Observational and numerical studies of SST variability at South Atlantic using the Regional CPTEC Oceanic Data Assimilation System (R-CODAS)

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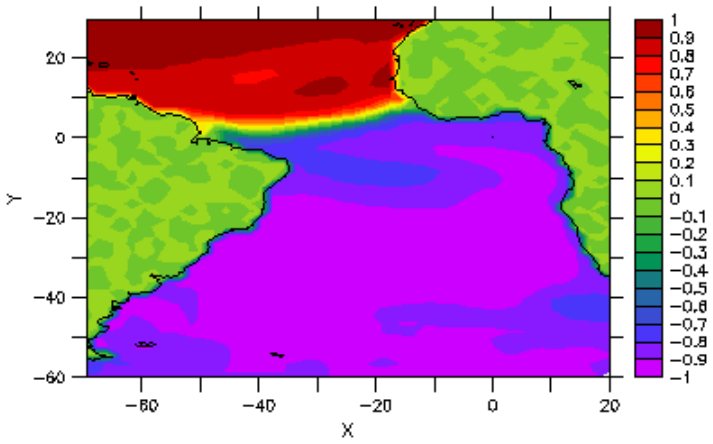
Motivation

- Understand the SST variability and the related mechanisms/processes
- OISSTv2 as the base data set
- ROMS as the modelling tool
- LETKF as the scheme for data assimilation

EOF results



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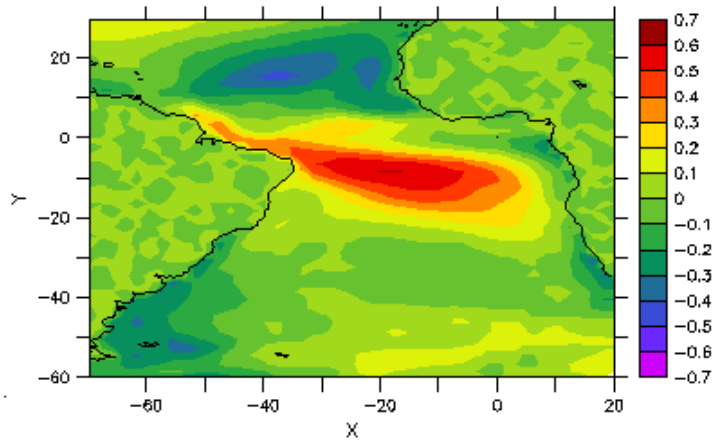

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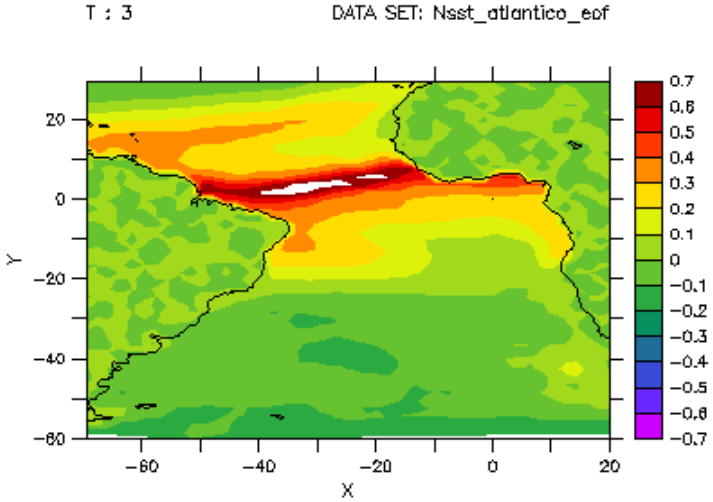

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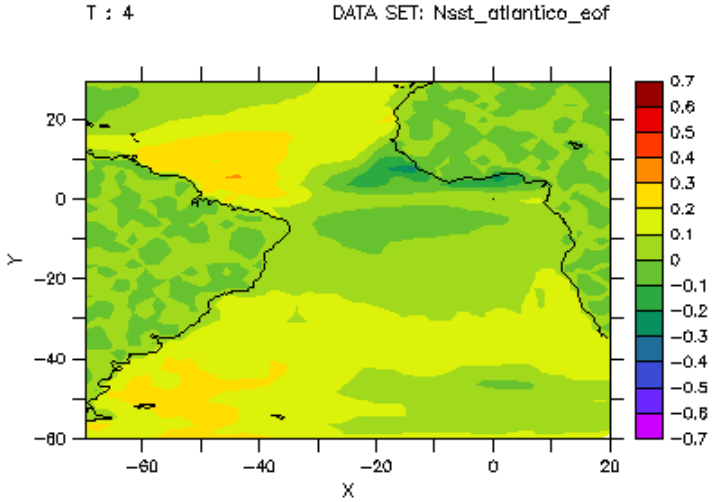

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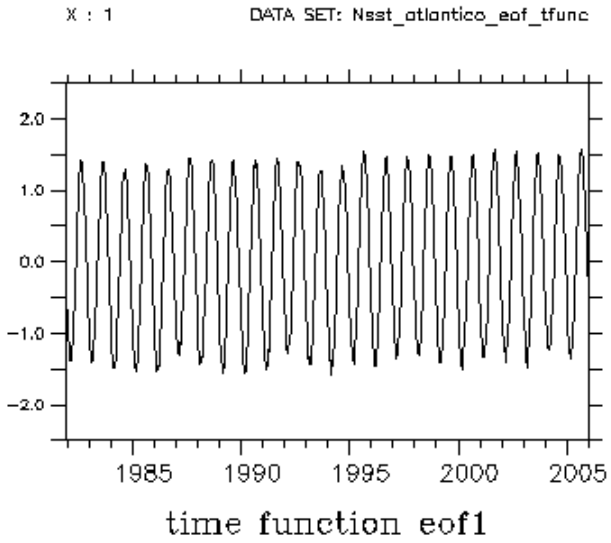
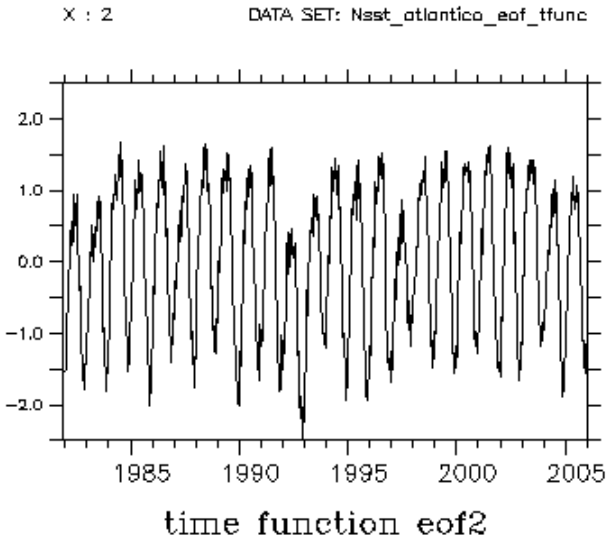
EOF results



time function eof1



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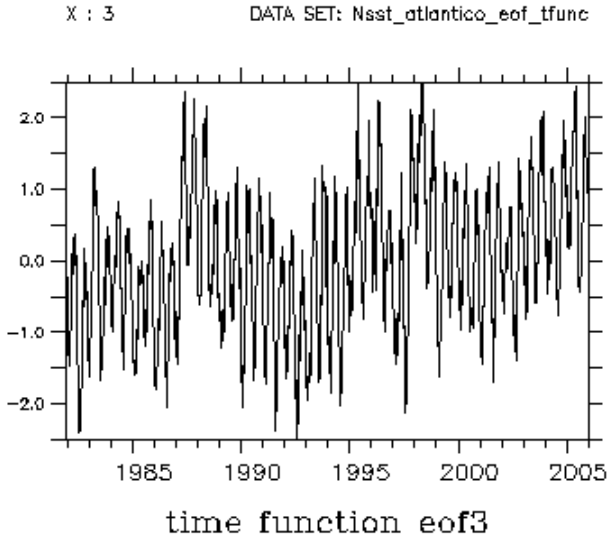
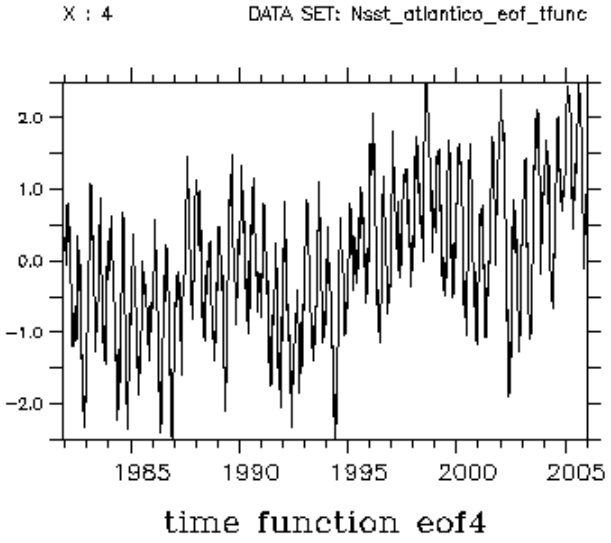
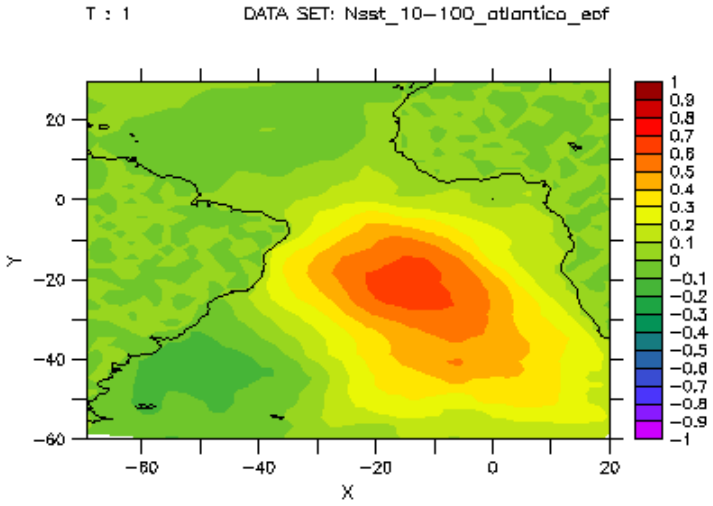


time function eof3



time function eof4

EOF results – 10-100 days



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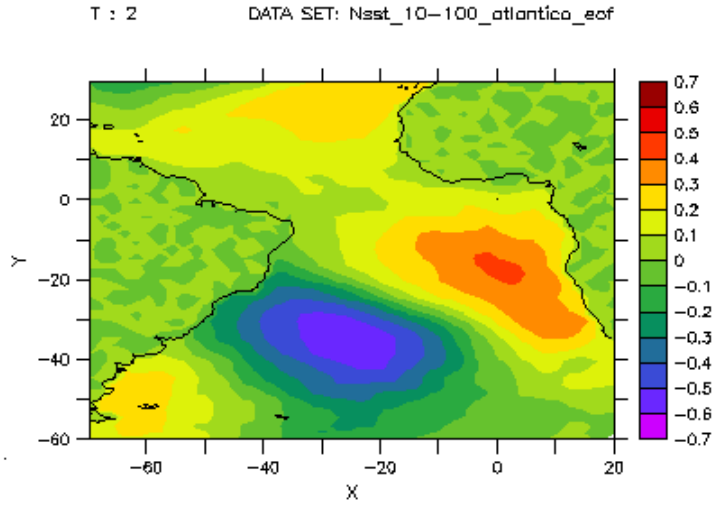

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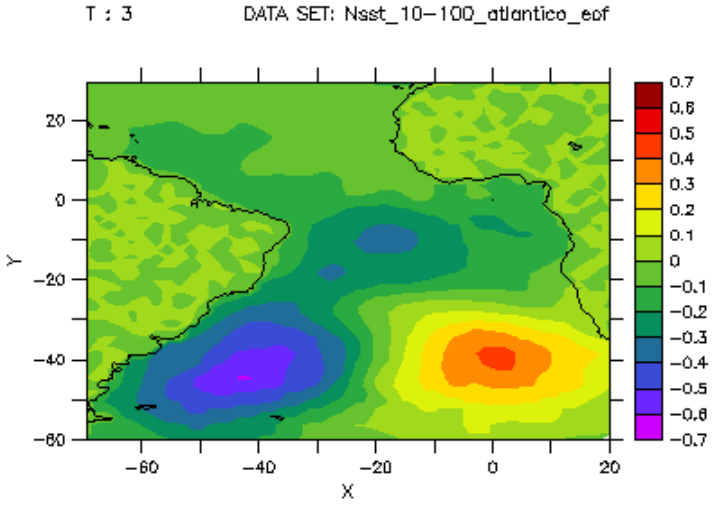

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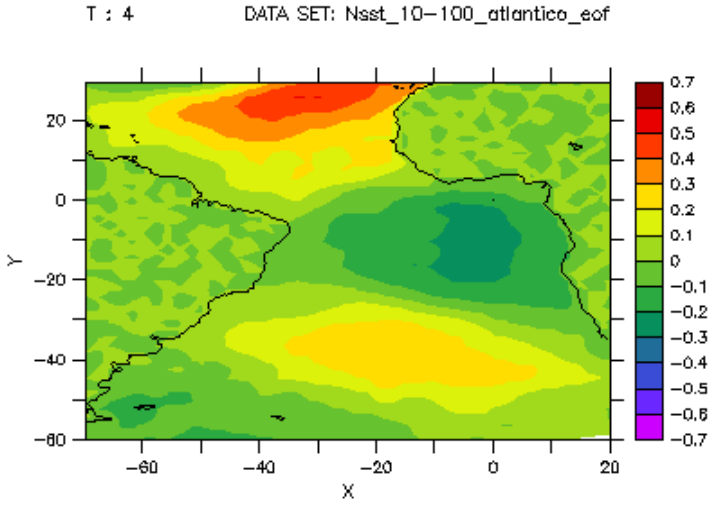
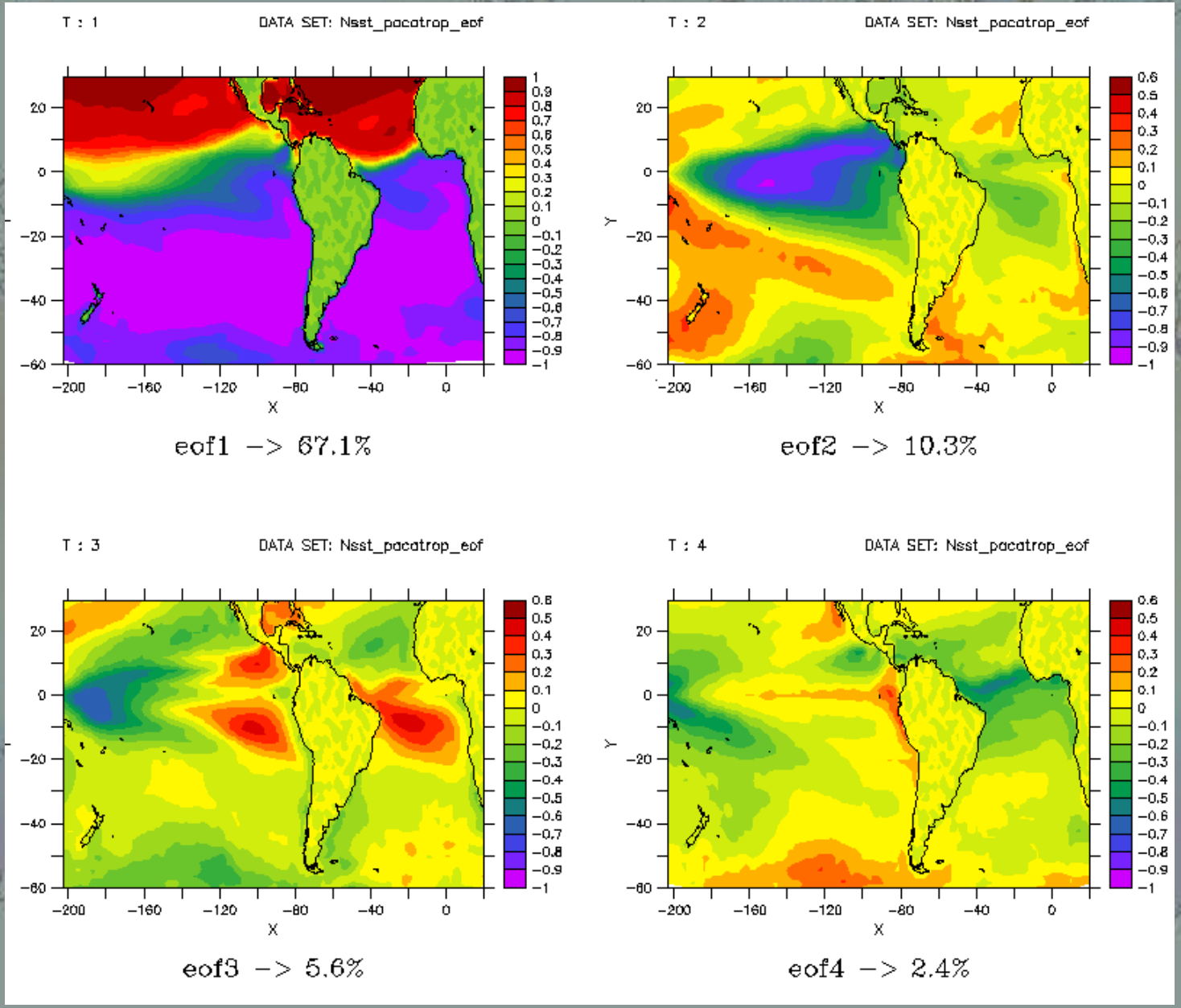


eof4 -> 3.6%

EOF results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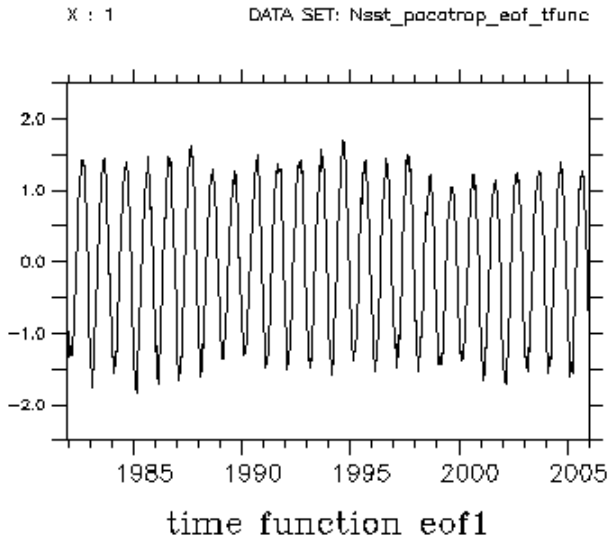
T : 2
DATA SET: Nsst_pacatrop_eof
X
Y
eof2 -> 10.3%
T : 3
DATA SET: Nsst_pacatrop_eof
X
eof3 -> 5.6%
T : 4
DATA SET: Nsst_pacatrop_eof
X
Y
eof4 -> 2.4%

EOF results



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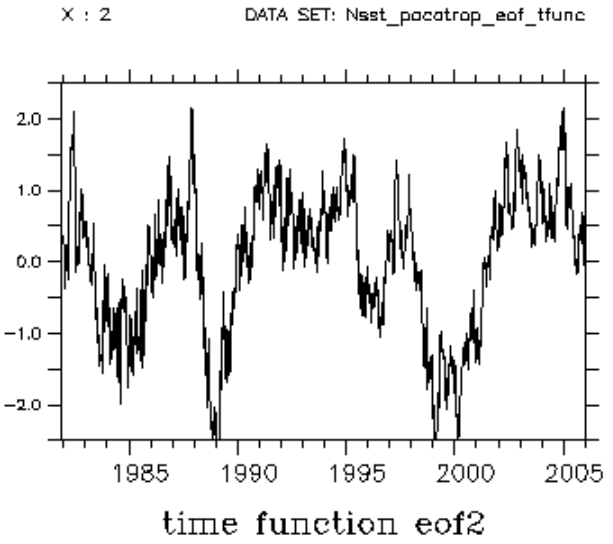

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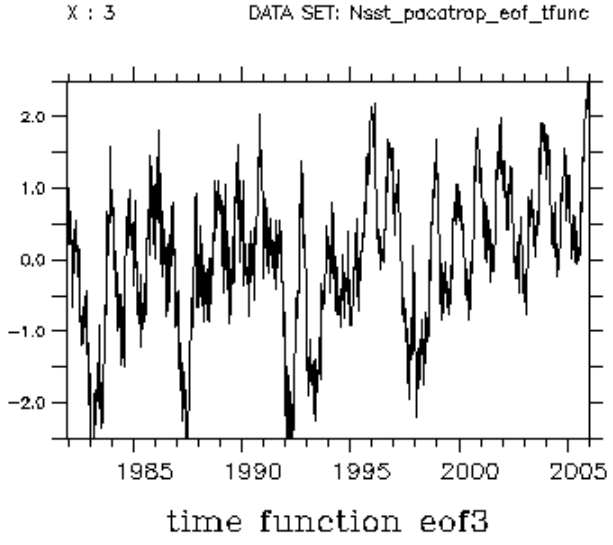
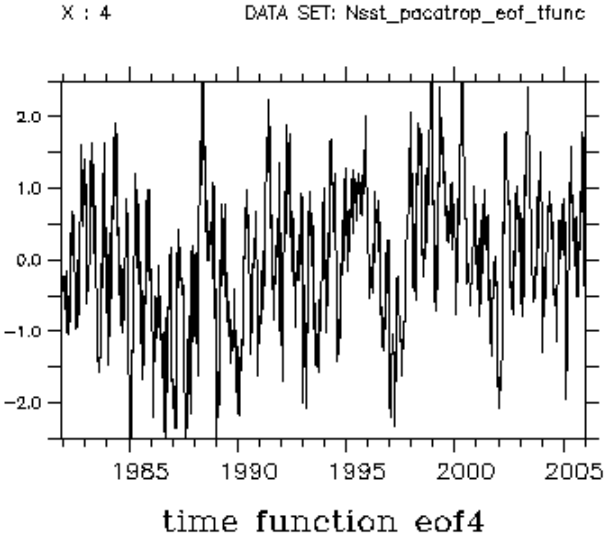
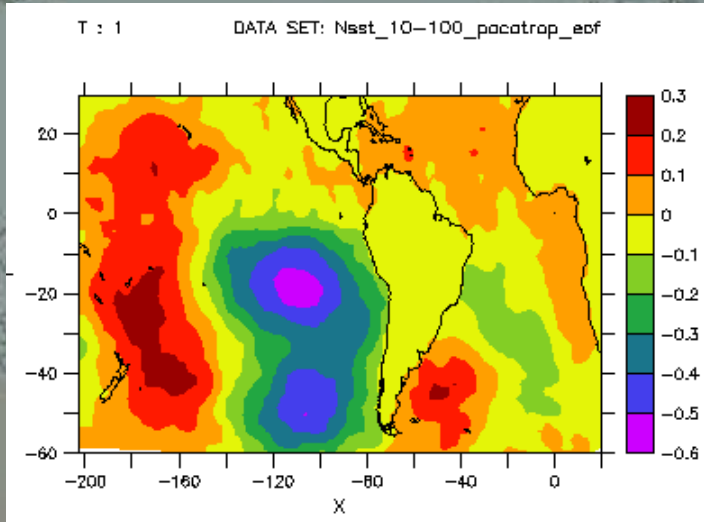


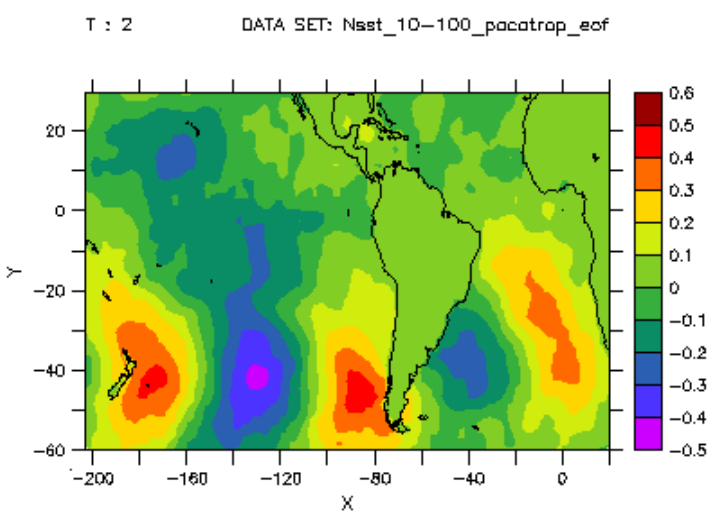
time function eof3

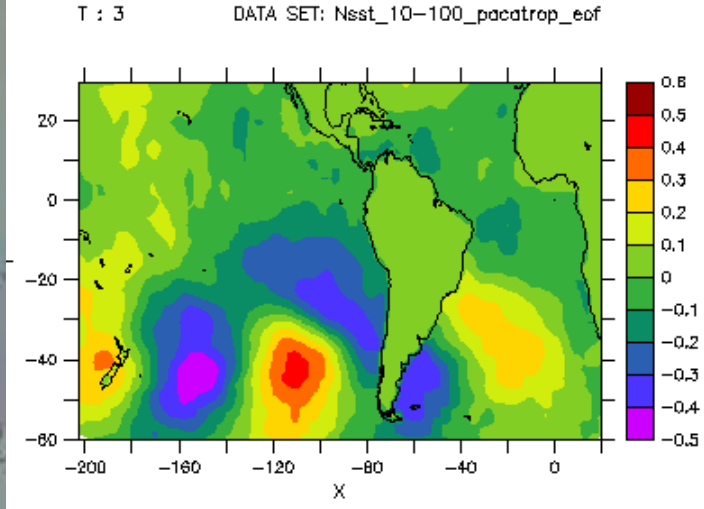


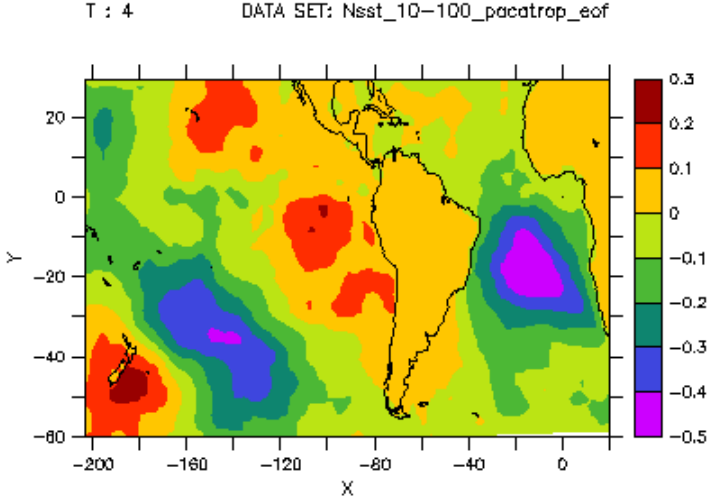
time function eof4

EOF results – 10-100 days

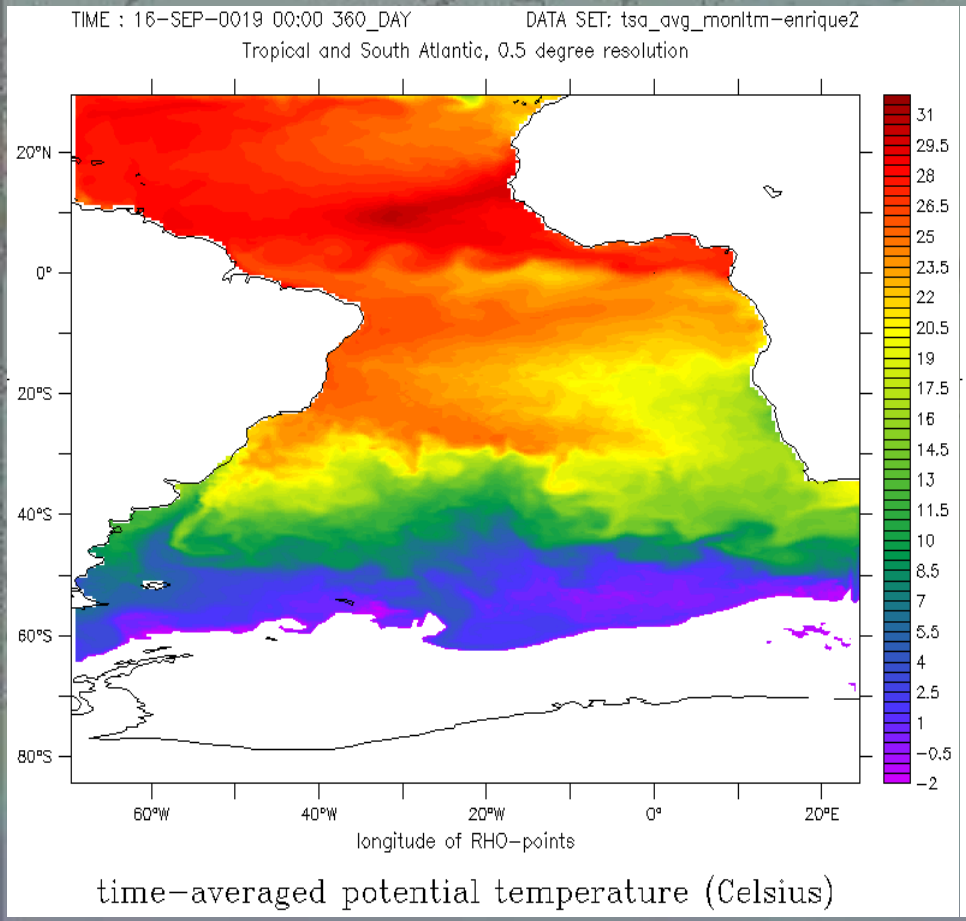




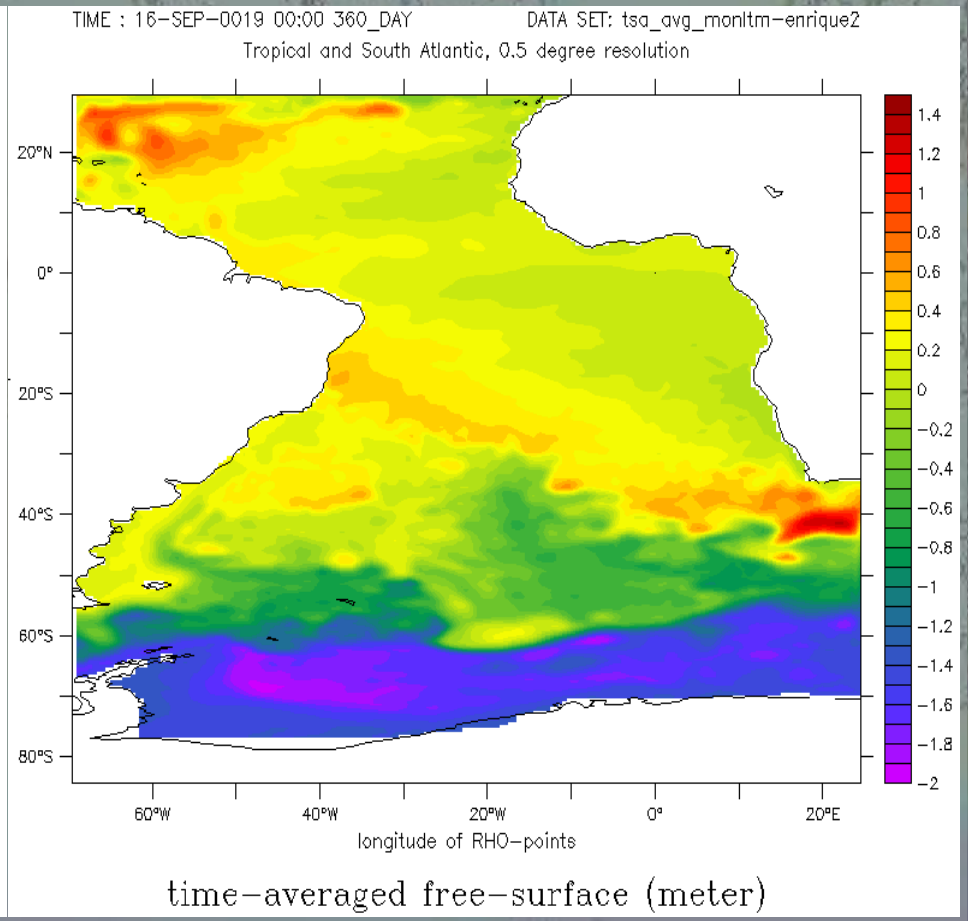




ROMS results - spinup

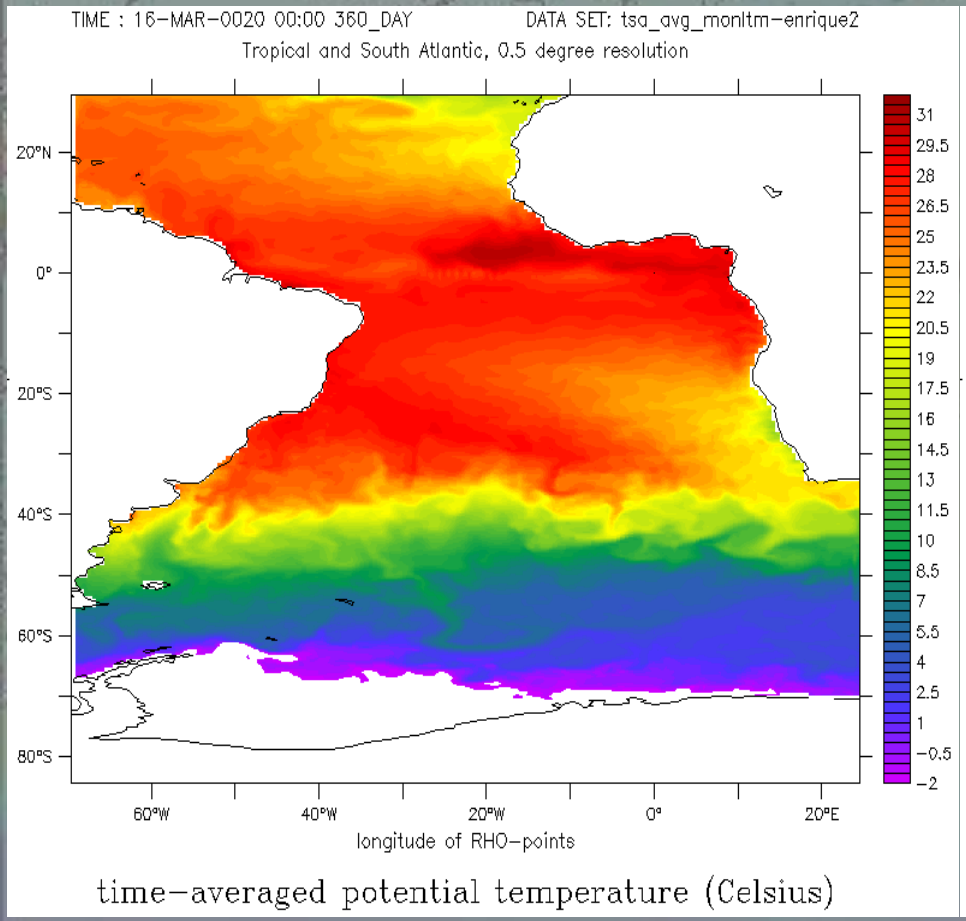


time-averaged potential temperature (Celsius)

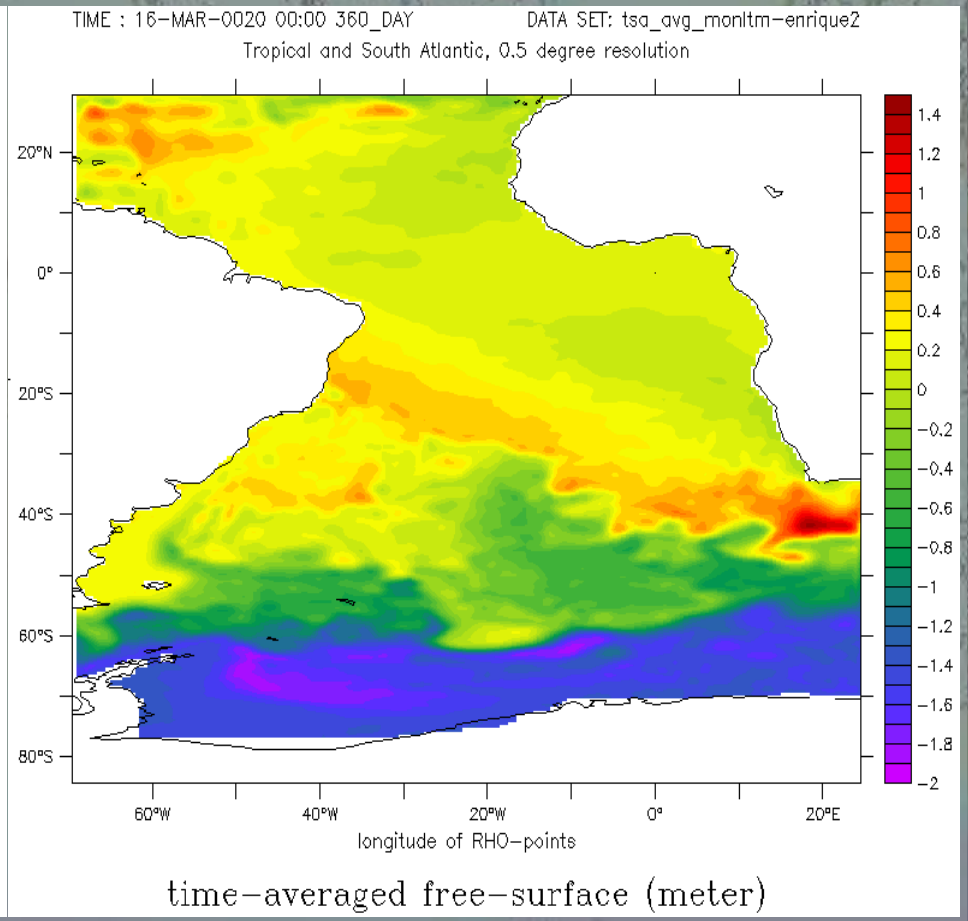


time-averaged free-surface (meter)

ROMS results - spinup



time-averaged potential temperature (Celsius)

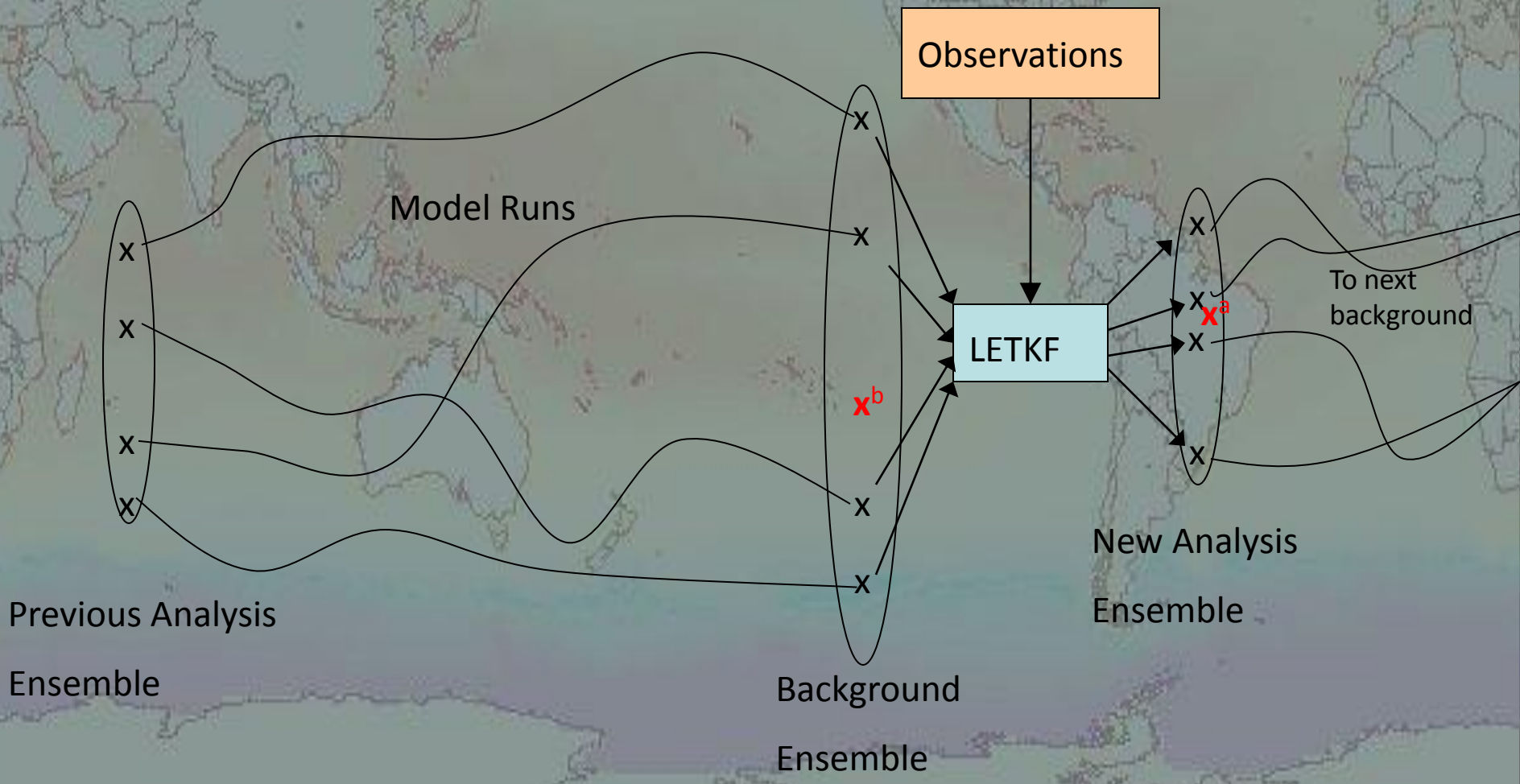


time-averaged free-surface (meter)

Data Assimilation at CPTEC

- LETKF is quicker and easier to develop and code than 3D-Var or 4D-Var since it does not require the adjoint model.
- LETKF gives the uncertainty along with the forecast.
- LETKF evolves covariance matrices, so it can correct “errors of the day.”
- LETKF are already being developed and used for global atmospheric runs at CPTEC.
- LETKF is being implemented to MOM4 and ROMS

An assimilation cycle



How to create the analysis ensemble?

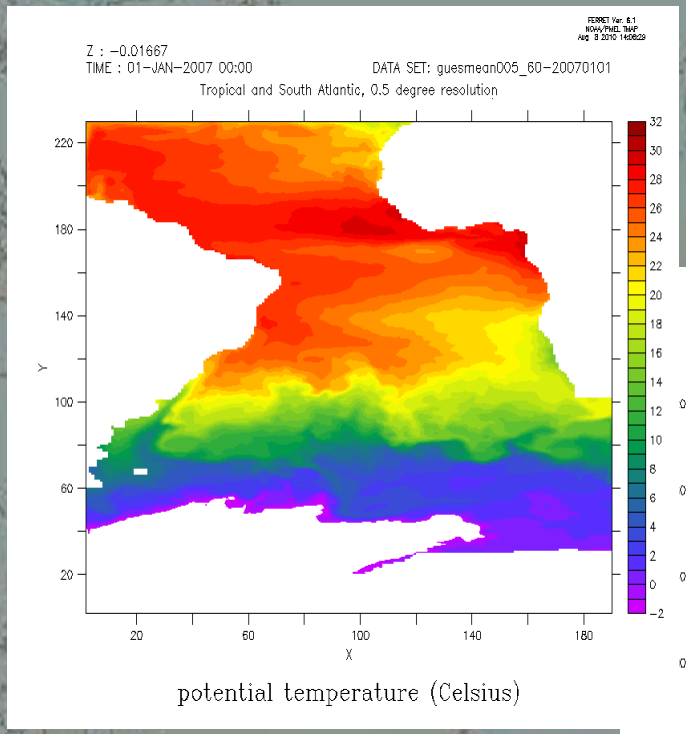
- There are many different types of EnKFs which differ in how they create the analysis ensemble.
- The LETKF uses a series of matrix operations to **transform** the background ensemble into the analysis ensemble. Hence the "T" in LETKF.
- This method comes from LTKF of Bishop et al. (2001).
- The version used (Miyoshi, 2010) uses adaptative inflation coefficient

LETKF results

- 2 months assimilation cycle at every 5 days
- SODA (pre-assimilated dataset) + OISSTv2
- 20, 40, 60 and 80 members for sensitivity tests

LETKF results – 60 members

01Jan2007



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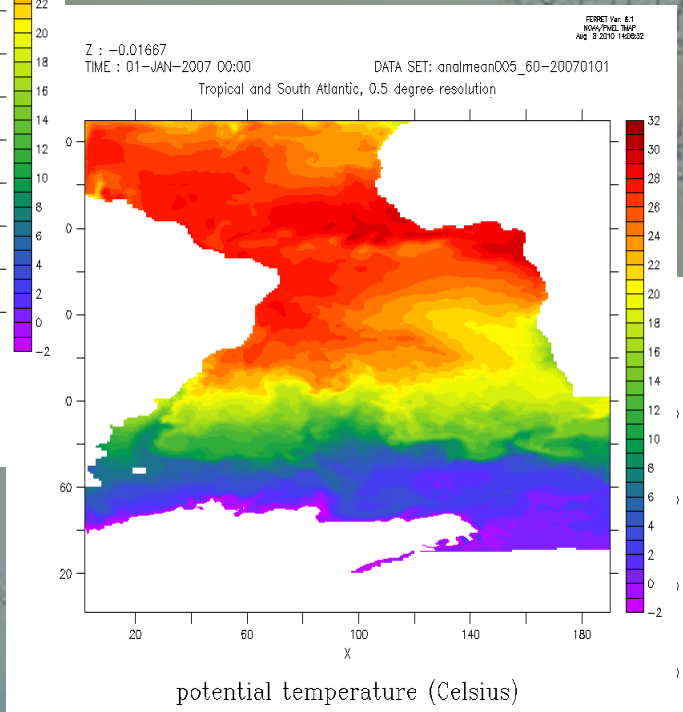
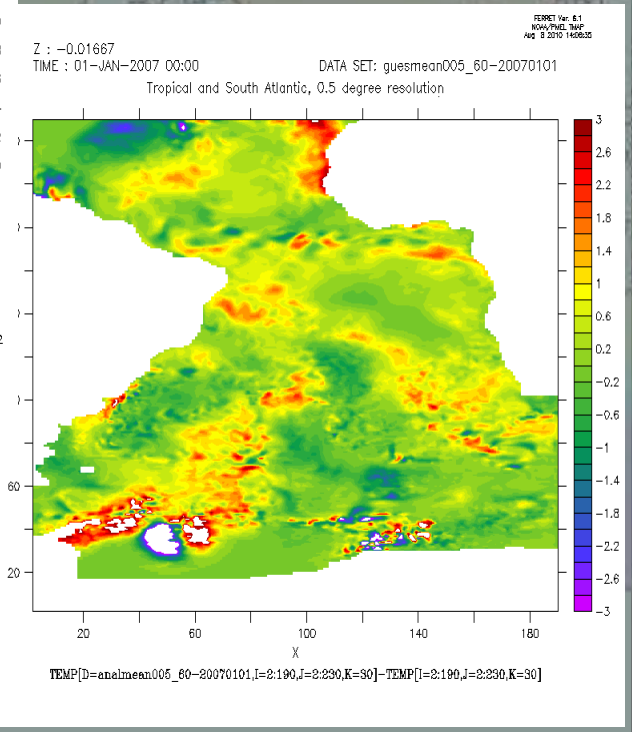


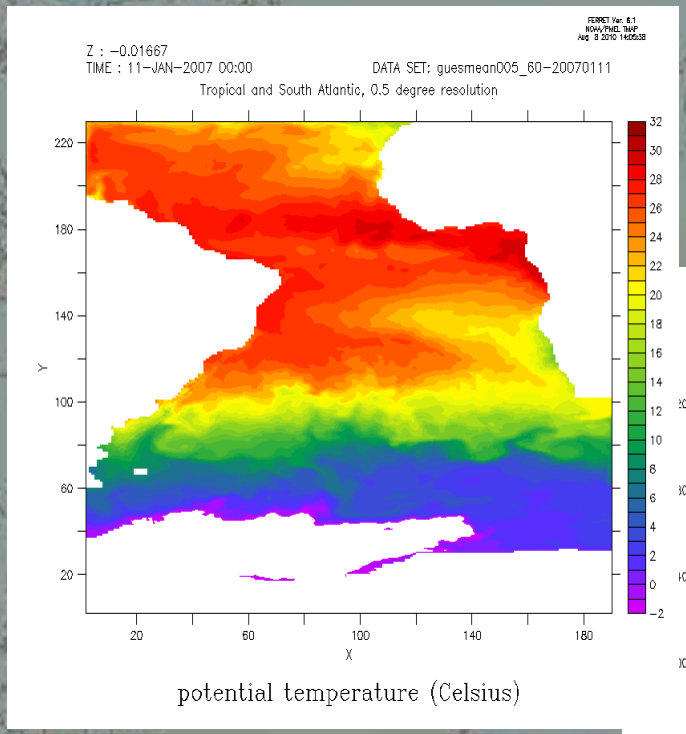
analysis

difference



LETKF results – 60 members

11Jan2007



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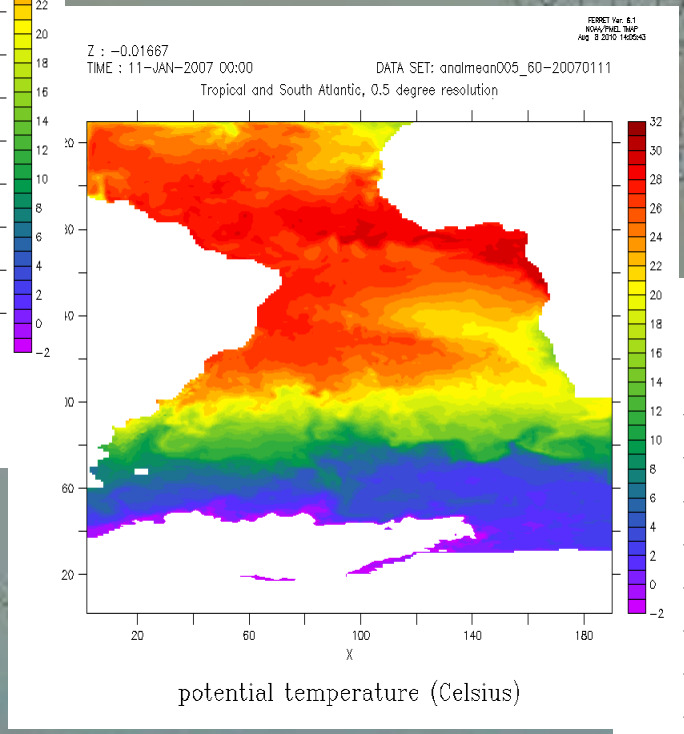
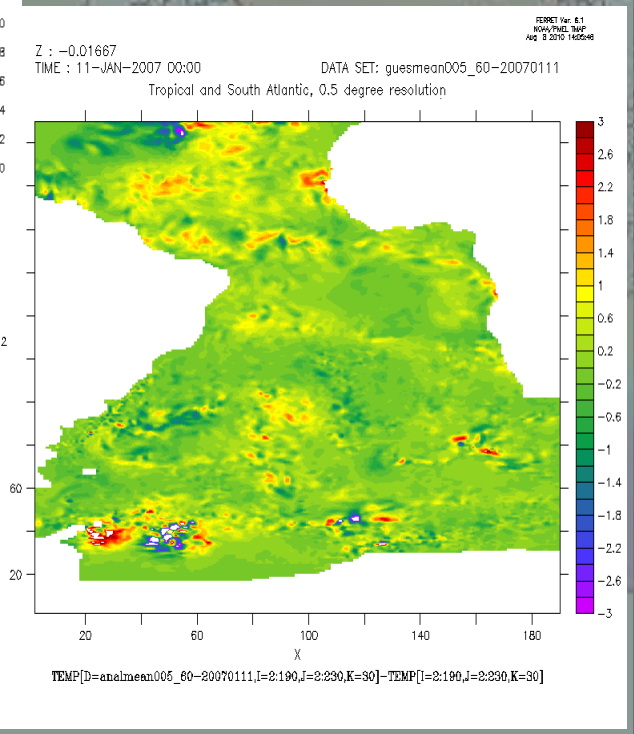


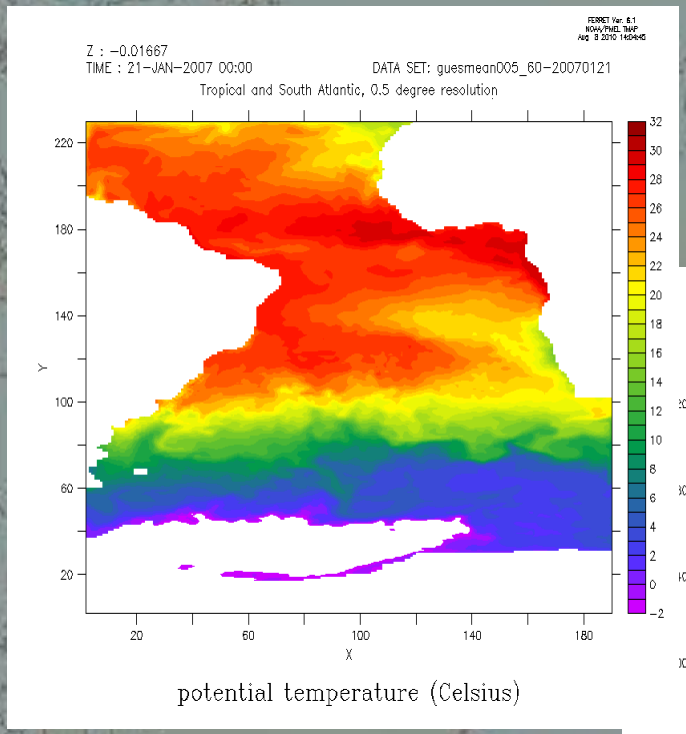
analysis

difference



LETKF results – 60 members

21Jan2007



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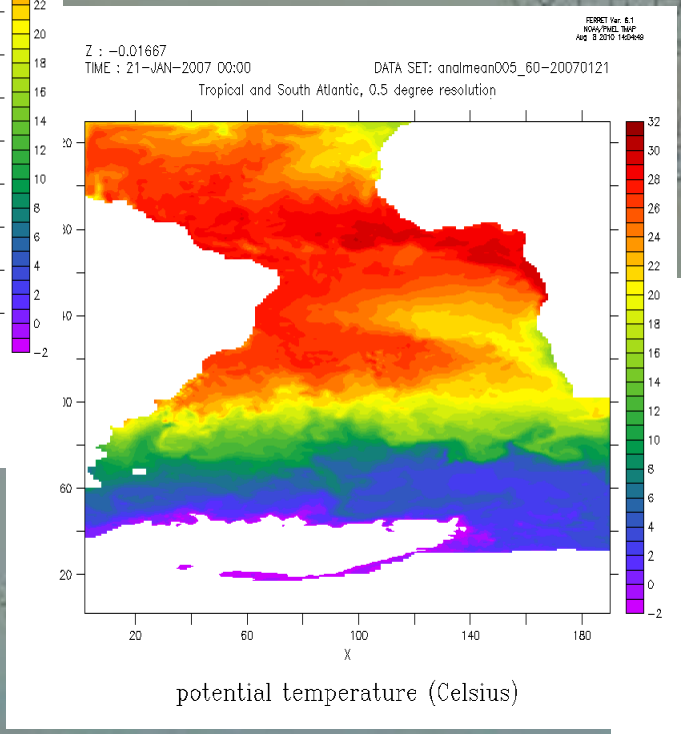
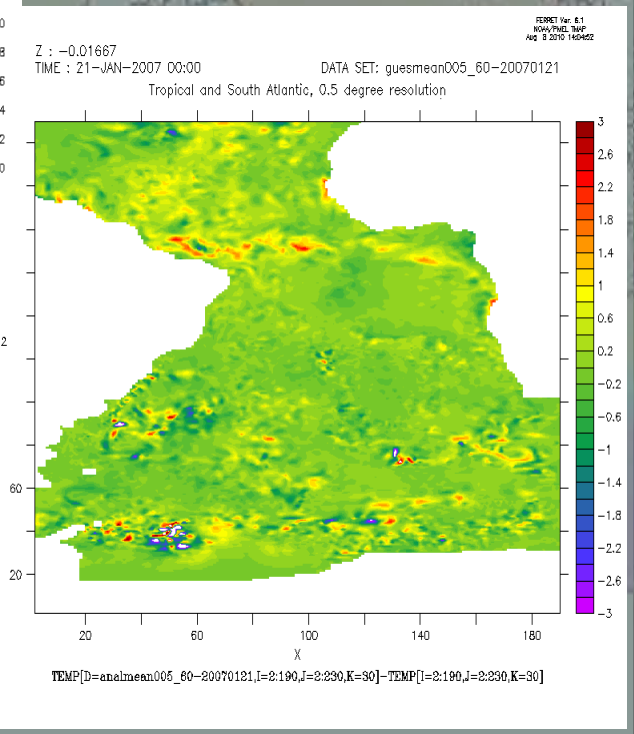


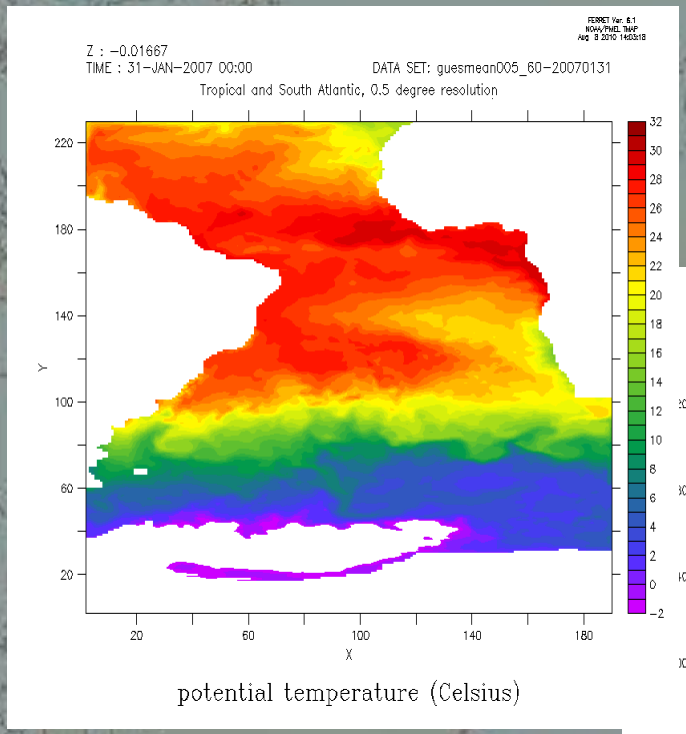
analysis

difference



LETKF results – 60 members

31Jan2007



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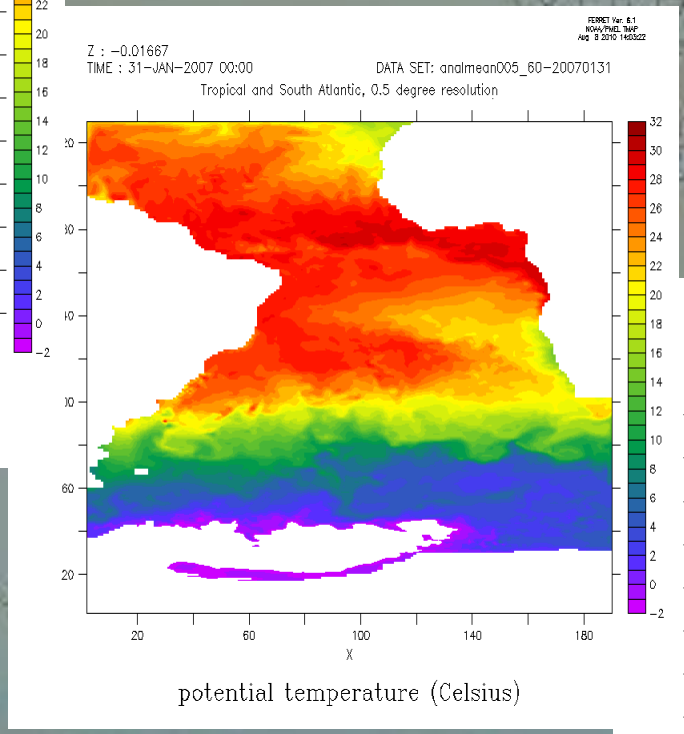
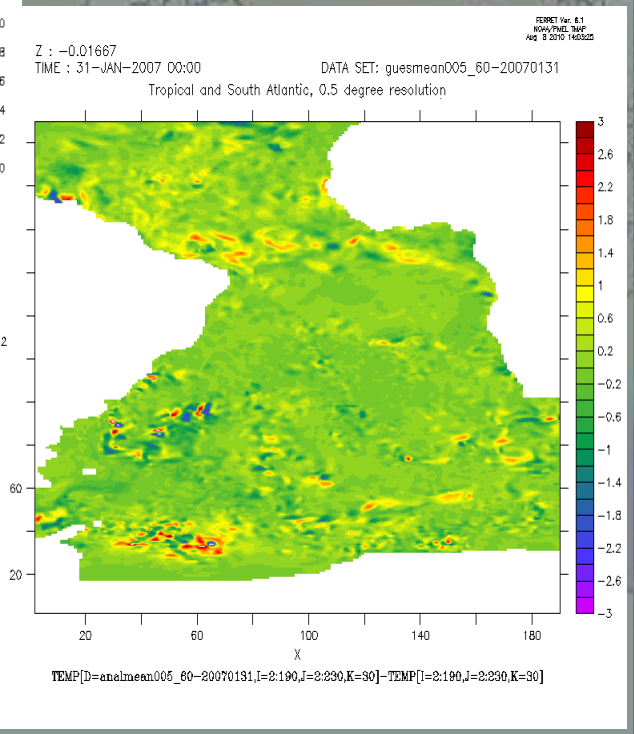


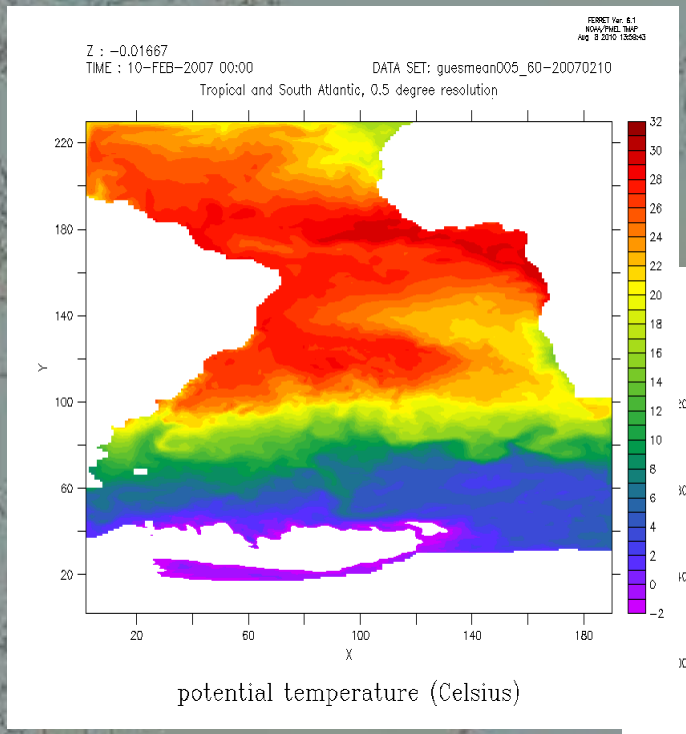
analysis

difference



LETKF results – 60 members

10Feb2007



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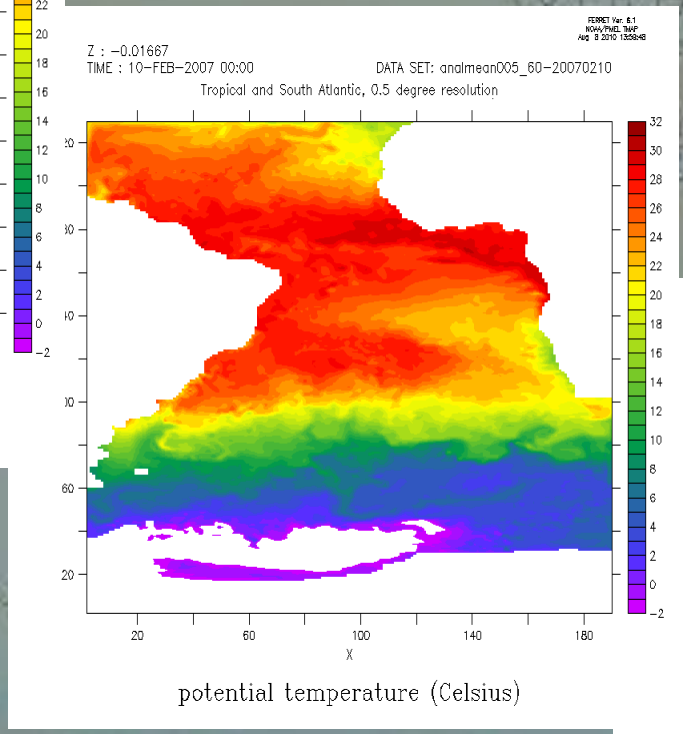

analysis

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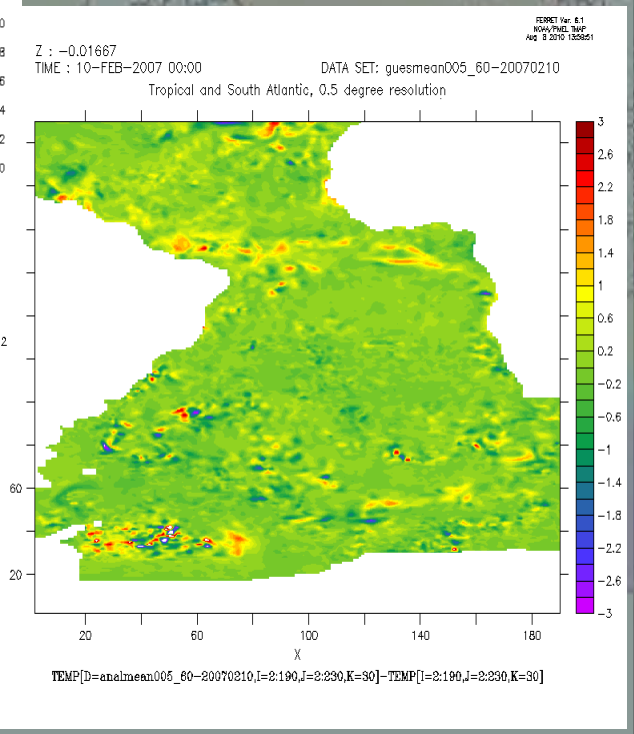
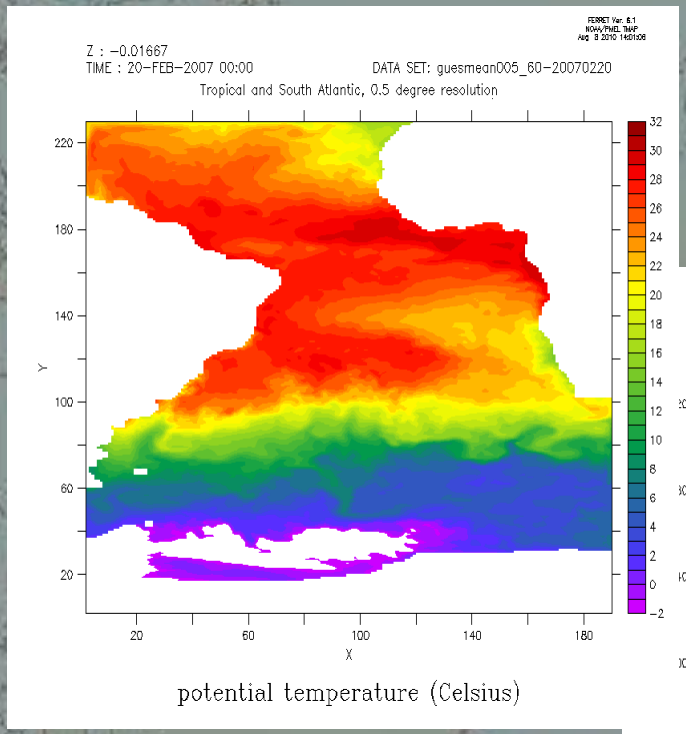


LETKF results – 60 members

20Feb2007



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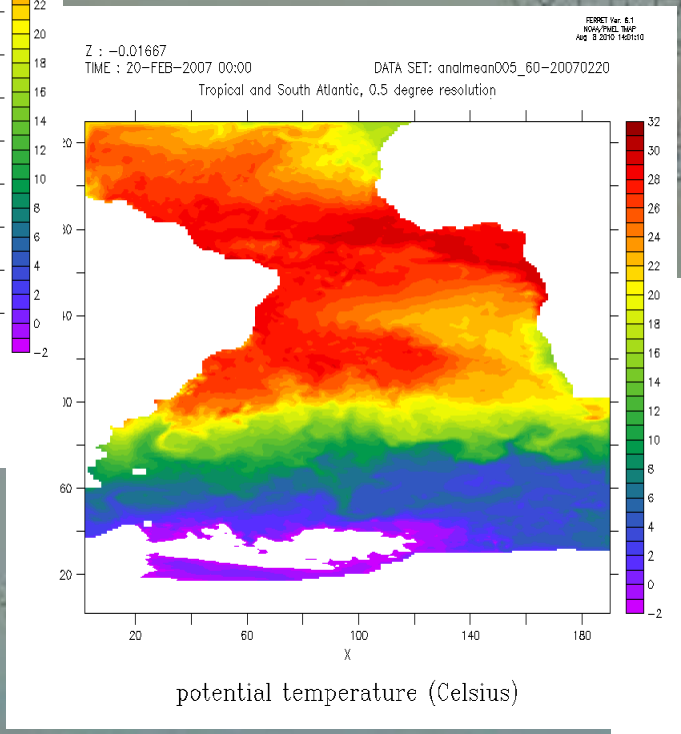

analysis

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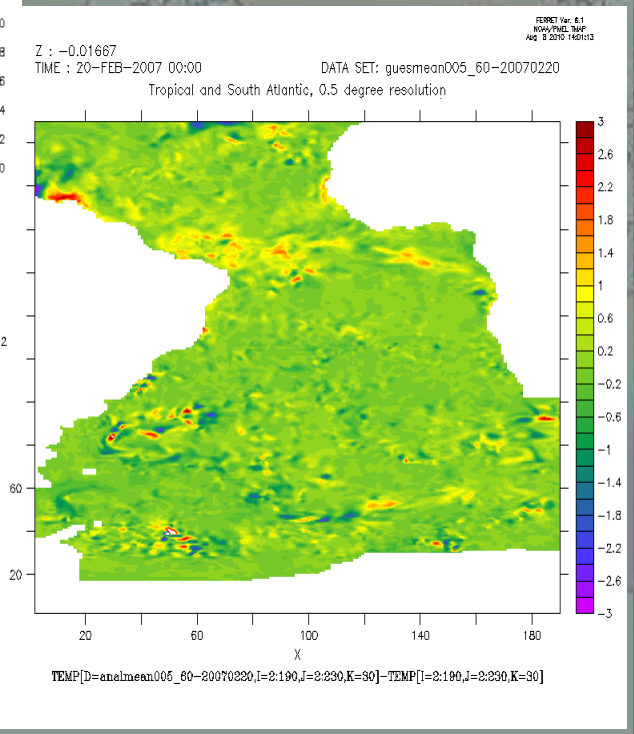
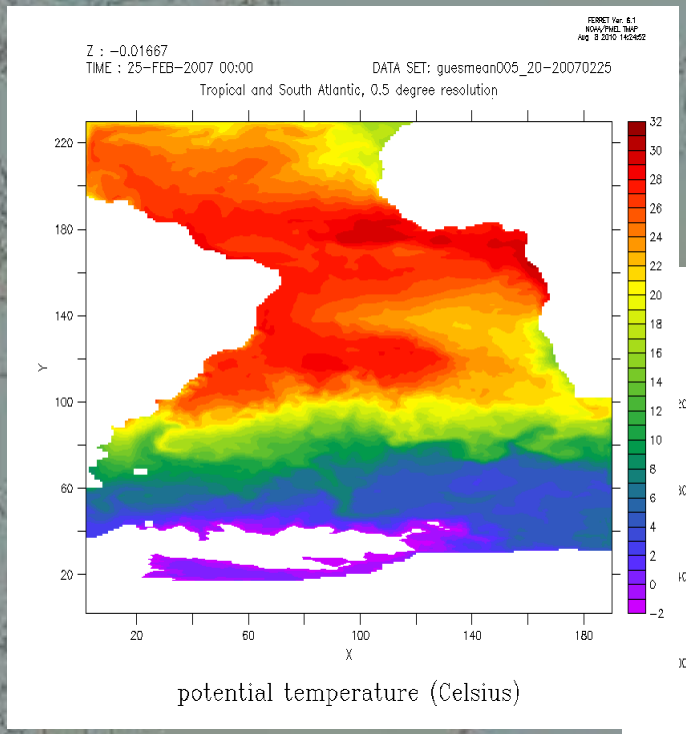


LETKF results – 20 members

25Feb2007



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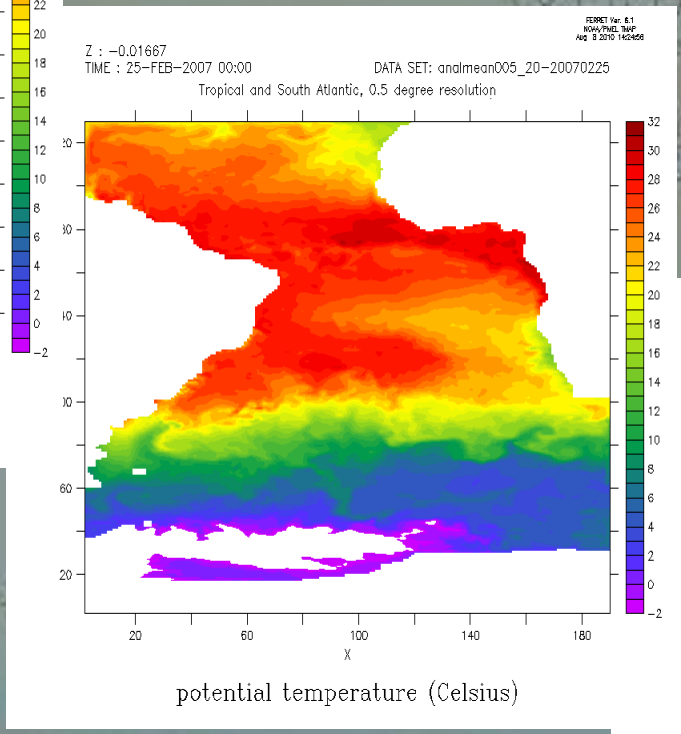

analysis

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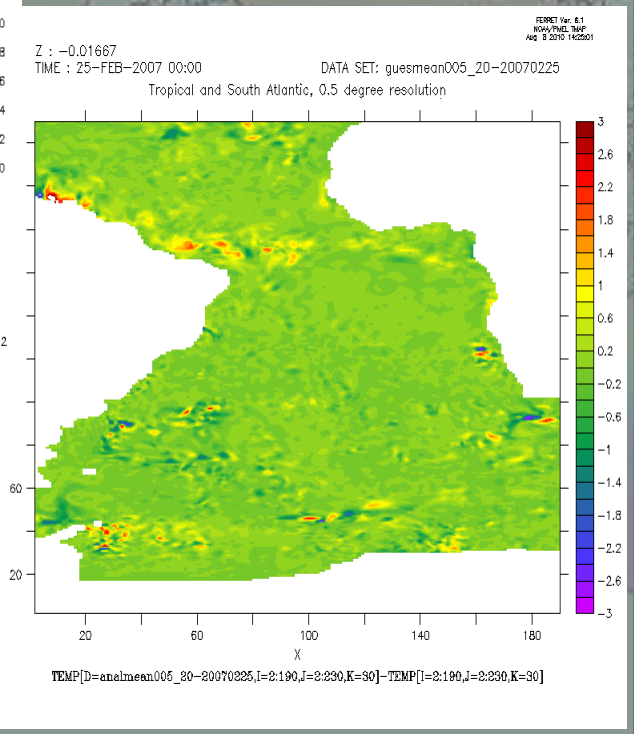
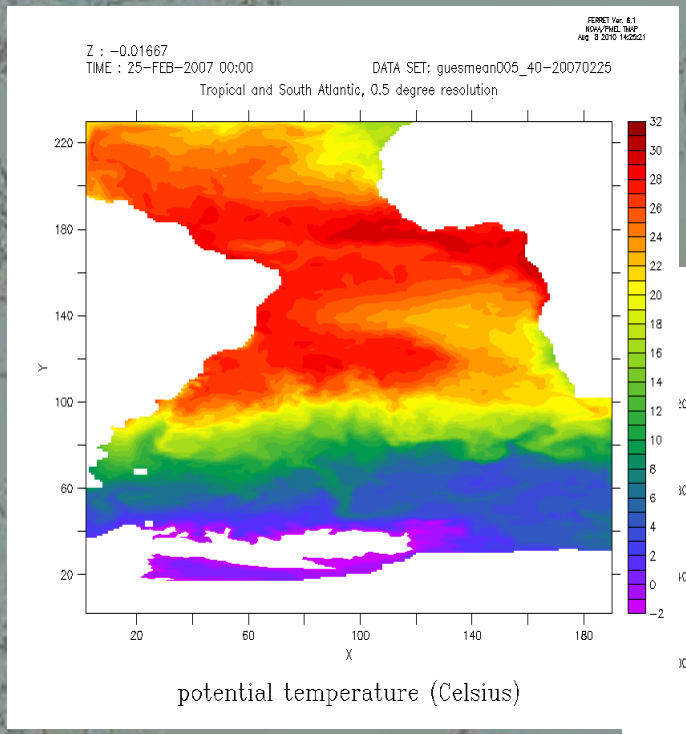


LETKF results – 40 members

25Feb2007



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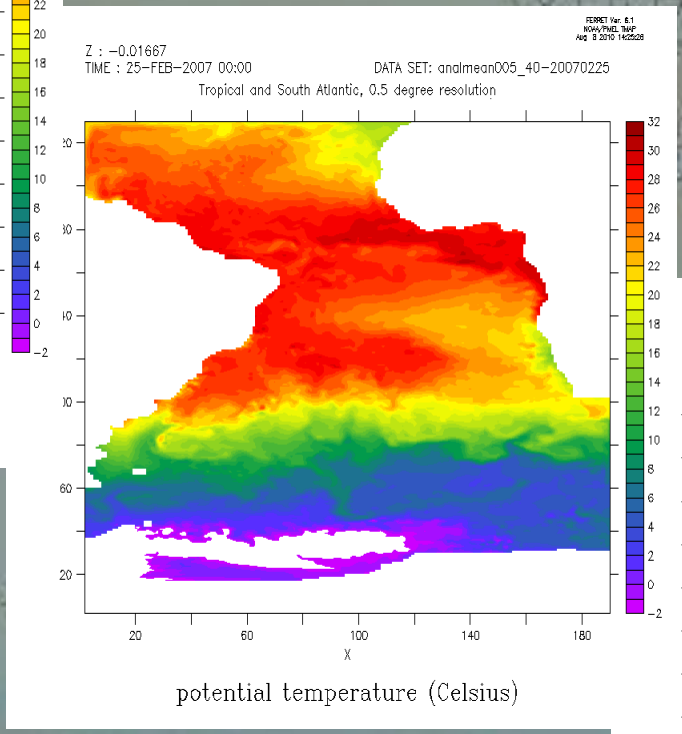
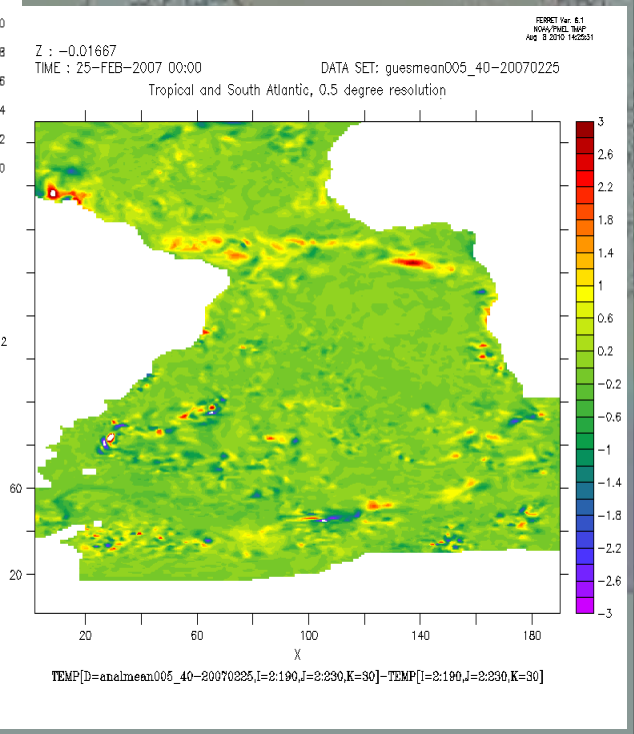


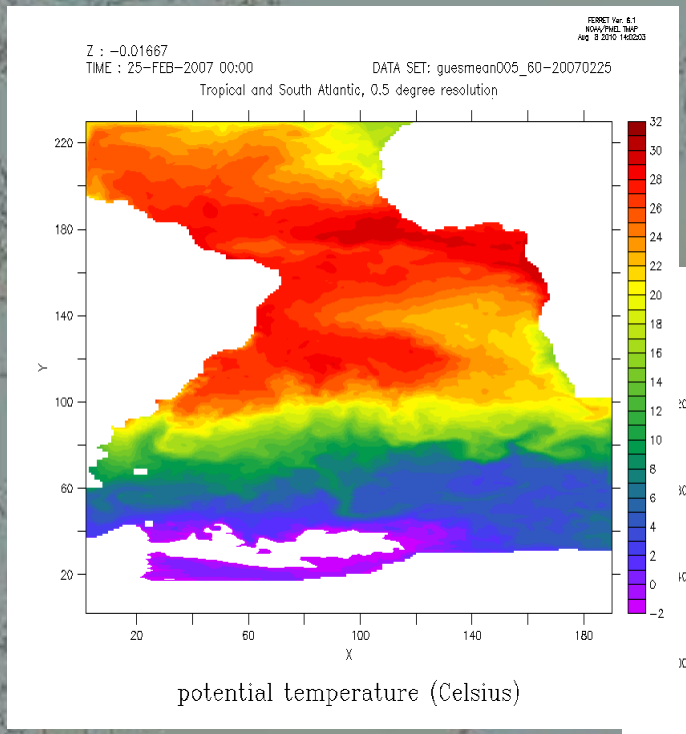
analysis

difference

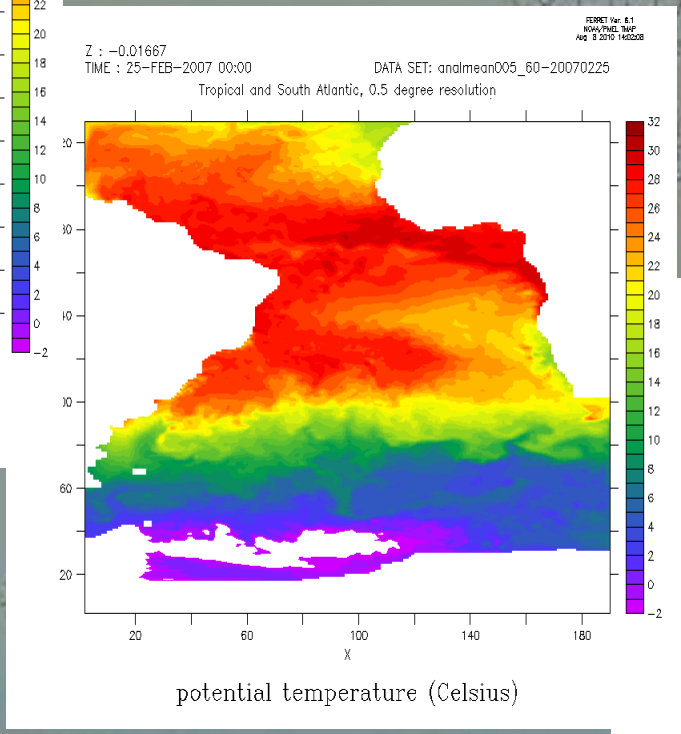


LETKF results – 60 members

25Feb2007

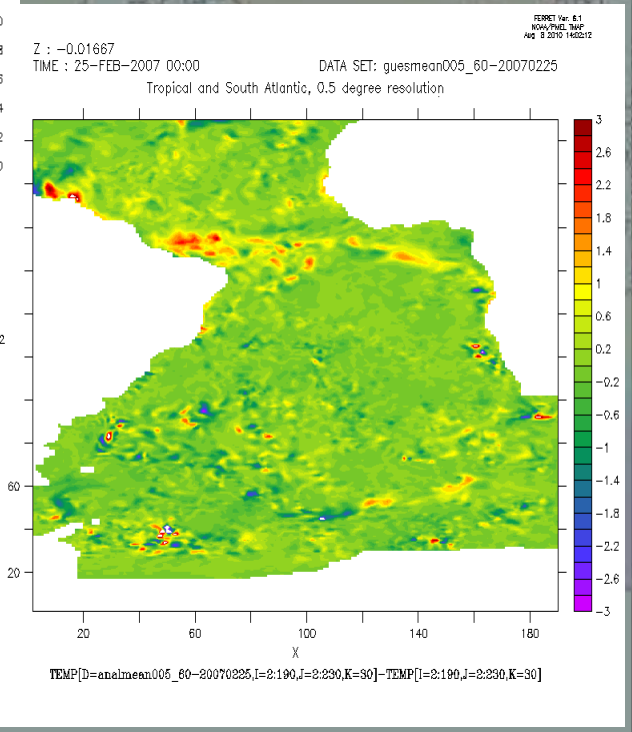


guess



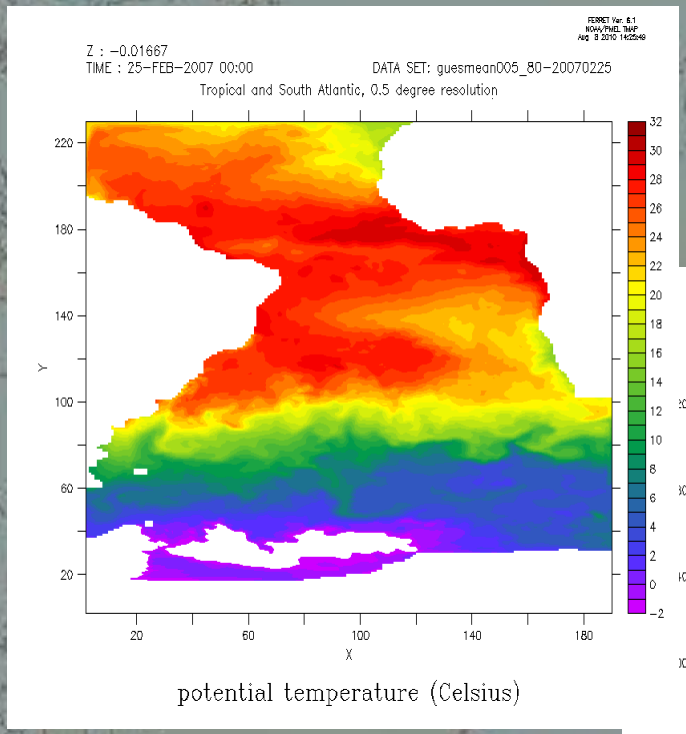
analysis

difference

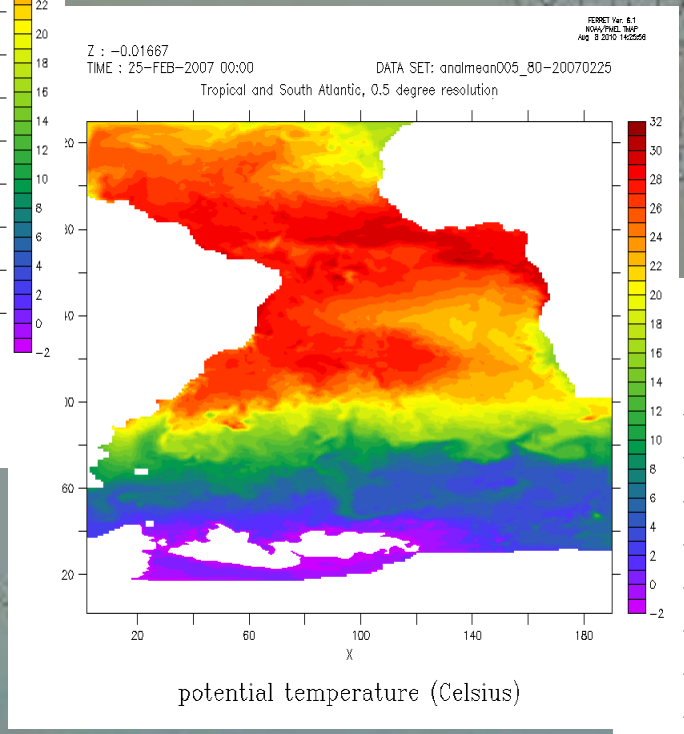


LETKF results – 80 members

25Feb2007

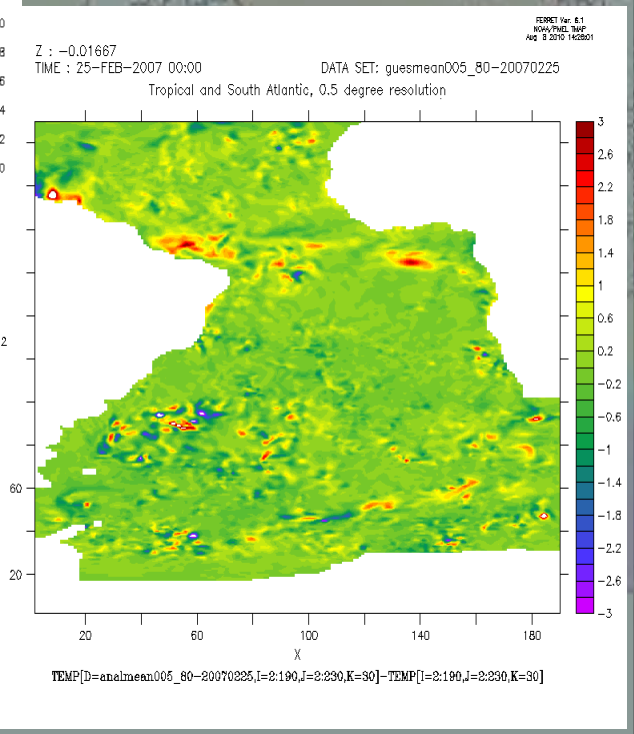


guess

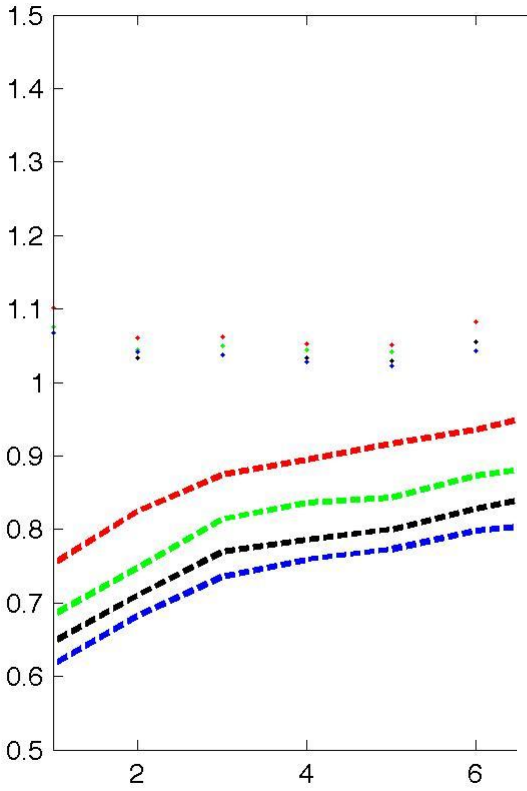


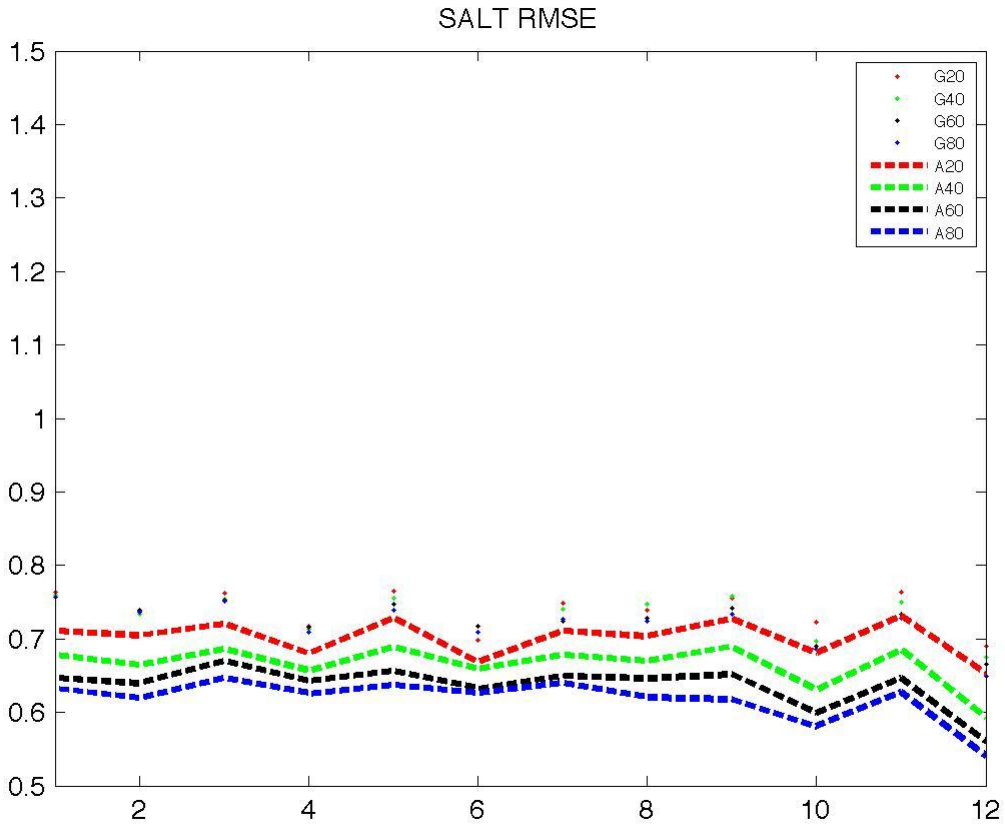
analysis

difference



LETKF results – # members





Preliminary conclusions

- Observational
  - Spatial patterns identified;
  - Needs further analysis (cross spectra, wavelet)
- ROMS
  - General features of superficial circulation well represented
  - Needs more efforts on boundary conditions and fresh water discharge
- LETKF
  - Initial corrections seem OK
  - Needs to test different subsets of assimilated data to verify the impact (surface and depth)
  - Inclusion of SSHA
  - Inclusion of Ice Model

MASTER
METEOROLOGIA APLICADA A SISTEMAS DE TEMPO REGIONAIS
CPTEC
Many thanks!