South Atlantic circulation from global 1/12° resolution simulations

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WORK IN PROGRESS Study of the Global 1/12º HYCOM products for the South Atlantic.

Objectives:

- Analyze different models and compare with observations
- Determine the main characteristics of the modeled South Atlantic flows, in particular in relation to the Atlantic Meridional Overturning Circulation

SIMULATIONS:

HYCOM global 1/12° produced at NRL:

- Climatological simulation (expt 09.4) with updated forcing (ECMWF with satellite corrected winds, with 6hourly anomalies), updated source and layer structure.
- 2004-2006 simulation, NOGAPS winds.
- Hindcast 2004-2006 (with data assimilation) (simulations produced by Metzger, Smedstad, Wallcraf; Chassignet and Hurlburt Pls)
- Regional model for extra diagnostics



AOML High density XBT lines:

•Temperature from AOML high density XBT lines,

•Salinity, based on historical T/S relationship (derived from CTD and Argo floats)

Upper ~800m

climatological interannual hindcast

lay	σ2*	Depth (m)	lay	σ ₂ *	Depth (m)	lay	σ ₂ *	Depth (m)
1-19	≤ 36.52	<1200	1-19	≤ 36.52	<1200	1-17	≤36.20	<1000
20-28	36.62- 37.06	<4000	20-27	36.62- 37.06	<4000	18-27	36.38- 37.06	<4000
29-32	≥ 37.09	>4000	28-32	≥ 37.10	>4000	28-32	≥37.10	>4000

Climatological model AMOC (yr 15)



Hindcast AMOC (yr 2005)



Nested model, as global model, with purpose of saving extra diagnostic quantities. Boundary conditions from global model.



S. Atlantic volume transport: upper, deep, bottom

daily archives (full), and every time step flux (dashed)

(regional model shows lower Drake transport than global model, 130 Sv vs 150 Sv)

From Dong, Garzoli, Baringer



Temperature from AOML high density XBT lines,
salinity, based on historical T/S relationship (derived from CTD and Argo floats)

Drake passage:

Seasonal cycle of volume and heat transport

(Observational transports from

Dong, Garzoli, Baringer)

Volume transport (SV)

Temperature transport (Pw)

Observations Climatol. HYCOM expt 09.4 (yr 11-15) Interannual HYCOM expt 05.8 Hindcast

South Atlantic circulation: Upper, intermediate, deep

SACW (100-500m) AAIW (500-1200m) NADW (>2000m)

Adapted from Stramma & England 1999

11S velocity section

6 year mean expt 09.4

v-velocity zonal sec. 10.97s mean: 10.001- 15.001 [09.4H]

Deep south: -19.3Sv Deep north: 4.1Sv Net deep: -15.2Sv

Upper 22.8 Sv

5 section avg Schott et al, JPO 2005

Deep south: -35.5Sv Deep north: 18.9Sv Net deep: -16.6Sv

Upper 23.8Sv

Transport: Upper branch (integrated in layers) interannual

Hindcast

Color plots: longitudinal dependence of meridional transport integrated from the west (from 70W).

11.6

99

9.6

11.5

11.2

54.9

11.3

21.0

-14.4

Box: region of closed sections. Brazil Current intensifies to the south in Climatolog. and Interannual expts

Transport: Deep branch

Hindcast

Color plots: longitudinal dependence of meridional transport integrated from west.

Transport: Bottom branch

Hindcast

Conclusions

Simulations reproduce the known aspects of the South Atlantic circulation, for the upper and deep flow: main currents and locations, mean pathways. Temperature transport time series at Drake passage is in good agreement between model and observations.

Future work

Further identification of mean pathways and quantification of the current transports in all the simulations.

Comparison with Argo floats reconstructions.

Estimation of water mass transformations from HYCOM.