Assessment of the ECCO2 High-Resolution Global-Ocean and Sea-Ice Data Synthesis

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Outline

1. RMS Model-Data Difference
   a. RMS misfit from Reynolds SST;
   b. RMS misfit from altimeter-derived SSH/SLA;
   c. Difference from WOA05 climatological T/S:
   d. Difference from in-situ T/S profiles

2. Meridional Transports

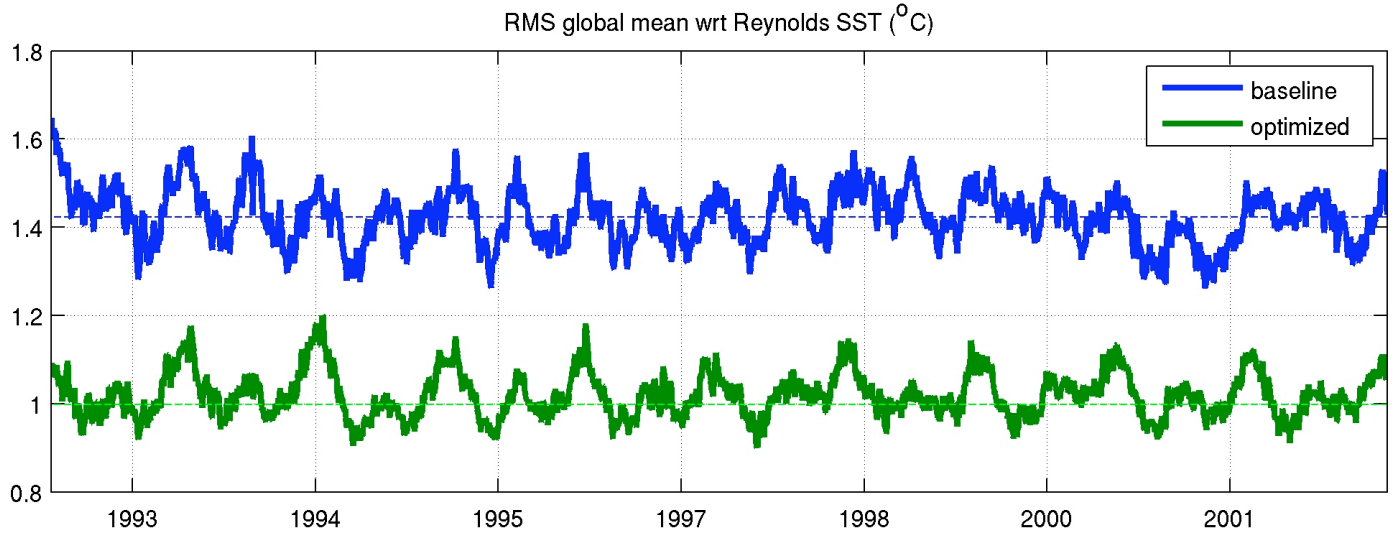
3. Change in Sea Level and Heat Content

4. Concluding Remarks

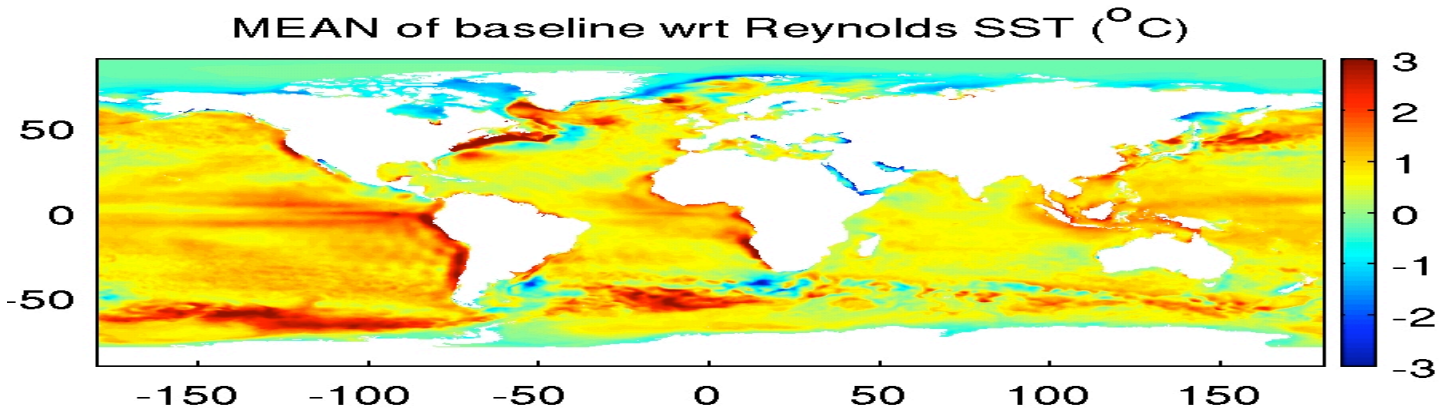
1. Model Data Difference

SST; SSH; T/S

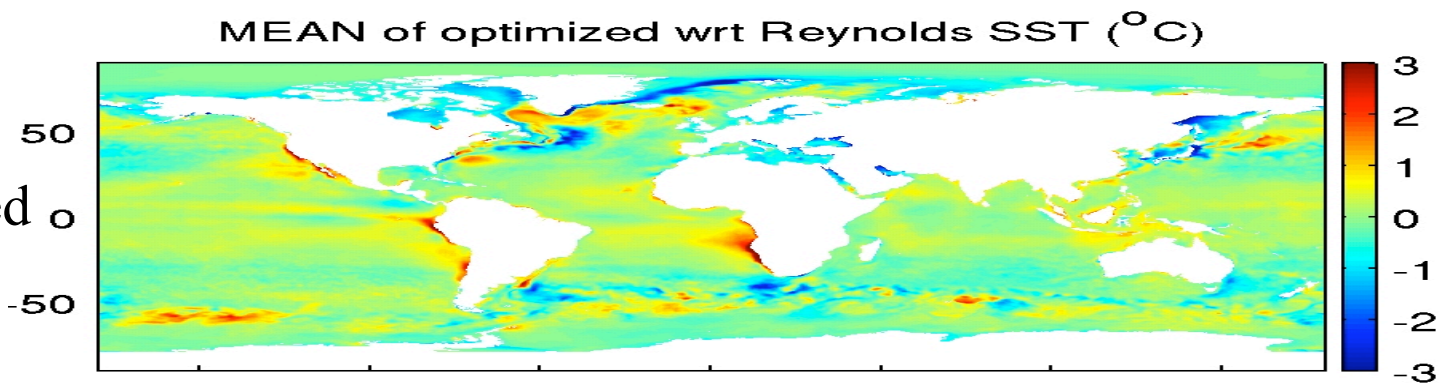
SST



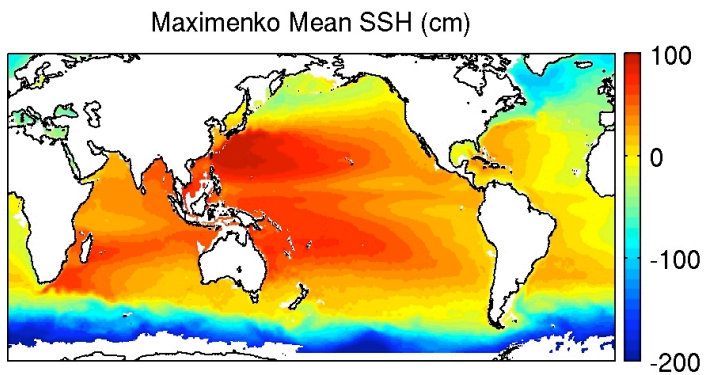
baseline

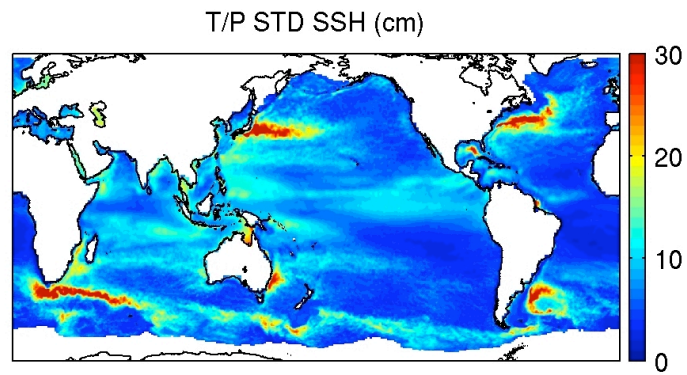


optimized



SSH





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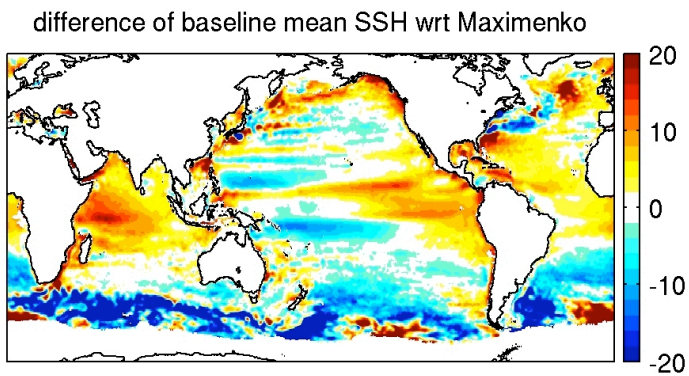
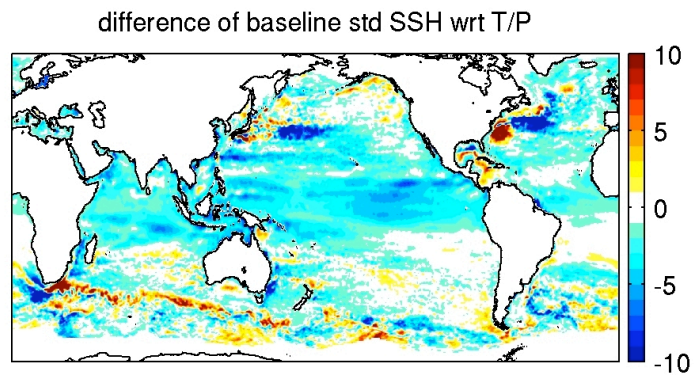
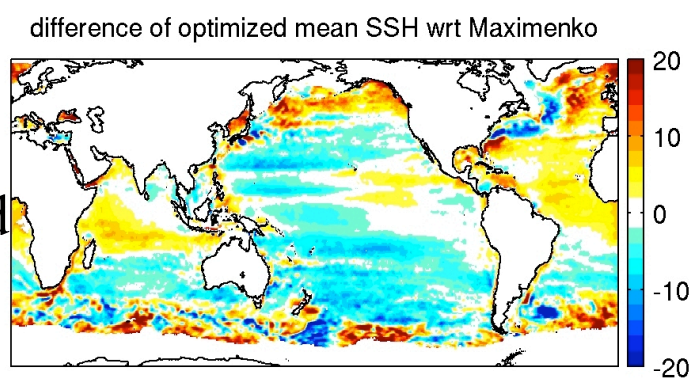
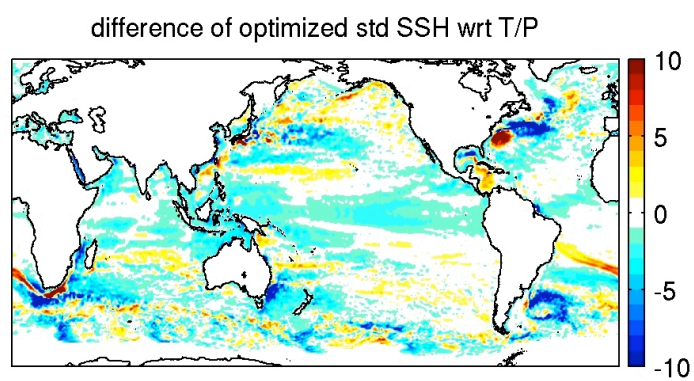


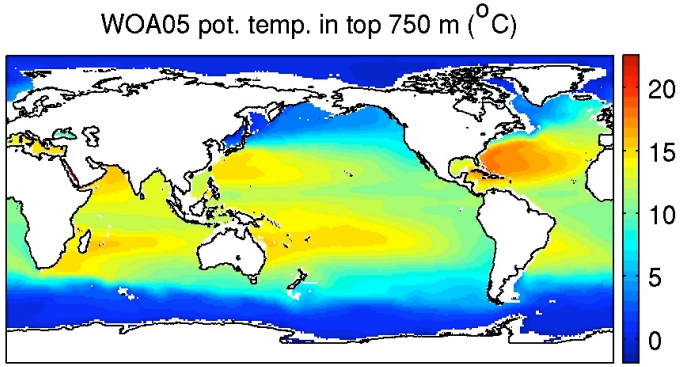


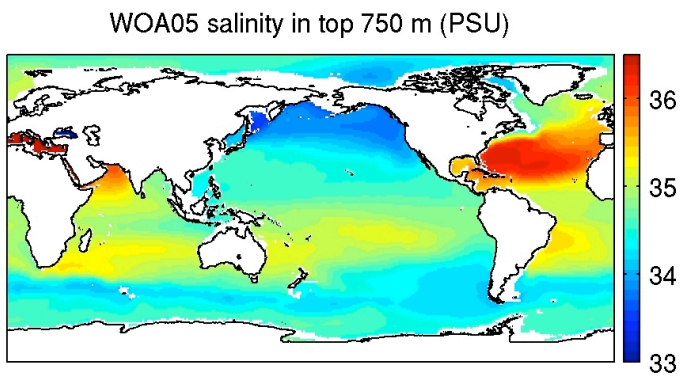
optimized





T/S





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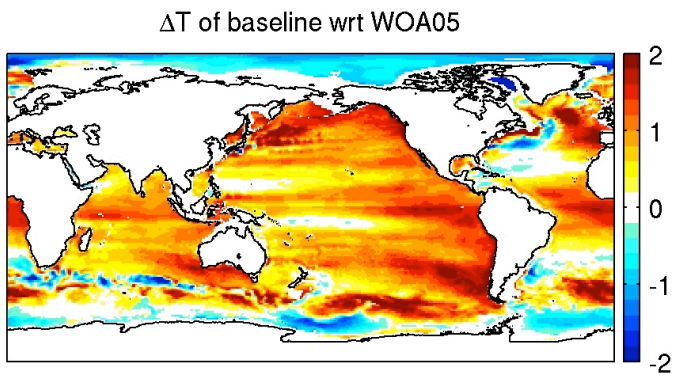

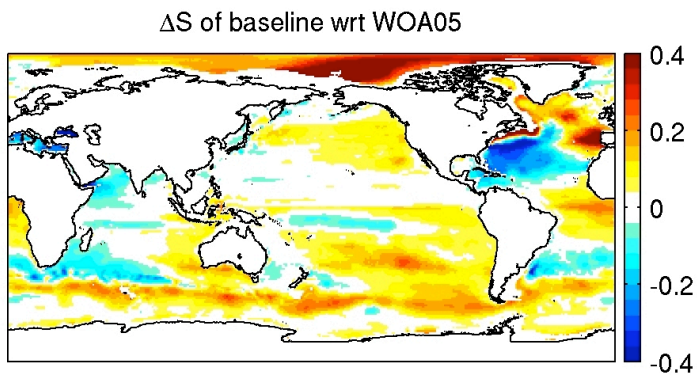

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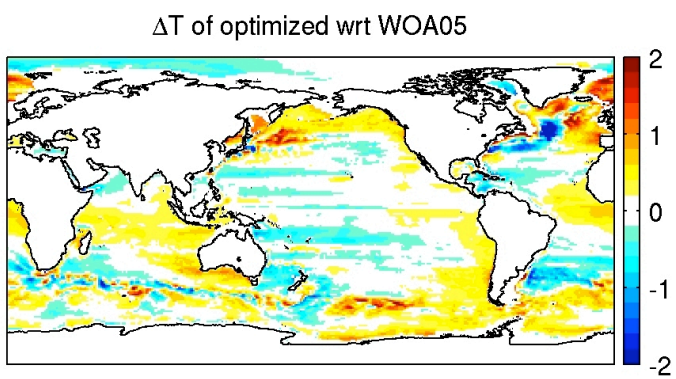
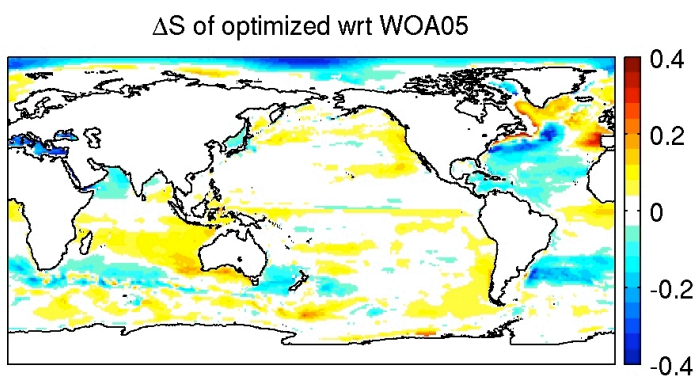
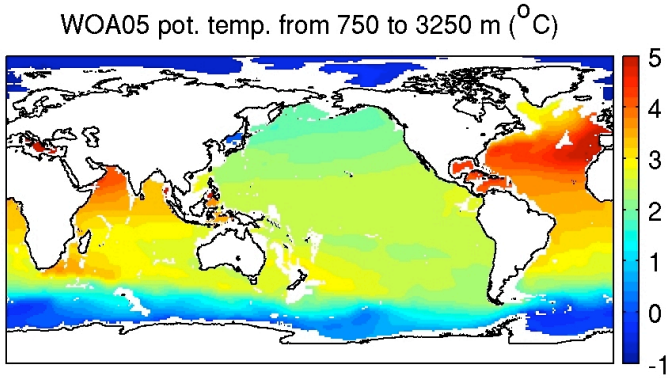
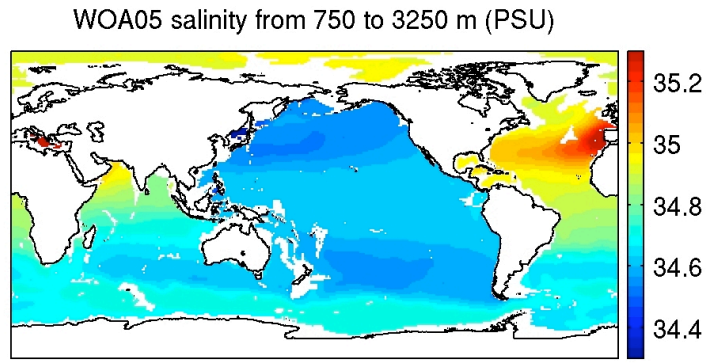


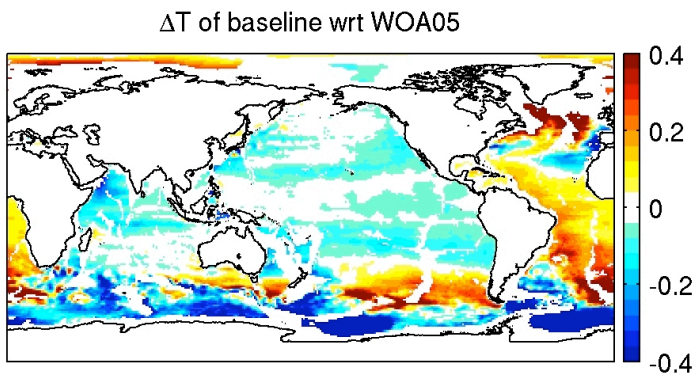


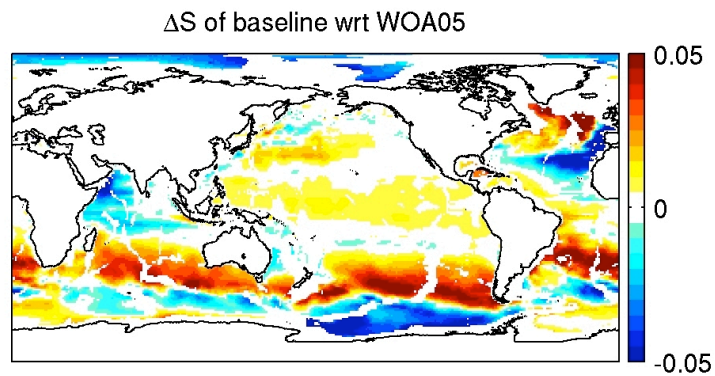
T/S



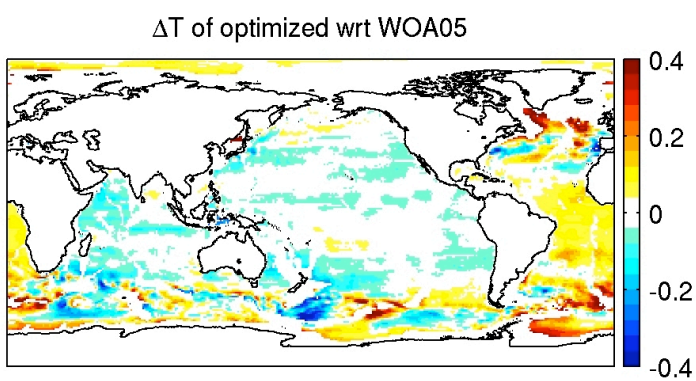


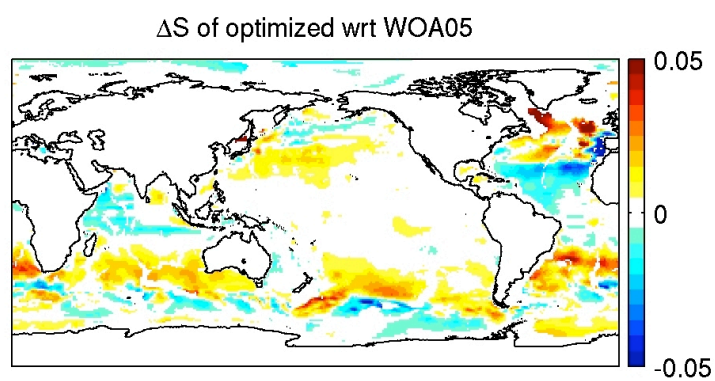
baseline



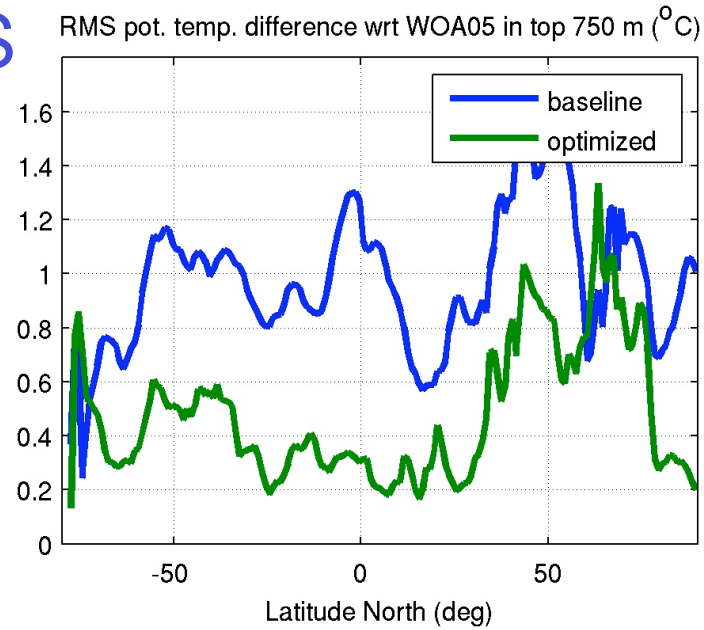


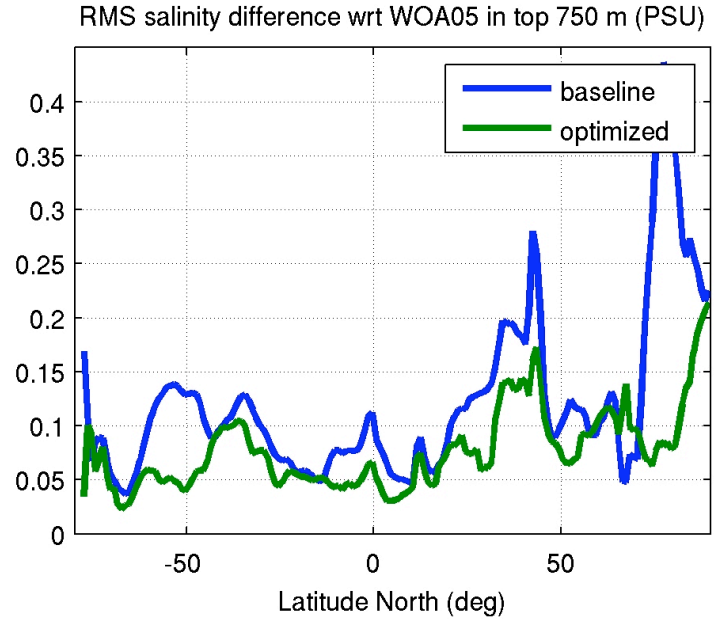
optimized

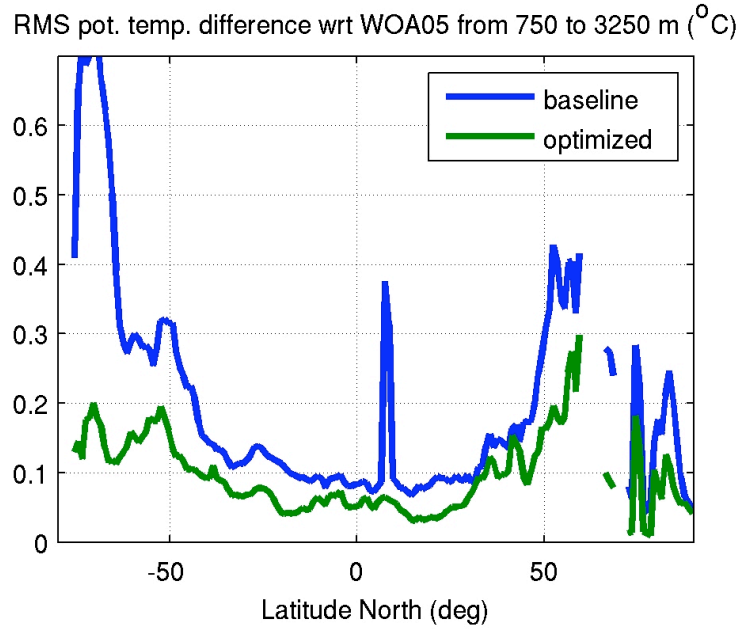


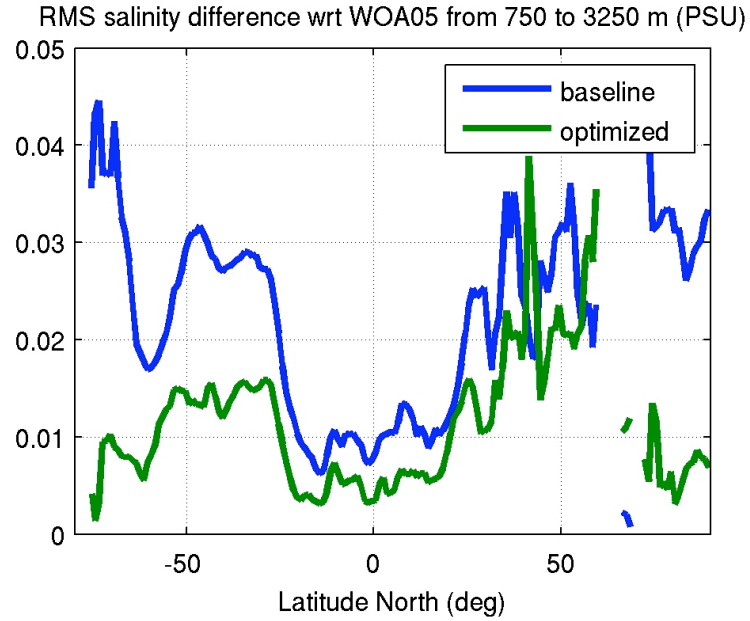


T/S


RMS pot. temp. difference wrt WOA05 in top 750 m (°C)
baseline
optimized
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-50
0
50
Latitude North (deg)


RMS salinity difference wrt WOA05 in top 750 m (PSU)
baseline
optimized
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-50
0
50
Latitude North (deg)


RMS pot. temp. difference wrt WOA05 from 750 to 3250 m (°C)
baseline
optimized
0.6
0.5
0.4
0.3
0.2
0.1
0
-50
0
50
Latitude North (deg)

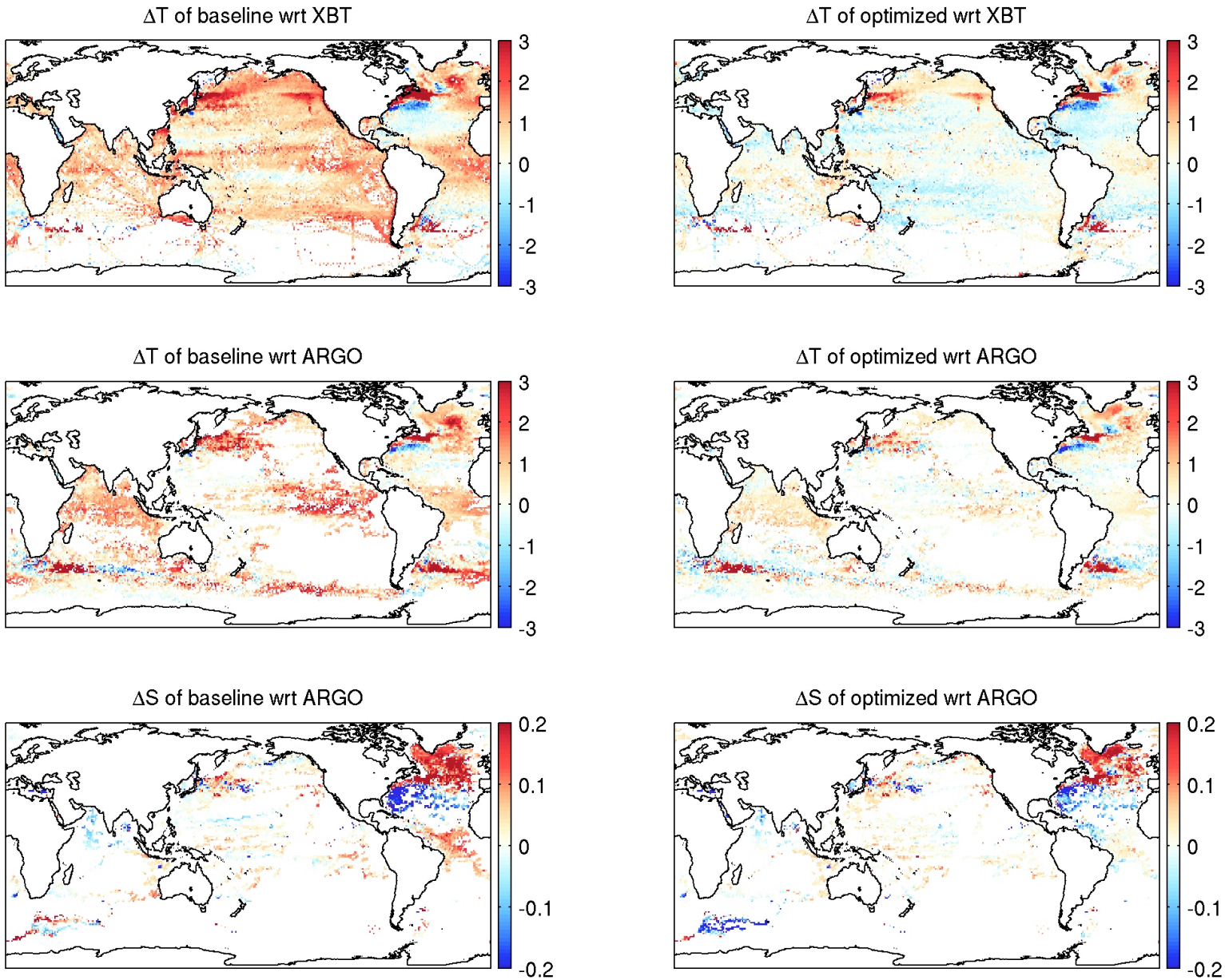

RMS salinity difference wrt WOA05 from 750 to 3250 m (PSU)
baseline
optimized
0.05
0.04
0.03
0.02
0.01
0
-50
0
50
Latitude North (deg)

T/S

XBT

Argo-T

Argo-S

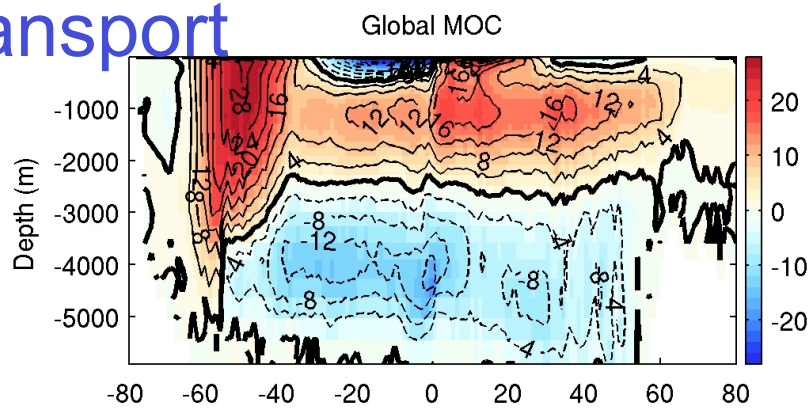


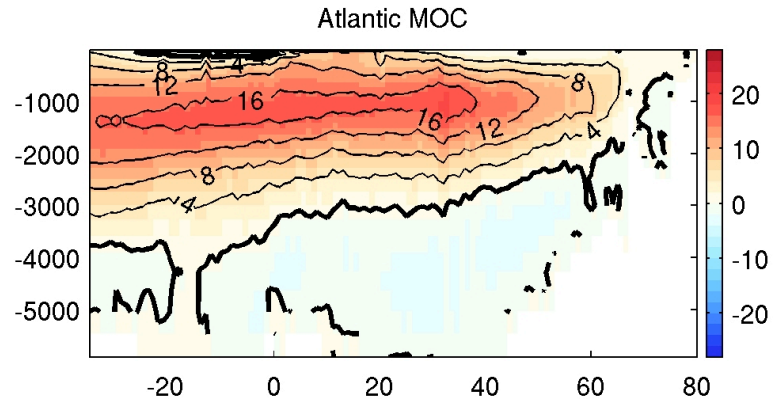
baseline

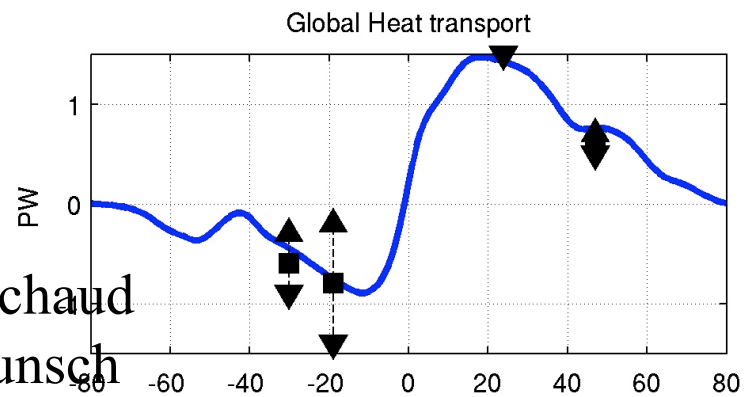
optimized

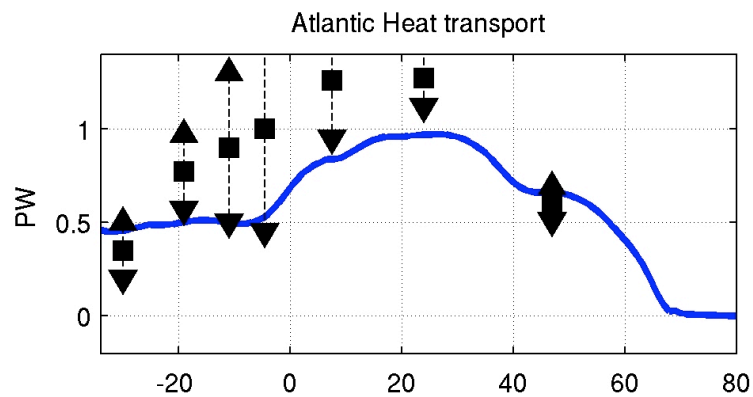
2. Meridional Tansports

Transport

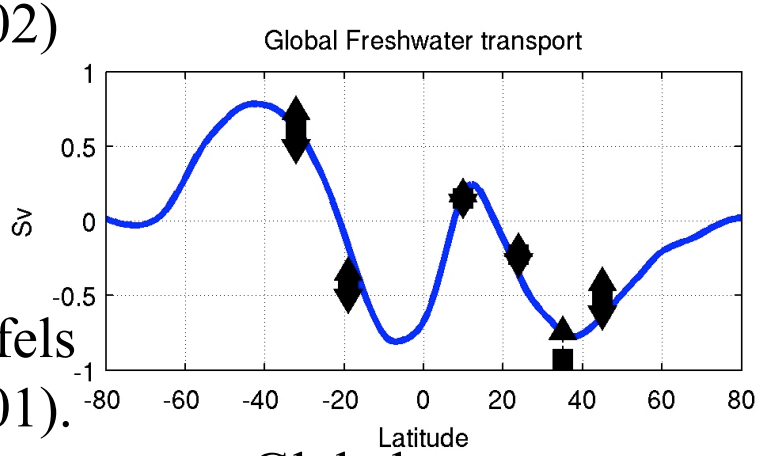


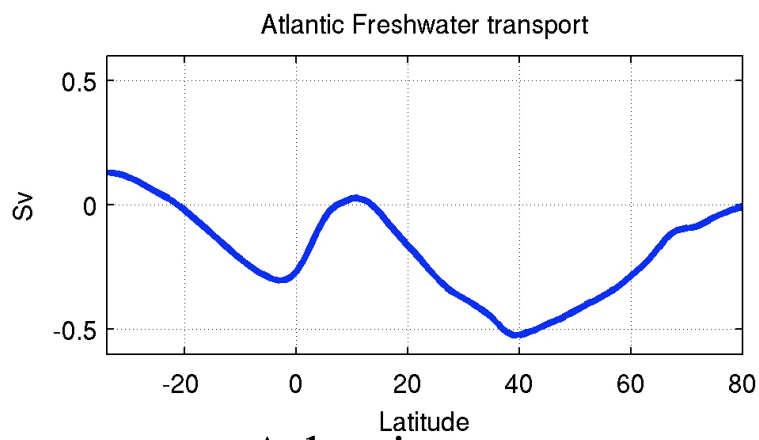






Ganachaud & Wunsch (2002)





Wijffels (2001).

Global ocean

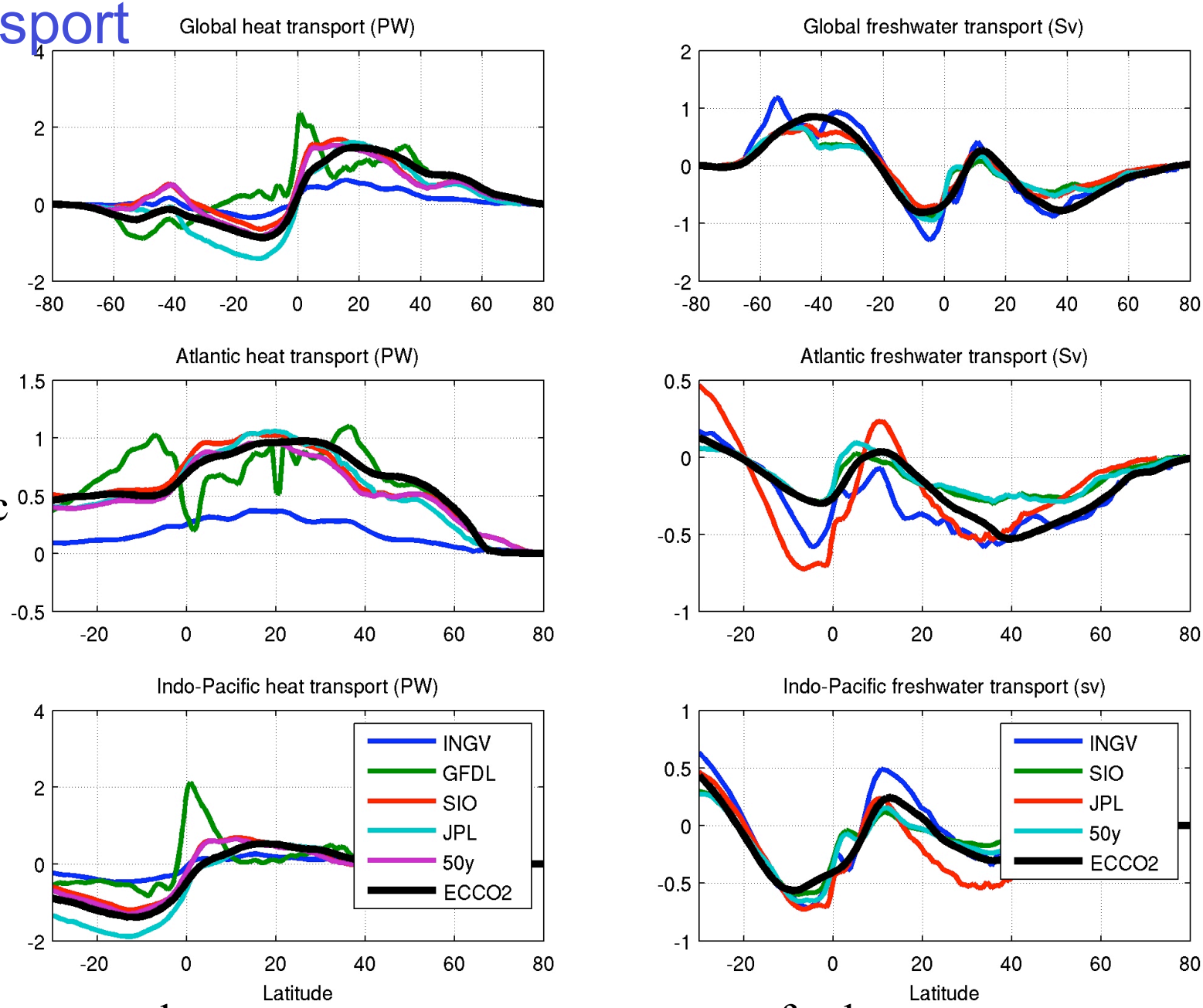
Atlantic ocean

Transport

Global

Atlantic

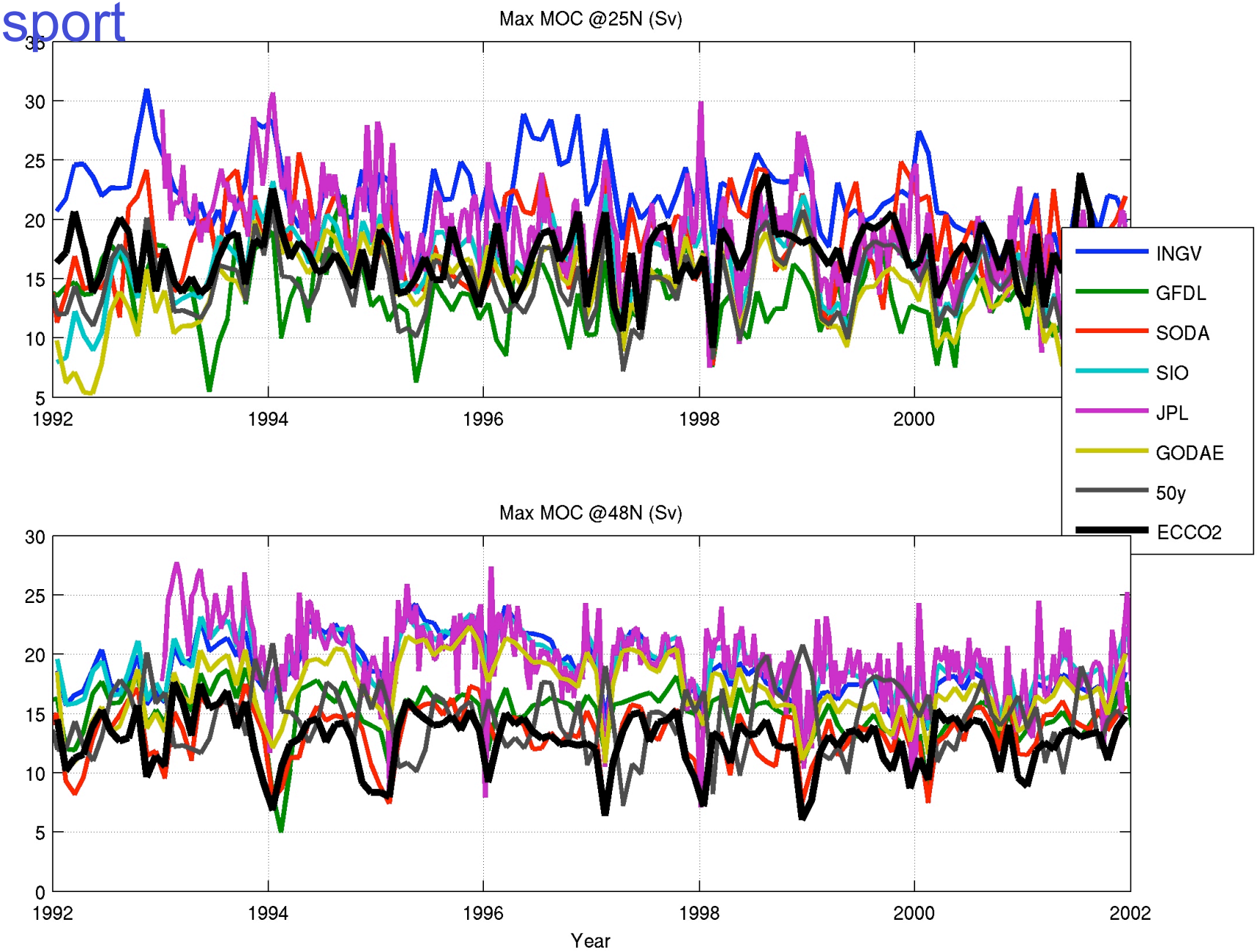
Indo-Pacfic



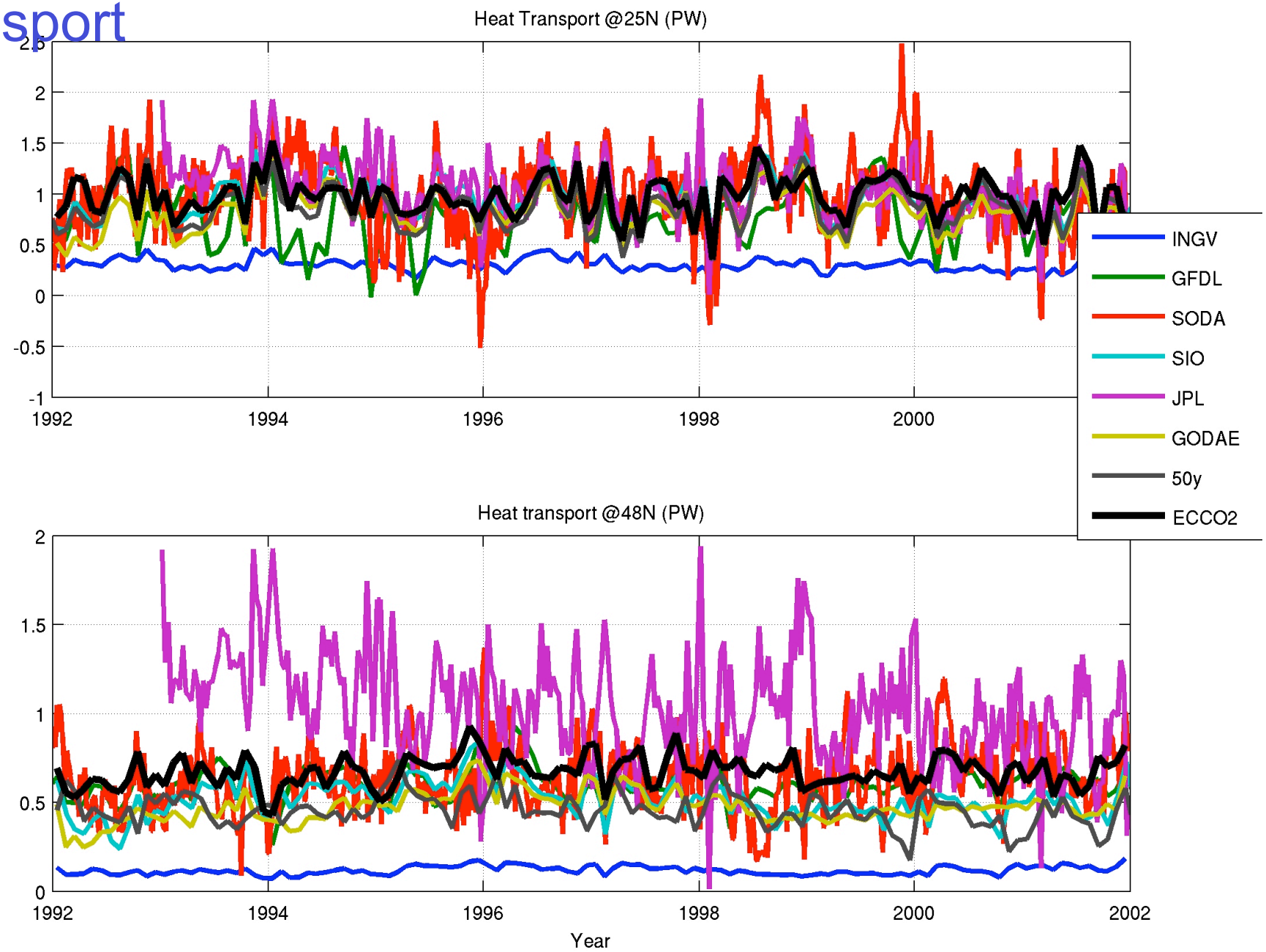
heat transport

freshwater transport

Transport

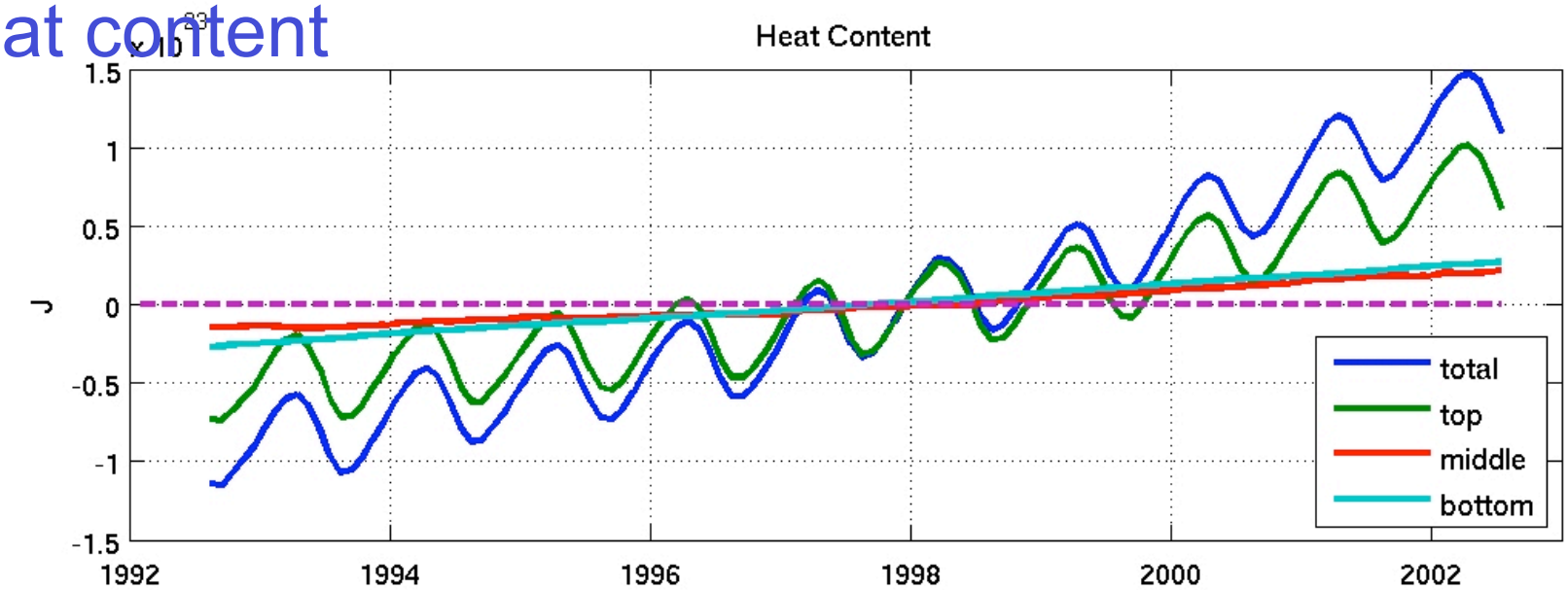

Max MOC @25N (Sv)
35
30
25
20
15
10
5
1992
1994
1996
1998
2000
INGV
GFDL
SODA
SIO
JPL
GODAE
50y
ECCO2
Max MOC @48N (Sv)
30
25
20
15
10
5
0
1992
1994
1996
1998
2000
2002
Year

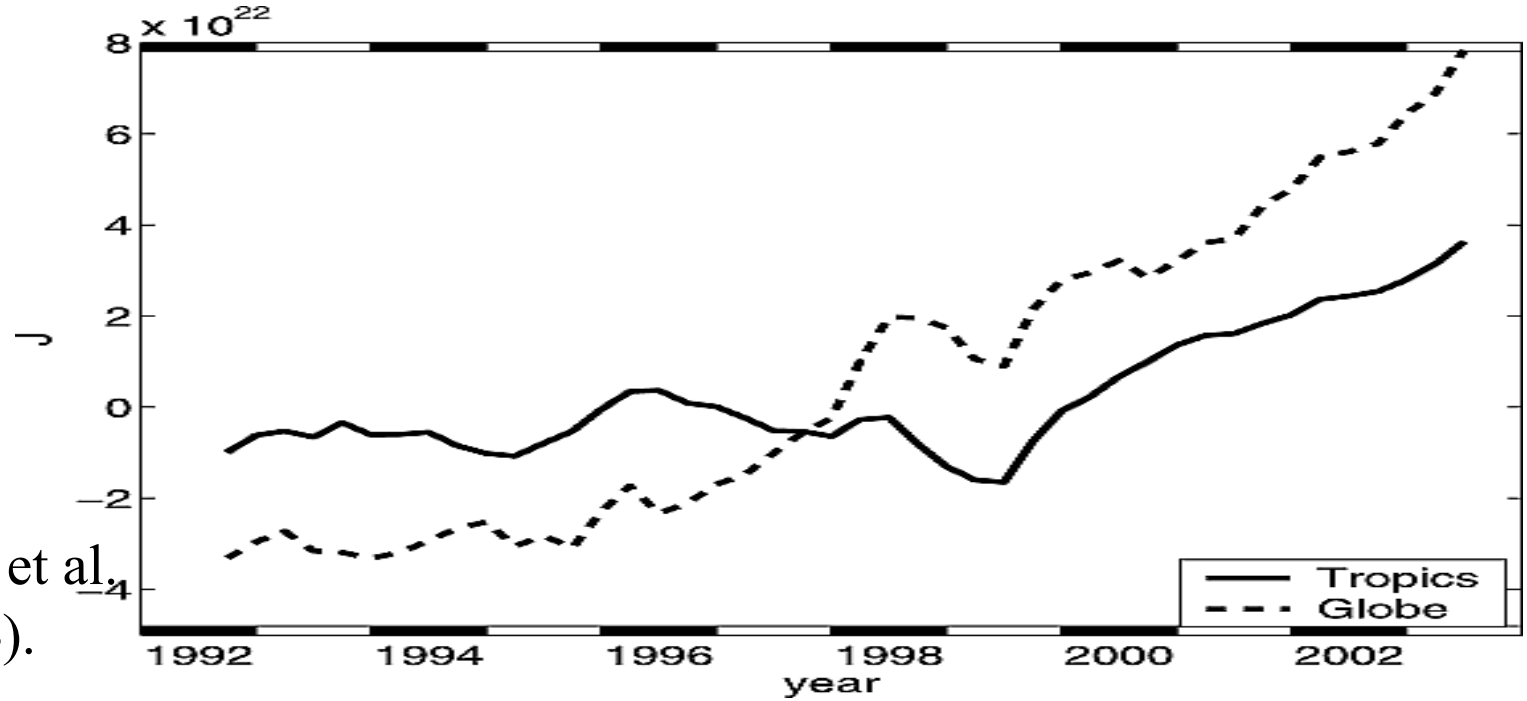
Transport


Heat Transport @25N (PW)
2.5
2
1.5
1
0.5
0
-0.5
-1
1992
1994
1996
1998
2000
Heat transport @48N (PW)
2
1.5
1
0.5
0
1992
1994
1996
1998
2000
2002
Year
INGV
GFDL
SODA
SIO
JPL
GODAE
50y
ECCO2

3. Sea Level and Heat Content Change

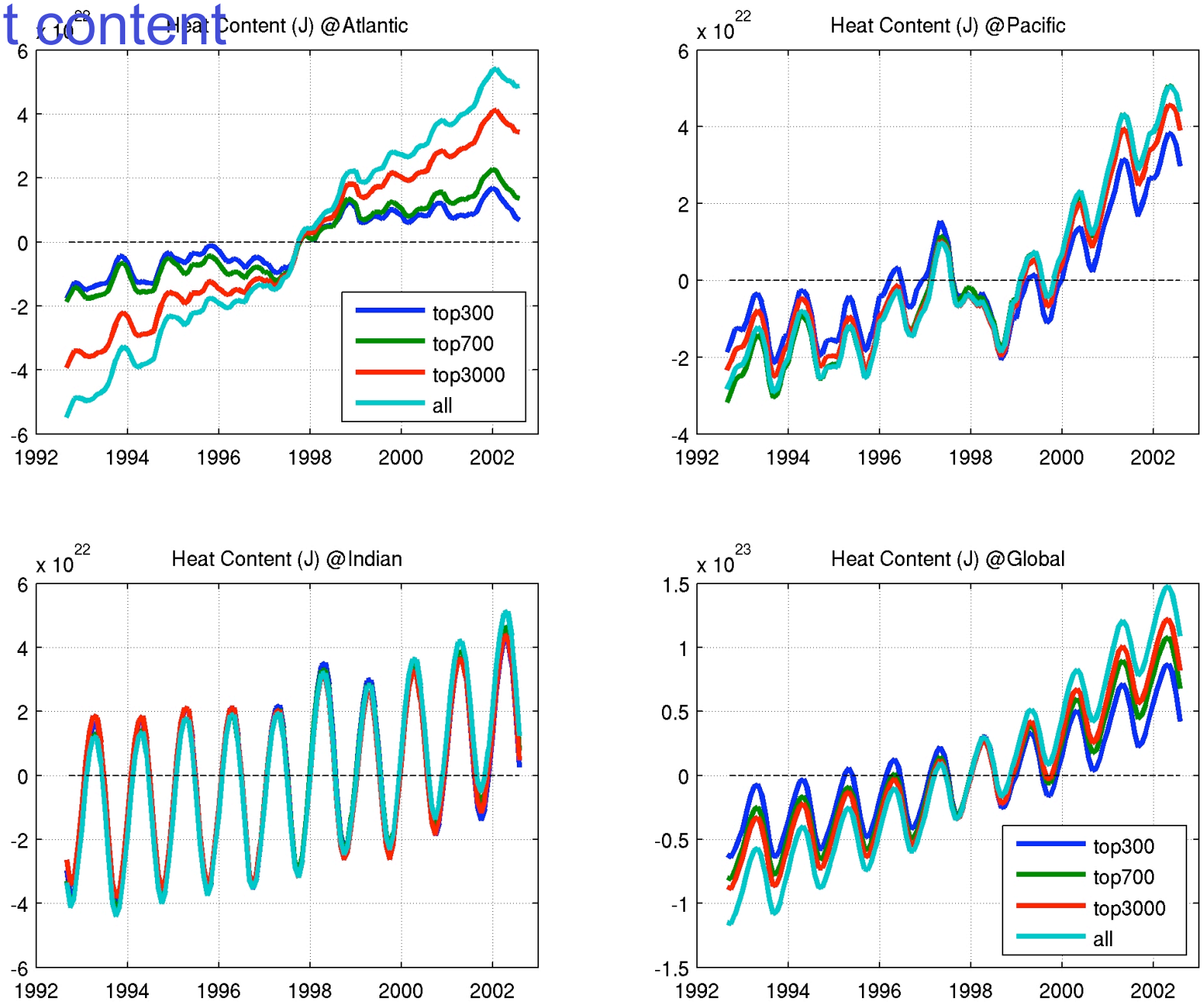
heat content



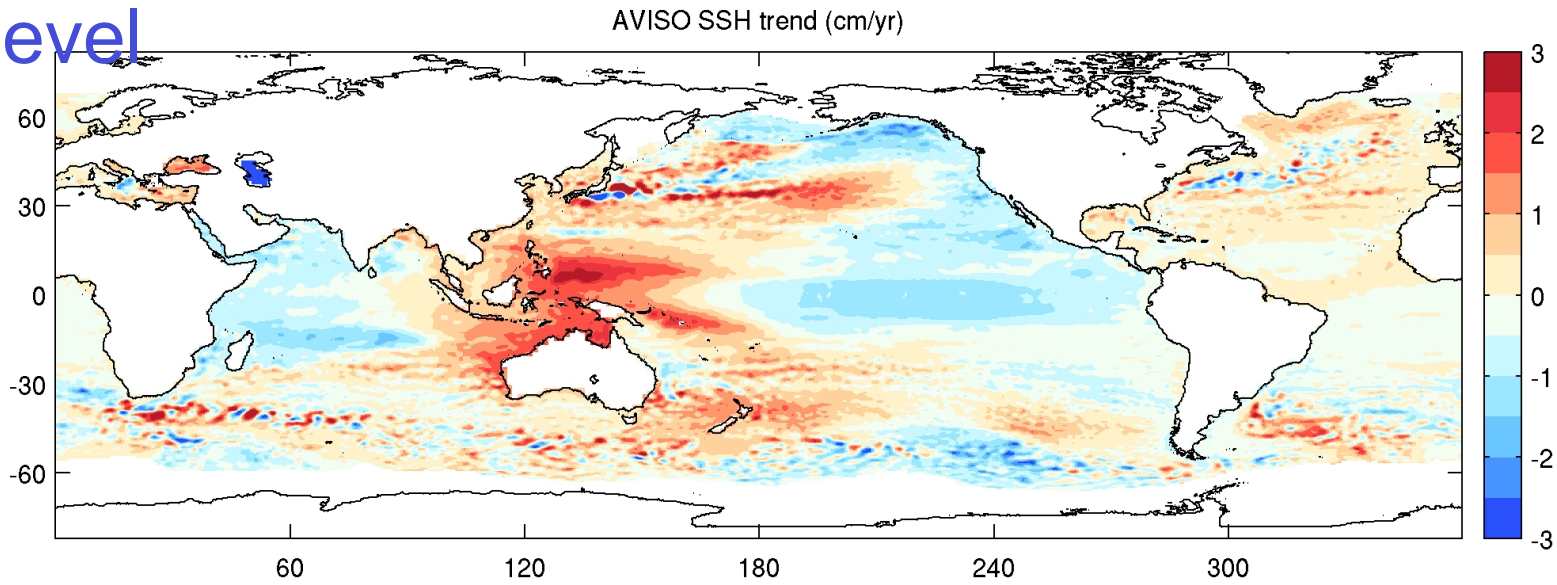


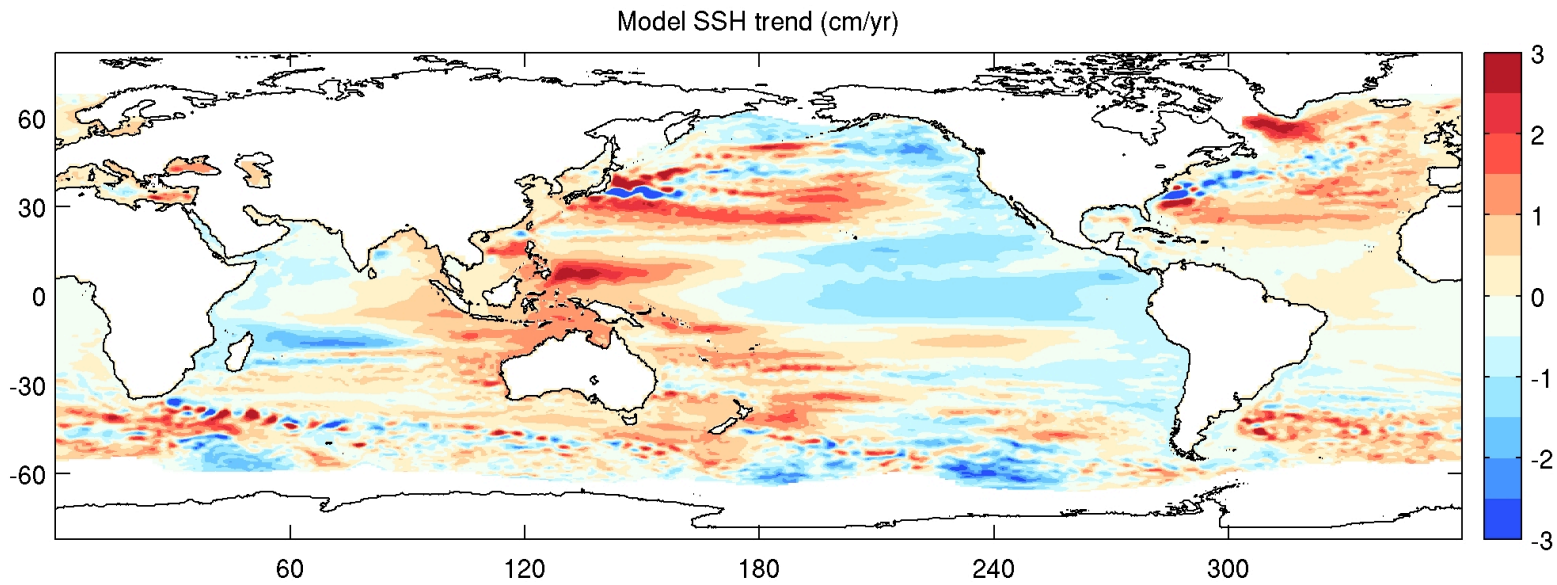
Willis et al. (2004).

heat content



sea level

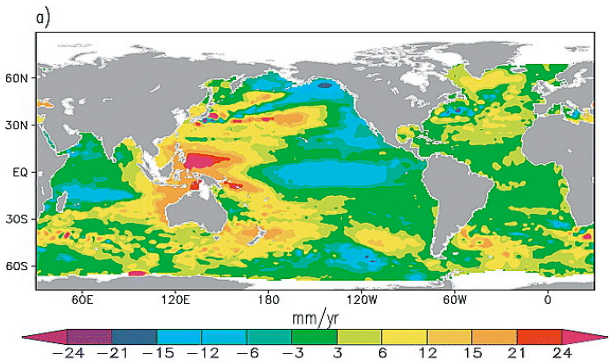

AVISO SSH trend (cm/yr)
60
30
0
-30
-60
60
120
180
240
300
3
2
1
0
-1
-2
-3

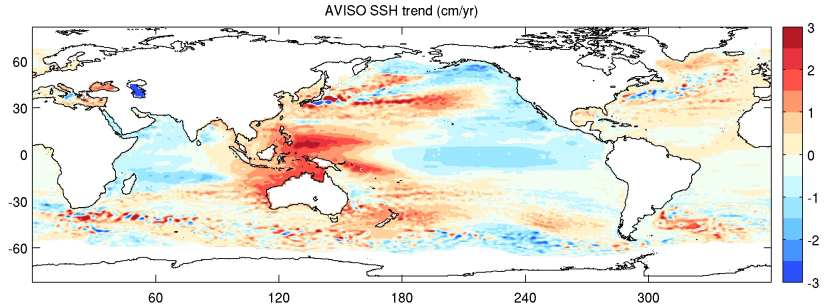

Model SSH trend (cm/yr)
60
30
0
-30
-60
60
120
180
240
300
3
2
1
0
-1
-2
-3

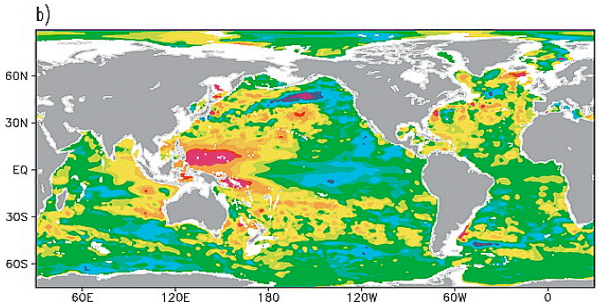
4. Concluding Remarks

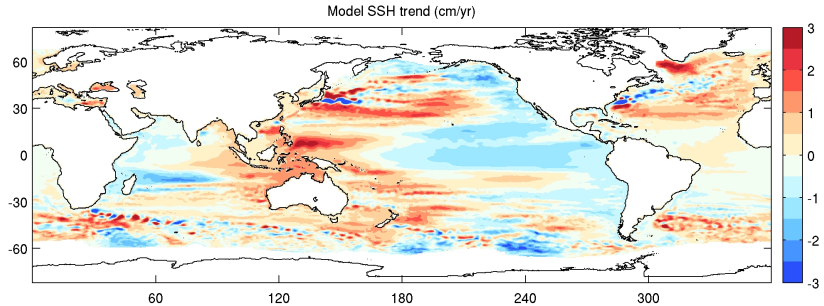
- A global, full-depth-ocean and sea-ice configuration of the MITgcm has been constrained with a variety of satellite and in-situ data products using a Green's function approach;
- This optimized solution is much closer to observations and to independent data-based estimates than the baseline integration for several key CLIVAR/GODAE metrics;
- Nevertheless, there remain discrepancies at the regional level, which are being addressed via a more complete optimization and via improved MITgcm parameterizations.

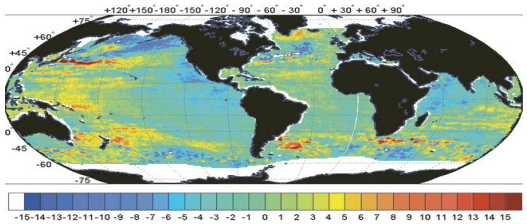
extras

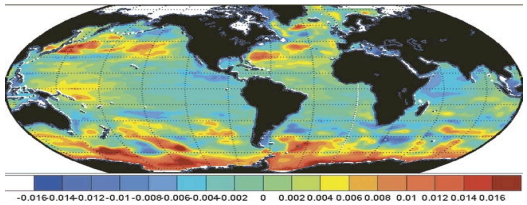

a)
60N
30N
EQ
30S
60S
60E
120E
180
120W
60W
0
mm/yr
−24 −21 −15 −12 −6 −3 3 6 12 15 21 24

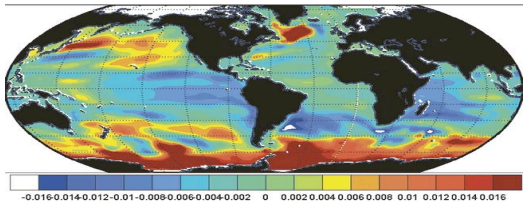

AVISO SSH trend (cm/yr)
60
30
0
-30
-60
60
120
180
240
300
3
2
1
0
-1
-2
-3

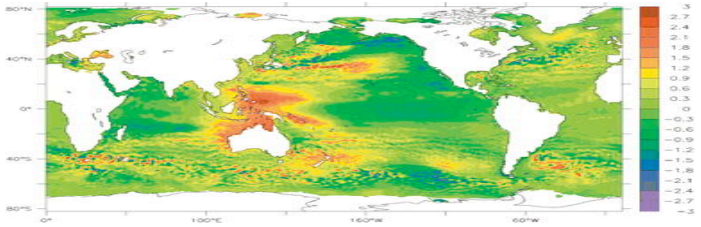

b)
60N
30N
EQ
30S
60S
60E
120E
180
120W
60W
0

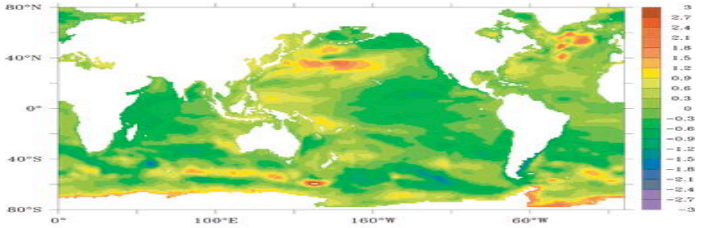

Model SSH trend (cm/yr)
60
30
0
-30
-60
60
120
180
240
300
3
2
1
0
-1
-2
-3

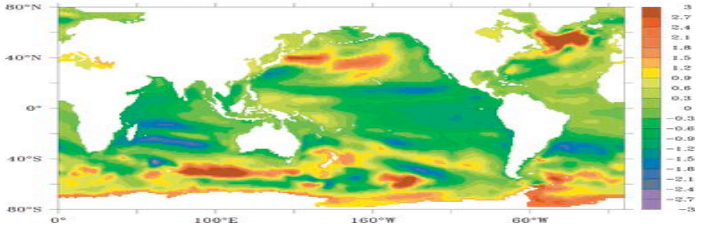

+120° +150° -180° -150° -120° -90° -60° -30° 0° +30° +60° +90°
-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15


-0.016 -0.014 -0.012 -0.01 -0.008 -0.006 -0.004 -0.002 0 0.002 0.004 0.006 0.008 0.01 0.012 0.014 0.016


-0.016 -0.014 -0.012 -0.01 -0.008 -0.006 -0.004 -0.002 0 0.002 0.004 0.006 0.008 0.01 0.012 0.014 0.016

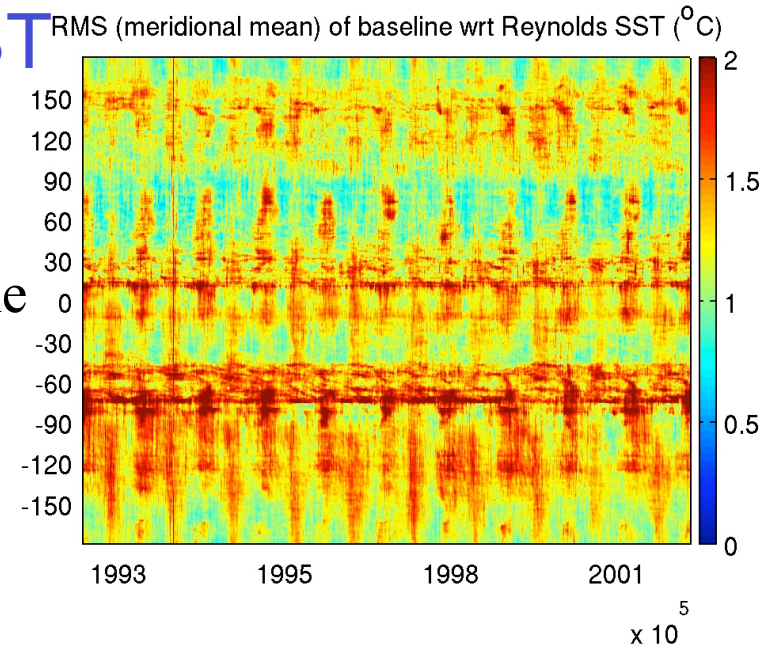

80°N
40°N
0°
40°S
80°S
0°
100°E
160°W
60°W

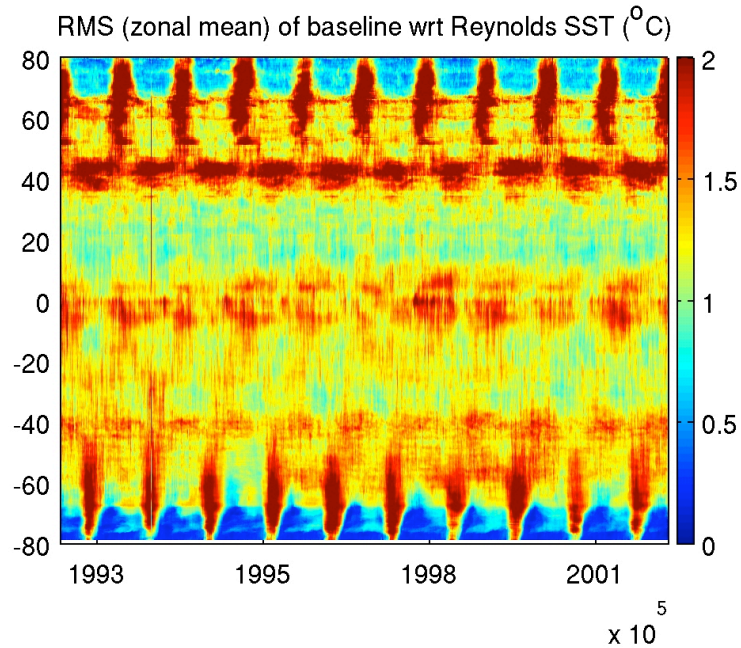

80°N
40°N
0°
40°S
80°S
0°
100°E
160°W
60°W


80°N
40°N
0°
40°S
80°S
0°
100°E
160°W
60°W

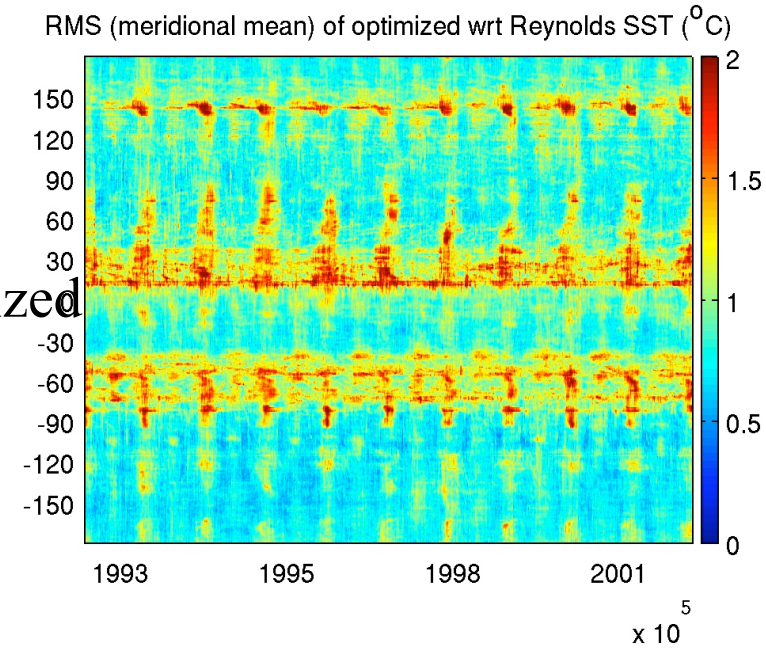
SST

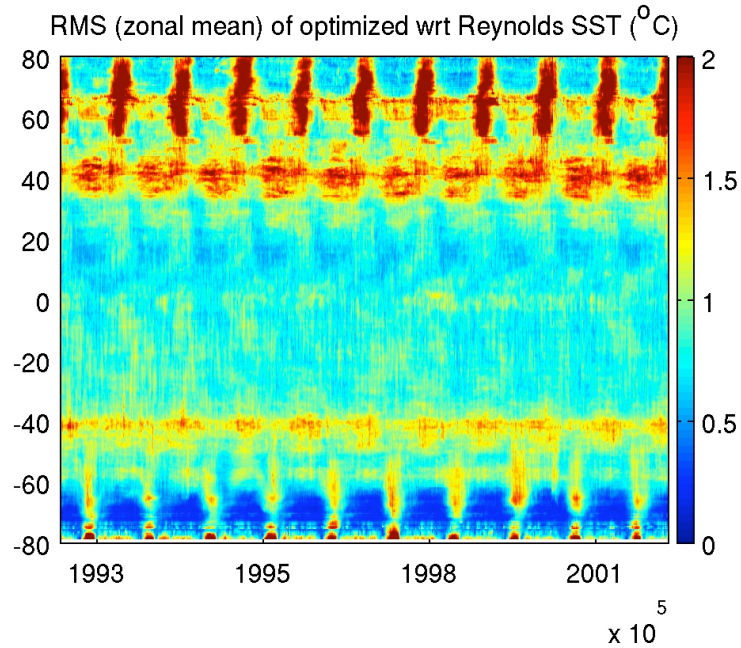
baseline



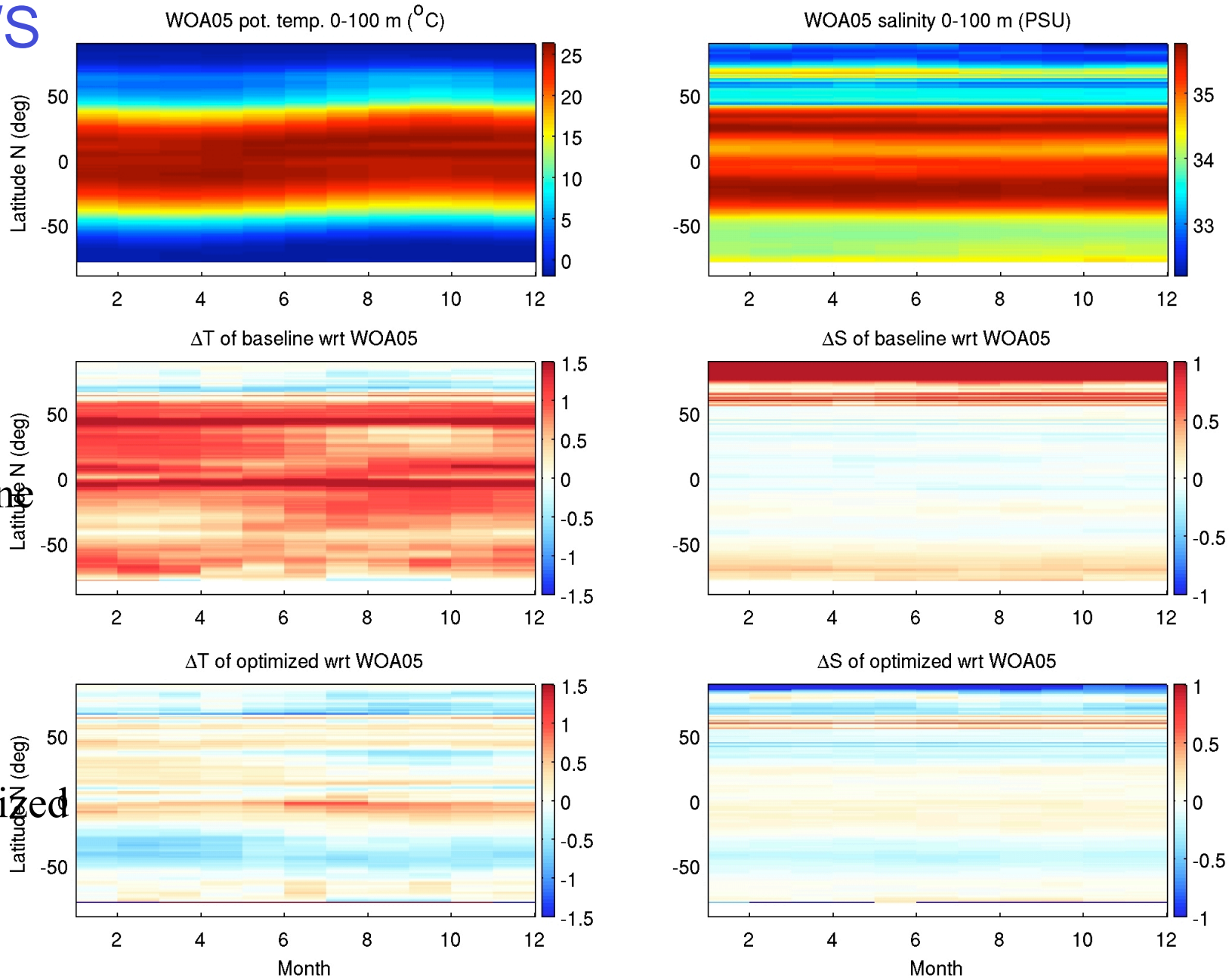


optimized





T/S



baseline

optimized