A hindcast experiment with the 1/12° North Atlantic HYCOM model: an upgrade of the current assimilation system

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* This work is based on results from european Diadem / Topaz projects: J.M. Brankart, F. Birol, P. Brasseur, LEGI-CNRS see P. Brasseur talk

* Time schedule:

 \rightarrow from 2003 to June 2004: benchmark with $1/3^\circ$ North Atlantic configuration + NRL input data: altimetry, MODAS SST, GDEM3 SSS, Niiler Mean SSH

 \rightarrow from July to December 2004: hindcast experiment with $1/12^\circ$ North Atlantic configuration

 \rightarrow January to July 2005: validation, diagnostics, paper

* See this paper for exhaustive results:

L. Parent, J.M. Brankart, O.M. Smedstad, A.J. Wallcraft, T.L. Townsend, P. Brasseur, H.E. Hurlburt, G.A. Jacobs and E.P. Chassignet

A data assimilative $1/12^{\circ}$ North Atlantic hindcast experiment using HYCOM: towards a reduced Kalman filter approach

submitted to Christian Le Provost Special Issue of Ocean Dynamics: available on http://hycom.rsmas.miami.edu

The HYCOM $1/12^{\circ}$ North Atlantic configuration

- source code: src_2.1.27_sig2a_28_mpi
- use the FCT advection scheme, KPP
- 3°-wide buffer zones: monthly GDEM3 climatology
- forcing fields: use ECMWF mean + FNMOC
- bulk parameterization
- no SST relaxation
- SSS GDEM3 relaxation
- interannual run: July 1998 \rightarrow September 2004

- it is not the latest simulation: see T. Townsend talk about the last progress / developments of this configuration

The System

- SEEK filter + Cooper&Haines
- T/P + ERS2 along track data + Niiler Mean SSH
- MODAS SST (operational gridded SST product)
- SSS from GDEM3 climatology
- hindcast experiment: July 1998 to August 1999

- estimation of the Eofs: 1998-2001 period of the reference run frequency of the snapshots: 14 days smoothing operator: 36 x 36 points, ${\sim}2.3^\circ$ at 40°N

Impact of the smoothing operator



 $100^{\circ}W 95^{\circ}W 90^{\circ}W 85^{\circ}W 80^{\circ}W 75^{\circ}W 70^{\circ}W 65^{\circ}W 60^{\circ}W 55^{\circ}W 50^{\circ}W 45^{\circ}W$







data mask / correction mask







\rightarrow it is necessary to build a 'good' MSSH product

Results, see my paper (August 1998 \rightarrow August 1999)

Rms misfit compared to SSH / SST assimilated data



Control of the SSH / SST bias

SSH

SST







SSH



SSH Standard Deviation



Comparison with in-situ data

Surface Currents





Northward heat transport



Front detection Laurence Crosnier (MERCATOR / MERSEA)



Conclusion and Discussion

* The system:

- it is not plug & play or black box
- the model is very expensive: cannot tune the system
- evaluation of the performances: \rightarrow validation team
- build a 'good' MSSH: who ?

* Results

- SEEK filter + Cooper&Haines is OK with $1/12^{\circ}$ N. Atlantic
- pb in the Mediterranean Sea
- equatorial band: turn off the assimilation
- it needs a better control of the mesoscale dynamics
- assimilate a T/S/P climatology to limit the bias

* Since July

support the implementation of the NCODA system: $1/12^\circ$ GOM in a sigma-z vertical coordinate