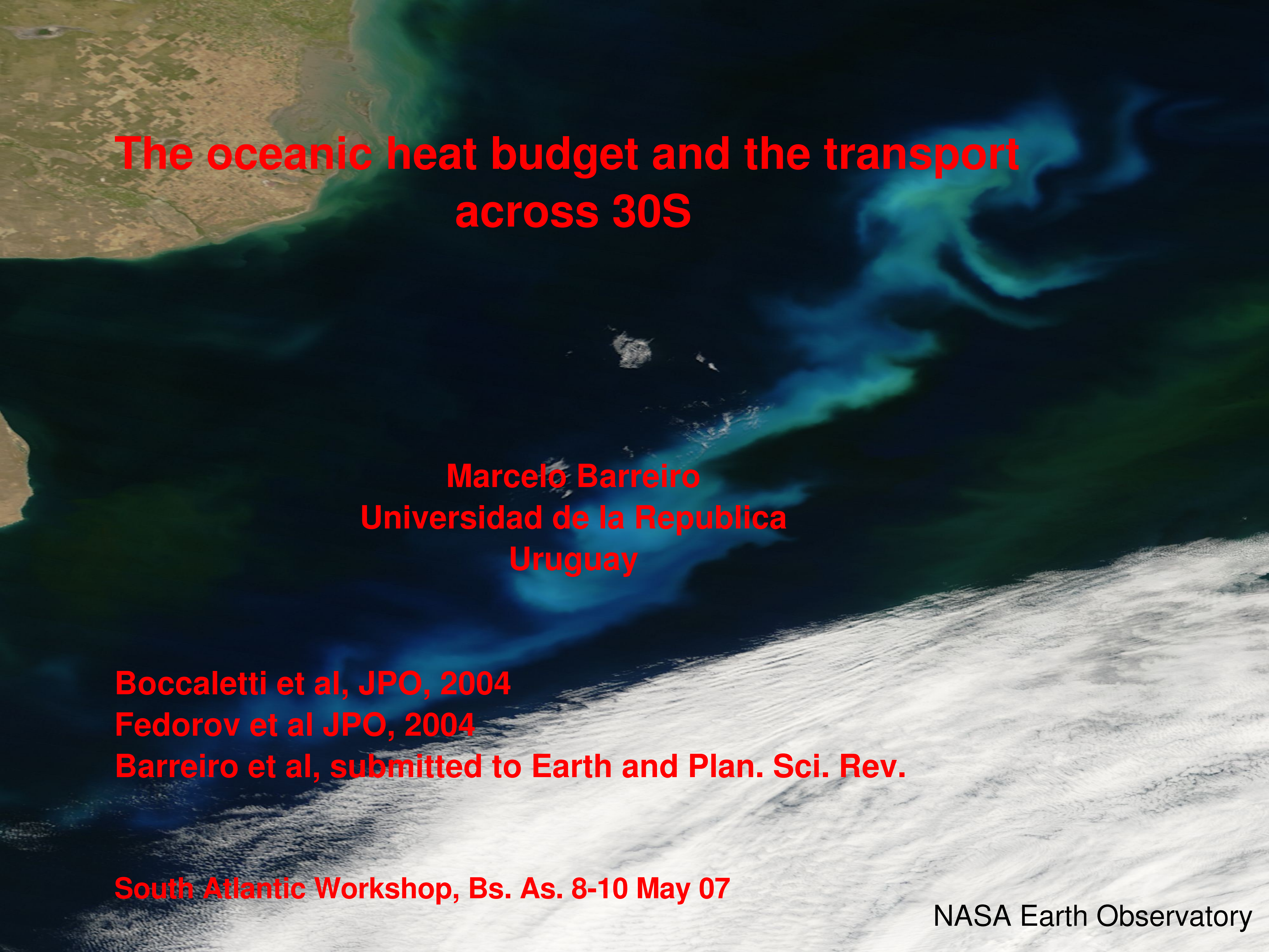


NASA Earth Observatory

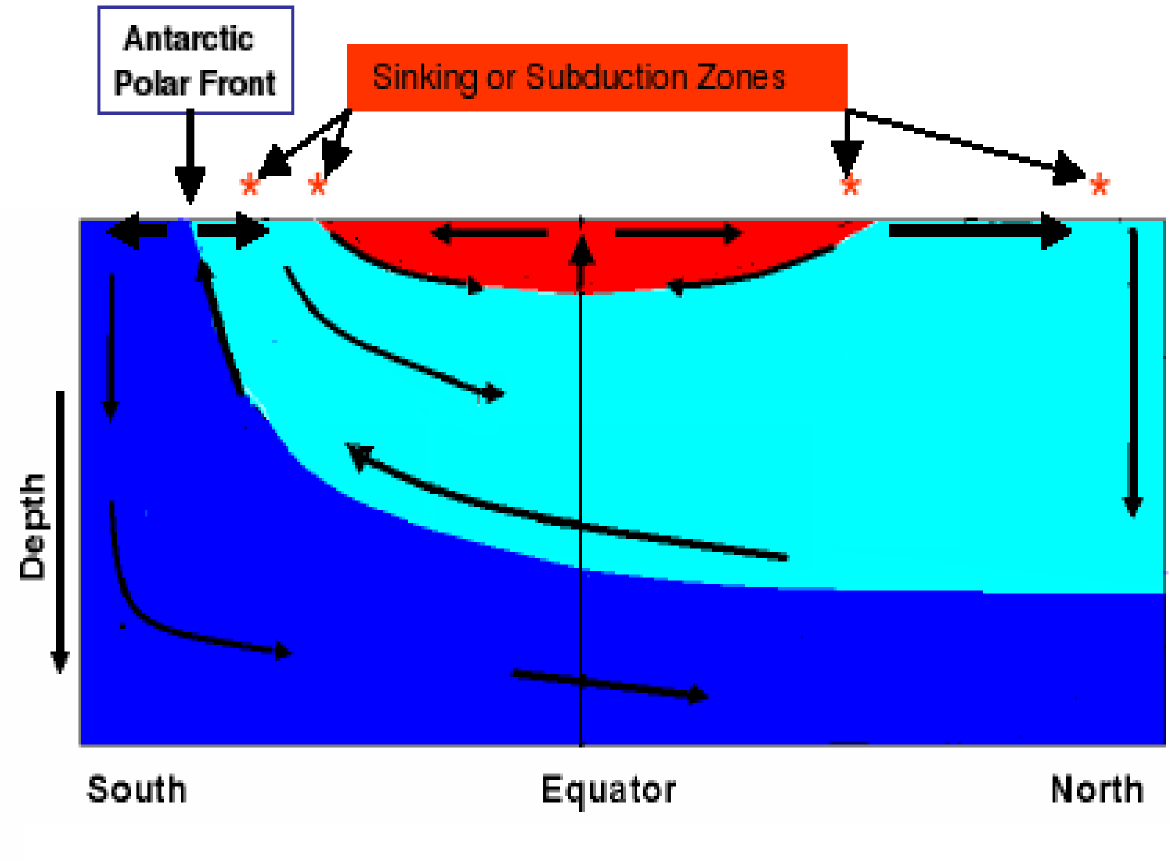
The oceanic heat budget and the transport across 30S

Marcelo Barreiro
Universidad de la Republica
Uruguay

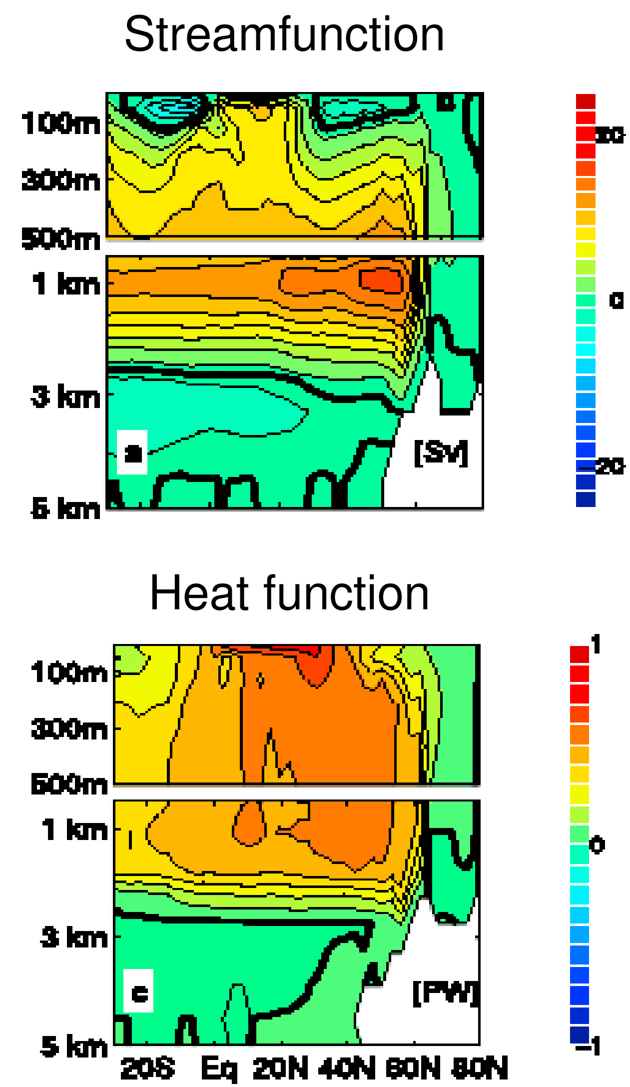
Boccaletti et al, JPO, 2004
Fedorov et al JPO, 2004
Barreiro et al, submitted to Earth and Plan. Sci. Rev.

South Atlantic Workshop, Bs. As. 8-10 May 07

Two main oceanic circulations: the circulation of the ventilated thermocline and the thermohaline circulation = MOC



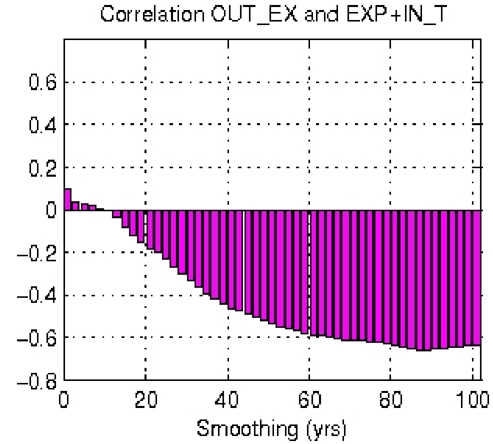
Atlantic

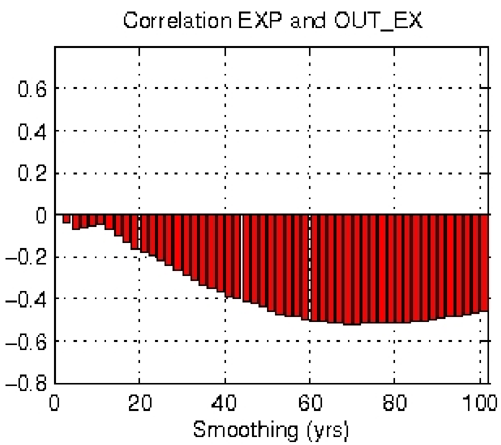


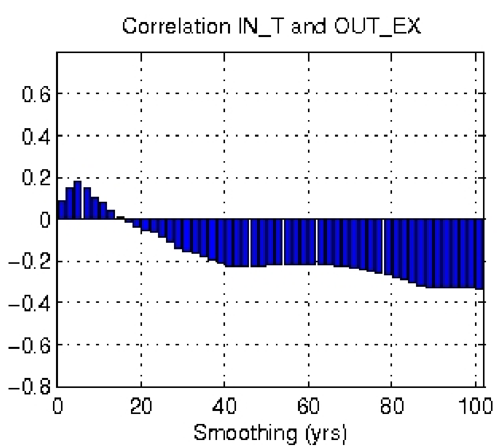
One way to unify the two circulations is based on a balanced oceanic heat budget.

The surface shallow circulation transports as much heat as the deep (Boccaletti et al 2005)

ECBILT-CLIO GFDL CM2.1

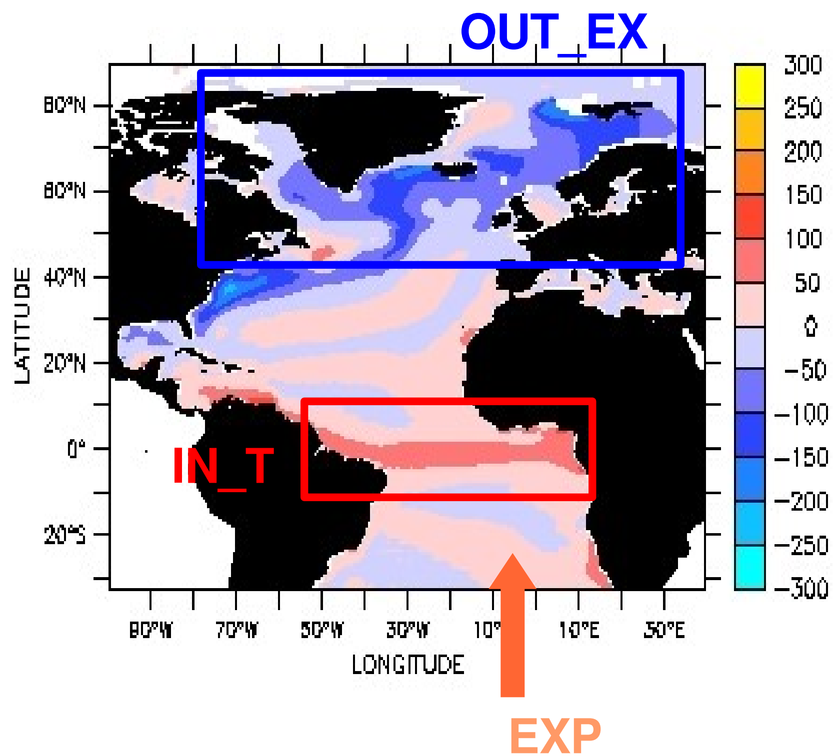






Heat Budget

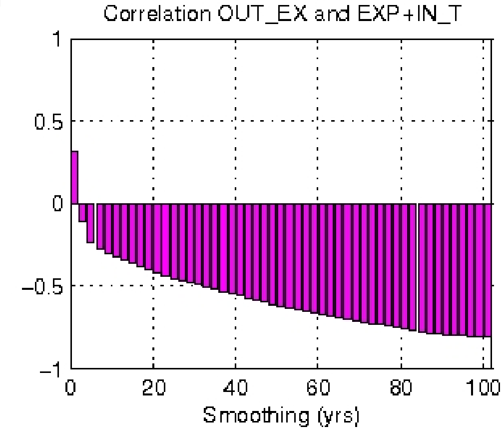
dH/dt = IN + EXP(30S) + OUT

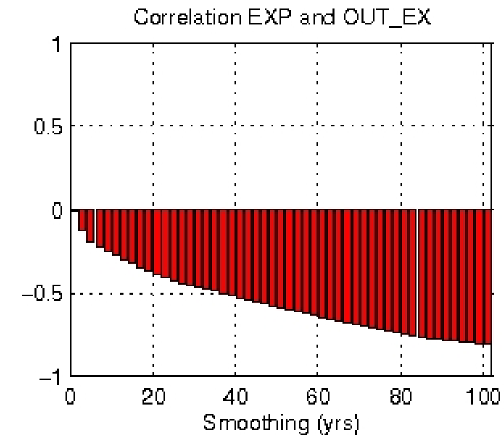


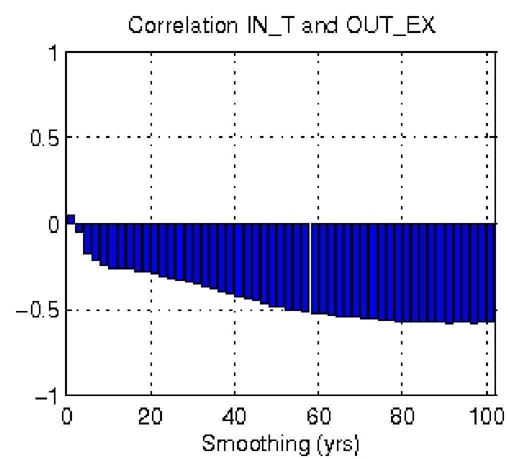
Heat budget tends to balance on interdecadal time scales.

Corr EXP & OUT_EX are similar

Corr EXP & IN_T are large only in CM2.1

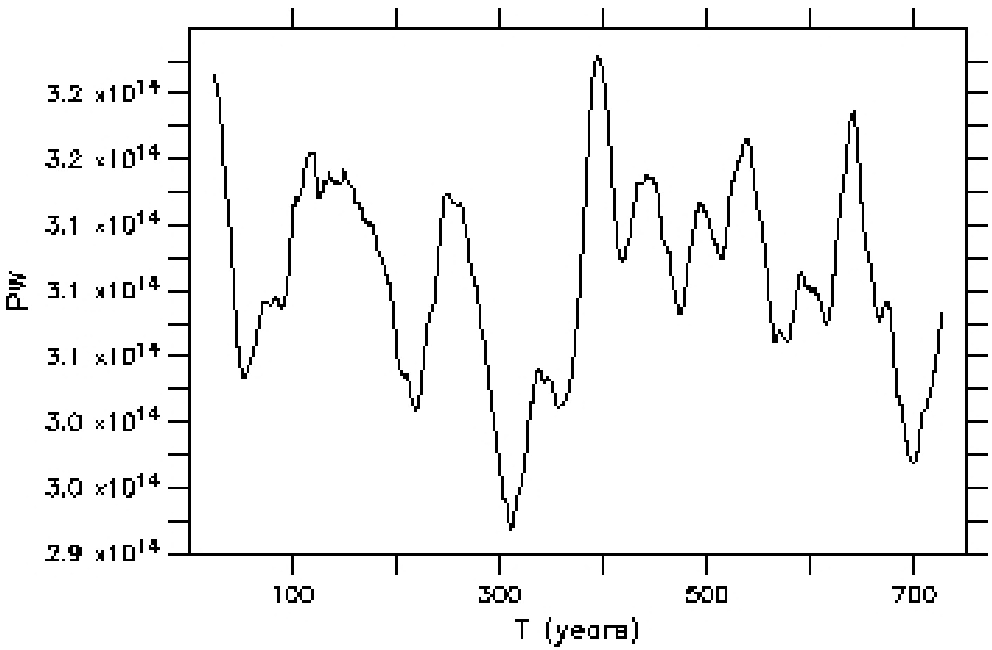




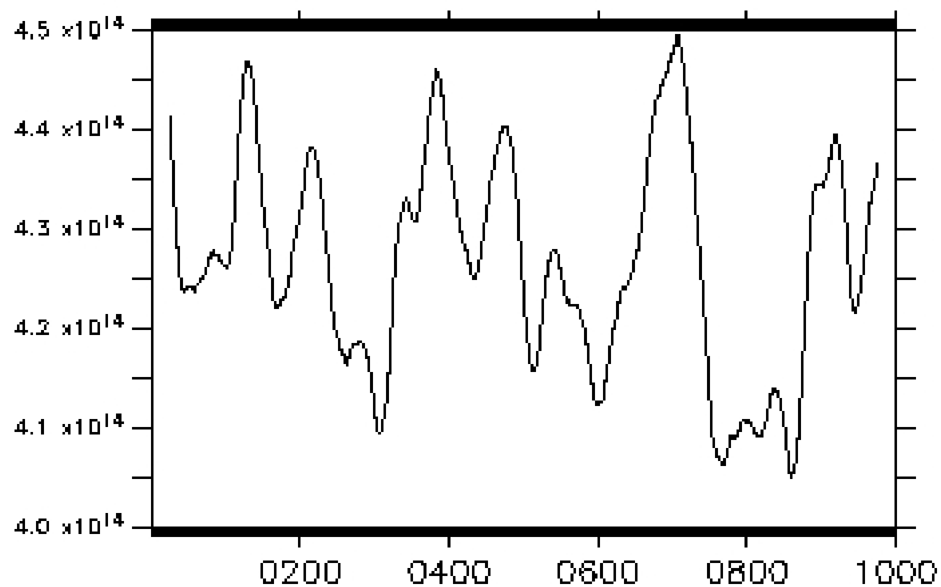


Time series of heat import across 33S in Atlantic basin 50-year smoothed.

ECBILT-CLIO



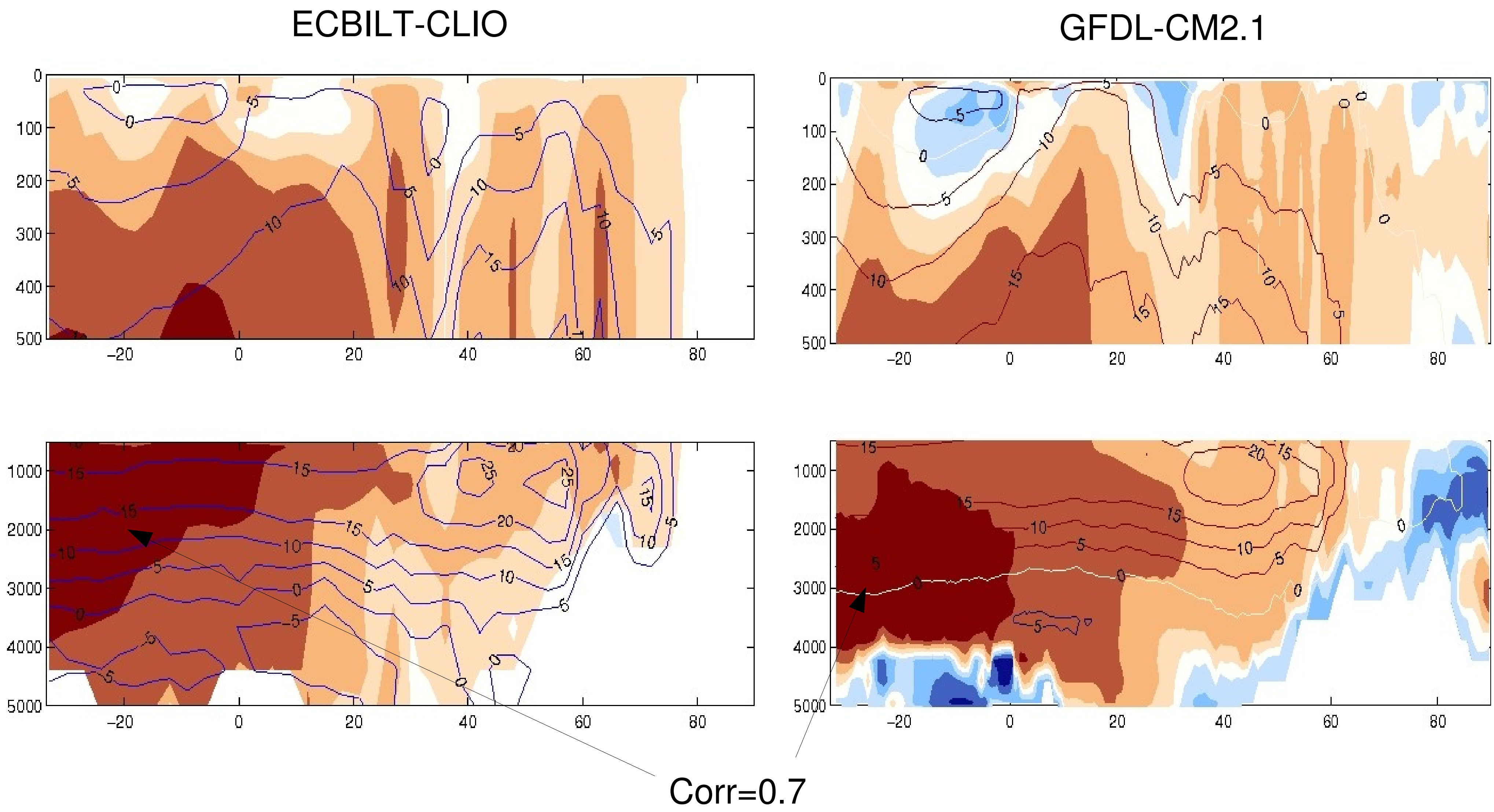
GFDL CM2.1



Mean ~ 0.31 PW
Peak-to-peak variability ~ 10%

Mean ~ 0.42 PW
Peak-to-peak variability ~10%

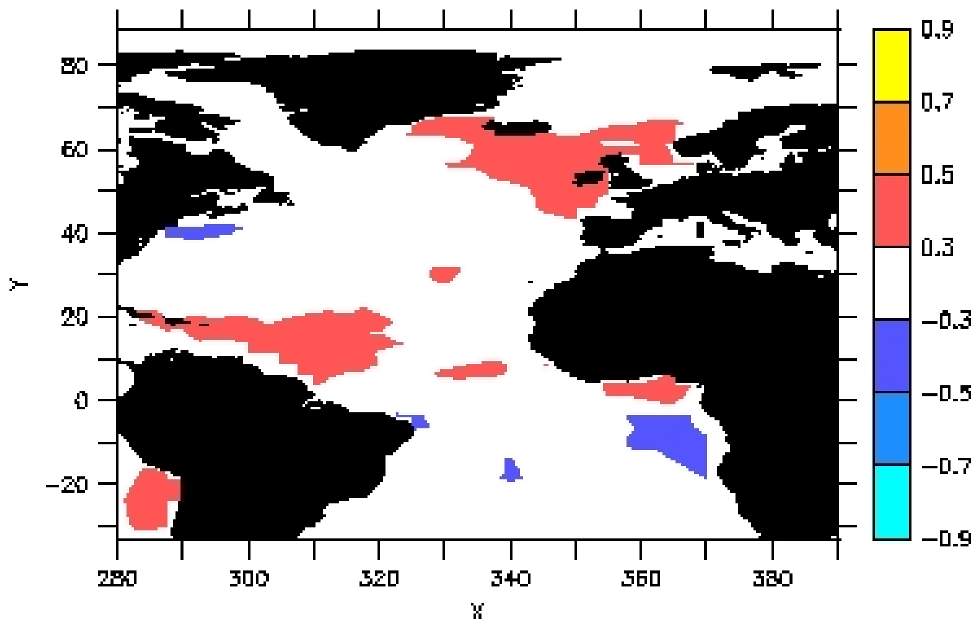
Correlation of MOC and import of heat across 33S (C.I.=0.2)



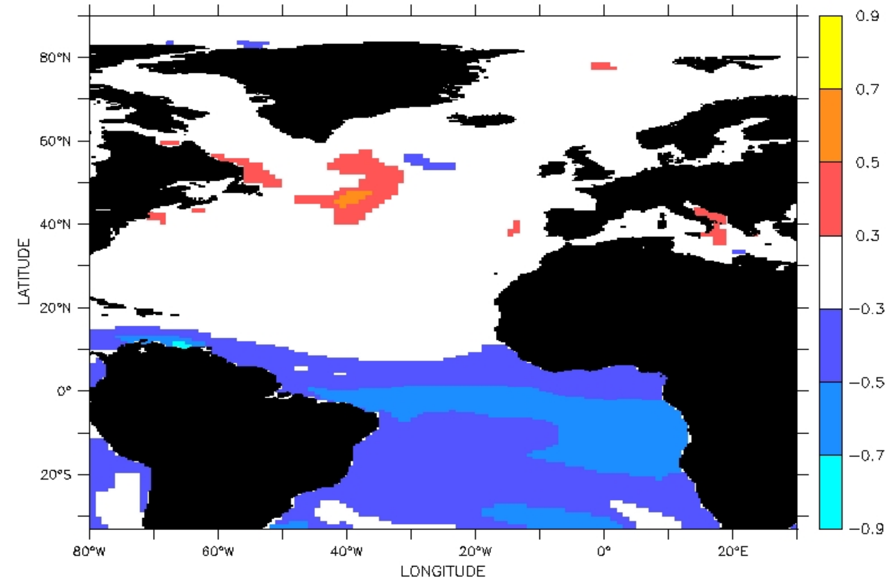
Largest correlation at depth, and both models show very similar structure.
The main differences are at the surface in the South Atlantic.

SST and import of heat across 33S

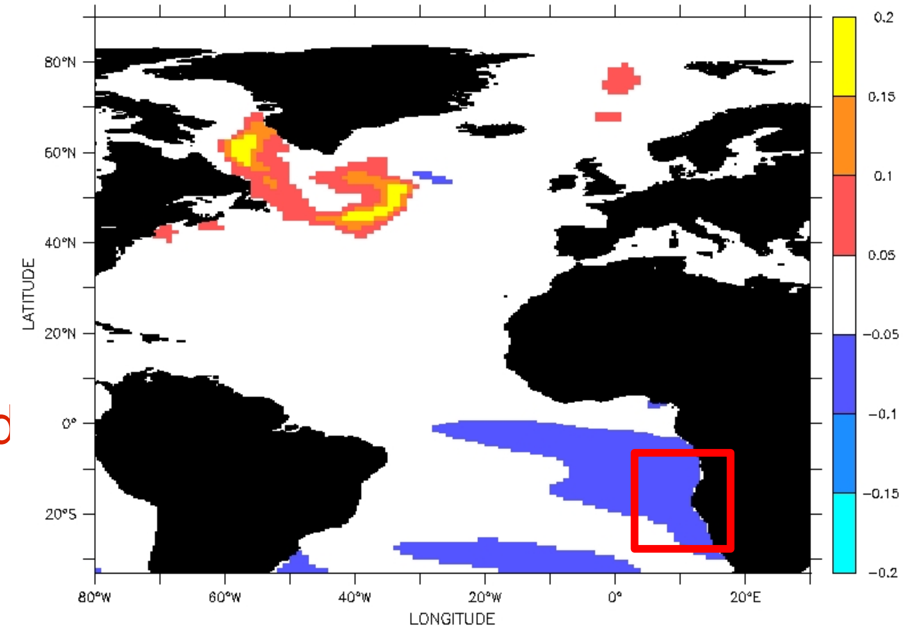
Correel ECBILT-CLIO



Correl GFDL-CM2.1



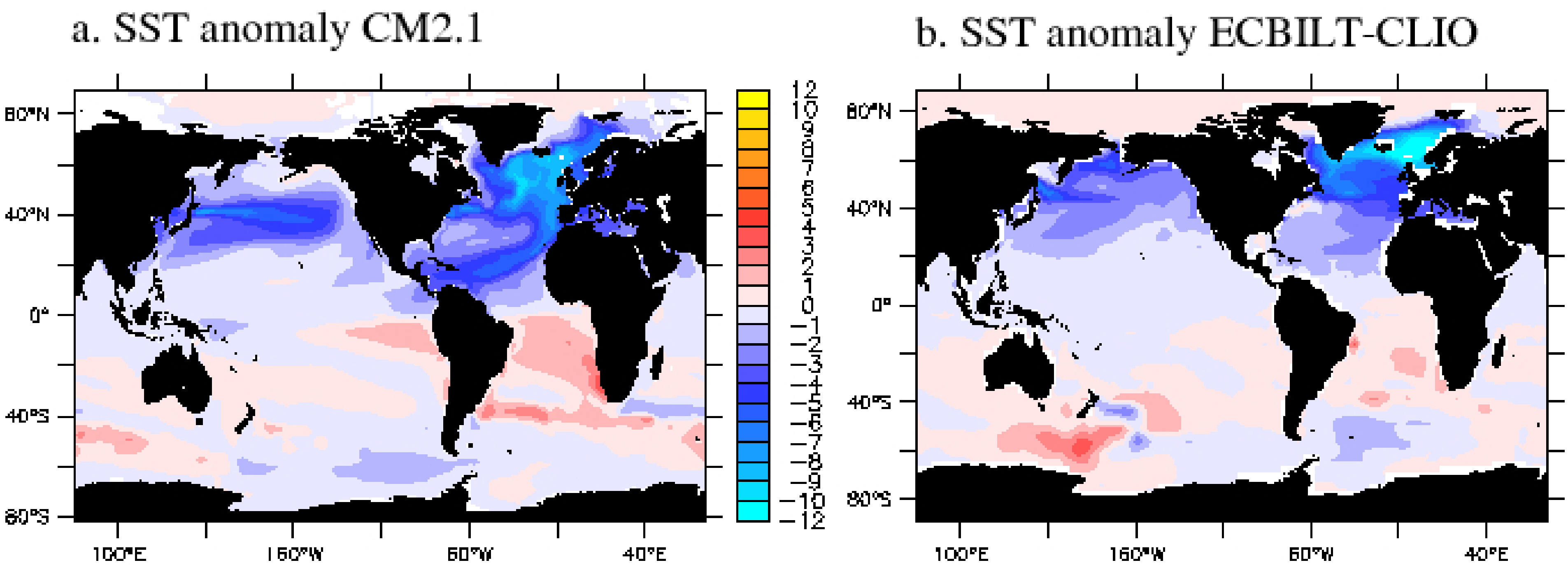
Regress GFDL-CM2.1



Even though the sign is similar,
in ECBILT-CLIO largest corrs are in the N.H.,
in GFDL CM2.1 the much larger corr are in
the equatorial and South Atlantic.

=> The largest impact of THC on climate may be through changes in the STC and reinforced through air-sea feedbacks. How do these circulations interact?

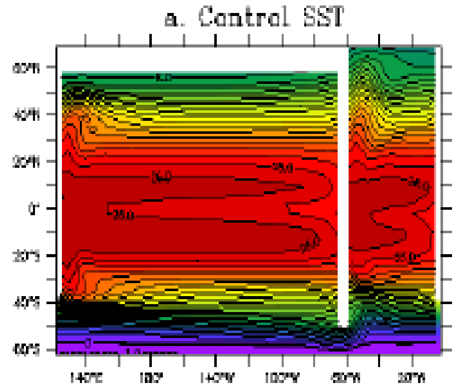
How will a freshening of the high latitudes of the North Atlantic affect the ocean circulation?

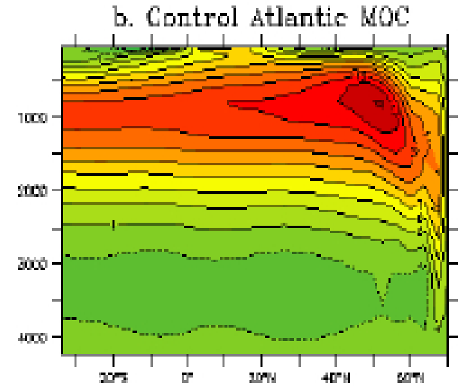


The equatorial response is largest in the high resolution model because the equatorial region is a special place of ocean heat gain.

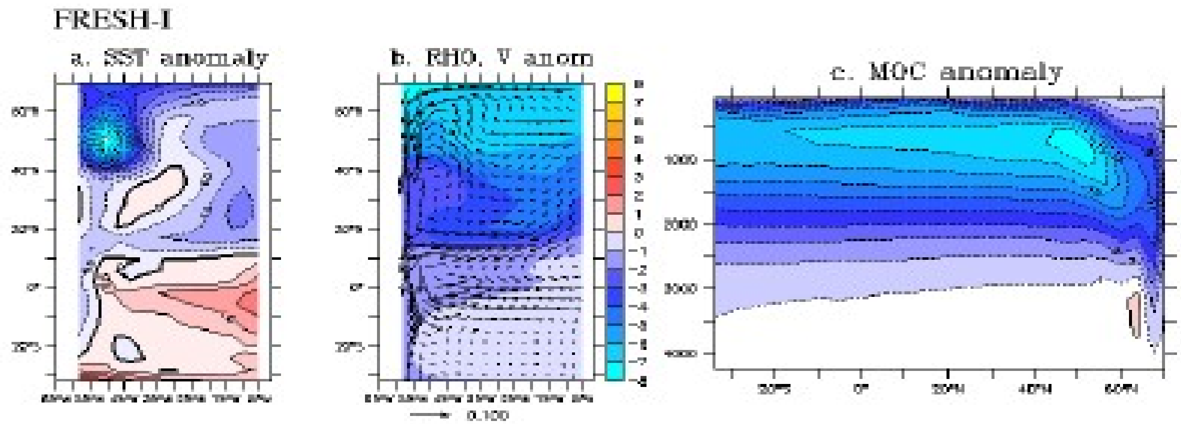
The atmospheric teleconnections will be different because the ocean is more sensitive in the equatorial region.

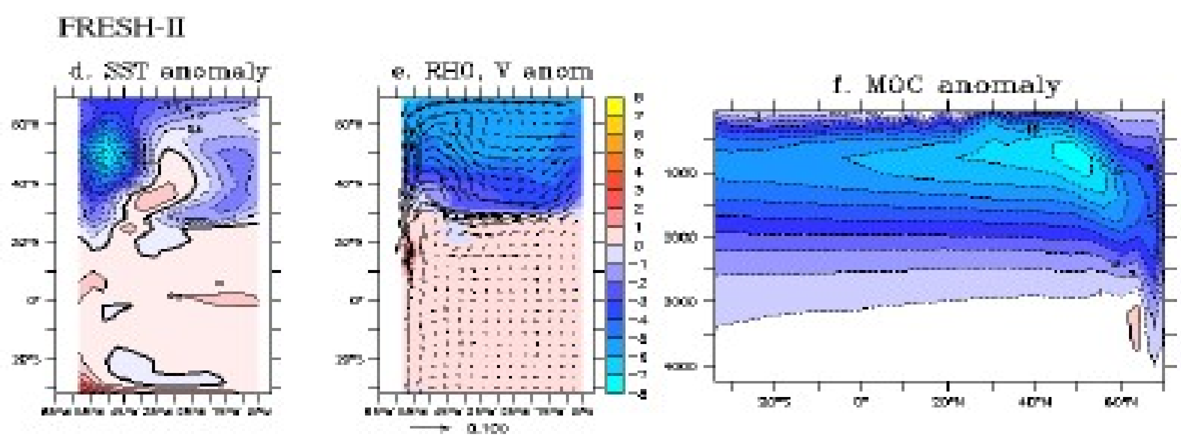
Why does the equatorial region warm up?





Freshening the North Atlantic





Freshening the subtropical Pacific