Towards the implementation of the SEEK filter with the Hycom model

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Last Fiscal Year

- use the low resolution of the North Atlantic configuration: $1/3°$, 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 $\rightarrow$ take care about the merge of Atlantic Mean SSH + Mediteranean Mean SSH

Since Summer

- start to work with the high resolution configuration: $1/12°$, 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 $\rightarrow$ September 2004

- thermobaricity effect on SSH (sigma2*):
  don't forget this !!

The assimilated data: SSH, SST, SSS

- **AVHRR SST**: $\sim$9km resolution (from JPL)
  - clouds $\rightarrow$ 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
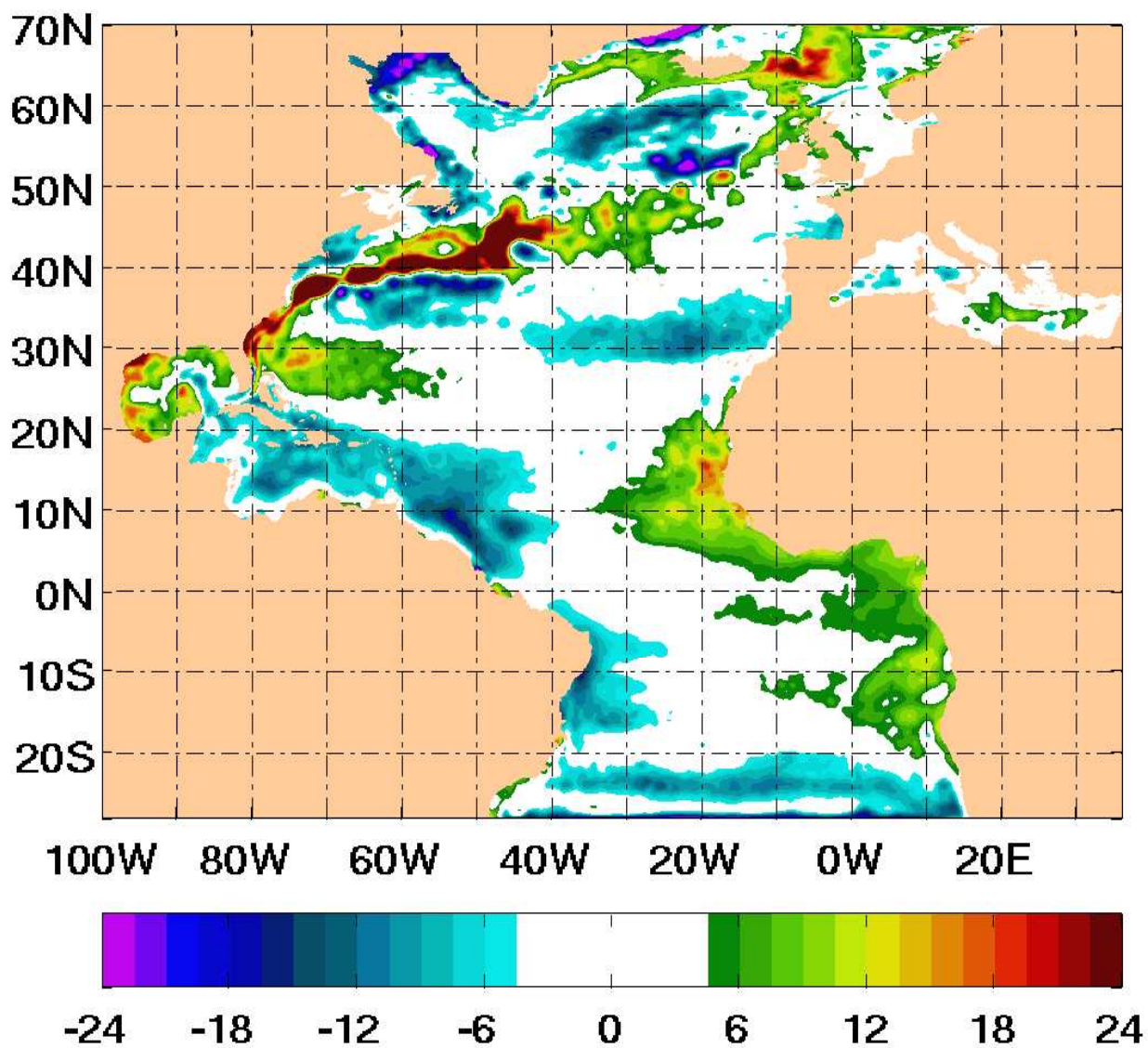 - spatial interpolation onto the HYCOM grid
  . . .

HYCOM Mean SSH (July 1998 - July 2001)
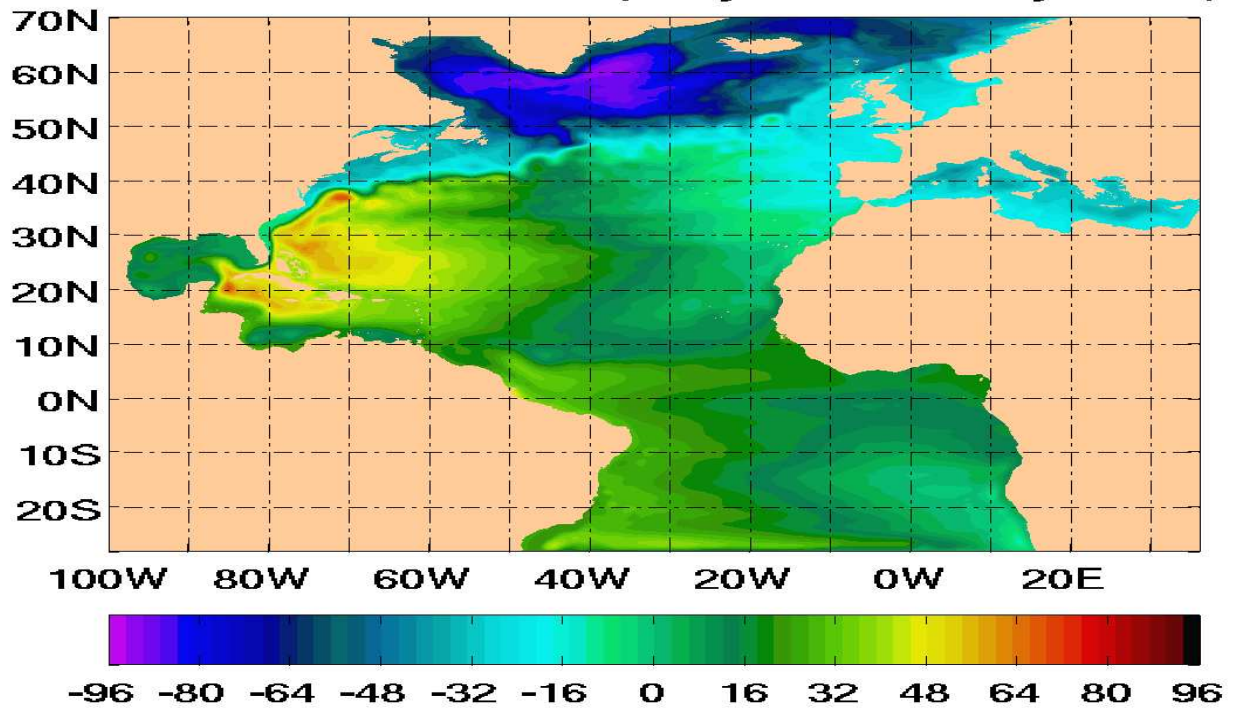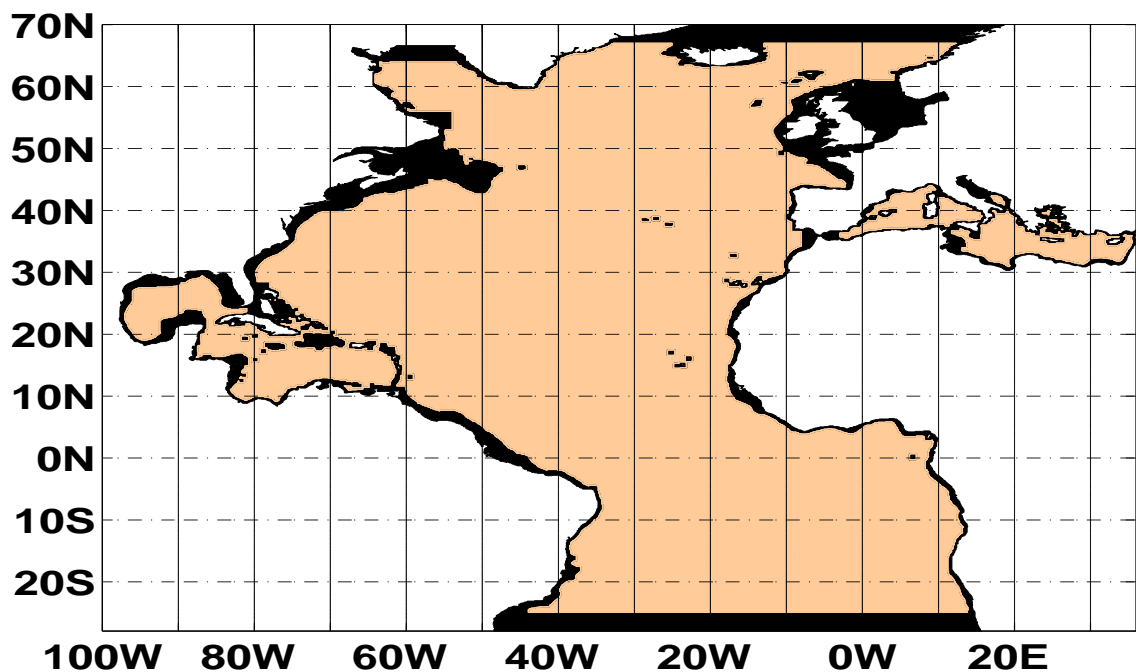

Niiler Mean SSH
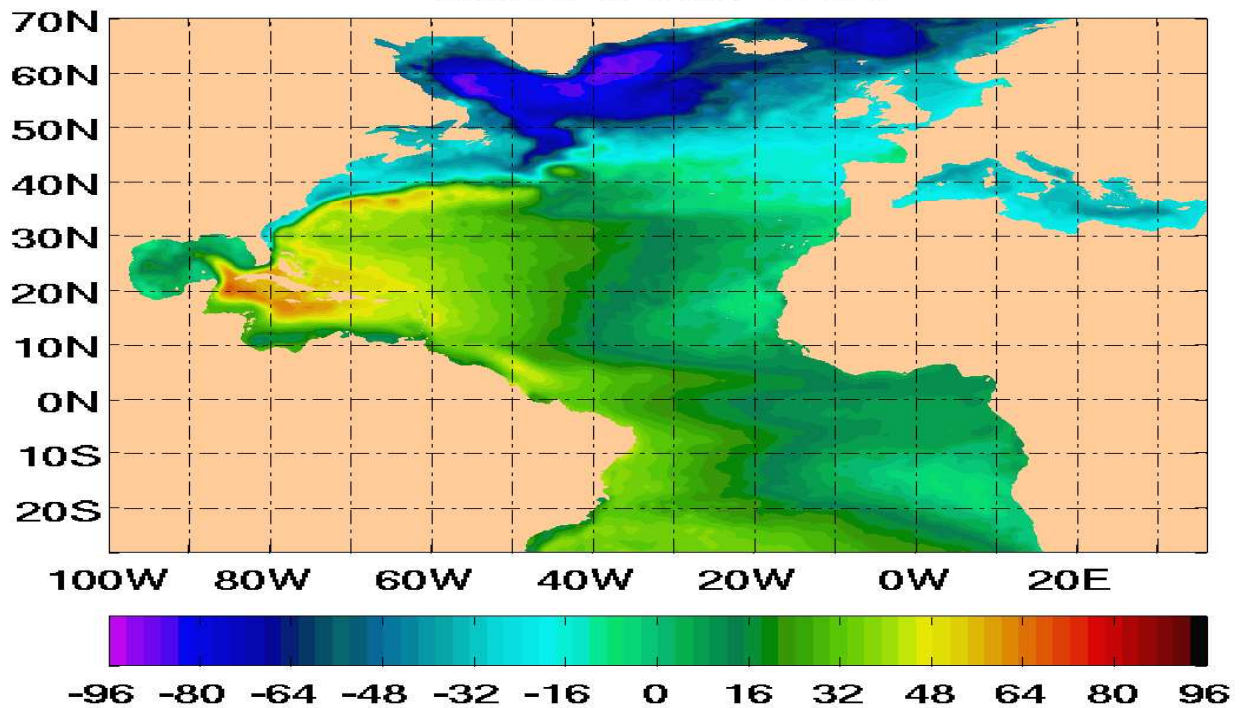
HYCOM - Niiler Mean SSH

- **Mask SLA data**:
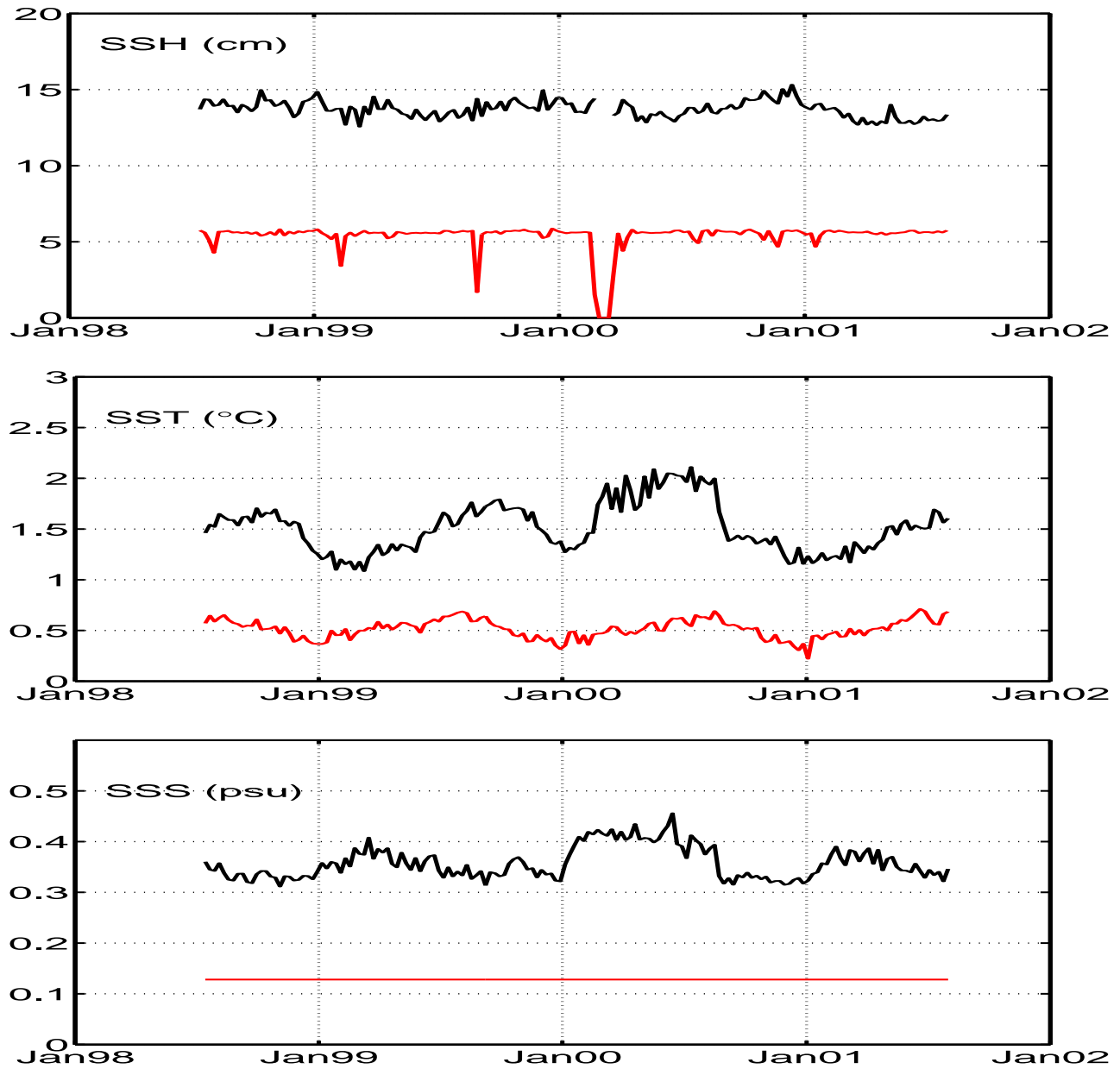 - problem with the SLA signal near coasts
  - problem with the tidal model onto shelves
  - bad Niiler's Mean SSH → mask

  - no assimilation near Gibraltar Strait
  - if abs(SLA) ≥ 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 $\rightarrow$ July 2001

- local analysis: same as $1/3^\circ$
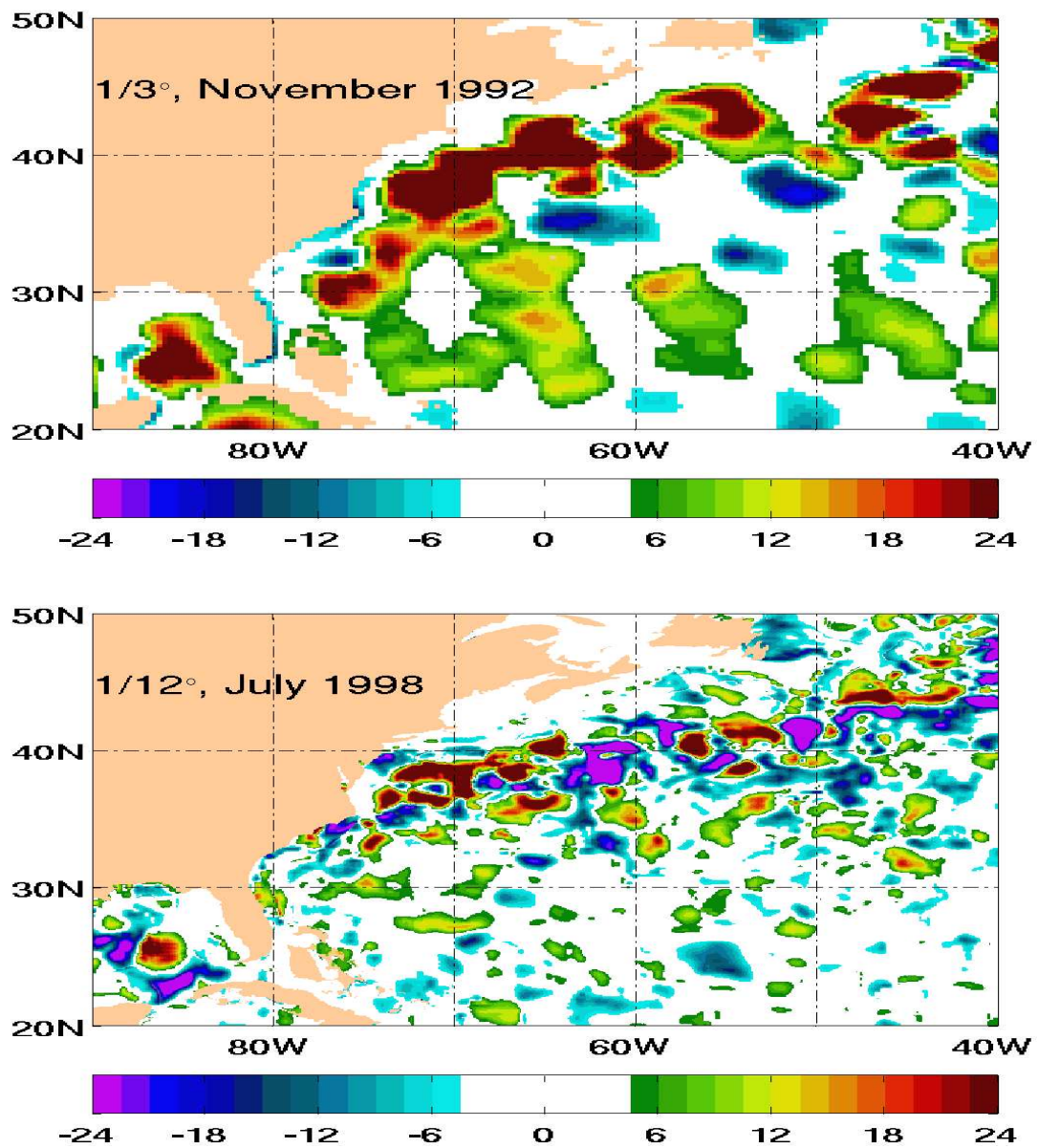 size of the influence data bubble is 4°

there is a reduction of the Rms misfit:
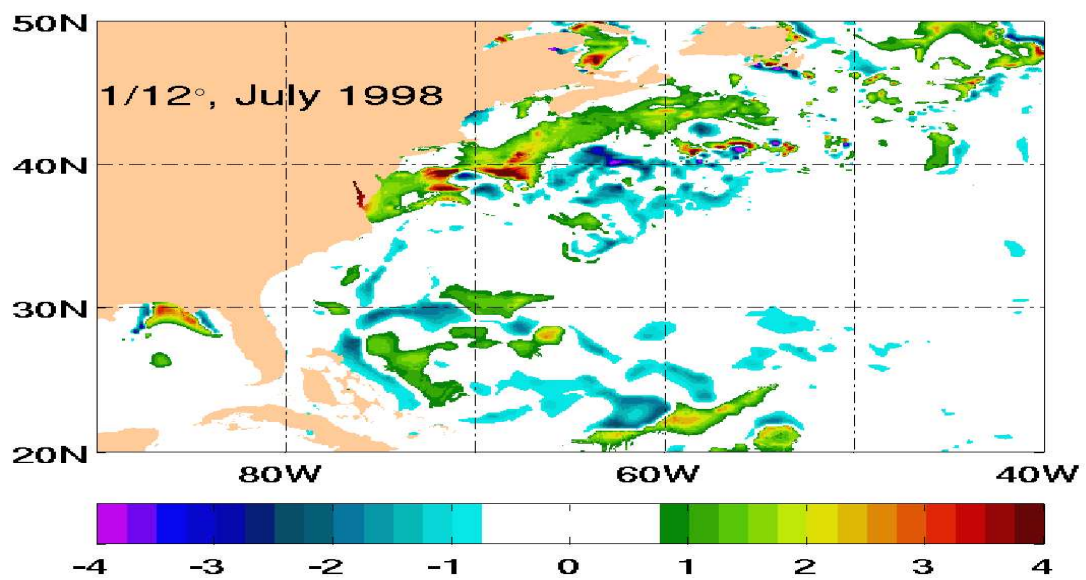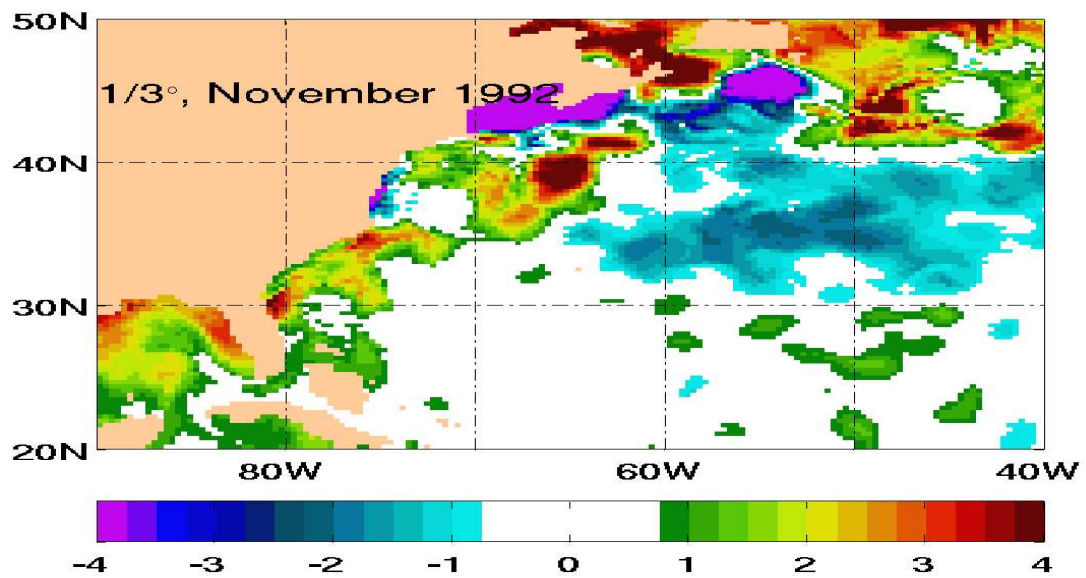14cm $\rightarrow$ 10cm (Topex SLA)
1.5°C $\rightarrow$ 0.8°C (AVHRR SST)

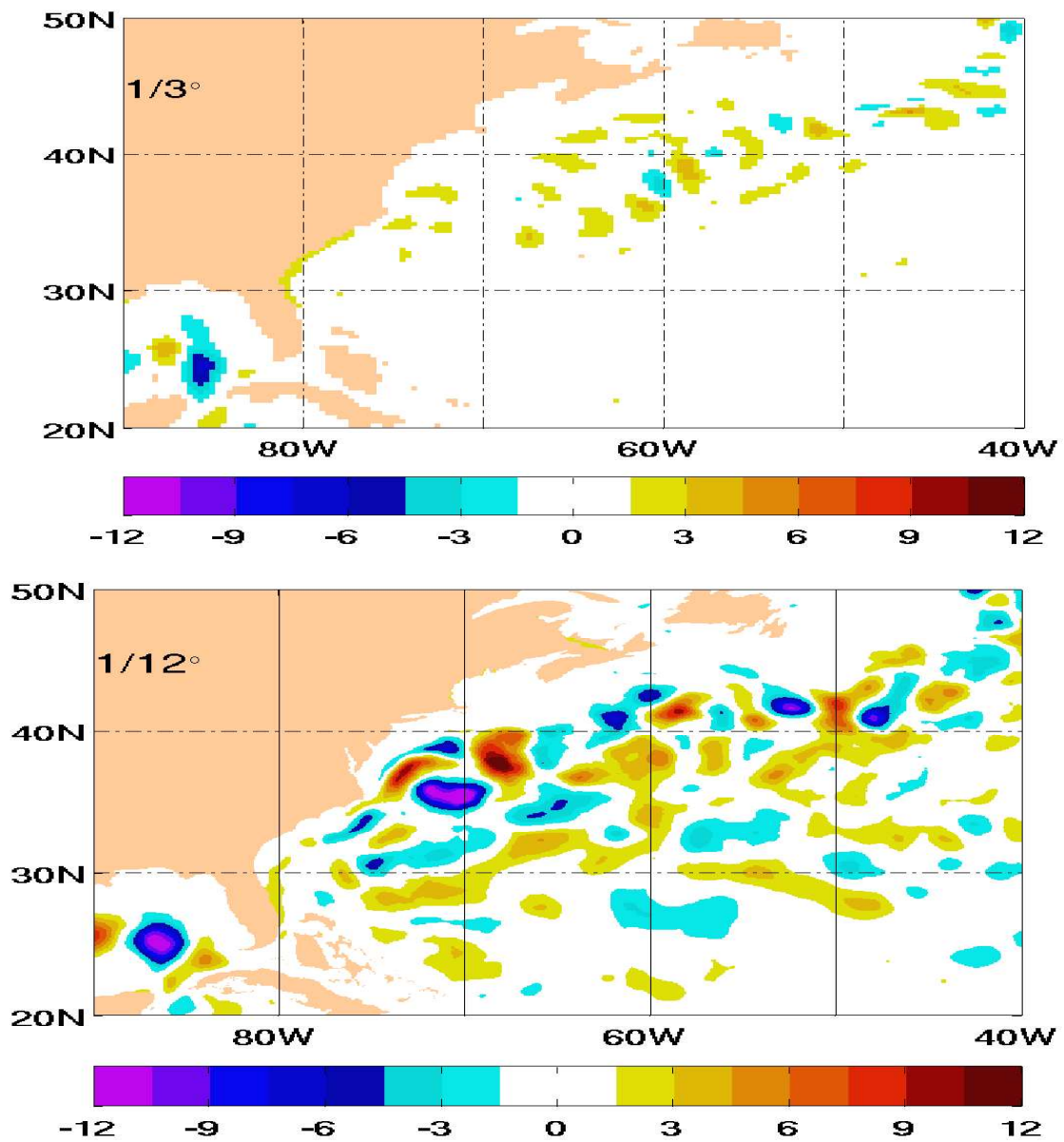but the analysis SSH, SST or SSS is too noisy

the first SSH analysis stage: xf-xa

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: $4° \rightarrow$?

- 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 $1/3°$)
or not . . .