

# Comparing sea-surface topography modes of variability from altimetry and global models

Bernard Barnier, Thierry Penduff, Mélanie Juza

## ▶ To cite this version:

Bernard Barnier, Thierry Penduff, Mélanie Juza. Comparing sea-surface topography modes of variability from altimetry and global models. Ocean Surface Topography Science Team (OST/ST) Meeting, Mar 2007, Hobart, Australia. 2007. hal-00267048

HAL Id: hal-00267048

https://hal.science/hal-00267048

Submitted on 25 Mar 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers. L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.







# COMPARING SEA-SURFACE TOPOGRAPHY MODES OF VARIABILITY FROM ALTIMETRY AND GLOBAL MODELS

Bernard BARNIER Thierry PENDUFF Mélanie JUZA



2° MODEL

Laplacian momentum

Mixing, GM90

1/4° MODEL

Biharmonic momentun

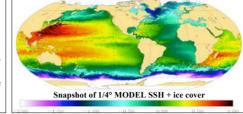
Mixing

+ CFC/14C tracers

#### DRAKKAR



The international DRAKKAR program is building a hierarchy of ocean/sea-ice/passive tracer models to simulate and study the dynamical processes involved in the oceanic variability and scale interactions. This ensemble includes 1/2° and 1/4° configurations of the Global Ocean, 1/4° and (soon) 1/12° models of the Atlantic Ocean (30°S-80°N), all forced over the period 1950's-present by various reanalysed and observed atmospheric fields through bulk formulae. Reanalyses since 1950 will be conducted at Mercator with the 1/4° global model.



#### GLOBAL MODEL SETUPS

- NEMO code (OPA9 ocean + LIM sea-ice)
- Partial steps+BBL, TKE mixed layer (waves+Langmuir cells)
- · Advection: enstr./energy conserv. (momentum). FCT (tracers)
- · Isopycnal laplacian tracer mixing.

#### 1958-2004 FORCING (Brodeau, Barnier et al)

- · CORE bulk formulae. Dai & Trenberth monthly runoffs.
- . 6-hourly ERA40 (T.g.wind) + CORE LW/SW radiative fluxes
- No SST restoring. But SSS restoring (τ=36 days on 1st level)

SAME FORCING FOR THE 2° AND THF 1/4° SIMULATIONS

#### ABSTRACT

The quasi-global sea-level anomaly AVISO altimetric database (weekly SLA, 1993-present) is compared with its collocated counterparts simulated by the models in various wavenumber-frequency bands. This assessment concerns the structure&intensity of the leading modes of variability at global and basin scale, the part of the observed SLA variance simulated by the model (and their mutual correlation), and local investigations of the simulated and observed variabilities in selected regions. We discuss realism of the variability simulated by the 2° and the 1/4° global models with the same forcing, and the sensitivity to resolution is commented. More generally, this validation procedure is applied to all DRAKKAR simulations to guide physical investigations, characterize the structure of model biases, and assess the impact of numerical and physical choices.

See the Poster by Penduff, Juza, Barnier concerning validation against hydrography

#### **PROCESSING**

AVISO SLA(x,v,t) database asiglobal, 1993-2004

MODEL

 Mask MODEL under AVISO Ice · Linear detrending of full datasets

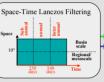
· Trilinear collocation

• Remove 1993-1999 means · Remove spatial averages

on 1/3°x1/3°x7day AVISO Map

· Mask AVISO under MODEL Ice

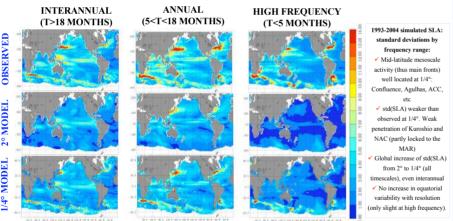








### GLOBAL Std(SLA) BY FREOUENCY RANGE (cm)

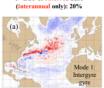


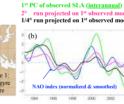
# MODES OF INTERANNUAL VARIABILITY

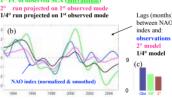
The ability of the 2° and 1/4° model to reproduce the observed interannual variability is compared in various regions as follows: -Compute the first 4 EOFs of observed interannual SLA variability in key regions (1st observed N.Atl. mode shown in Fig. a. associated PC is green in Fig. b)

- -Project the 2° and 1/4° simulated SLA fields on these 4 observed modes (time series of these projections shown for the 1st mode in Fig b for the two runs)
- -Compare the variances of these projections with the variances of each observed mode (shown in Fig d)
- -Compare the correlations between these projections and the observed PC of each observed mode (shown in Fig d)

#### NORTH ATLANTIC 1st EOF of observed SLA







The 1st EOF of observed SLA at nual scales corresponds to Marshall et al (2001)'s intergyre gyre, which reflects the NAO impact

transitions (e.g. 1995, 1999). The projections of both simulated SLA on this mode reproduce the main features of this observed variability

NAO index by 6.5 months. The simulated lag is more realistic at 1/4° than at 2°



Obs/model

SLA correlation

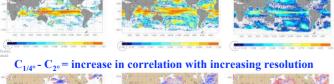
% of observed

nth EOF

variance

the first 4 observed modes of North Atlantic interannual variability (more explained variance, better correlation)

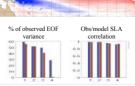
# C<sub>1/4°</sub> = temporal correlation [observed SLA, 1/4° model SLA]



1993-2004 simulated SLA: Impact of resolution on local SLA correlation with obs:

- low-lat: realistic both at 1/4° & 2° elsewhere: no clear improvement
- low-lat: slight improvement - coastal zones: clear improvement ✓ High frequency
- hetter: coastal zones
- midlatitudes, north high latitudes eastern basins
- worse: ACC 10°N/S bands

# EQUATORIAL PAFICIC 1st EOF of observed SLA (interannual only): 51% Mode 1 ENSO







The 1/4° model represents the leading modes of observed interannual variability better than the 2° model: - simulated counterparts of observed

modes are stronger at 1/40 - higher correlation between

timeseries of observed modes and their model projection

 true in most regions investigated Pacific., etc.)

More realistic lag with NAO in the North Atlantic

Other regions are currently under investigation