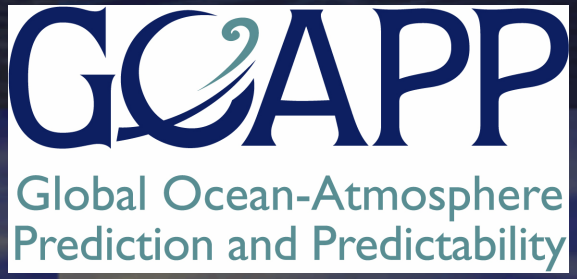
Optimizing parameters and code updates in NEMO/AGRIF

F. Dupont, D. Wright, Z. Wang, K. Thompson



Optimizing parameters:

Before starting the reanalysis work the model must be tuned to give optimal results based on model physics.

Procedure:

Summer 2007: tests using the GYRE configuration (single wind driven gyre at coarse resolution) and ORCA2_LIM in order to sort the importance of each parameters. One model solution is arbitrarily defined as being the “truth”.

Parameters considered for investigation:

-lateral mixing : *aht0, ahm0*

-vertical background mixing : *avt0, at0, avevd*

-vertical turbulence : *ediff* (coeff. used in computing the vertical eddy diffusion), *ebb* (coeff. in input surface TKE). Default values: *ediff=0.1* , *ebb=3.75*

-solar penetration(*nam_qsr*) : *rabs* (ratio between the two penetrative length scales), *xsi1* (scale 1), *xsi2* (scale 2). Default values: *rabs=0.58*, *xsi1*=0.35m, *xsi2*=23m

Mixing processes can influence the energy available from the mean state as well as directly damp eddy variability once present.

Vertical physics modifies the stratification, steric height and ssh.

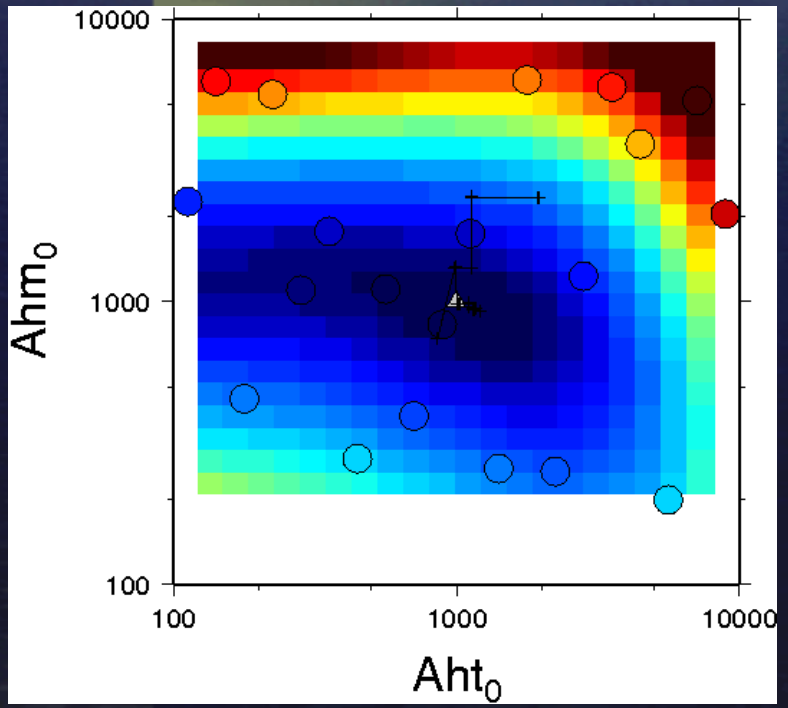
Conclusions:

In decreasing order of sensitivity in ssh variability, we have:

Ahm0, Aht0 – strongly significant

Avt0, rabs, ediff - weakly significant

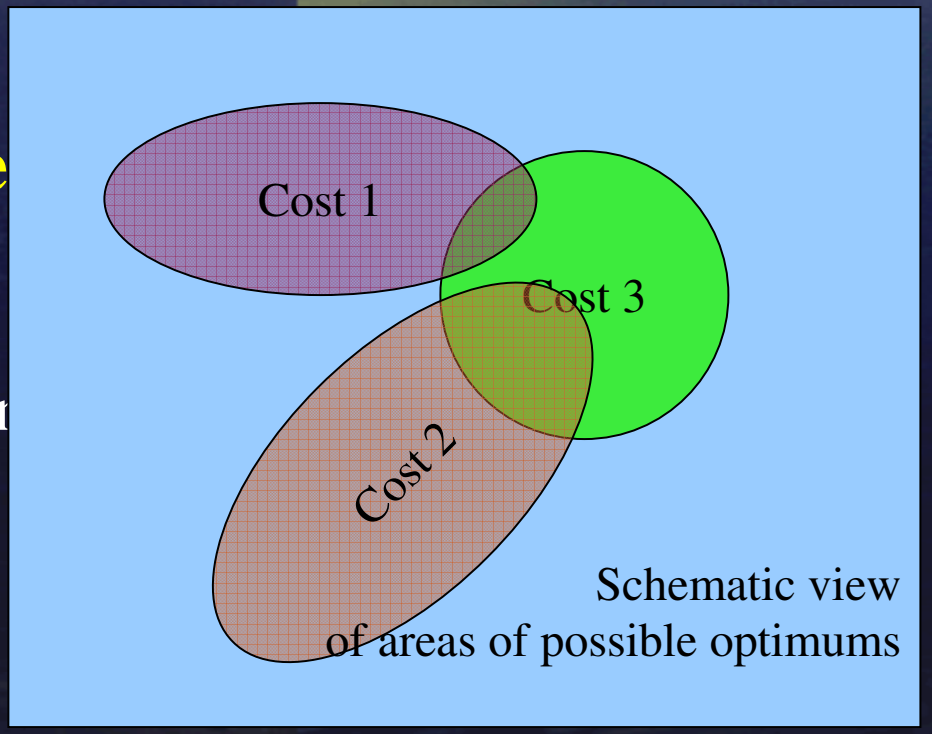
Avm0, ebb, xsi1, xsi2, Avevd - not very significant



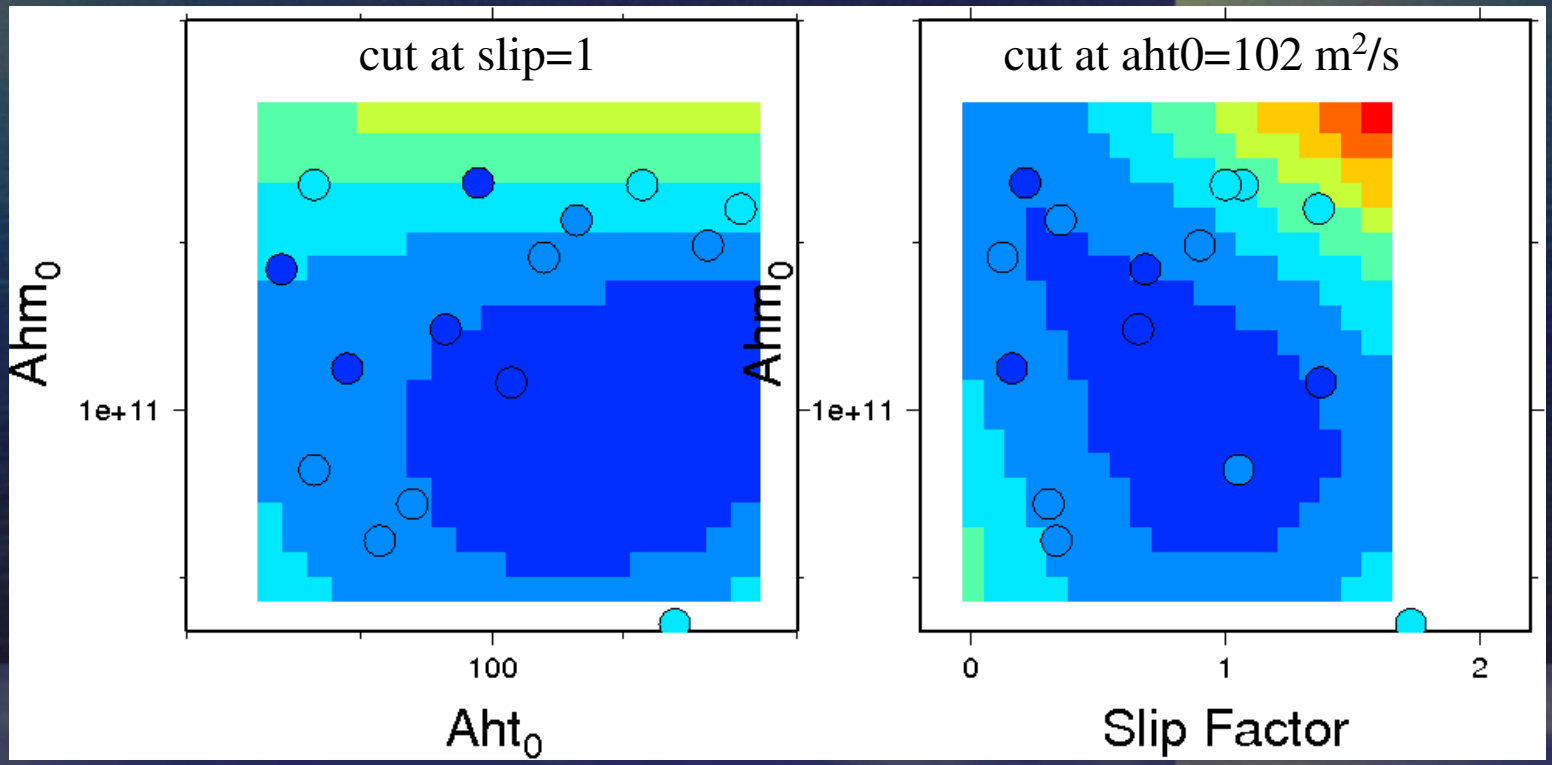
On top of lateral mixing, choice of advection schemes and **dynamic momentum condition** (free-slip/no-slip) has been raised as potentially very significant to SSH statistics.

Issues in finding optimums when comparing a multi-variable cost function in a realistic setting/versus mode truth:

- The different terms in the cost functio could lead to different optimums
- There could be therefore multiple optimums with no real good global optimum.

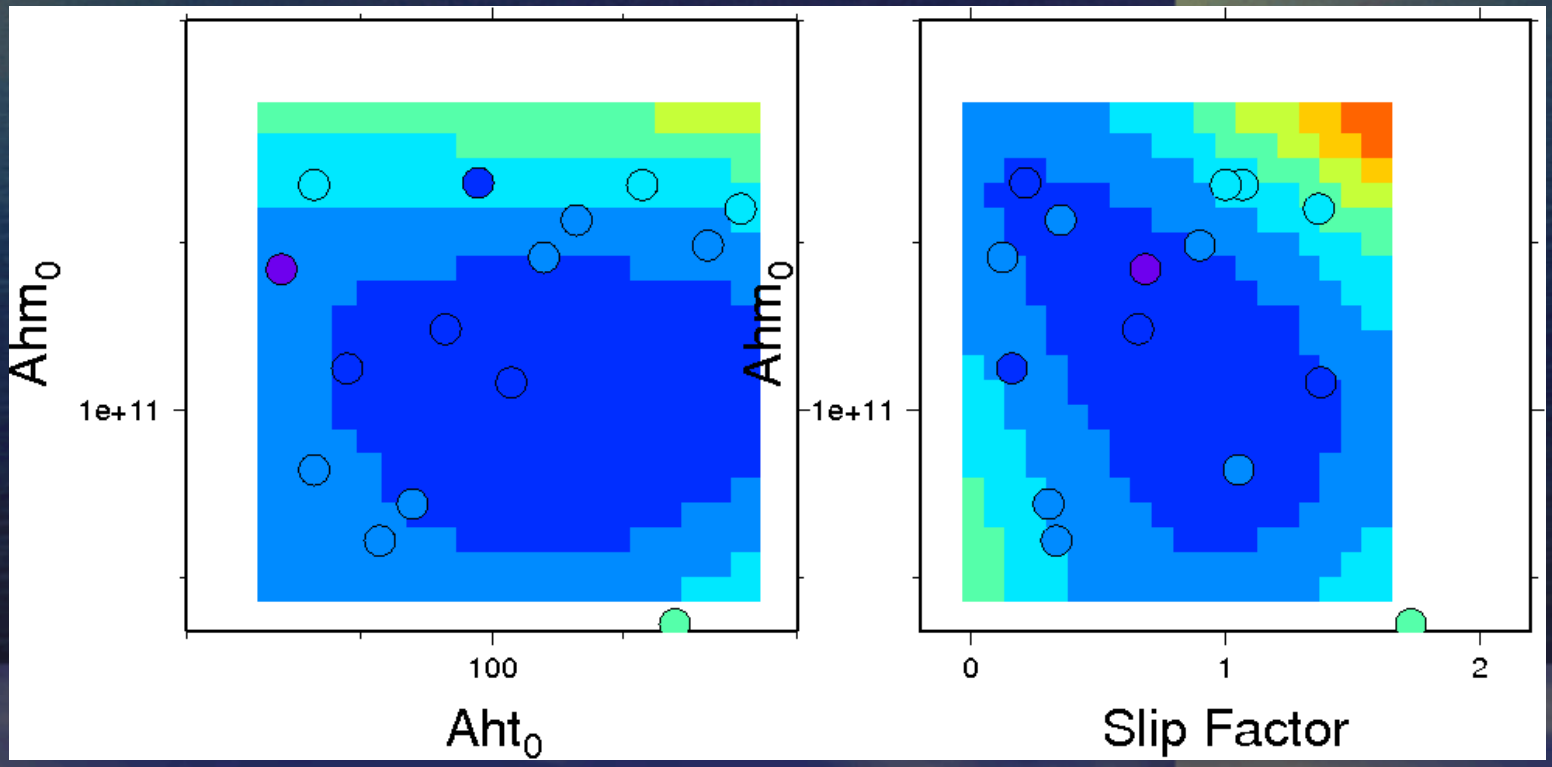


Preliminary results with 3 parameters (3-dimensional minimization) for the ¼ degree NA domain: ahm0, aht0, slip parameter

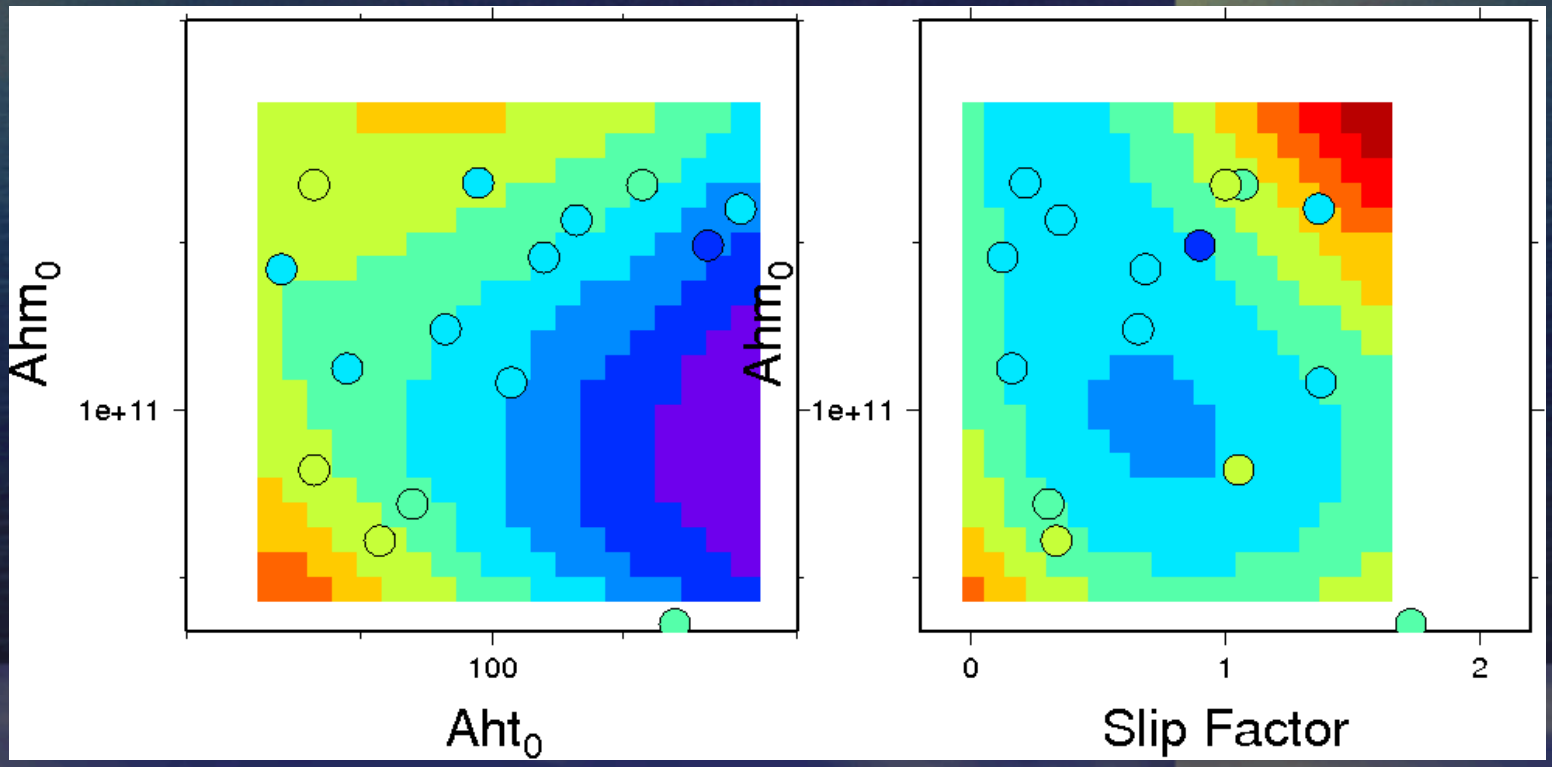


The metric being minimzed is $0.5*\iint (ssh\_mean--ssh\_mean\_obs)^2 + \iint (ssh\_std--ssh\_std\_obs)^2 + 1/100 * 0.5*\iint (ssh\_skew--ssh\_skew\_obs)^2$

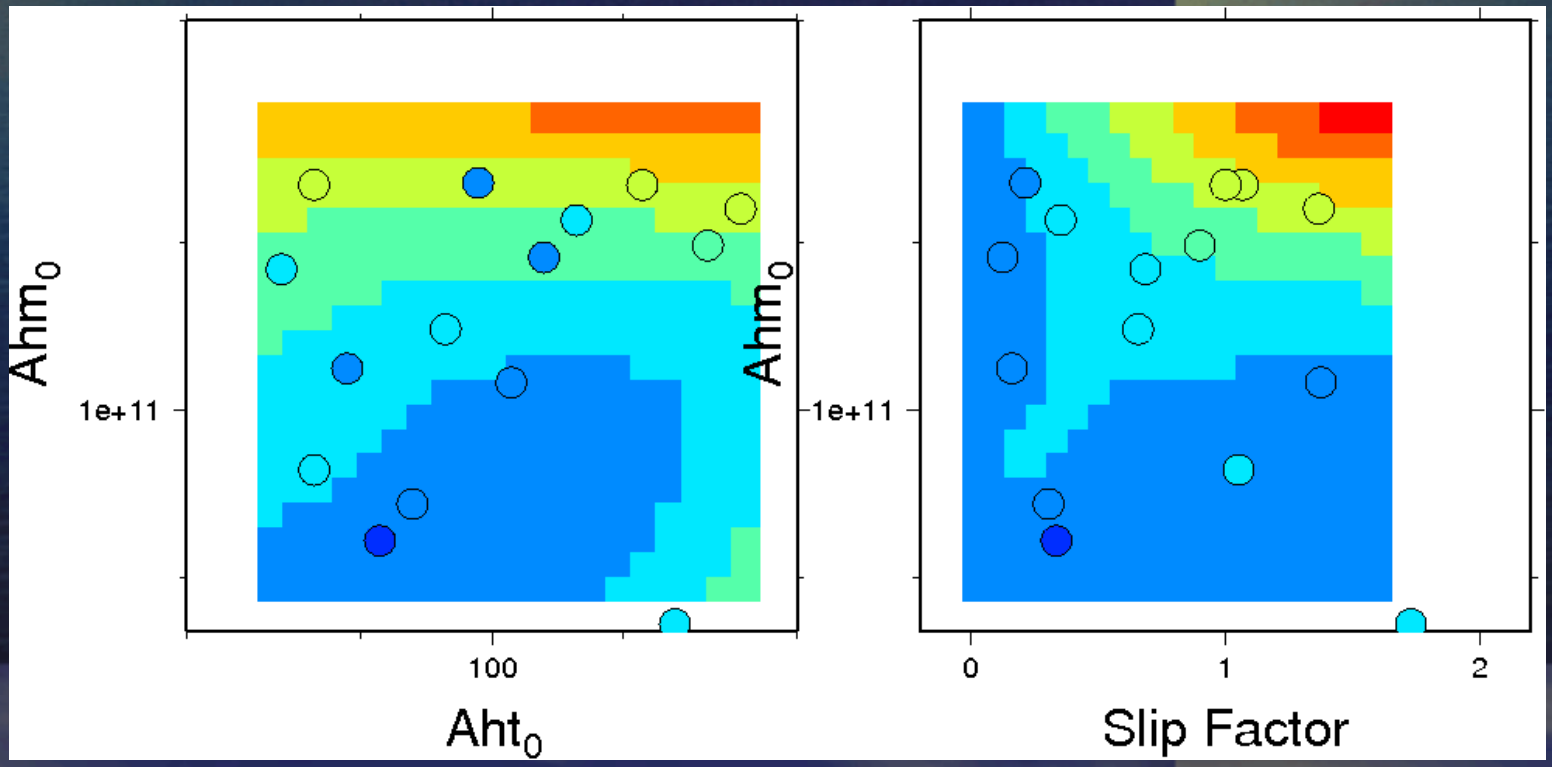
Same for mean ssh alone

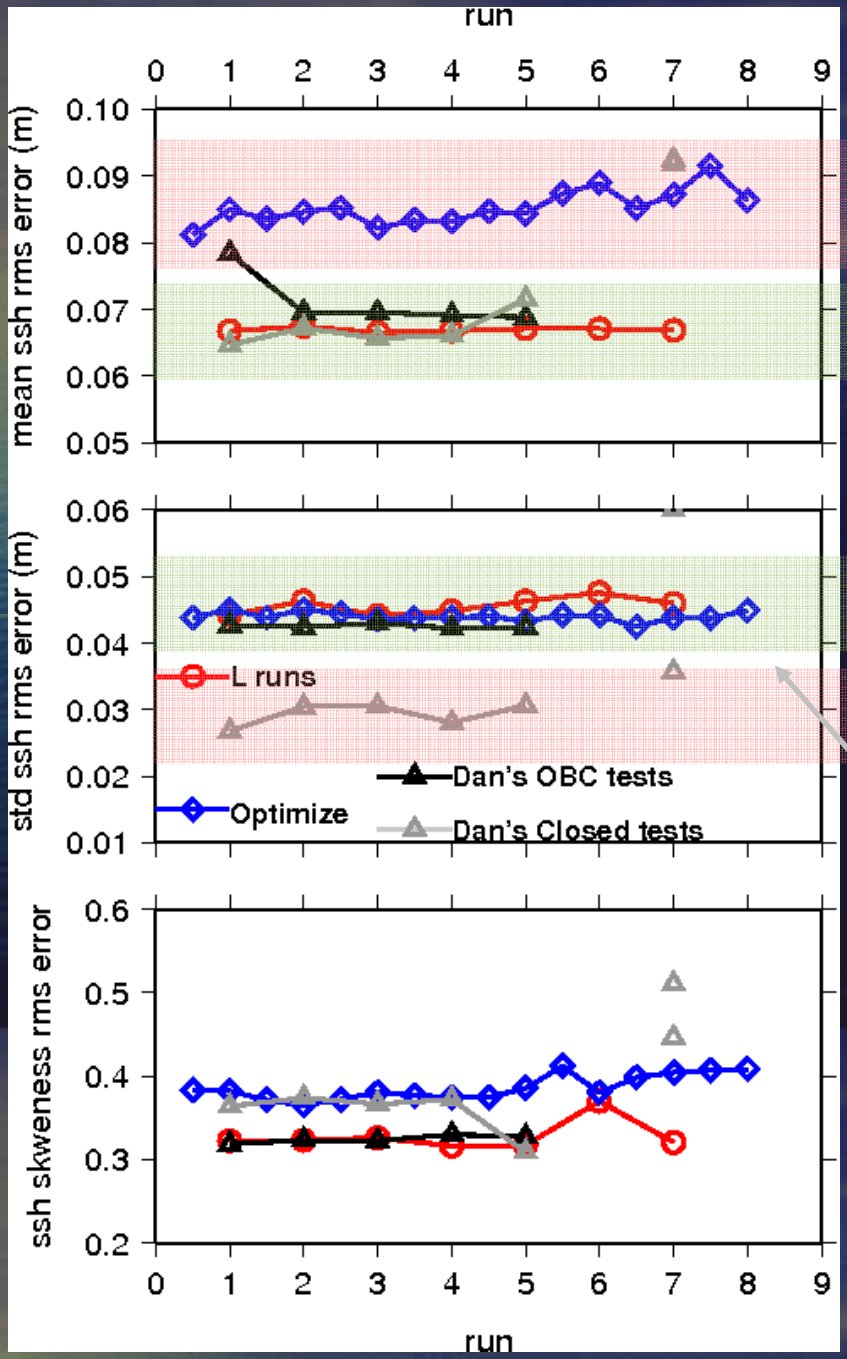


Same for std of ssh alone



Same for skewness of ssh alone





no-nudging

nudged runs

OBC runs

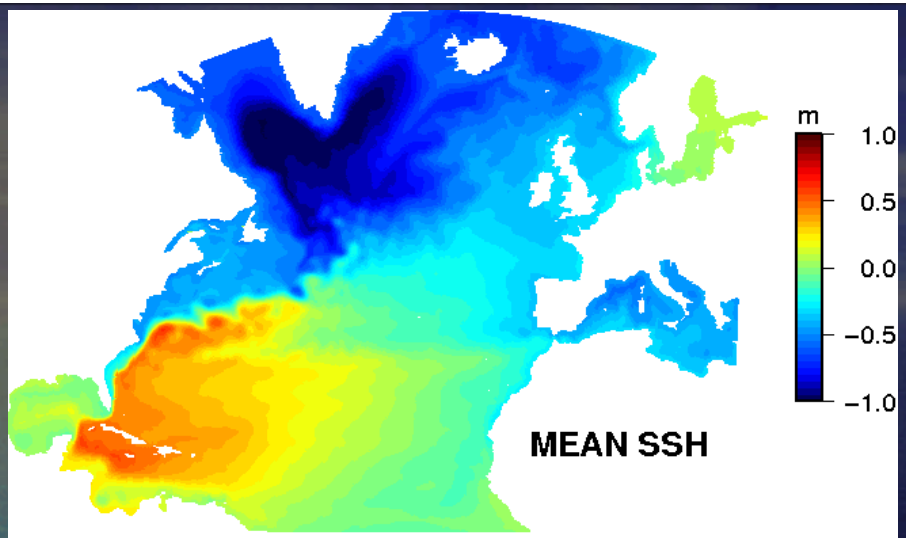
Closed boundaries

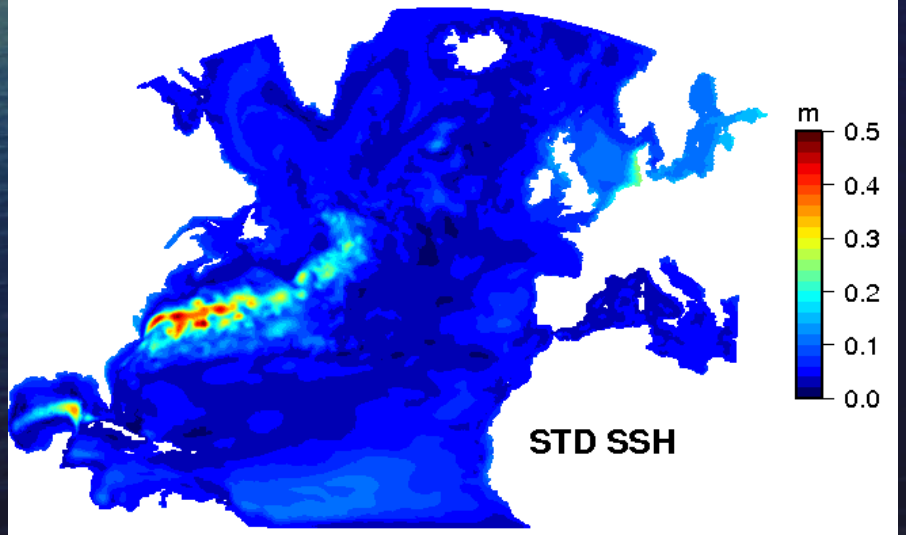
When one looks at the whole history of Runs we have at BIO, forcing, nudging and setup are more important than choice of parameters.

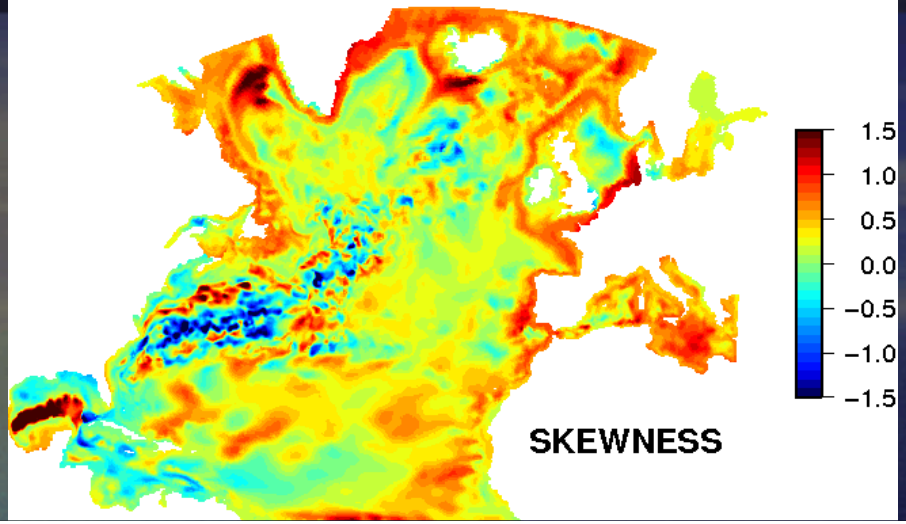
Apparent effect of seasonal volume change which is included in closed walls but removed with OBC

Code updates

- **OBC fully enabled** (October version) and tested for the NA ¼ degree and the CNOOFS domain. The radiation condition for velocity was disactivated as this feature was not found to be very robust.
- **OBC volume conservation for multi-processors**: bug corrected in original NEMO code: missing mask for active nodes, missing double double precision summation. **Effect:artificial drift in SSH depending on domain decomposition.**
- **Sea ice:** Wind stress over ice cleaned-up, SSH tilt over ice, correction in flx_CORE (Y. Lu, J. Sue, JM Molines, S Alderson).
- **AGRIF enabled** and ice included



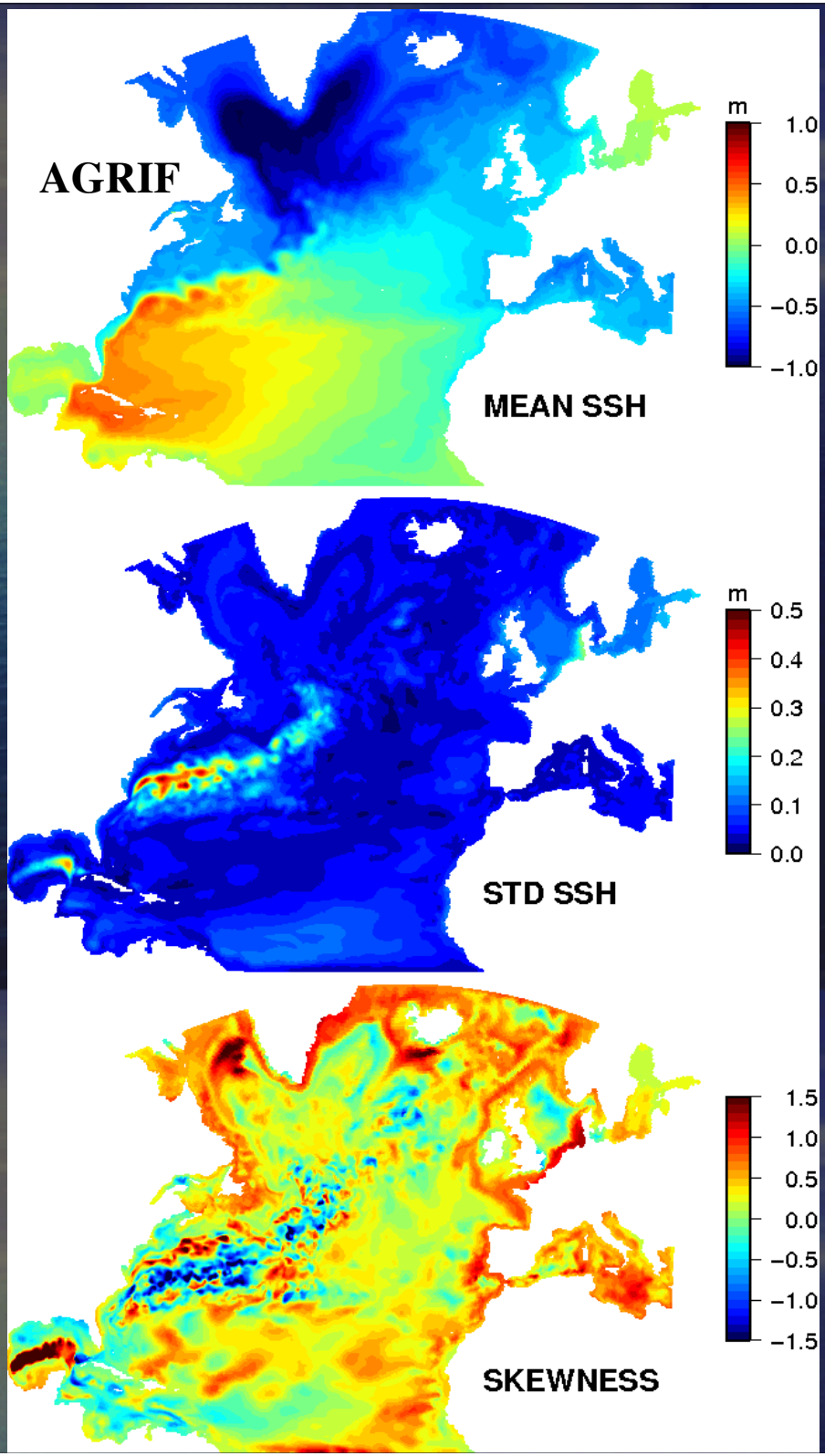


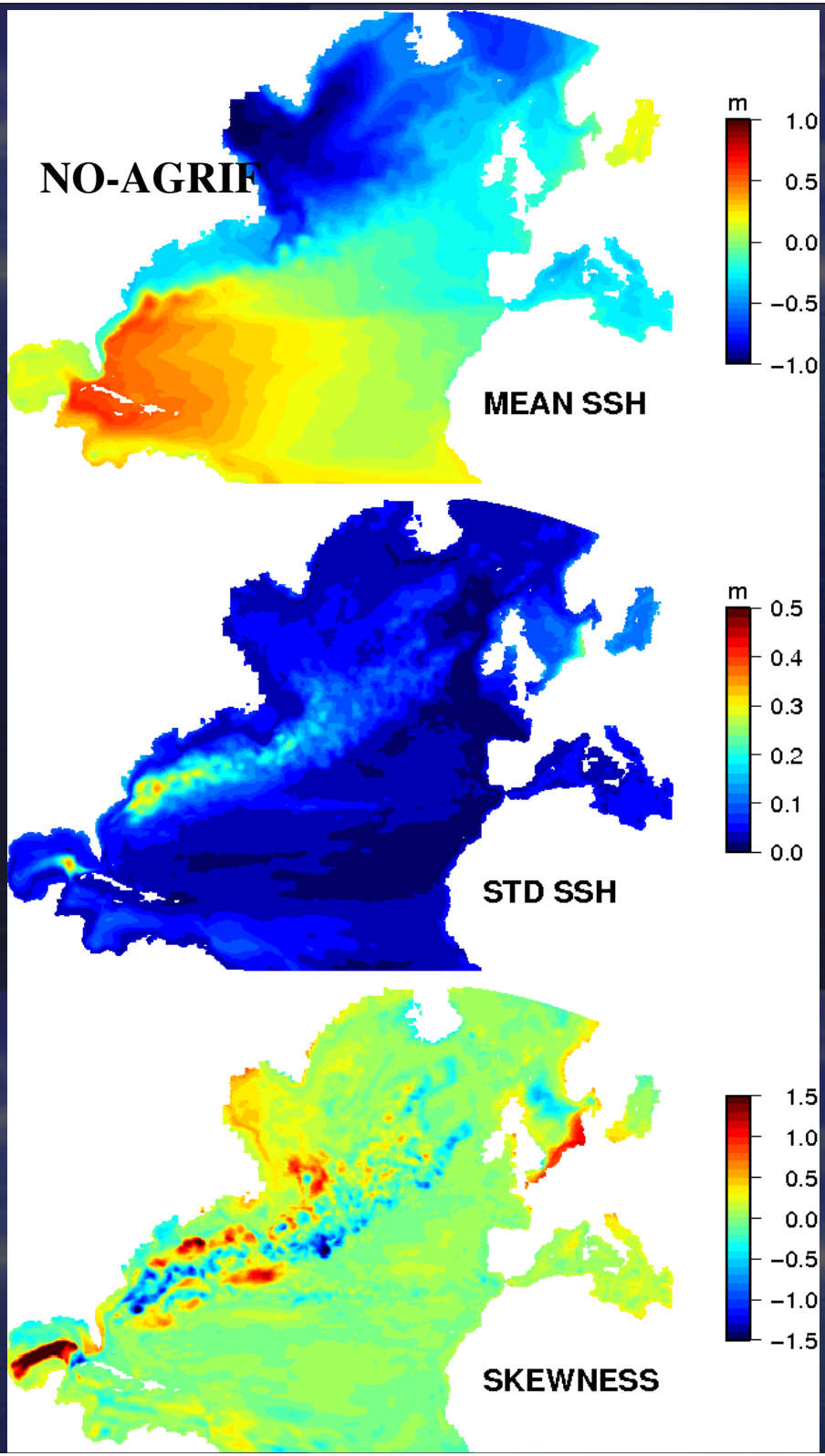


AGRIF test with ¼ degree NA with 1/12 degree embedded.

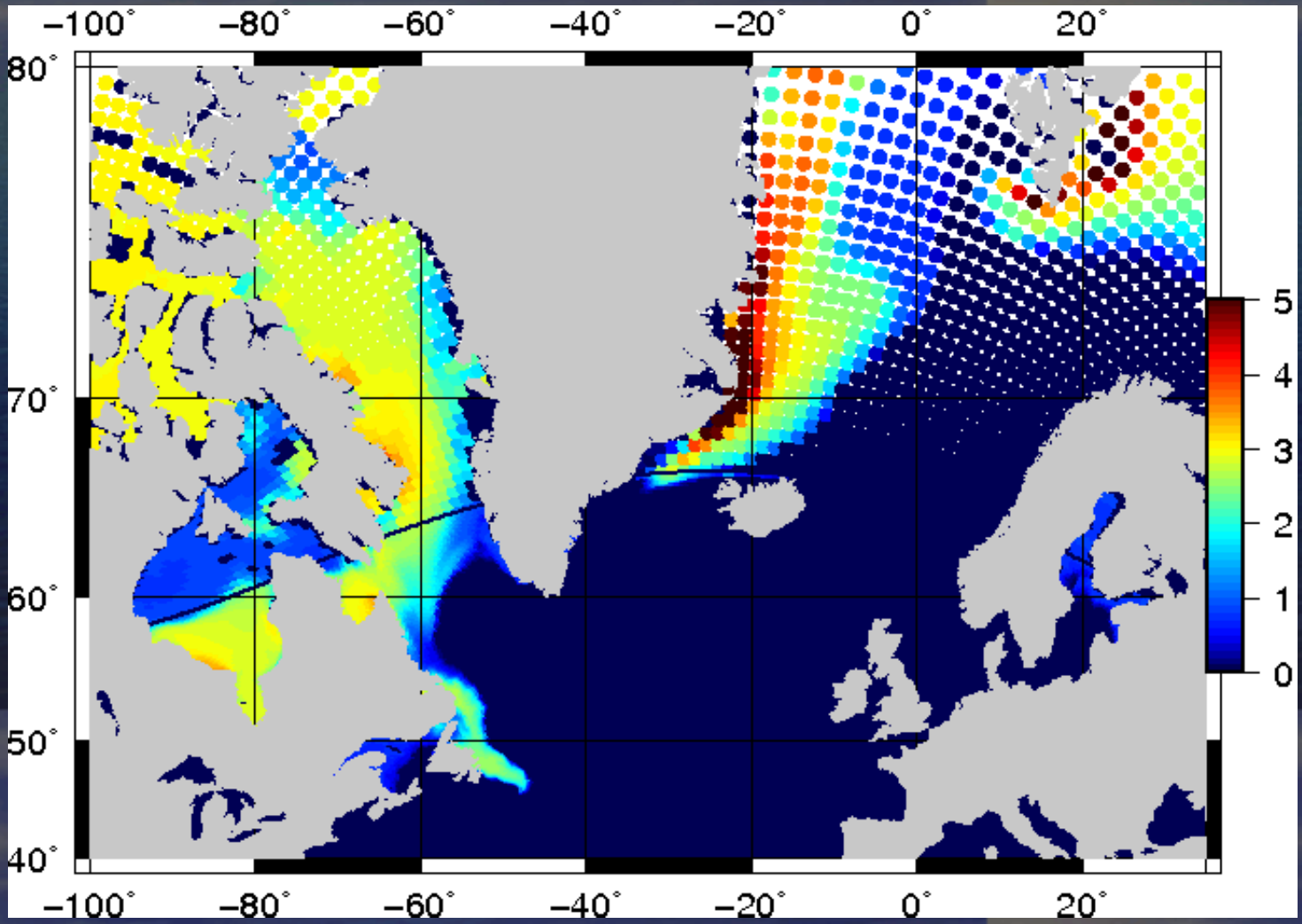
This test run has been run for only 2 years and the statistics only excludes the first 2 month: large possibilities for biases to be still present therefore remain, in particular in skewness.

Remaining issues: Transferring E-P fields between the child and patent grids.


AGRIF
MEAN SSH
m
1.0
0.5
0.0
−0.5
−1.0
STD SSH
m
0.5
0.4
0.3
0.2
0.1
0.0
SKEWNESS
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5


NO-AGRIF
MEAN SSH
m
1.0
0.5
0.0
−0.5
−1.0
STD SSH
m
0.5
0.4
0.3
0.2
0.1
0.0
SKEWNESS
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5

AGRIF test with ice between 1 degree global and ¼ North Atlantic after one month



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