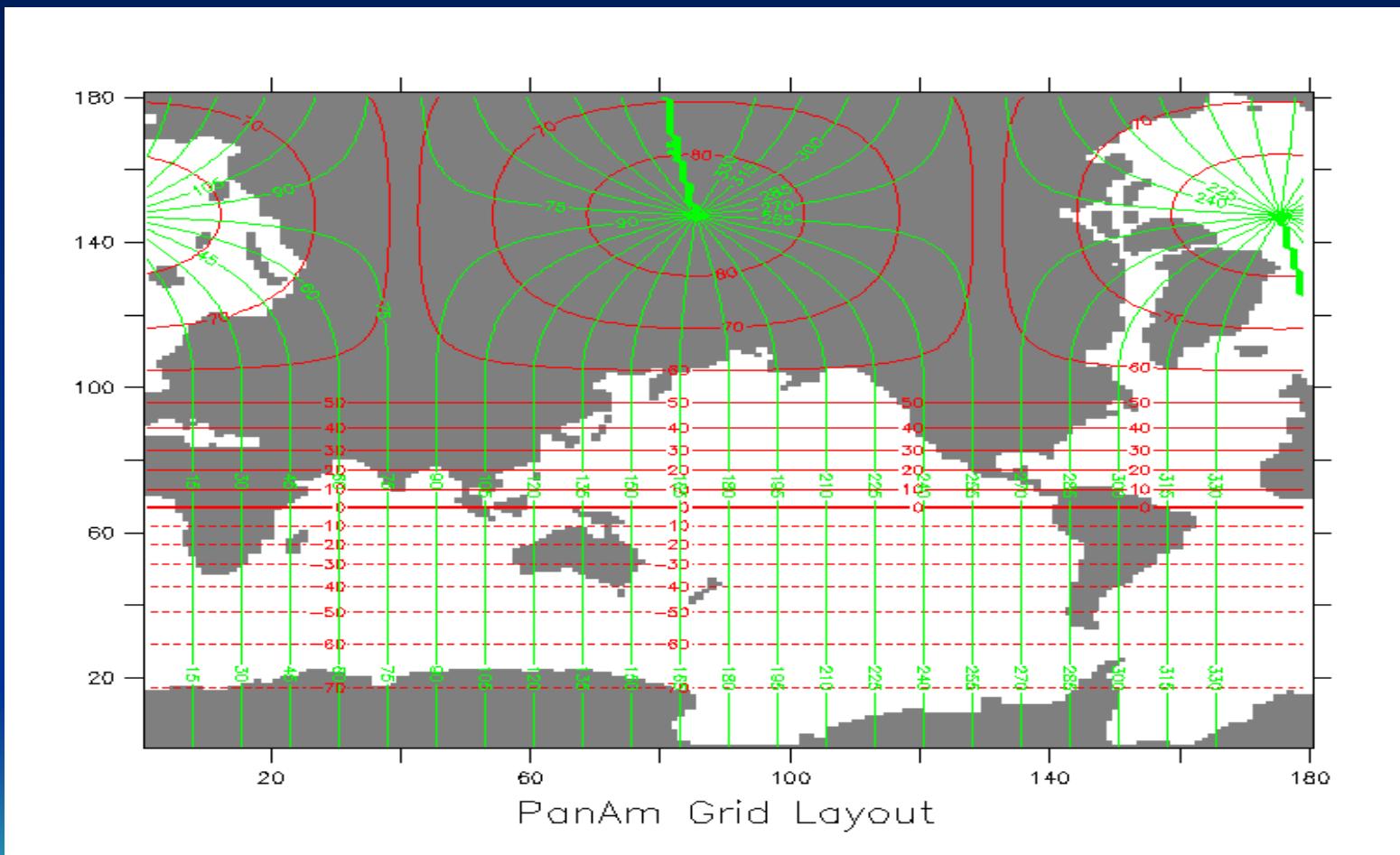


Outline of Models

- **The Ocean Model**
 - HYCOM PanAm 2.1 (hybrid, tri-polar projection)
 - Normally 2° horizontal resolution
 - 26 vertical layers
- **The Ice Model**
 - CICE (Los Alamos Sea Ice Model)
 - Active components: a thermodynamic model, a model of ice dynamics, a transport model, and a ridging parameterization



HYCOM Dipole PanAm Grid



Forcing: NCAR-CNYF

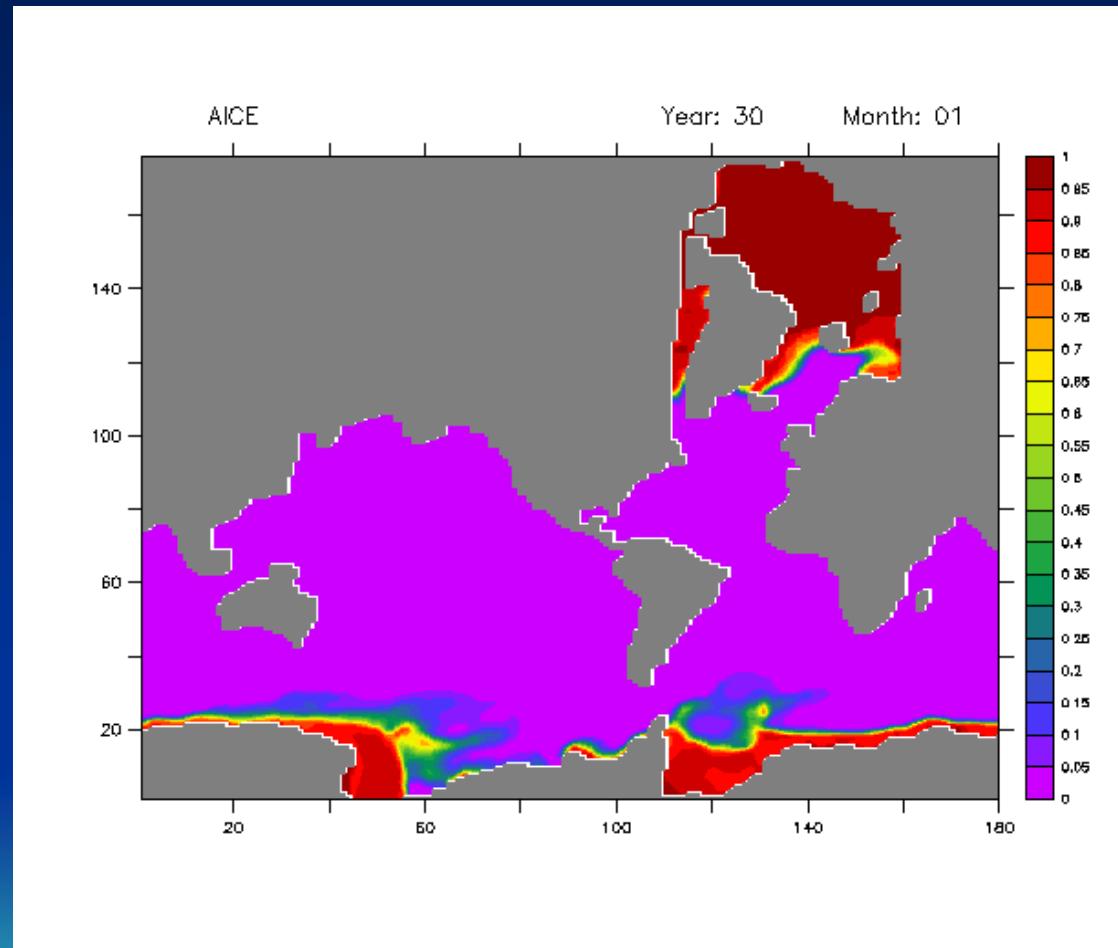
- **Larger and Yeager (NCAR, 2004): Diurnal to Decadal Global Forcing for Ocean and Sea-Ice Models**
- **Corrected “Normal” Year Forcing: 1958 – 2000 (43 years)**
- **Retaining Seasonal and Synoptic Variability**



Some Preliminary Results

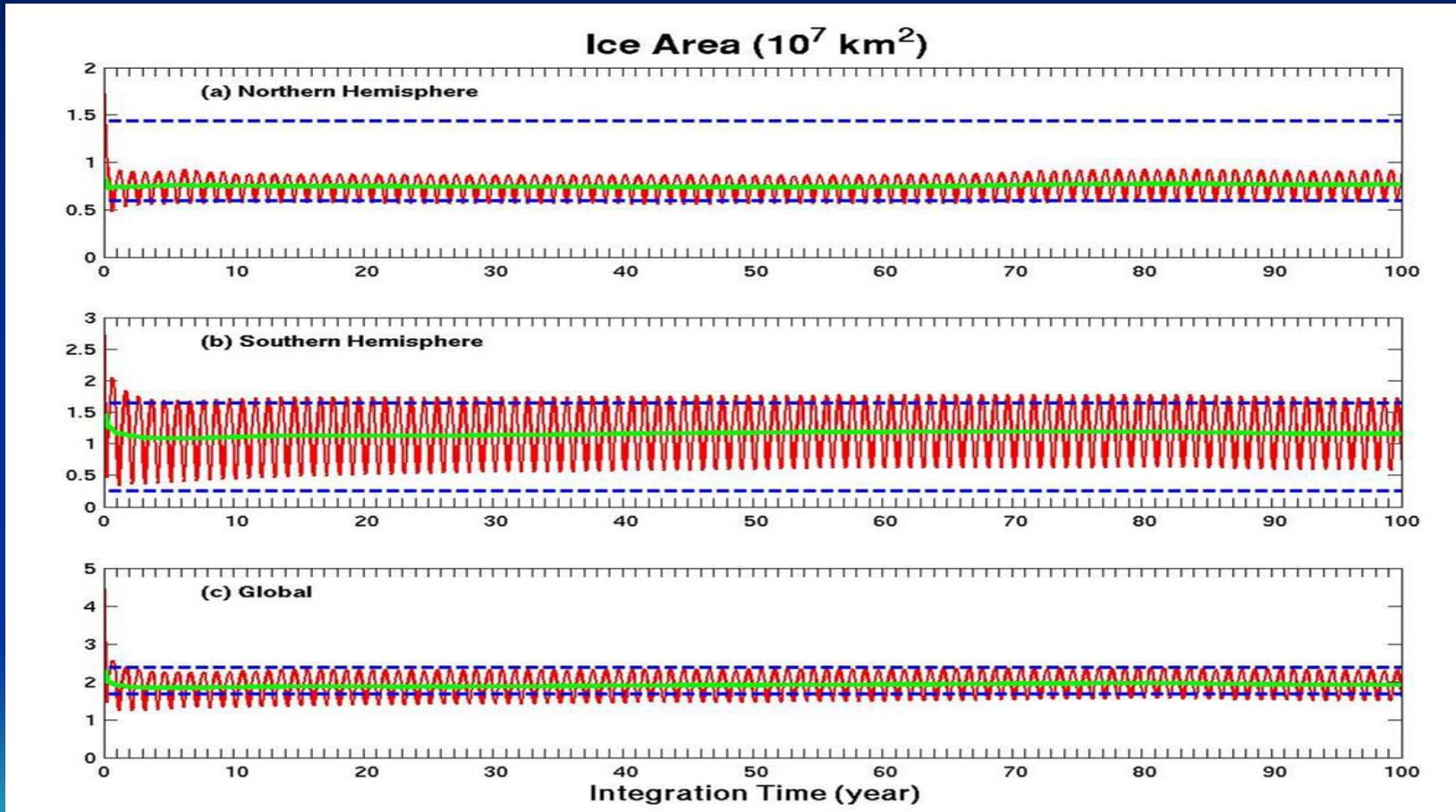
A HYCOM-CICE/NCAR-CNYF 100-years run

Monthly Sea Ice Coverage



Sea Ice Coverage Area Evolution

—: model —: Model 12-mon running mean - - - : Observations



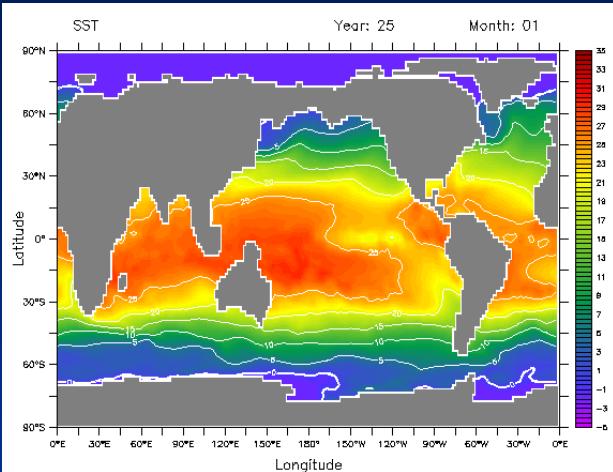
Sea Surface Temperature

Seasonal

Time evolution

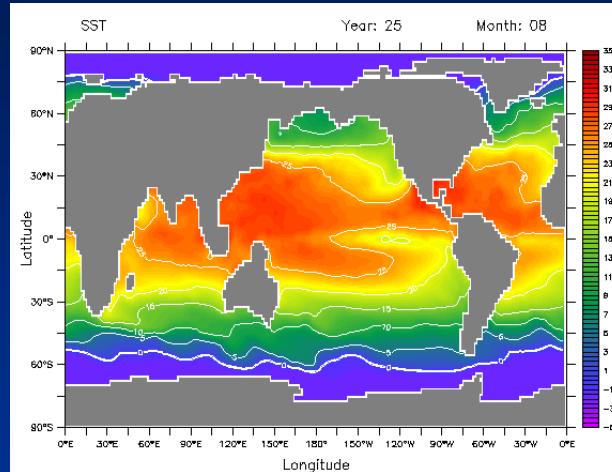
Year 25

Jan



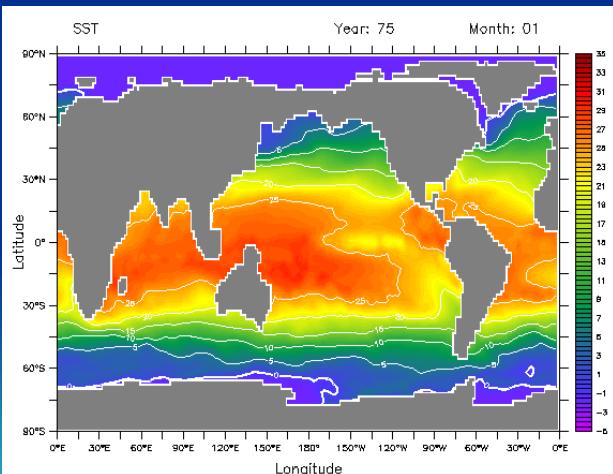
Year 25

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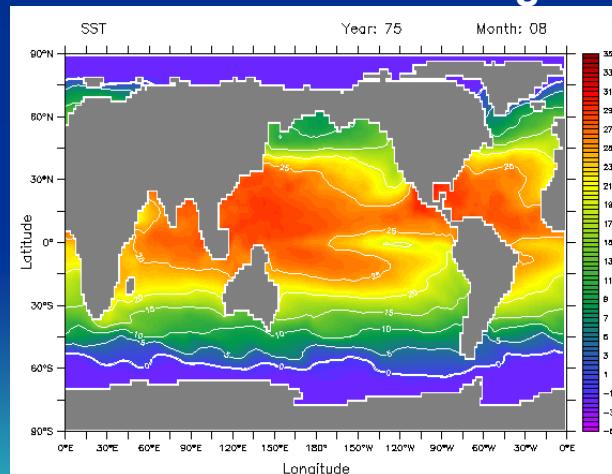
Year 75

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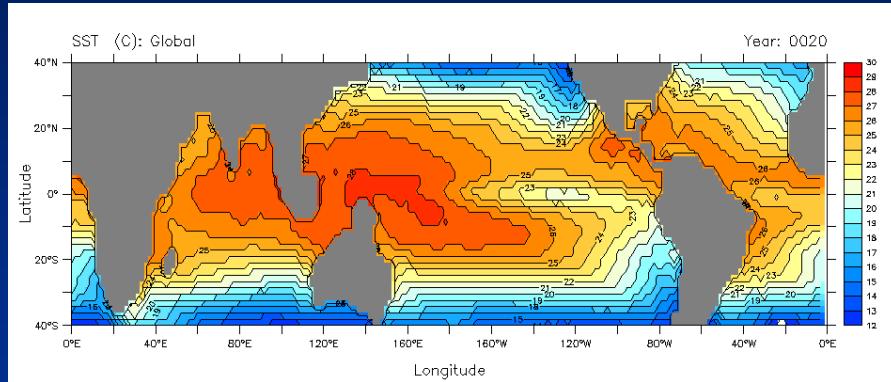
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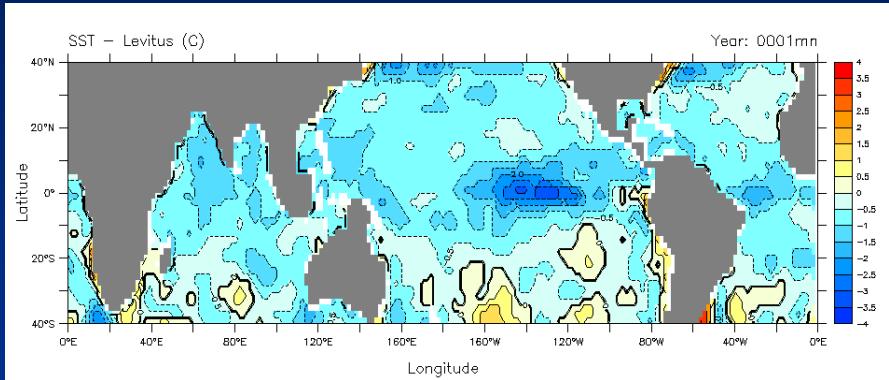


SST (40°S – 40°N) - Global

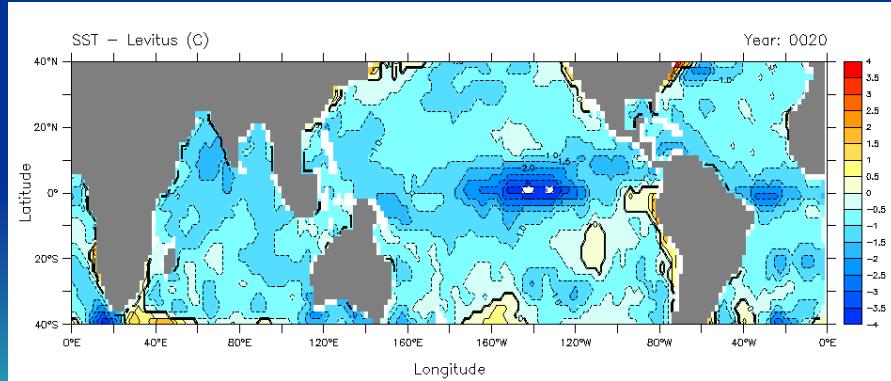
Year 20: Mean



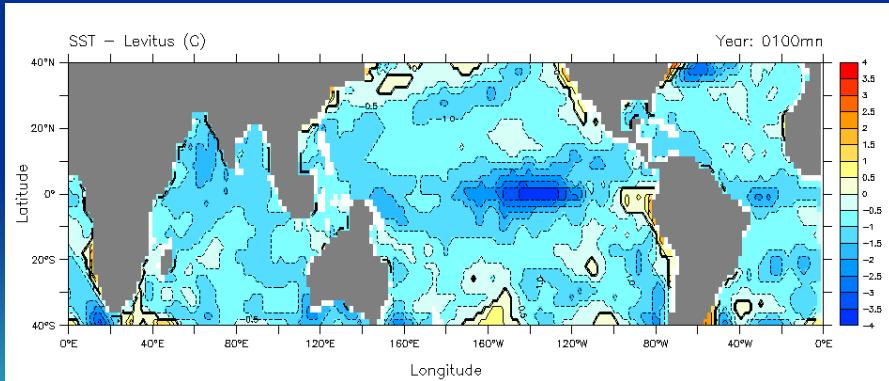
Year 1 – Levitus



Year 20 – Levitus

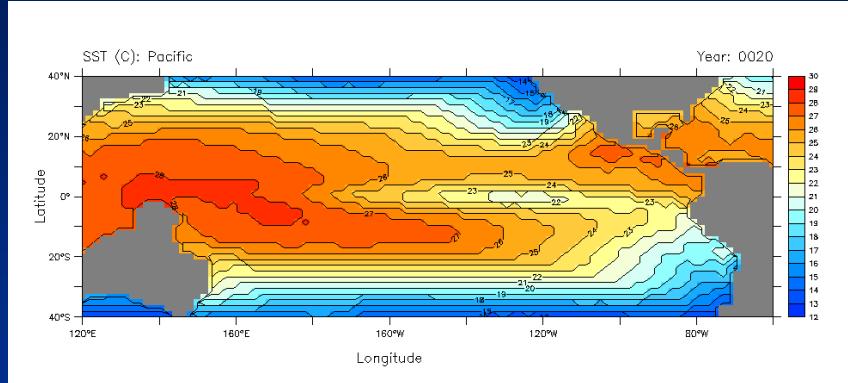


Year 100 – Levitus

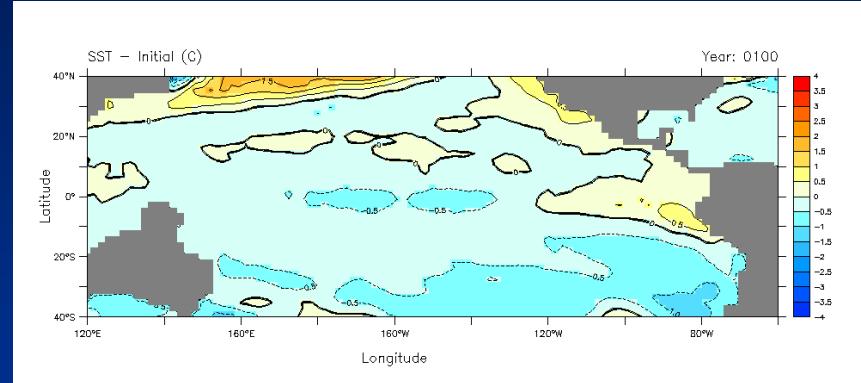


SST (40°S – 40°N) - Pacific

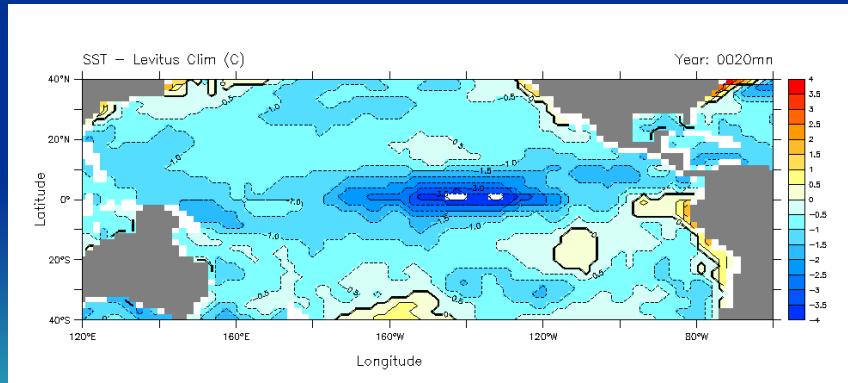
Year 20: Mean



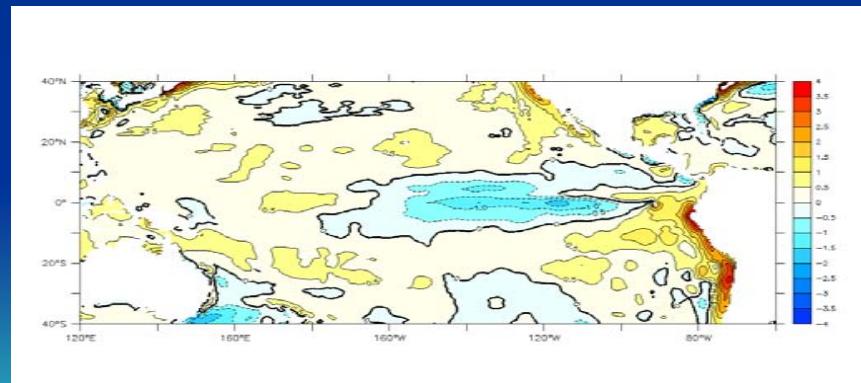
Year 20 – Year 1



Year 20 – Levitus: HYCOM



Year 20 – Levitus: ORCA2



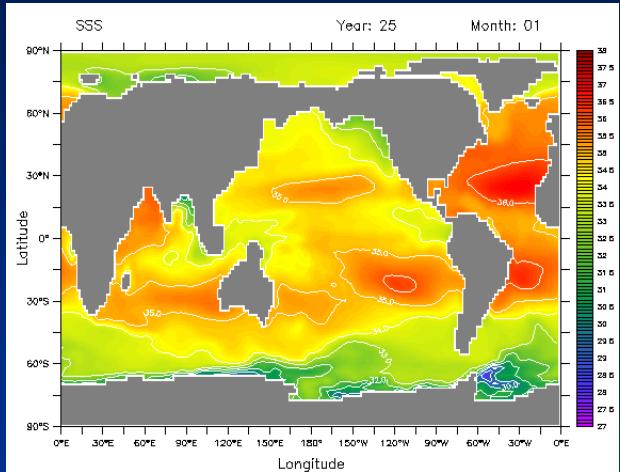
Sea Surface Salinity

Seasonal

Time evolution

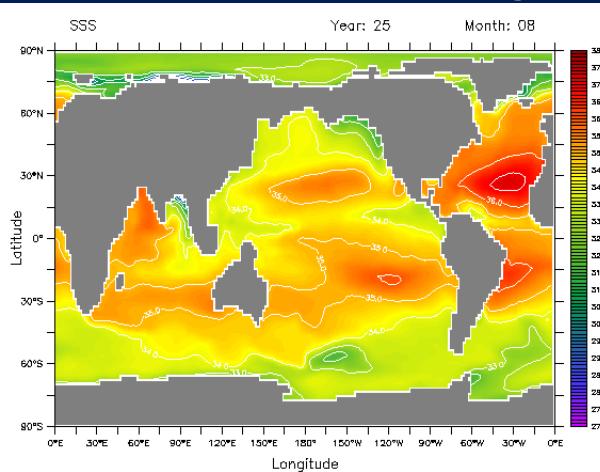
Year 25

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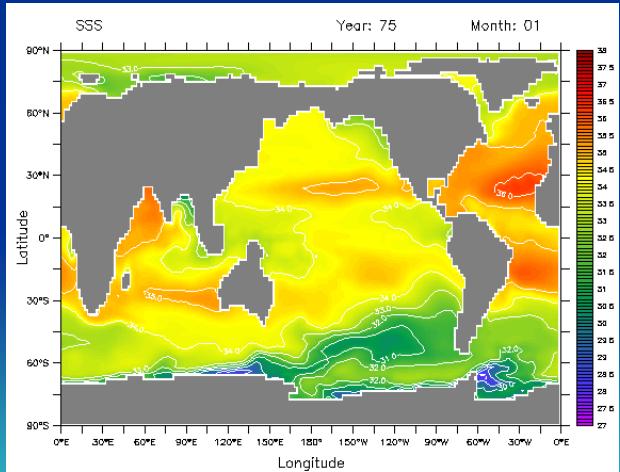
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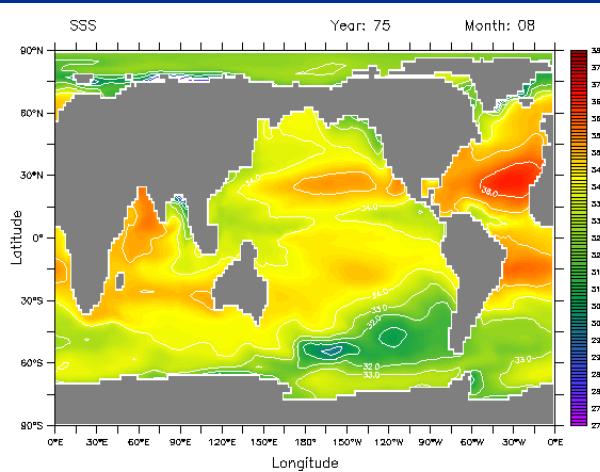
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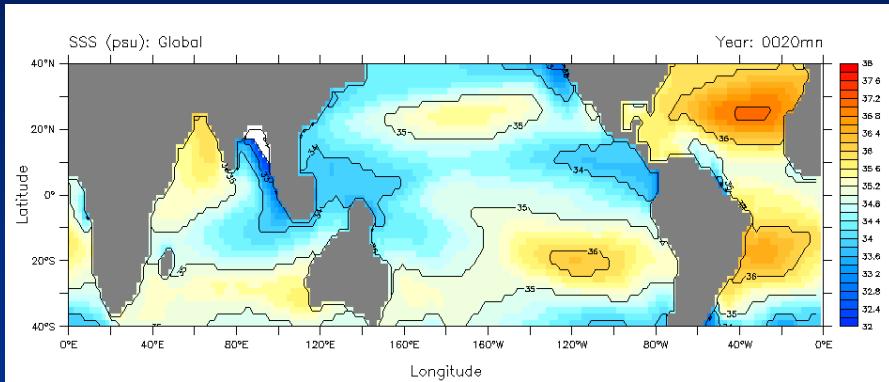
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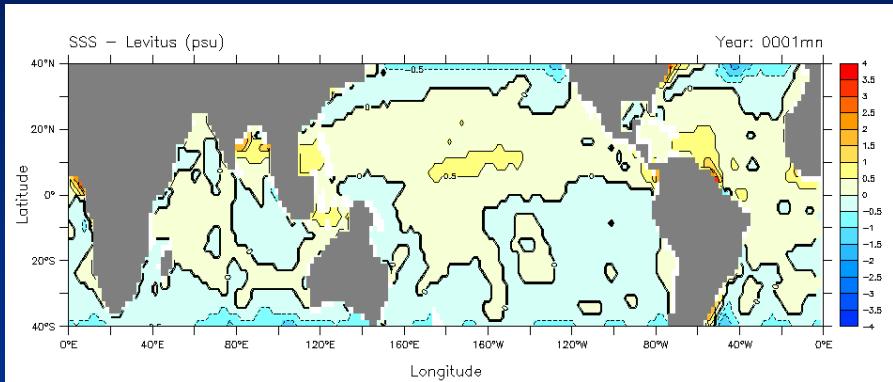


SSS (40°S – 40°N) - Global

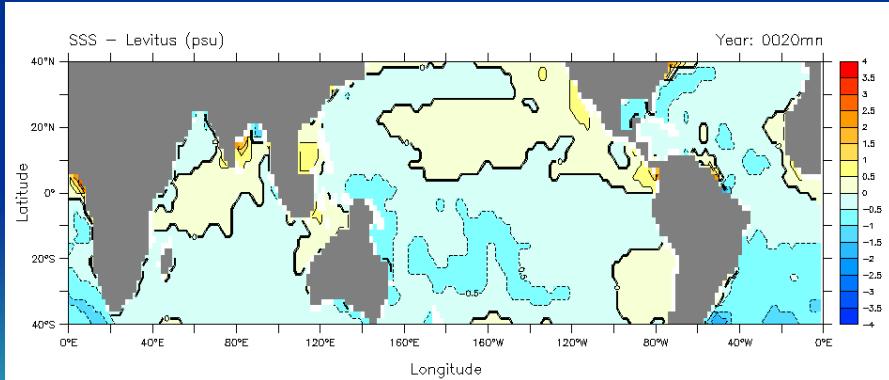
Year 20: Mean



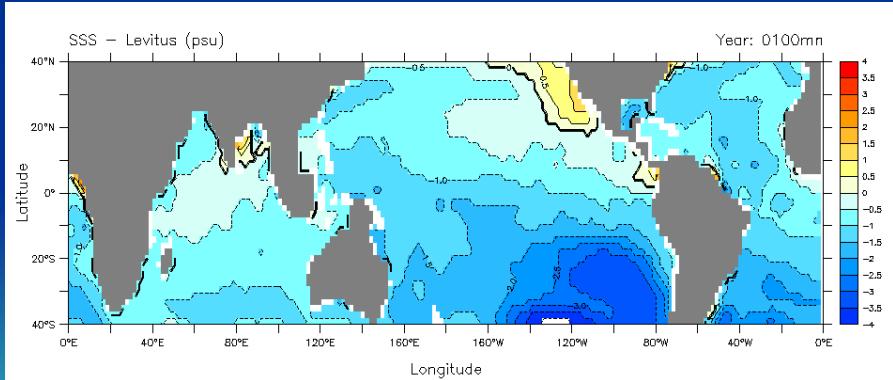
Year 1 - Levitus



Year 20 – Levitus



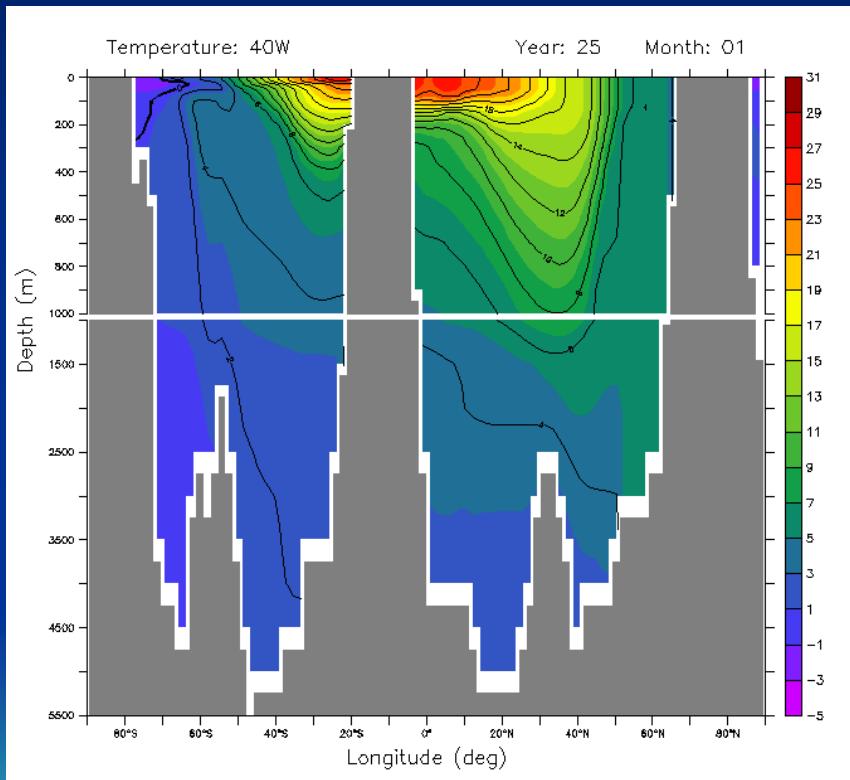
Year 100 – Levitus



Cross-sections: Temp 40°W

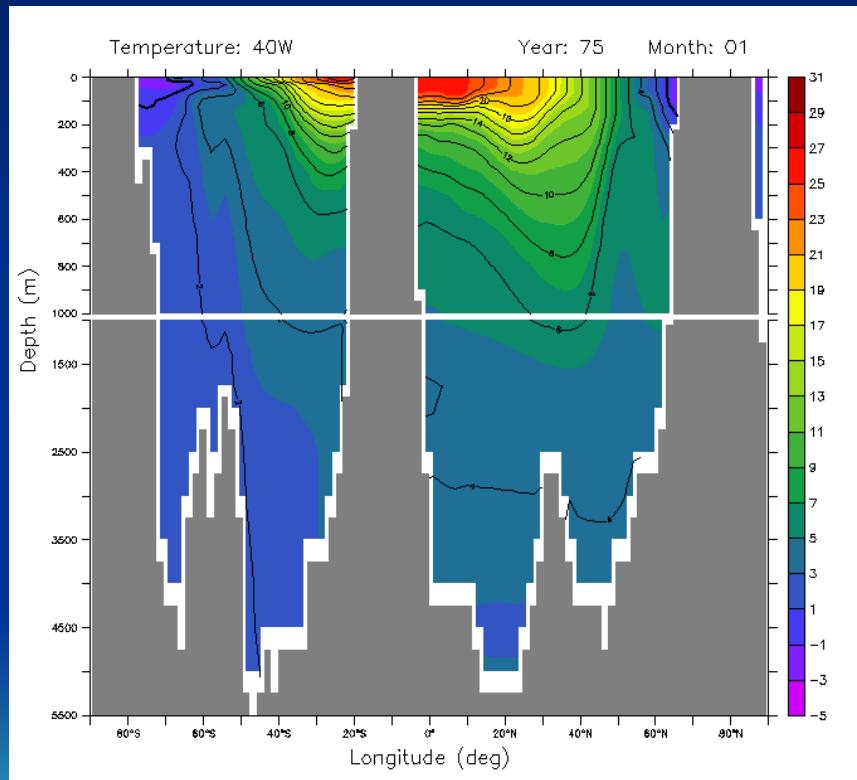
Year 25

Jan



Year 75

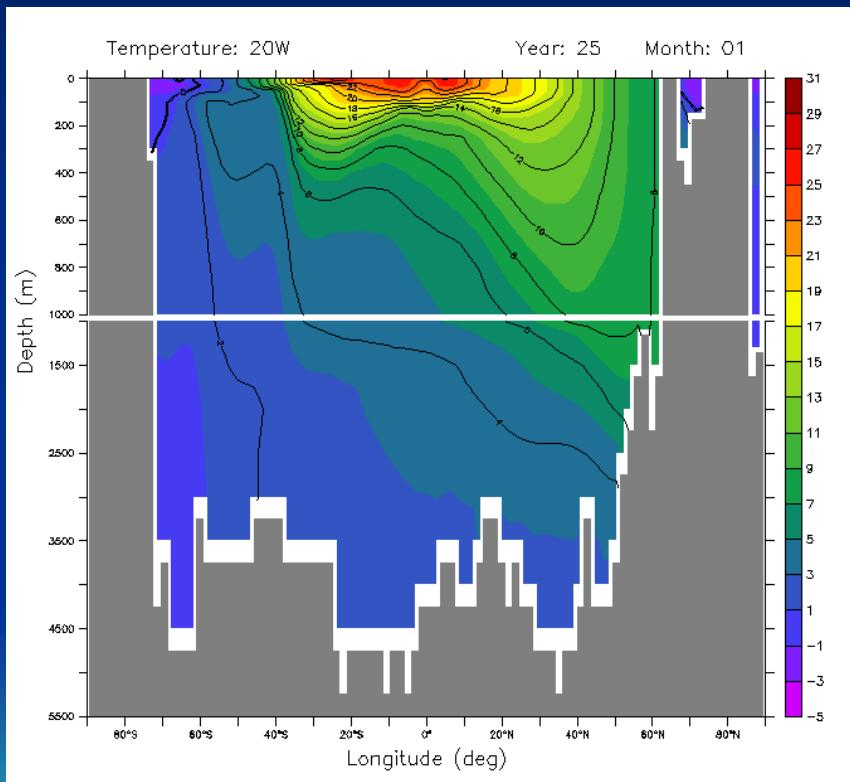
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Cross-sections: Temp 20°W

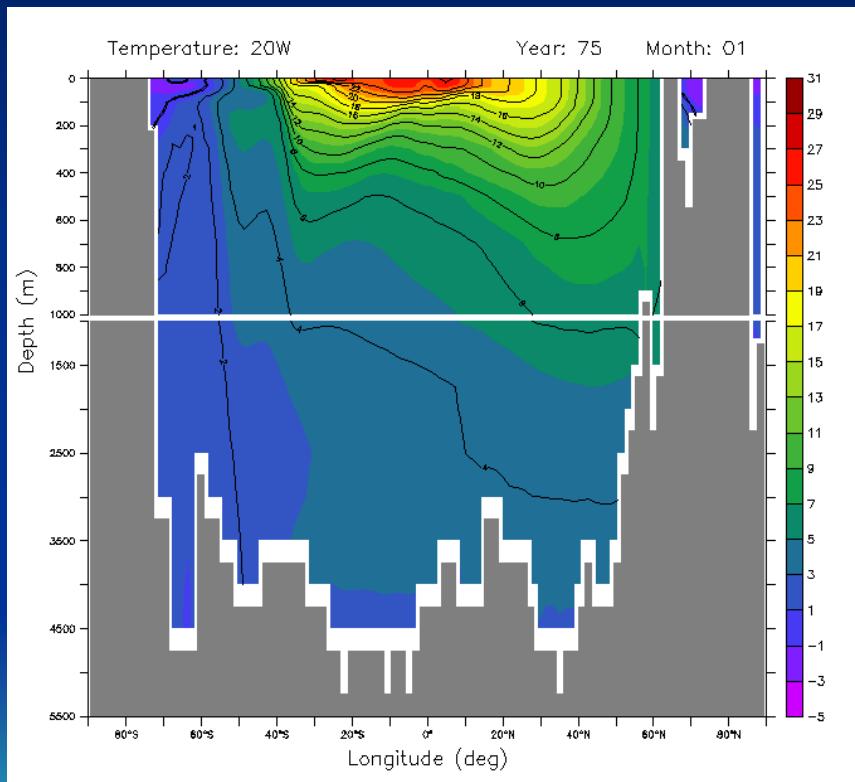
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Year 75

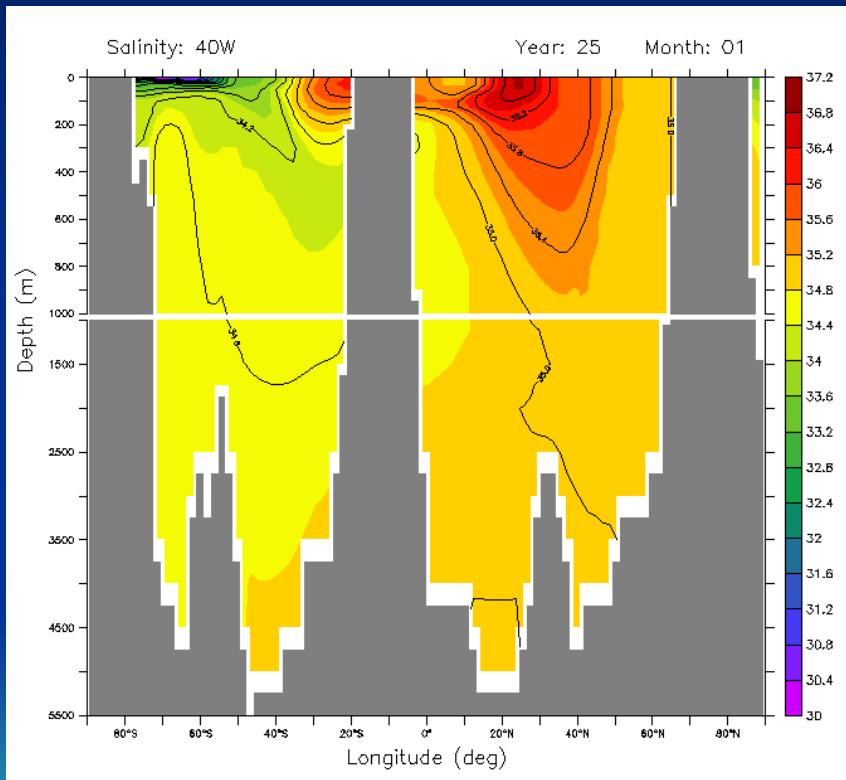
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Cross-sections: Saln 40°W

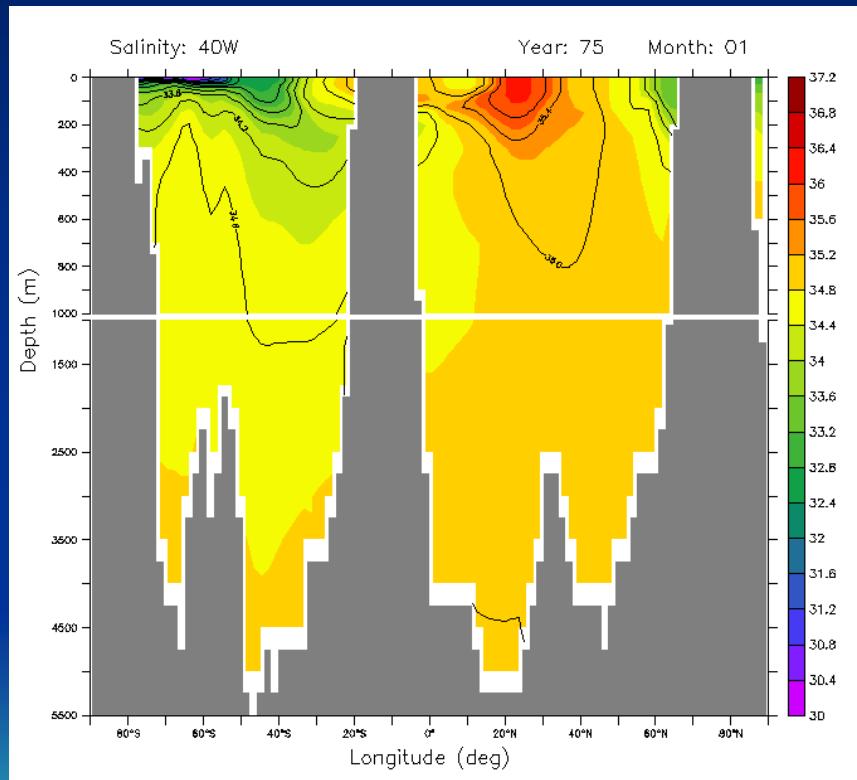
Year 25

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Year 75

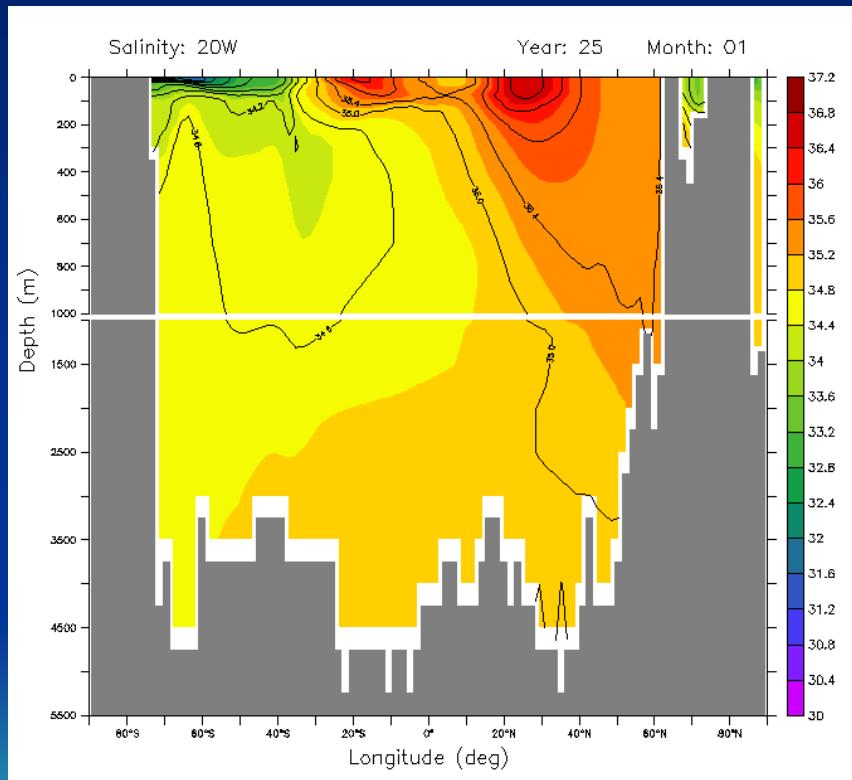
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Cross-sections: Salinity 20°W

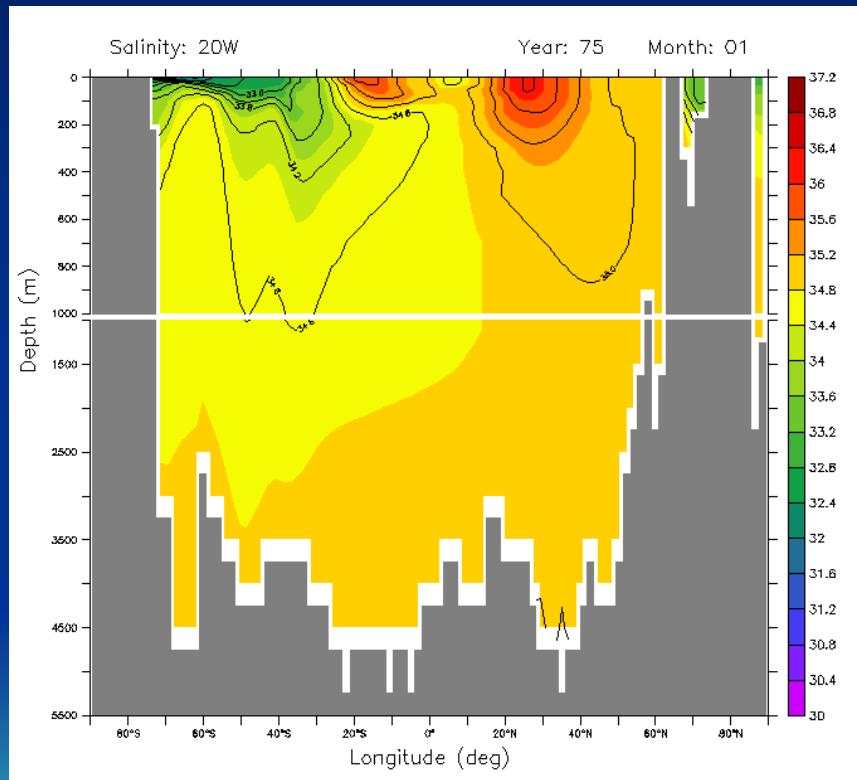
Year 25

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Year 75

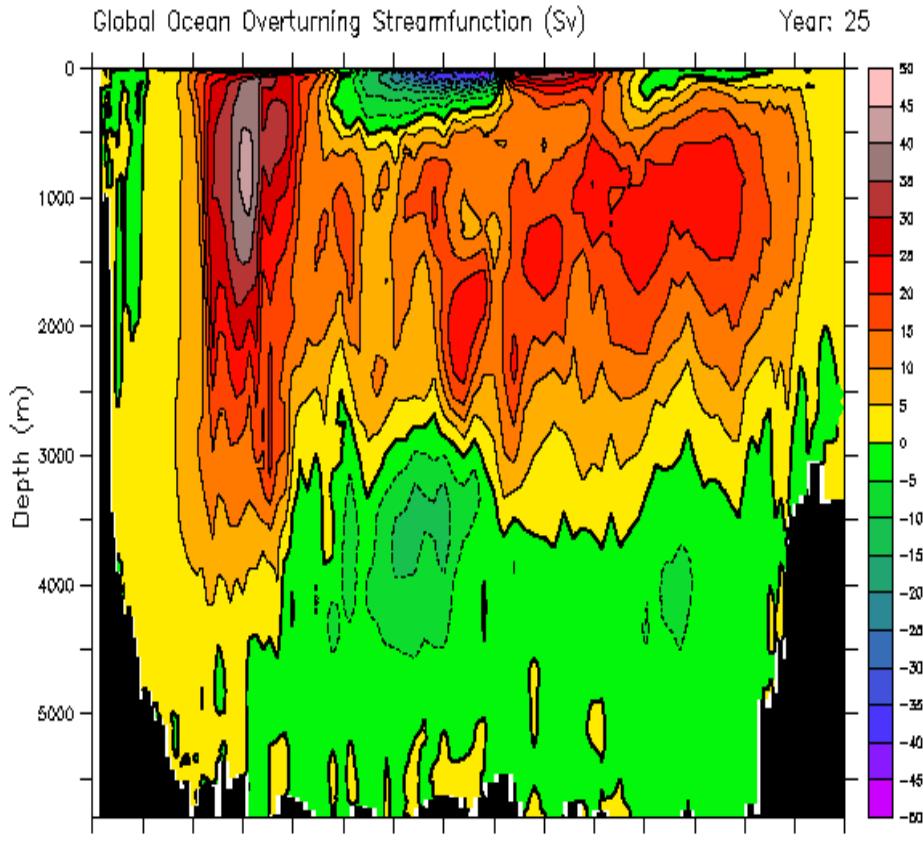
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Global Ocean Overturning

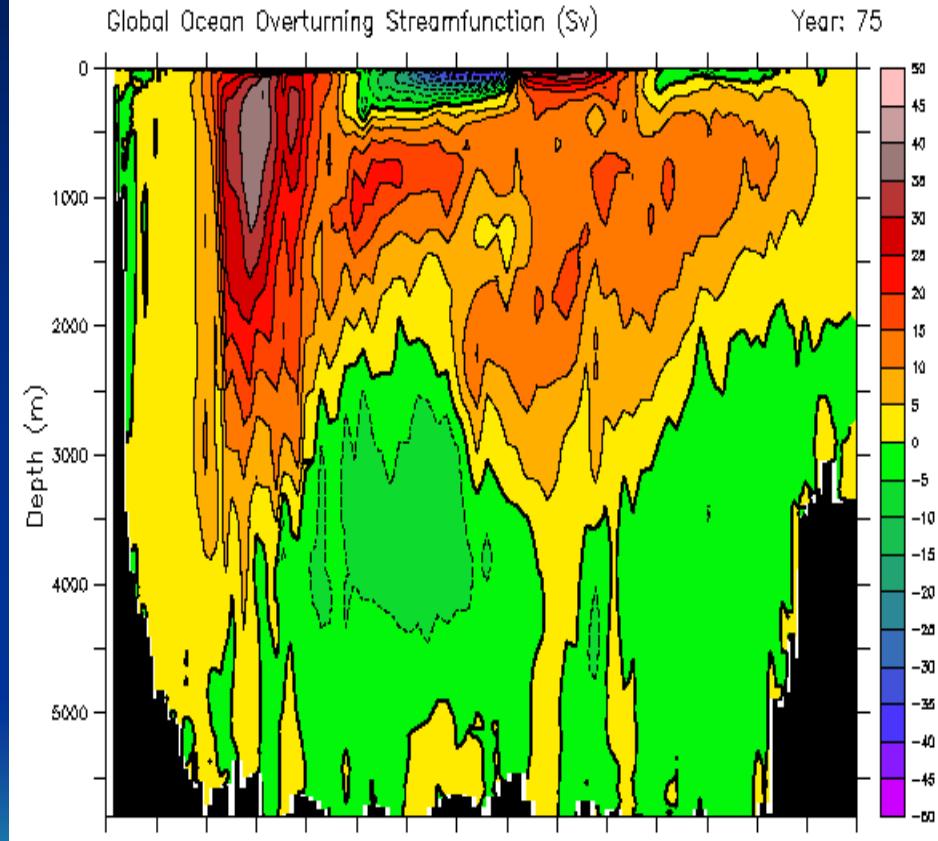
Year 25

Global Ocean Overturning Streamfunction (Sv)

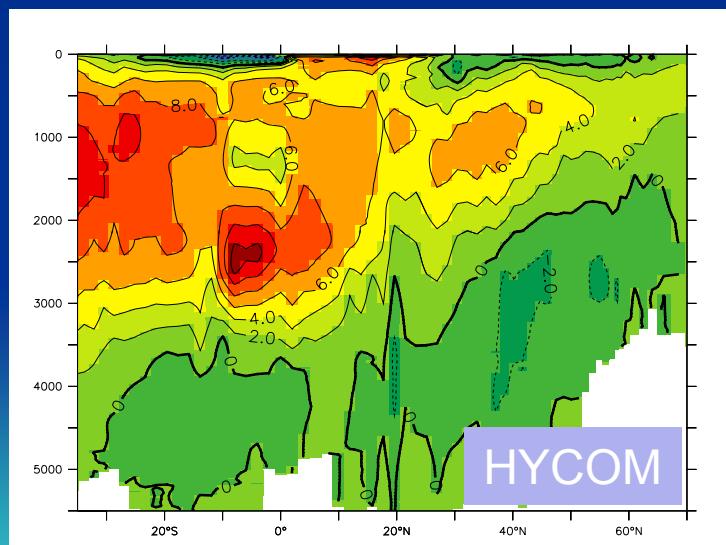
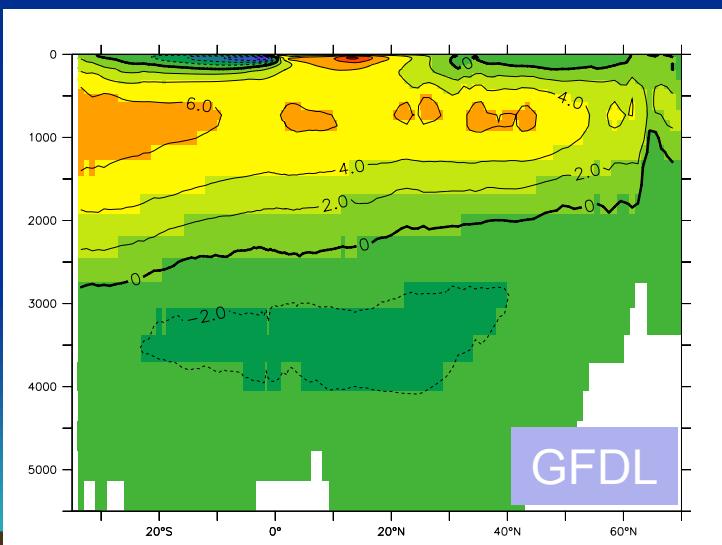
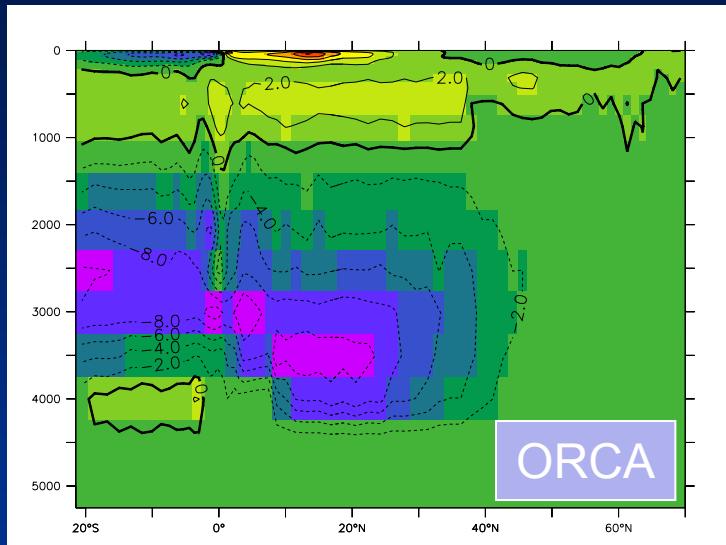
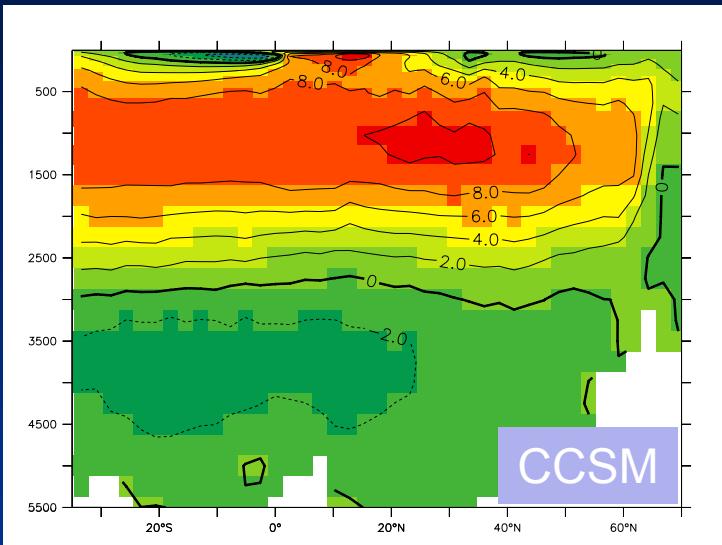


Year 75

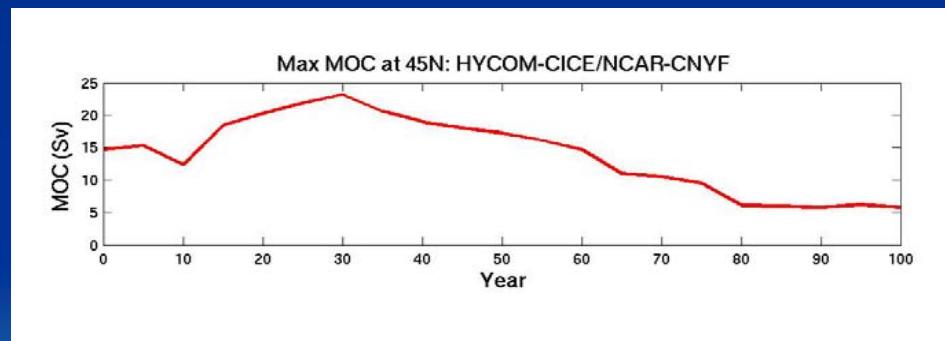
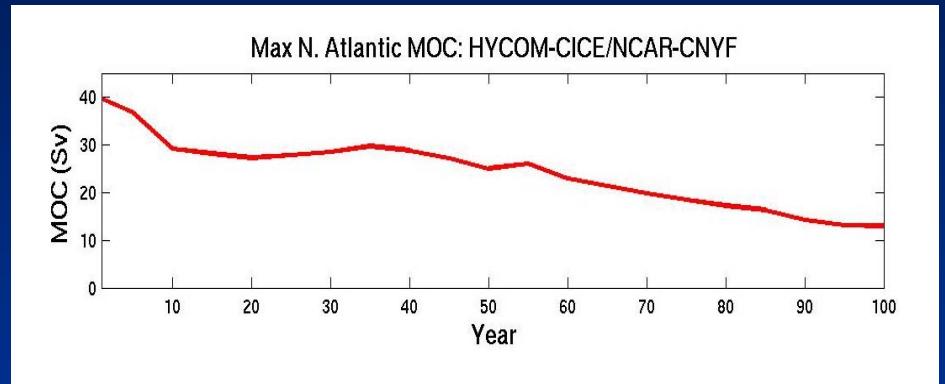
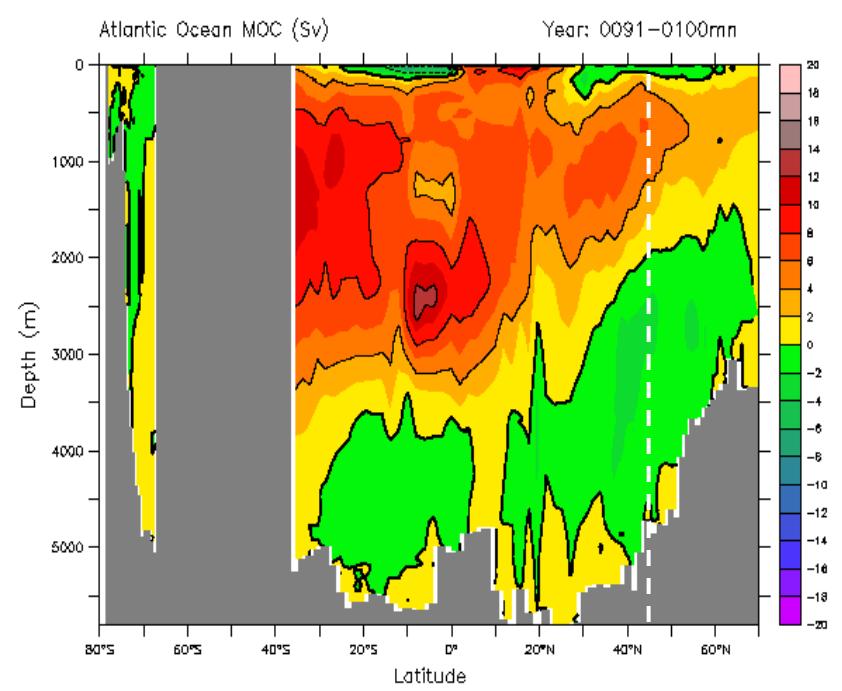
Global Ocean Overturning Streamfunction (Sv)



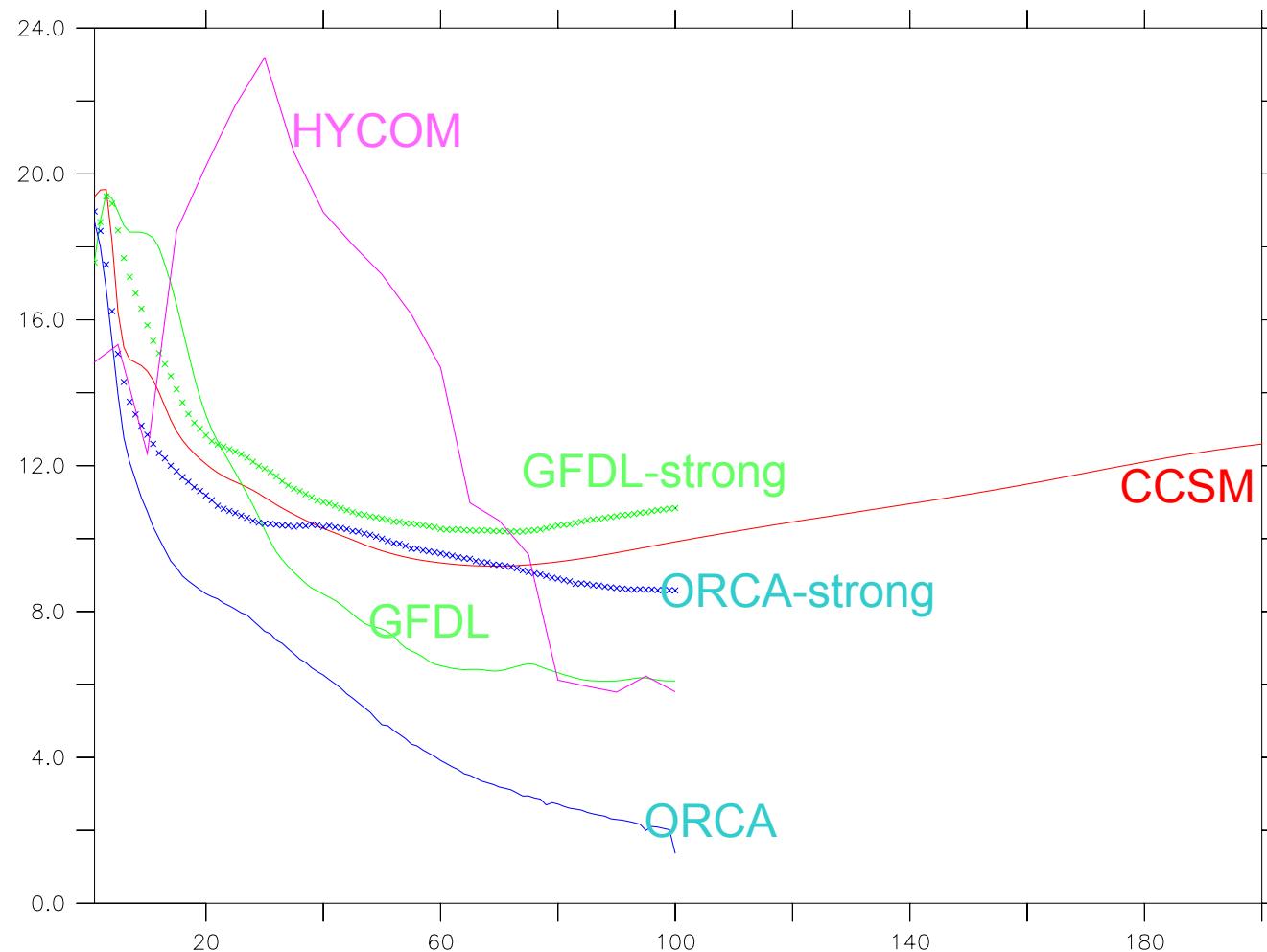
Atlantic Overturning



Atlantic Overturning



Atlantic Meridional Circulation Index at 45°N



Weak or strong relaxation to salinity, except for HYCOM

Future Work

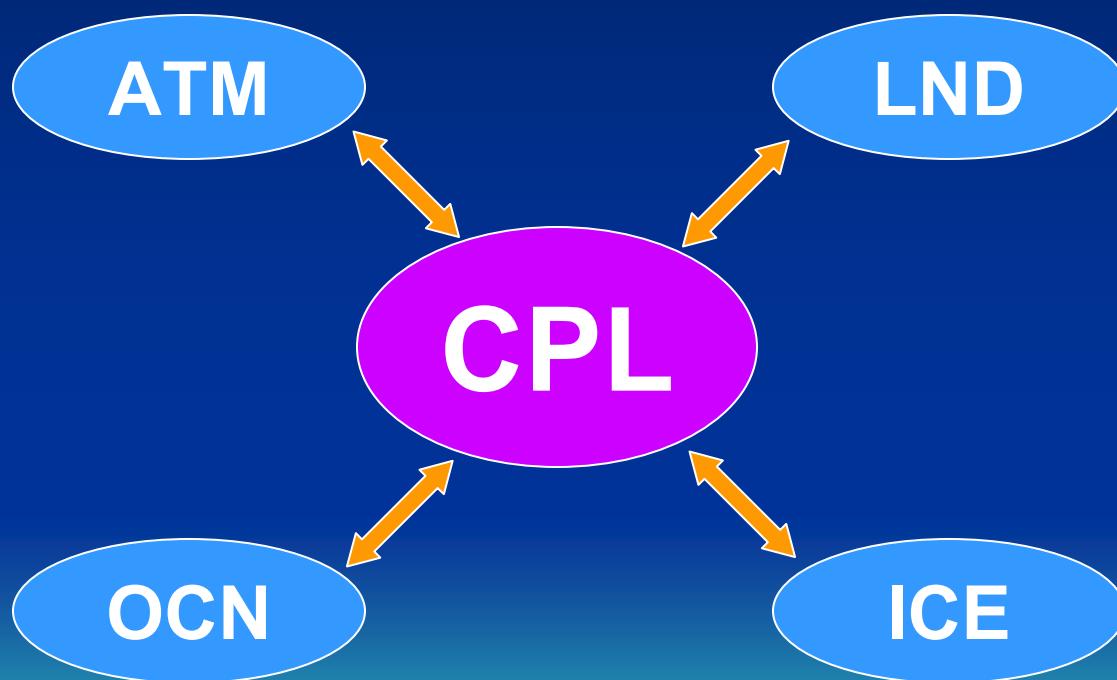


CORE: Goals

- **Systematically compare coupled ice-ocean model simulations to validate the performance of a coupled system**
- **Comparing model sensitivities to different parameterizations**
- **Unified forcing datasets, values of key variables to be used for evaluating the ice-ocean simulations**



Fully Coupled Climate System within the CSM Framework



END

