

CORE II simulation with HYCOM

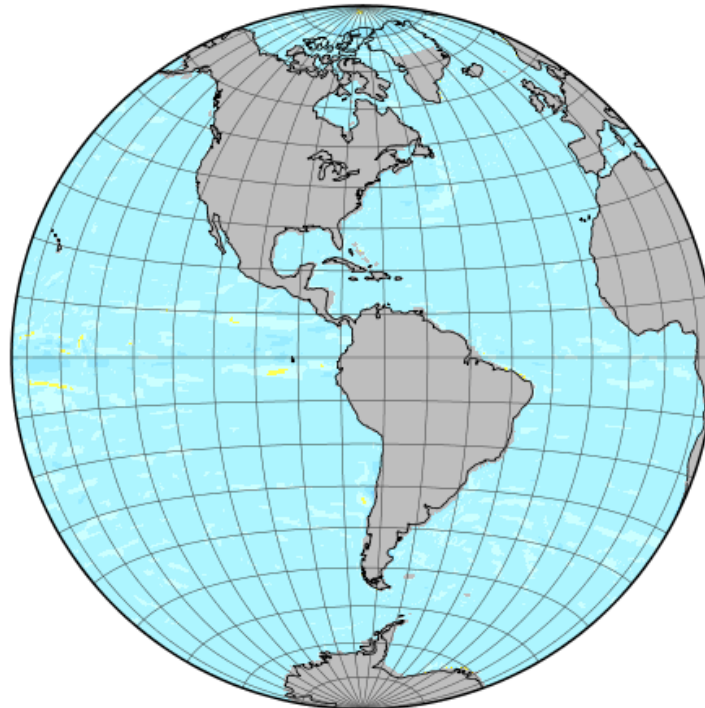
gx1v3 and GLBt0.72: Two Global Configurations of HYCOM

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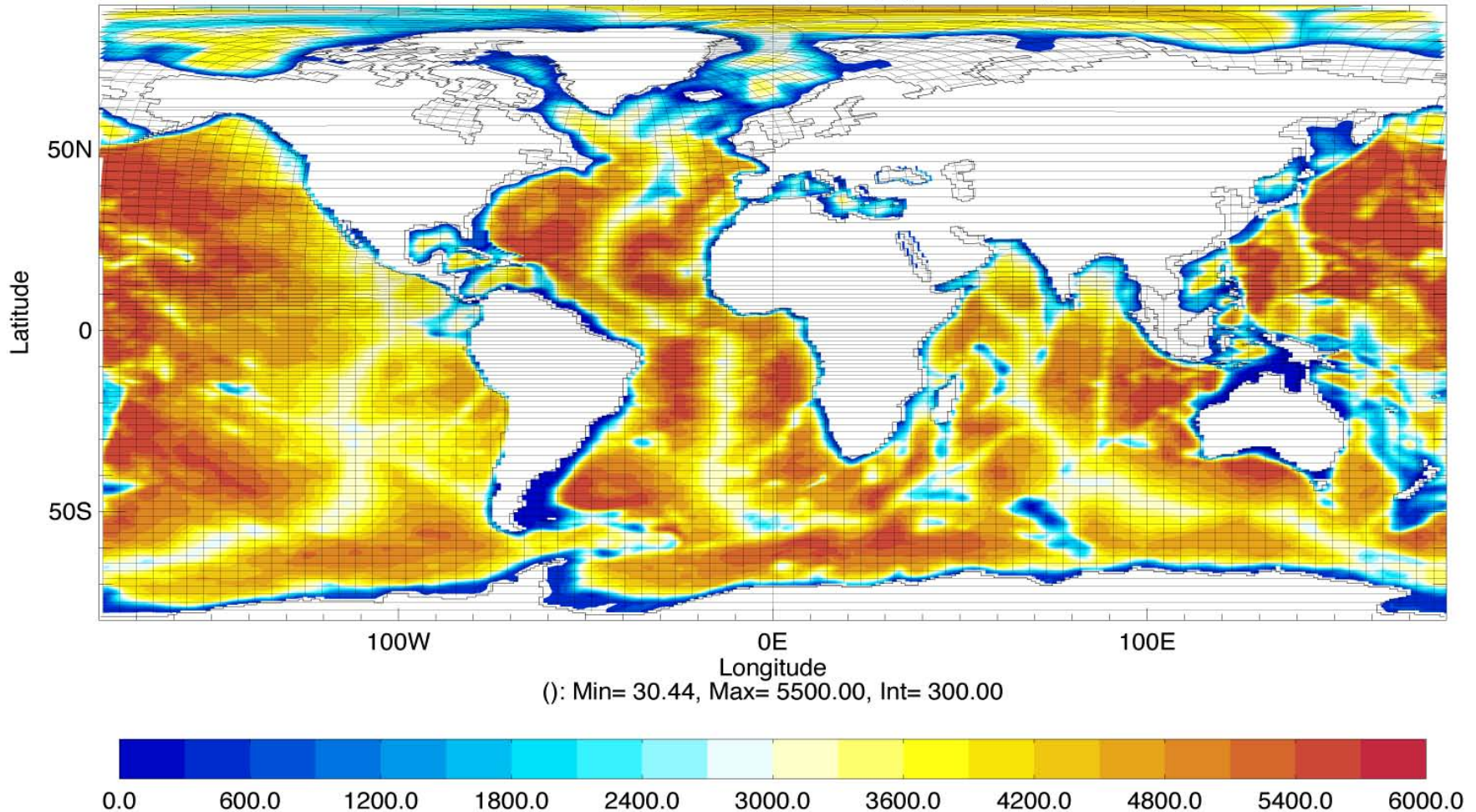


gx1v3 HYCOM Model grid and Bathymetry

Resolution: 1° with Mercator grid from the POP2gx1v3

Horizontal Grids: 320 x 384, 32 sigma2 layers, Hybrid layers extends from target density 28.10 to 37.25

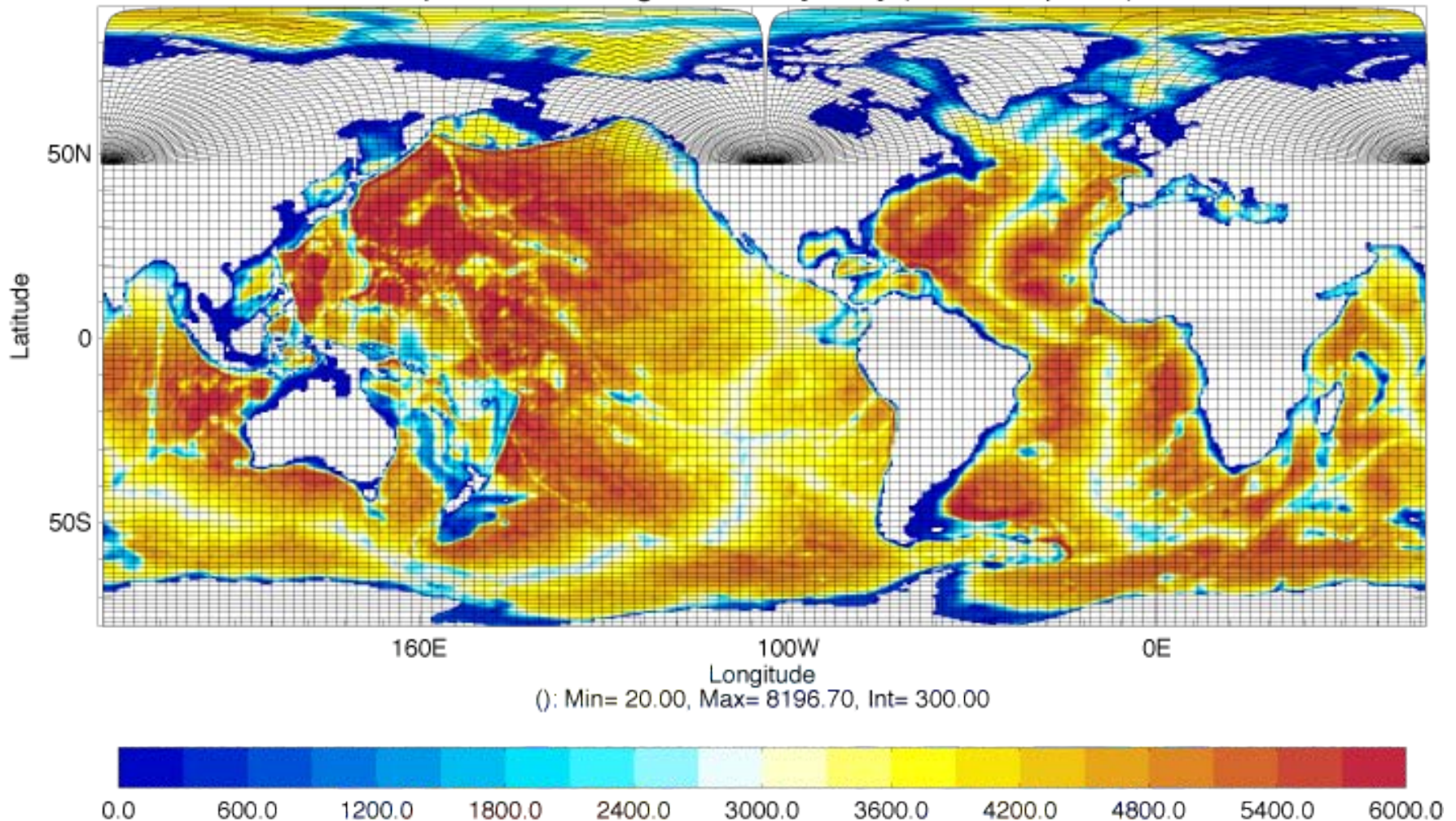
Bipolar GLB1x3 grid on Bathymetry (1 out of 4 points)



GLBt0.72 HYCOM Model grid and Bathymetry

Resolution: 0.72° with Mercator grid and Bathymetry : 2 minute NAVO/NRL DBDB2- NGDC
Horizontal Grids: 500 x 382, 32 sigma2 layers, Hybrid layers extends from target density 27.00 to 37.42

Tripolar GLBt0.72 grid on Bathymetry (1 out of 4 points)



Initial States

gx1v3

- ✓ No velocity
- ✓ PHC3 Climatology (at NCAR's gx1v3 grid(320x384), 32 Hybrid layers range from target density 28.1 to 37.25)
- ✓ Sea surface Salinity relaxation 30 days
- ✓ NO SST relaxation

GLBt0.72

- ✓ No velocity
- ✓ GDEM4 Climatology (at HYCOM grid of 500x382, Hybrid layers ranges from target density 27.00 to 37.42)
- ✓ Sea surface Salinity relaxation 30 days and no restoration for $|\Delta SSS| > 0.5$
- ✓ NO SST relaxation

Forcing

- Version 2 Data from Common Ocean-ice Reference Experiments (CORE II) 1948-2007

CORE II Provides		HYCOM requires	
Parameters	Time Int.	Parameters	Time Int.
Downward Longwave*	Daily	Total Radiative Flux	6 hourly
Downward Shortwave*	Daily	Net Shortwave	6 hourly
Zonal Wind (10 m)	6 hourly	Wind Stress	6 hourly
Meridional Wind (10 m)	6 hourly	Wind Speed	6 hourly
Specific Humidity (10 m)	6 hourly	Specific Humidity	6 hourly
Air Temperature (10 m)	6 hourly	Air Temperature	6 hourly
Precipitation	Monthly	Precipitation	6 hourly
River Discharge	Monthly	River discharge	Monthly

*Albedo correction to downward flux using sea-ice extent monthly climatology

Methods to incorporate the Forcing in HYCOM

For gx1v3:

- Adapt the forcing to HYCOM input
 - ✓ Wind stress forcing and bulk formula: calculated through the cpl6 in NCAR's CCSM3
 - ✓ The new corrections of the CORE-II atmospheric forcing have been incorporated in latm6 (CCSM3)
 - ✓ Effective Ocean albedo is calculated $A(\theta)=0.069-0.011*\text{Cos}(2\theta)$ for ice-free regions, for sea-ice part, calculated by active ice model CISM.

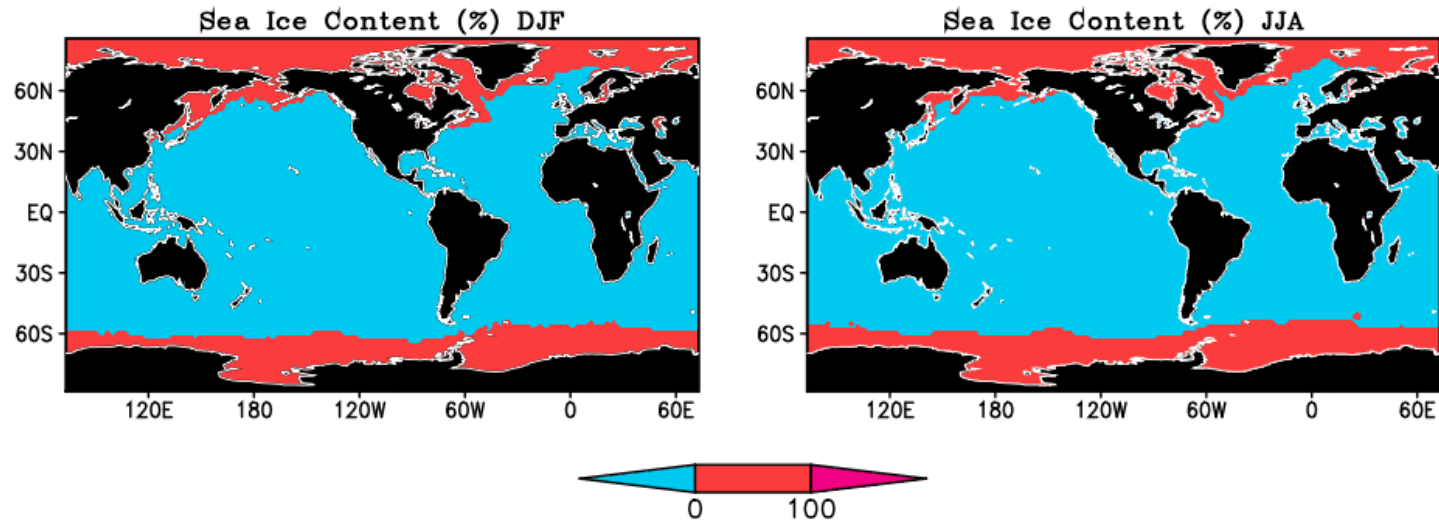
Methods to incorporate the Forcing in HYCOM

For GLBt0.72:

- Adapt the forcing to HYCOM input (spatially interpolated on HYCOM grid and temporally using cubic-spline method)
 - ✓ Only available Downward Radiative and downward Shortwave fluxes, Q_{net} is calculated using model SST inside HYCOM
 - ✓ Wind stress is calculated inside HYCOM using model currents,
Wind Stress → $0.5C_d*(u_{10}-u)$ and $0.5C_d*(v_{10}-v)$
Where u and v are surface ocean currents and u_{10} and v_{10} are zonal and meridional winds at 10 m from CORE II
 - ✓ Ice Energy Loan Model for the ice
 - ✓ Get the albedo from Ice extent climatology From CORE I, to correct shortwave and Radiative fluxes

Forcing cont.

For GLBt0.72:

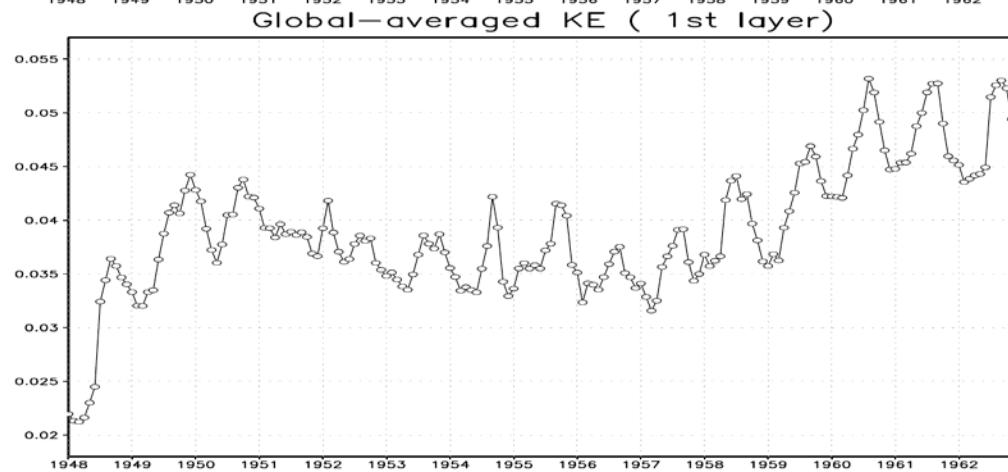
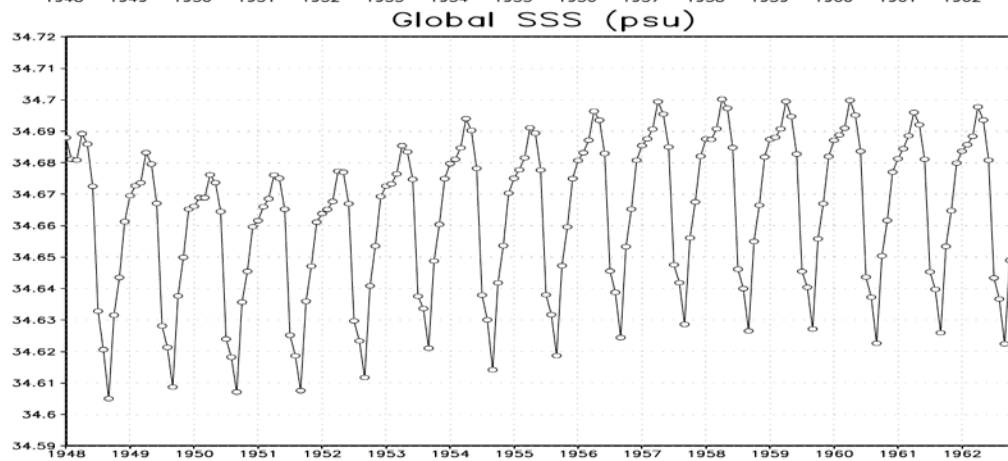
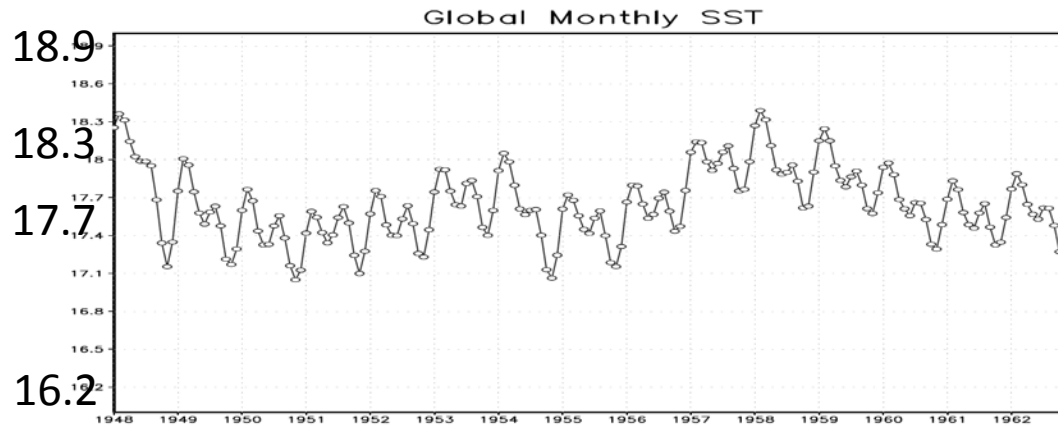


- ✓ Monthly Rivers 1948-2007 (CORE II)
- ✓ Kara Bulk Formulae for fluxes and wind-stress
“Value of bulk heat flux parameterizations for ocean SST prediction” A. J. Wallcraft, A. B. Kara, H. E. Hurlburt, E. P. Chassignet and G. H. Halliwell, , *Journal of Marine Systems* vol 74 doi:10.1016/j.marsys.2008.01.009
- ✓ No Flux offset
- ✓ diurnal cycle on shortwave and Net radiative.

Results...

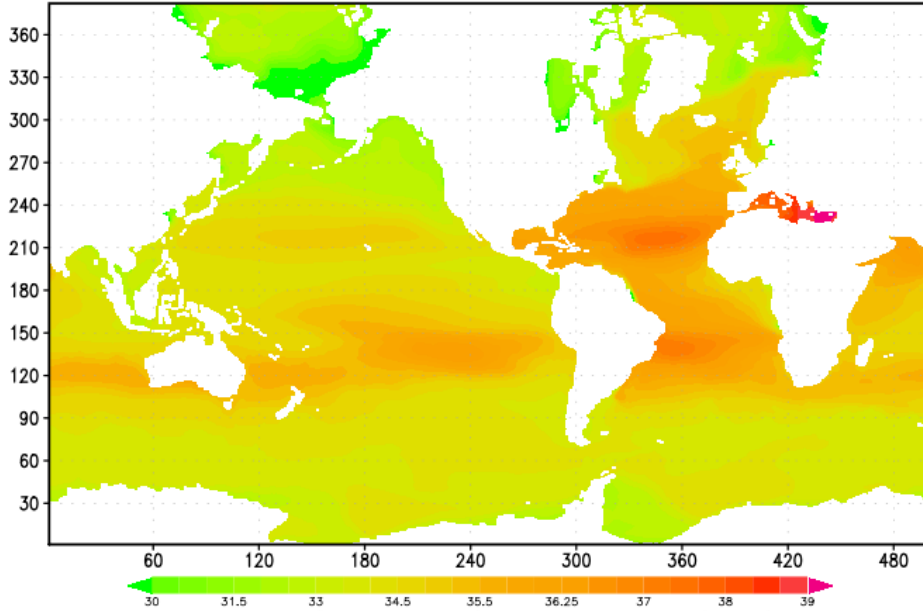
- gx1v3: The CORE-II has been integrated for 15 years, but there is a bug in the SSS relaxation. It is under investigation.
- GLBt0.72: 25 years and still running.

For gx1v3:

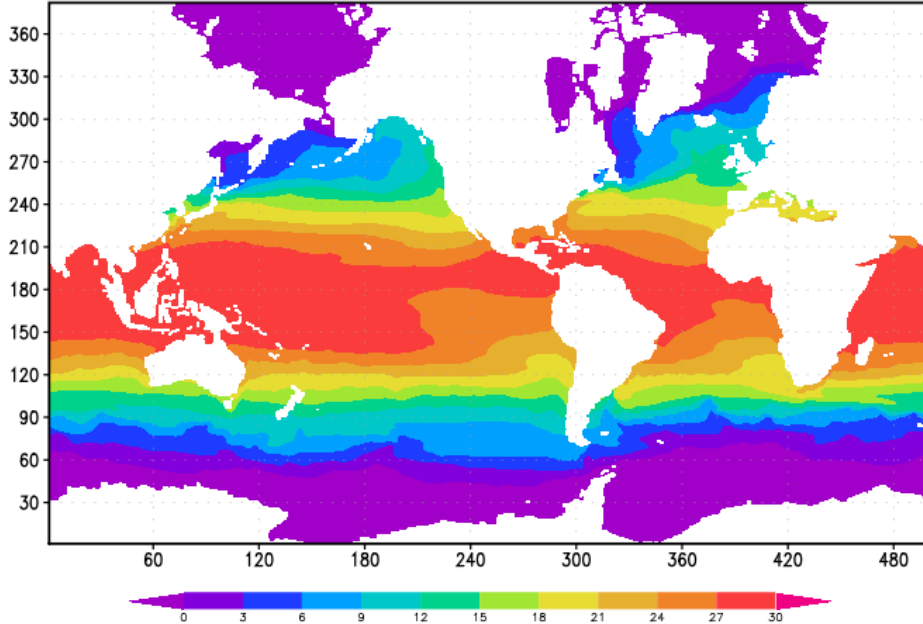


For GLBt0.72:

Mean (1966–1970) Salinity (0 m)

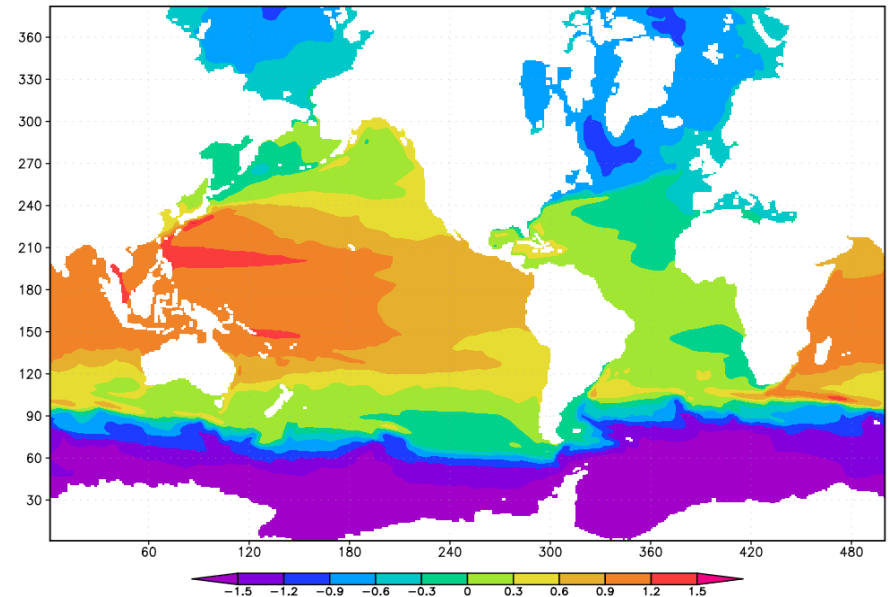


Mean (1966–1970) Temperature (0 m)

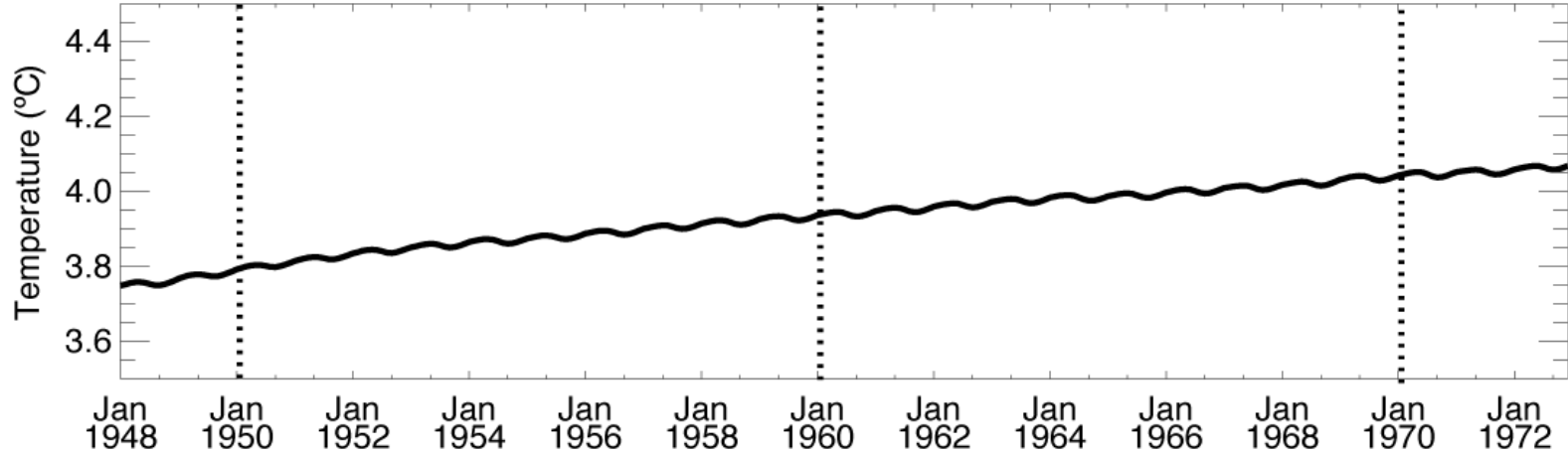


Mean of the Last Five Years
(1966-1970): First Cycle

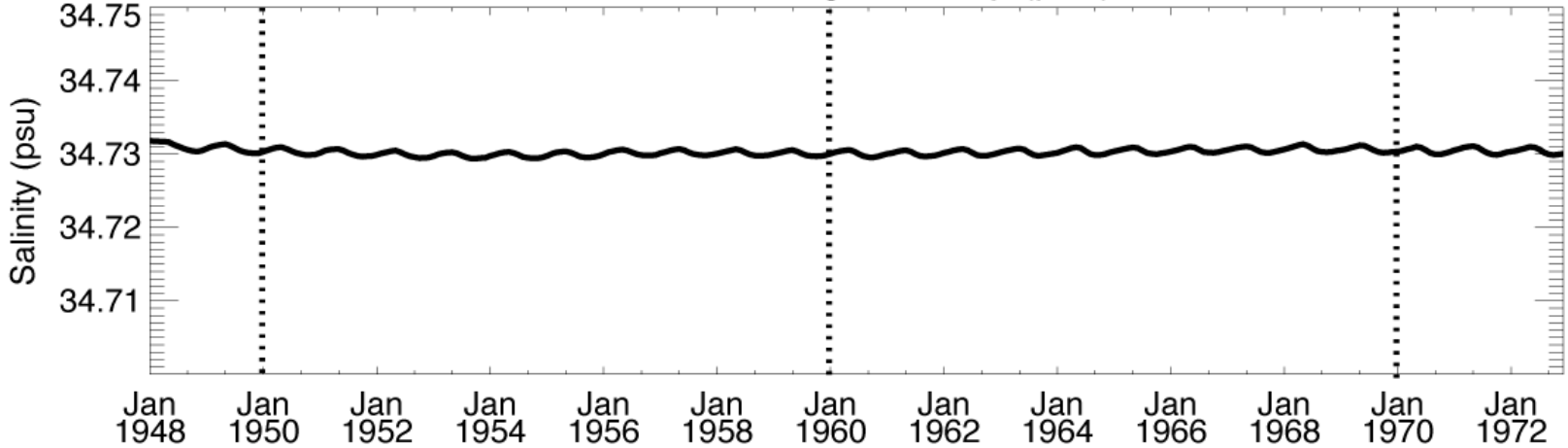
Mean(1966–1970) SSH (m)



Global Average Temperature (°C)

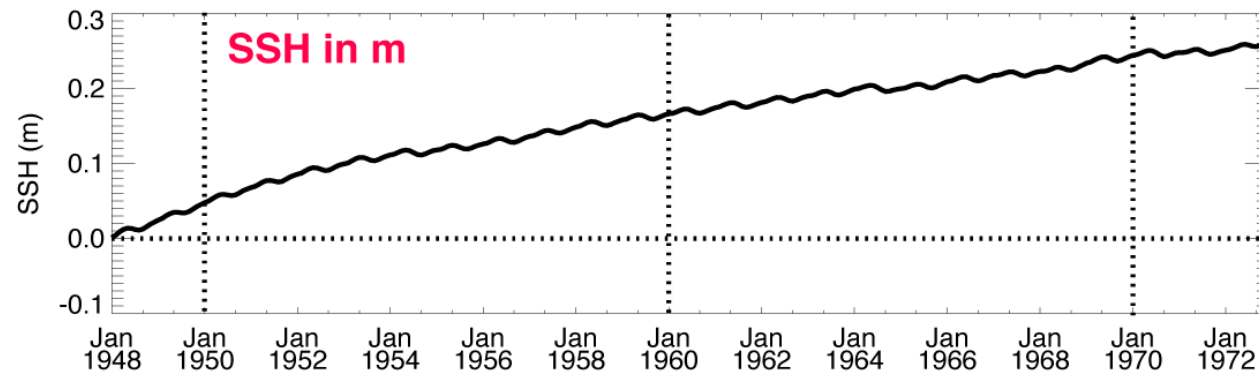
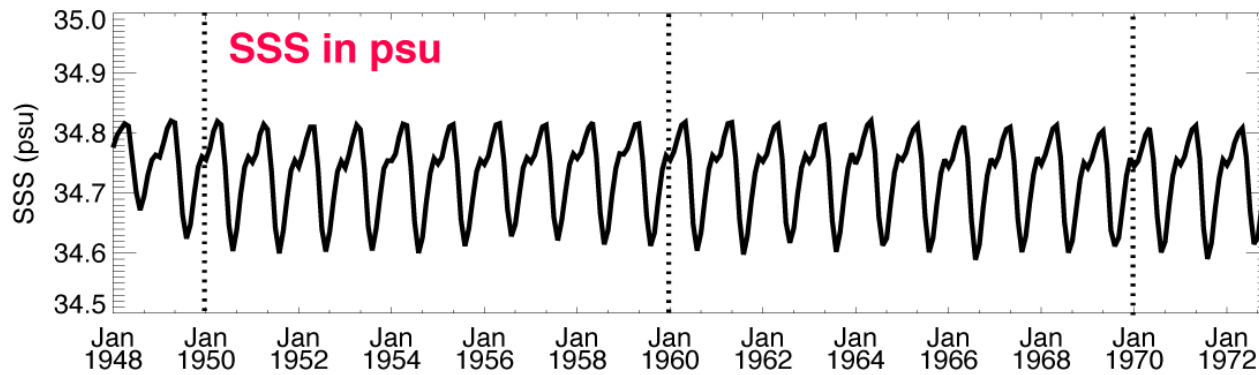
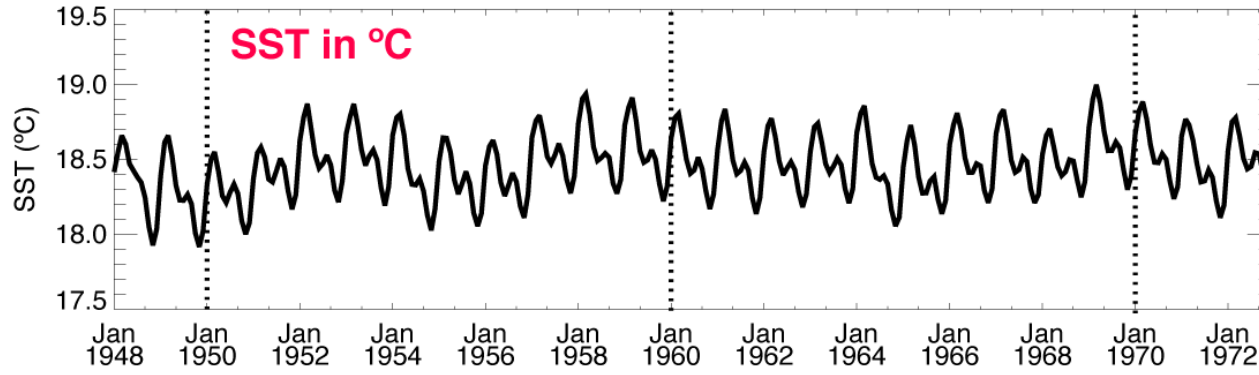


Global Average Salinity (psu)



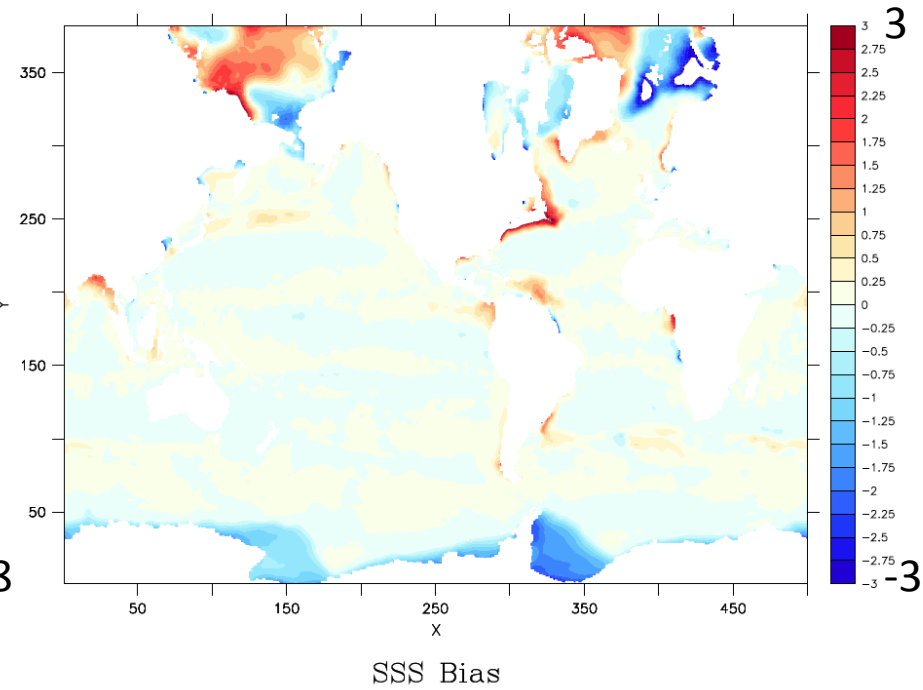
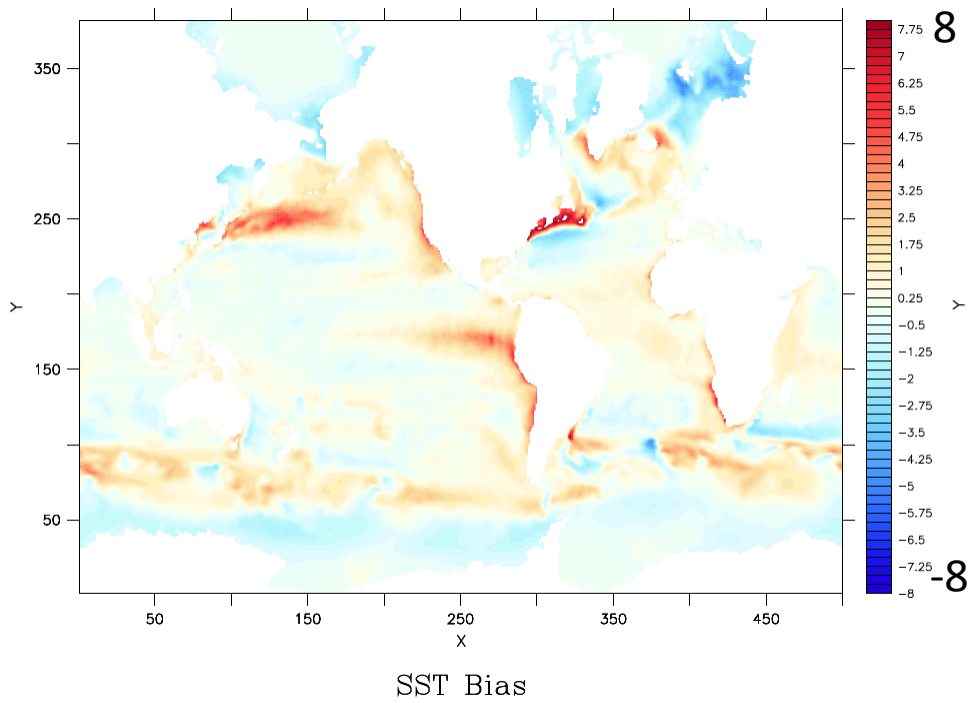
For GLBt0.72:

Time series of Global Mean SST , SSS and SSH



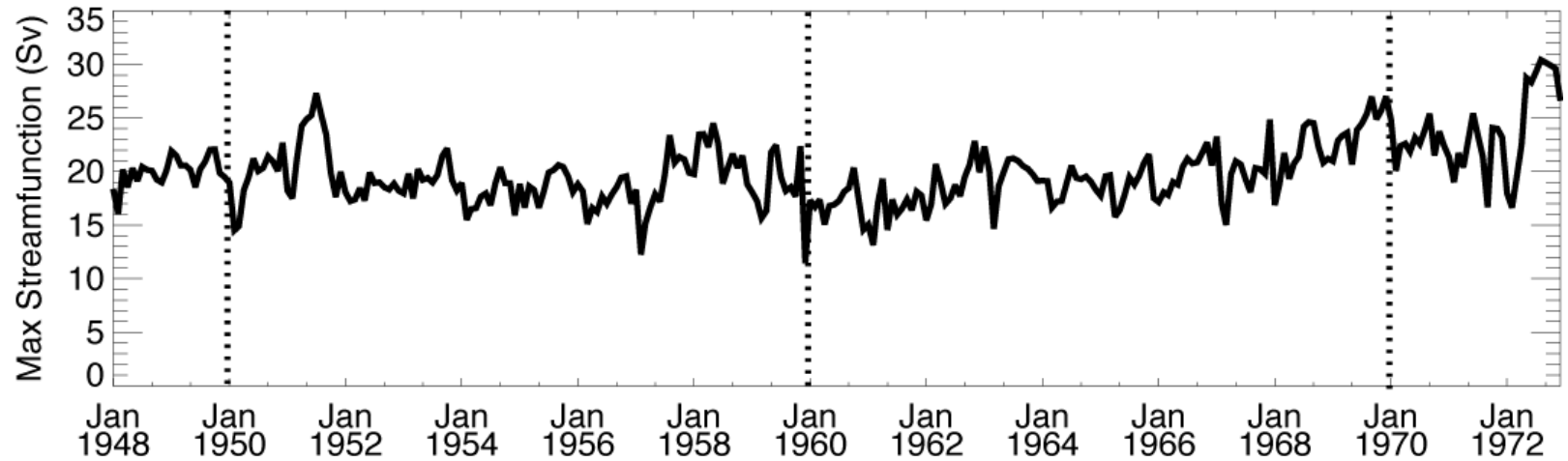
For GLBt0.72:

SST and SSS Bias: Last 5 Year Mean SST/SSS – Climatology (GDEM4)

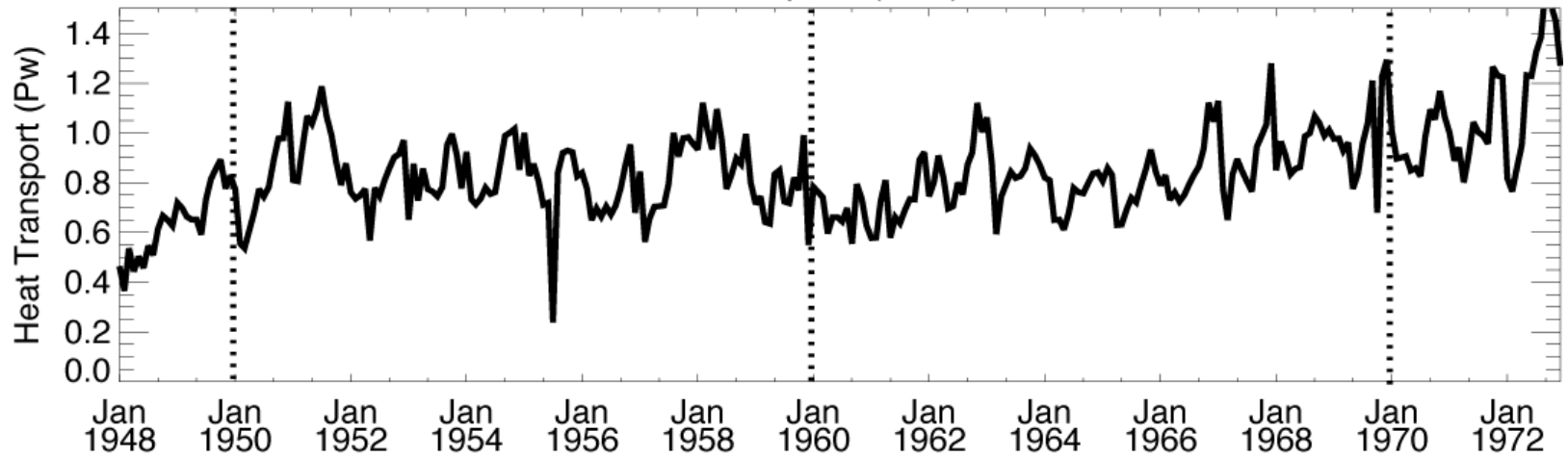


For GLBt0.72:

Maximum Streamfunction at 45°N



Heat Transport (PW) at 45°N



For GLBt0.72:

Disappearance of the MOW in the first 25 years.

