

Towards the implementation of the SEEK filter with the Hycom model

L. Parent, HYCOM consortium
Naval Research Laboratory (USA), Legi (France)

HYCOM Meeting
October 27-29th 2004

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE OCT 2004		2. REPORT TYPE		3. DATES COVERED 00-00-2004 to 00-00-2004	
4. TITLE AND SUBTITLE Towards the implementation of the SEEK filter with the Hycom model				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Research Laboratory,Stennis Space Center,MS,39529				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES 8th HYCOM NOPP GODAE Meeting, Oct. 27-29, 2004, RSMAS, Miami, FL					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 14	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Last Fiscal Year

- use the low resolution of the North Atlantic configuration: $1/3^\circ$, sigma0
- large processing regarding the Mean SSH, thanks to O.M. Smedstad: how to combine different Mean SSH products ?
- the Mediteranean Sea:
it is an issue for the HYCOM model and the assimilation of altimetry. It was partly fixed → take care about the merge of Atlantic Mean SSH + Mediteranean Mean SSH

Since Summer

- start to work with the high resolution configuration: $1/12^\circ$, sigma2*
- it's not only a more expensive configuration, it also needs to change some parameters of the assimilation system

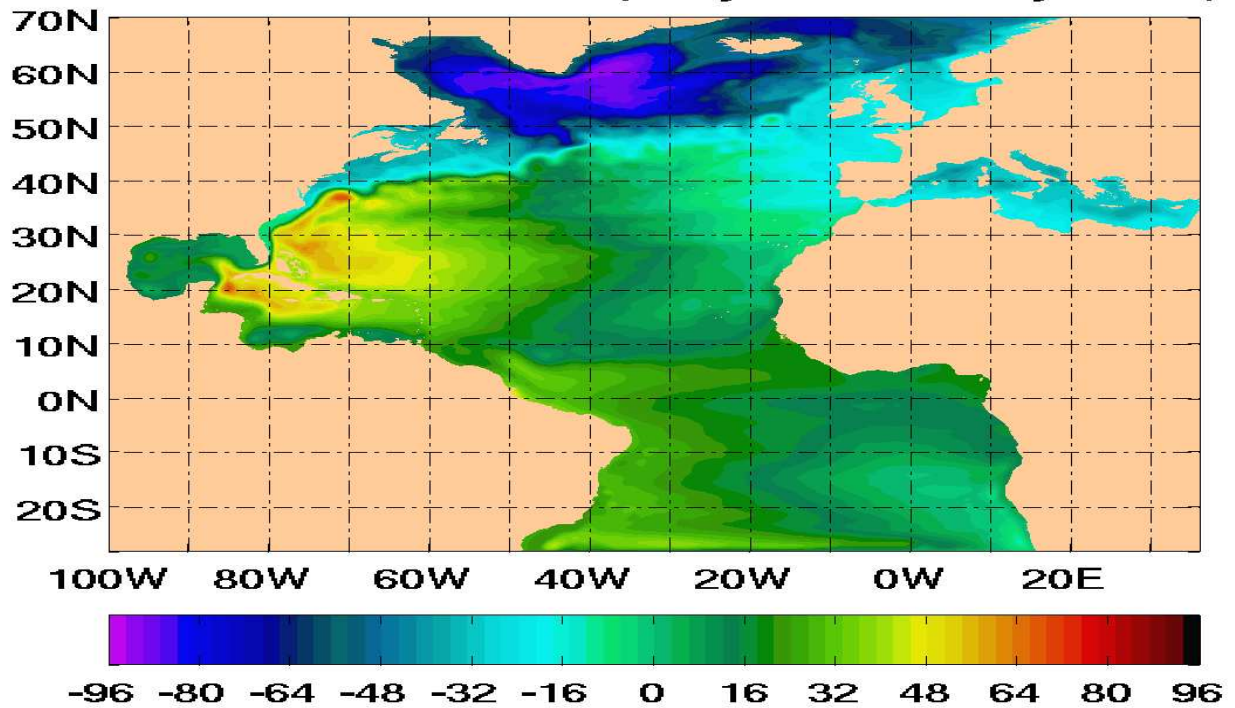
The 1/12° North Atlantic configuration, a brief description (see T. Townsend's talk)

- source code: src_2.1.27_sig2a_28_mpi
experiment number: 11.2
- use the FCT advection scheme, KPP
- no bottom boundary layer (BBL)
- northern and southern boundaries:
33-120 day e-folding time (GDEM3 climatology)
- forcing fields: use ECMWF mean + FNMOC
- no SST relaxation
- SSS GDEM3 relaxation
- interannual run: July 1998 → September 2004
- thermobaricity effect on SSH (sigma2*):
don't forget this !!

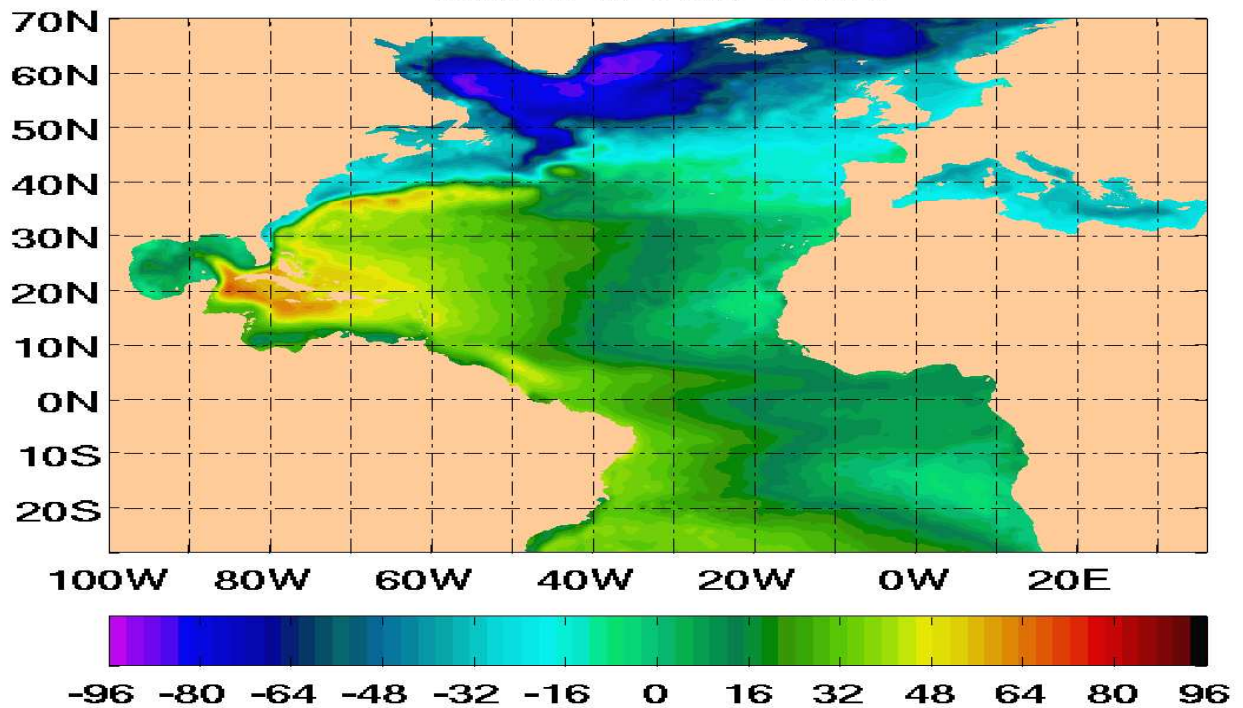
The assimilated data: SSH, SST, SSS

- **AVHRR SST**: ~9km resolution (from JPL)
 - clouds → large area without data during winter
 - suggestion: to add an other product (MODAS)
- **GDEM3 SSS** climatology (monthly)
- **SLA**: Topex, ERS2, GFO, Jason1, Envisat when available
- **Mean SSH**: based onto Niiler's Mean SSH
 - + processing
 - Mediteranean Sea: add the HYCOM Mean SSH (sigma0 run)
 - North Sea: from the Nowcast/Forecast System
 - spatial interpolation onto the HYCOM grid
 - ...

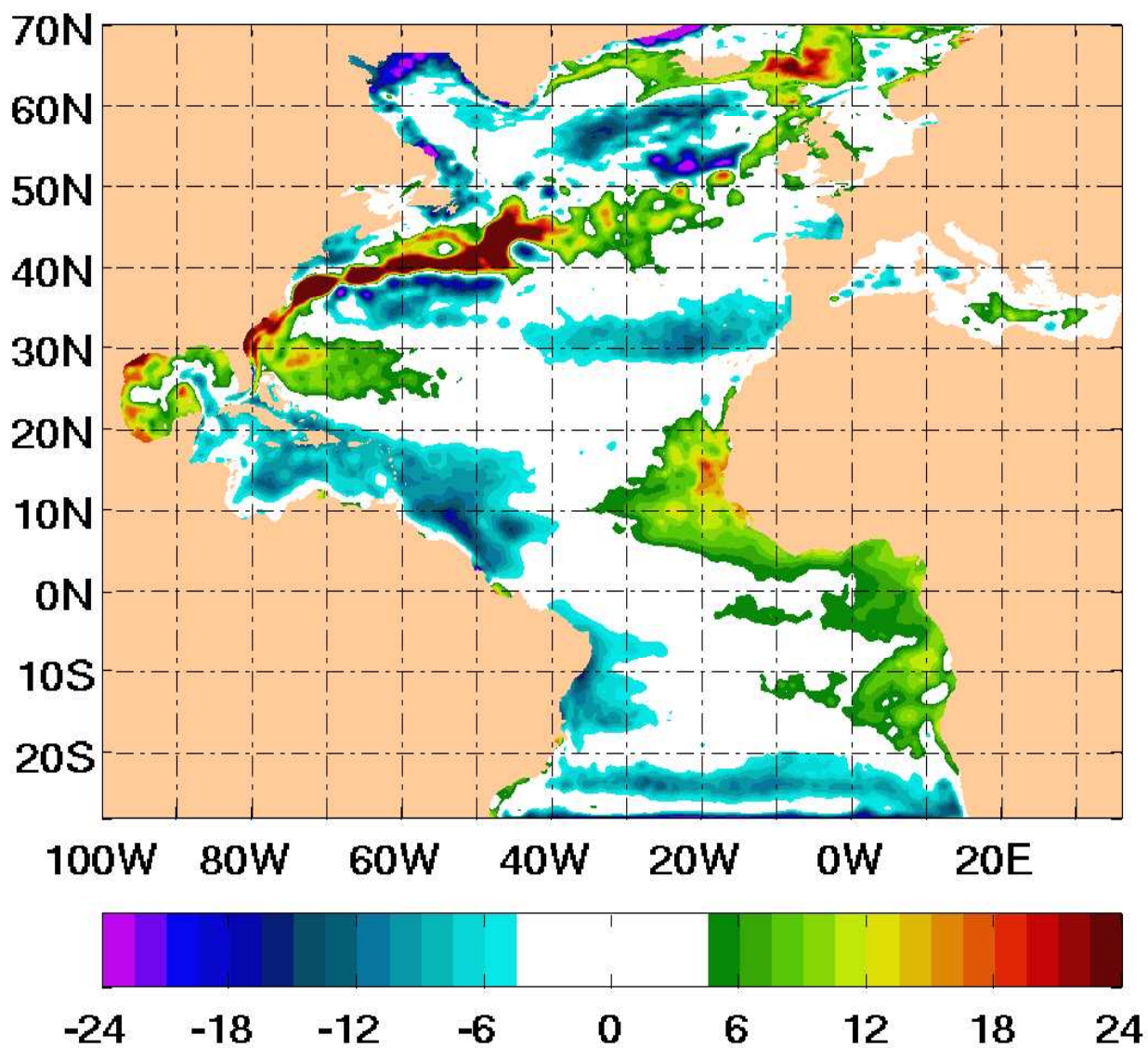
HYCOM Mean SSH (July 1998 - July 2001)



Niiler Mean SSH

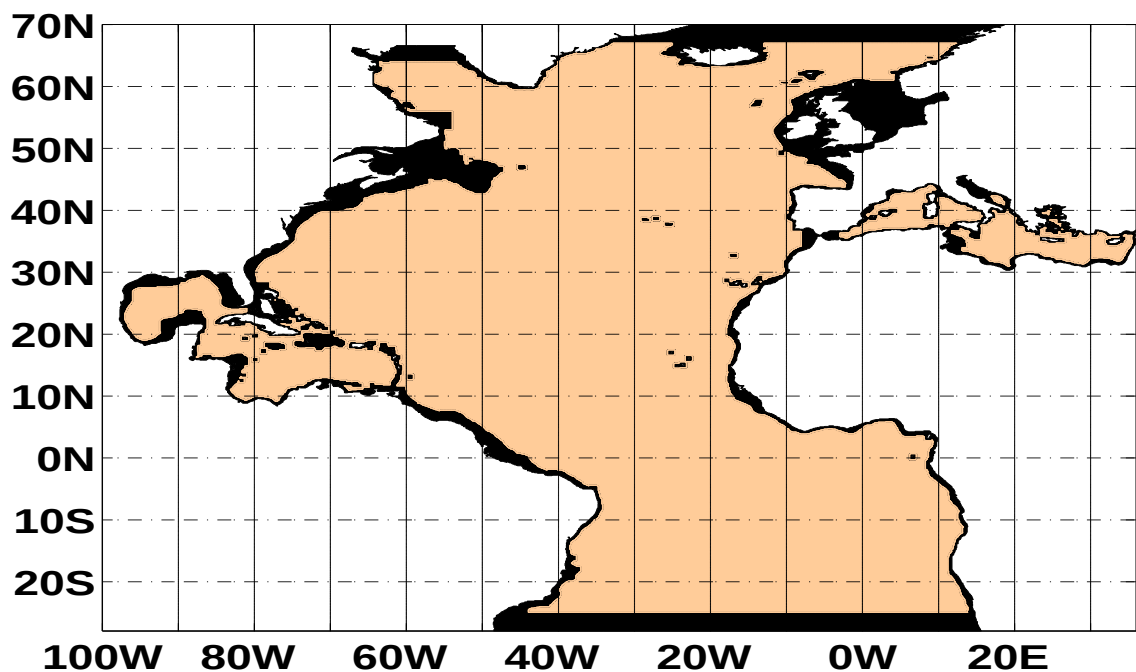


HYCOM - Niiler Mean SSH



- **Mask SLA data:**

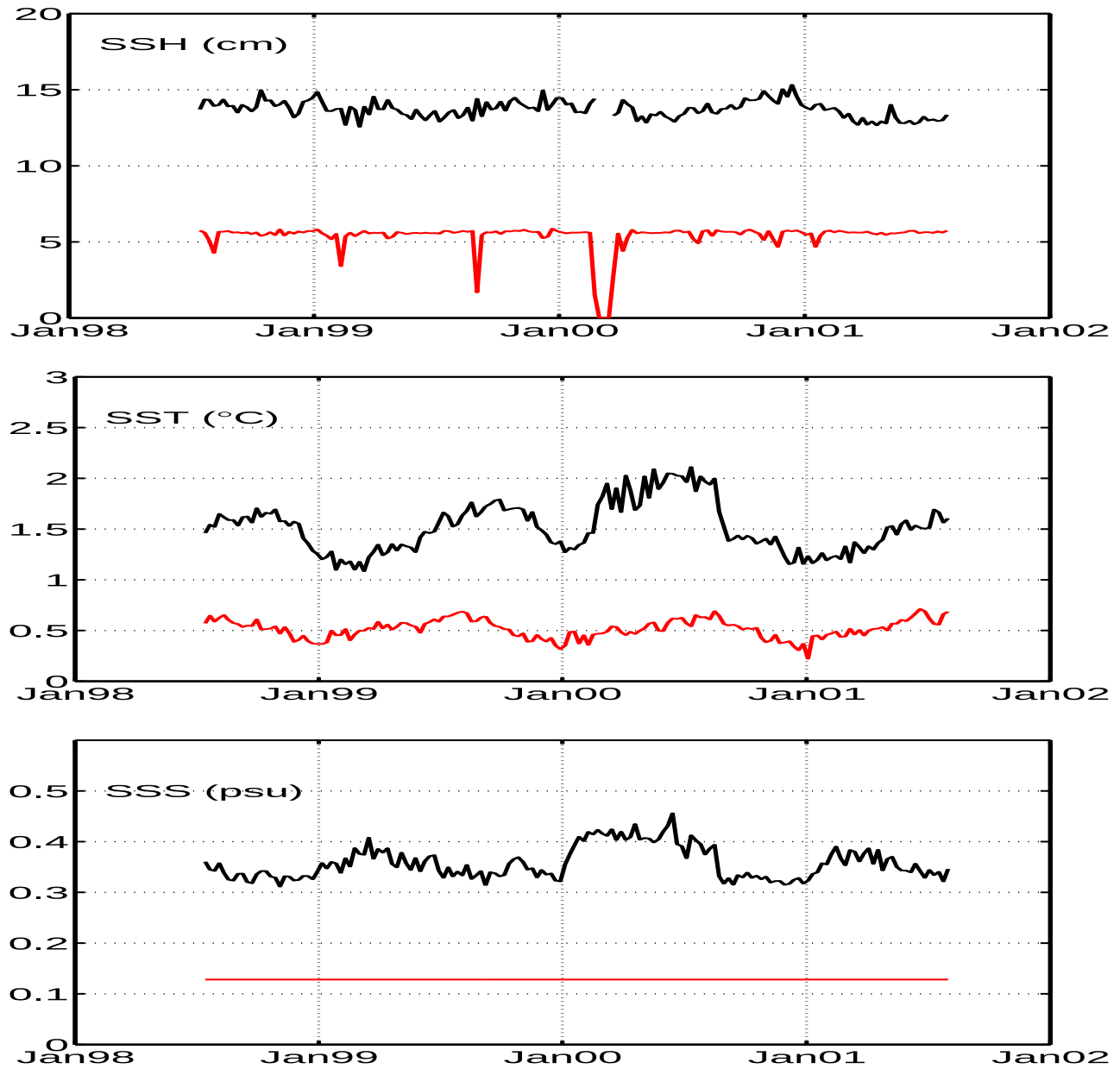
- problem with the SLA signal near coasts
- problem with the tidal model onto shelves
- bad Niiler's Mean SSH $\rightarrow$ mask



- no assimilation near Gibraltar Strait
- if $\text{abs}(\text{SLA}) \geq 1.5$ meter: data is removed

The Rms misfit of the free run

— rms misfit — data number



the first analysis stage: July, 8th 1998

- assimilation frequency: 7 days
- estimation of the error covariance matrix:
Eof analysis , 14 days frequency,
July 1998 → July 2001
- local analysis: same as $1/3^\circ$
size of the influence data bubble is 4°

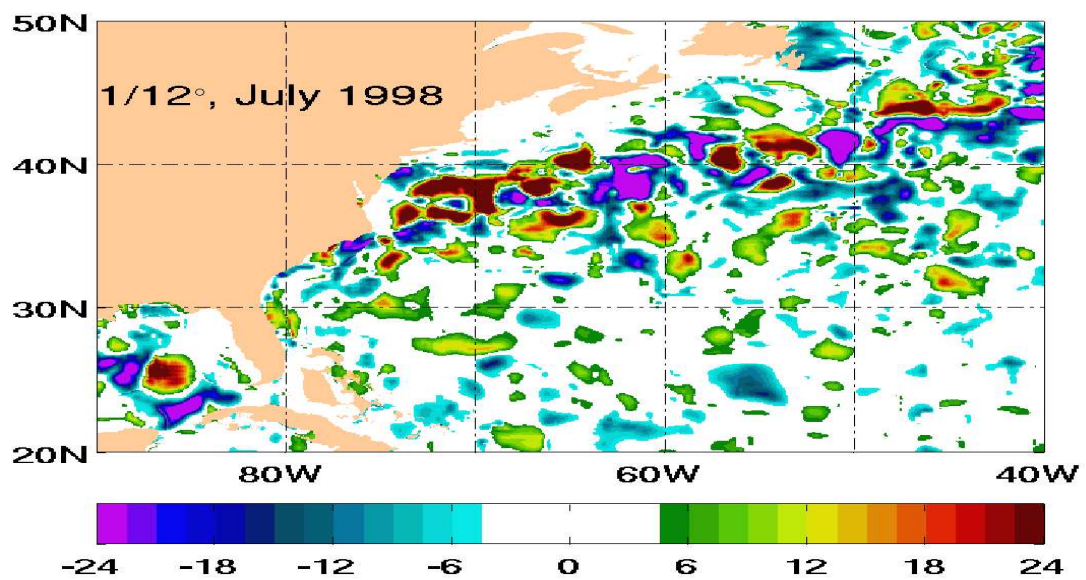
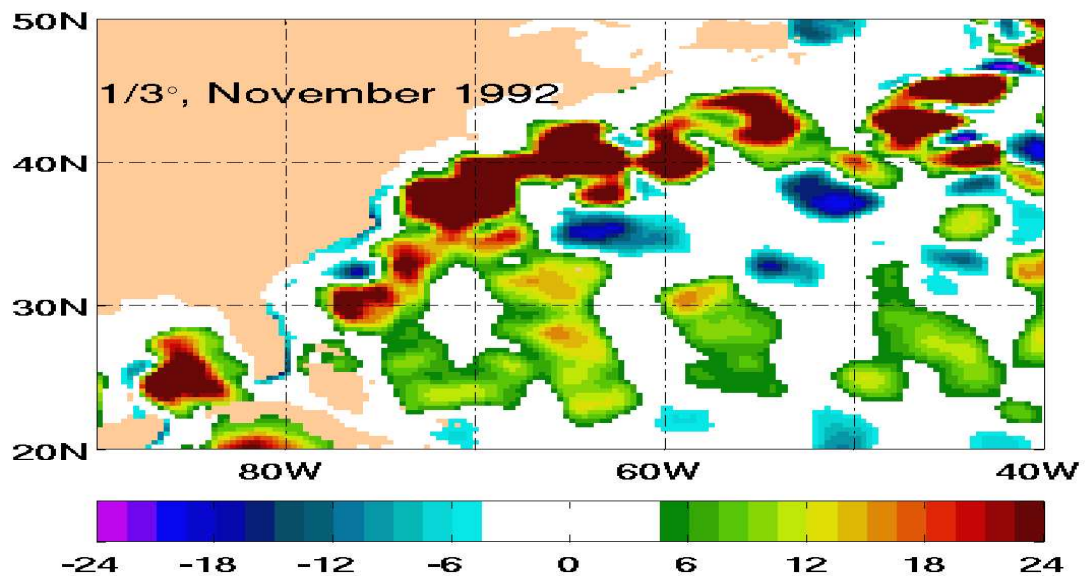
there is a reduction of the Rms misfit:

14cm → 10cm (Topex SLA)

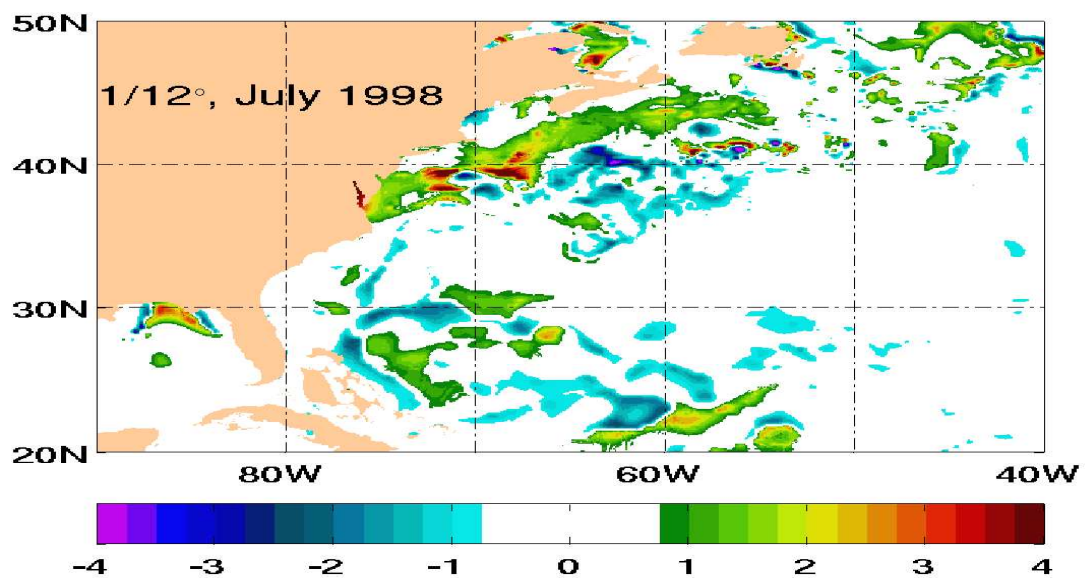
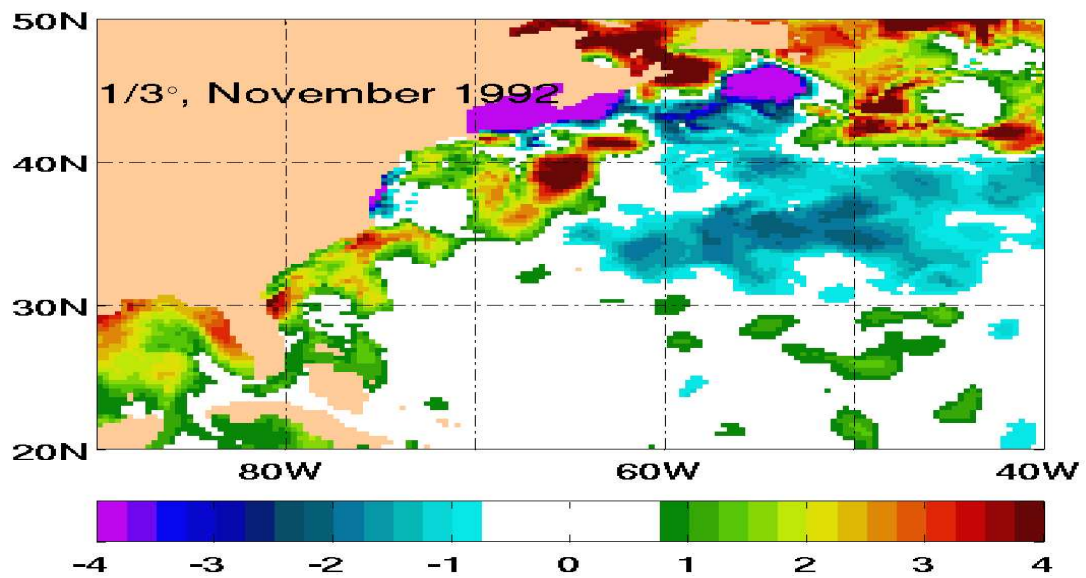
1.5°C → 0.8°C (AVHRR SST)

but the analysis SSH, SST or SSS is too noisy

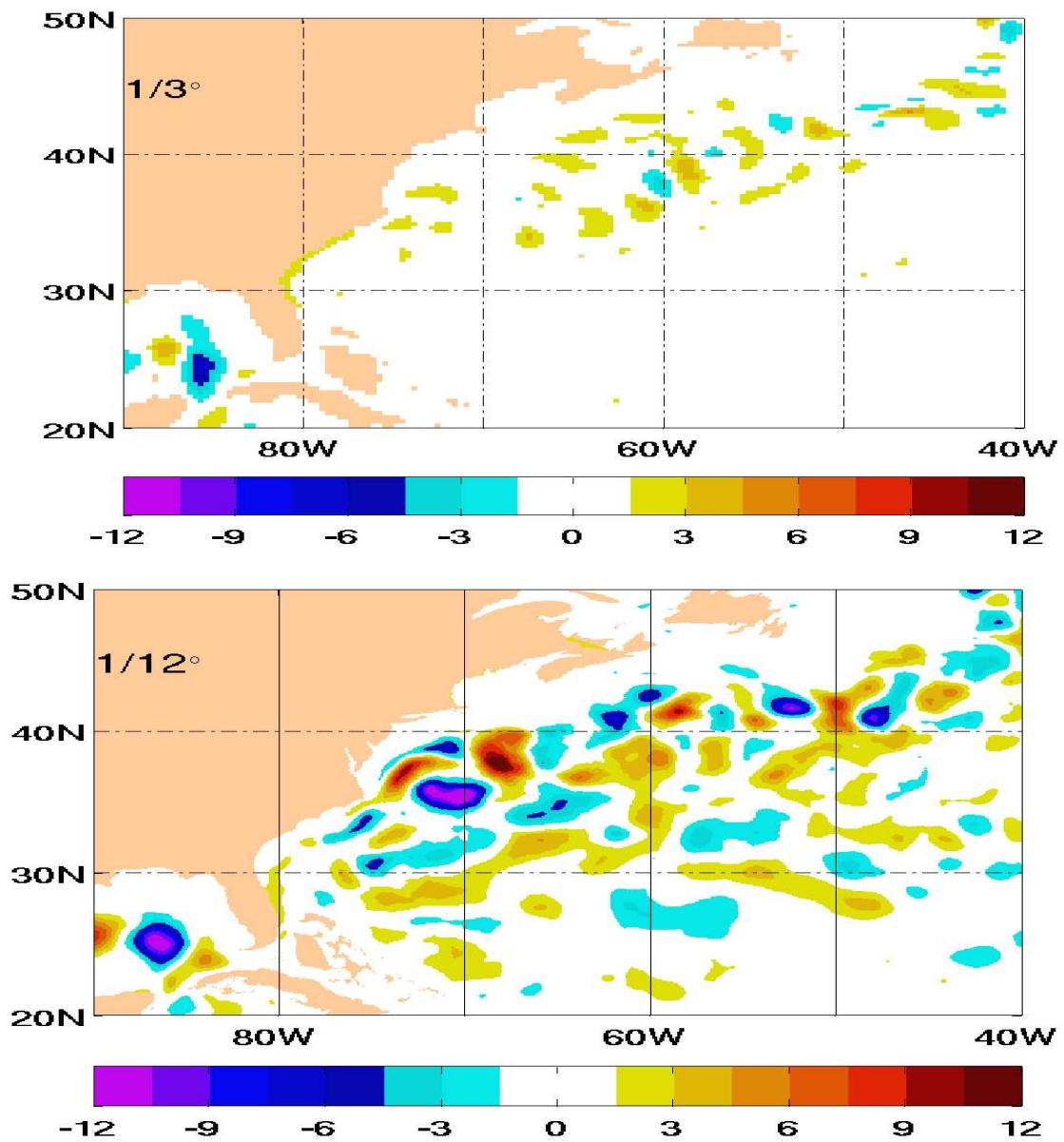
the first SSH analysis stage: $\mathbf{x_f - x_a}$



the first SST analysis stage: xf-xa



Eof 10 - SSH variable



It means that you need to change some parameters of the assimilation system. Which one ?

Note that the assimilation scheme has to correct the bias (large scale) + eddies (small scale)

example of parameters:

- the number of Eofs
- the size of the influence data bubble: $4^\circ \rightarrow ?$
- smooth snapshots before the estimation of the error covariance matrix
- to split the analysis stage in 2 parts: large / small scale
 - during the first stages: reduce the bias (SSH, SST, SSS) with a smooth error covariance matrix
 - then to use an unsmooth error covariance matrix
 - to use something like a "leap-frog error covariance matrix"

It's underway . . .

Conclusion

there are some problems regarding the analysis stage, not only because of the size but because the dynamics is different

- is it impossible to solve these problems: no
- does it take a while: probably
- when it is fixed, we can focus on the restart of the model:
it might be straightforward (same as $1/3^\circ$)
or not ...