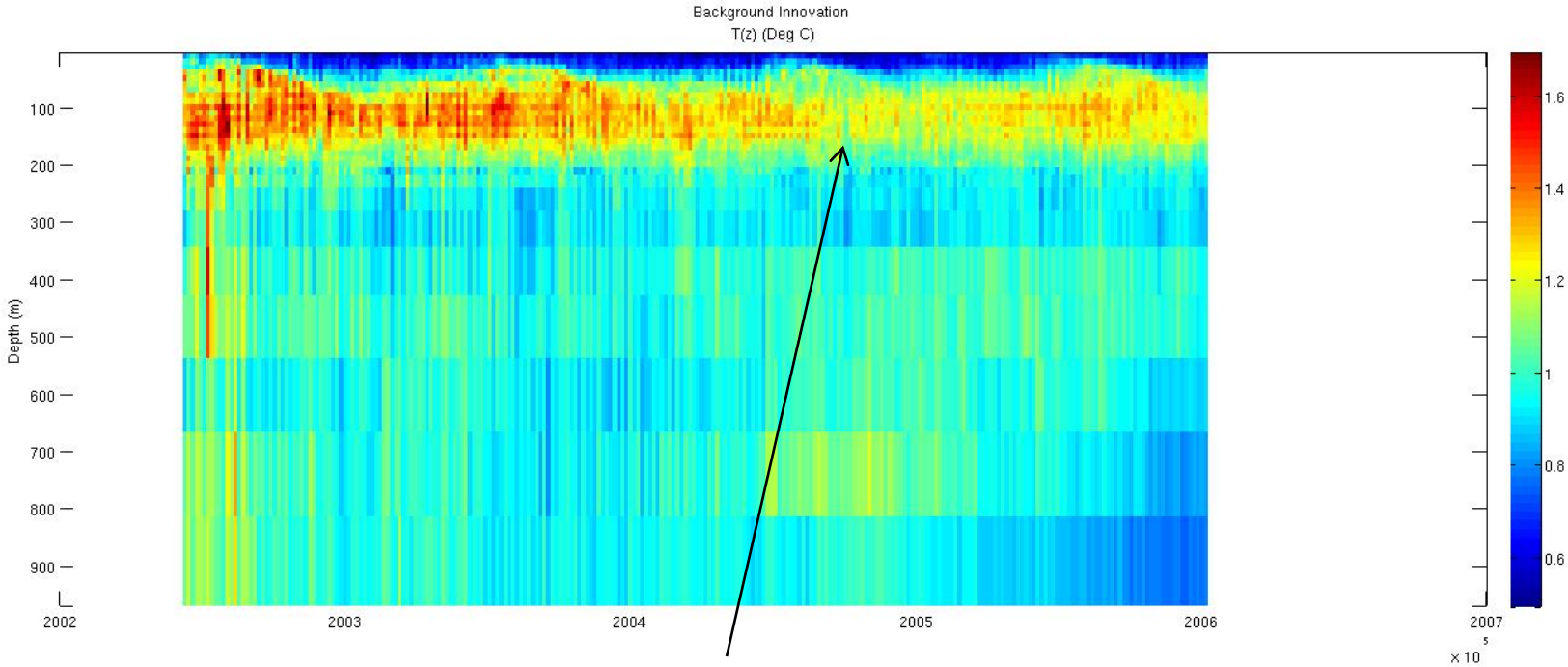
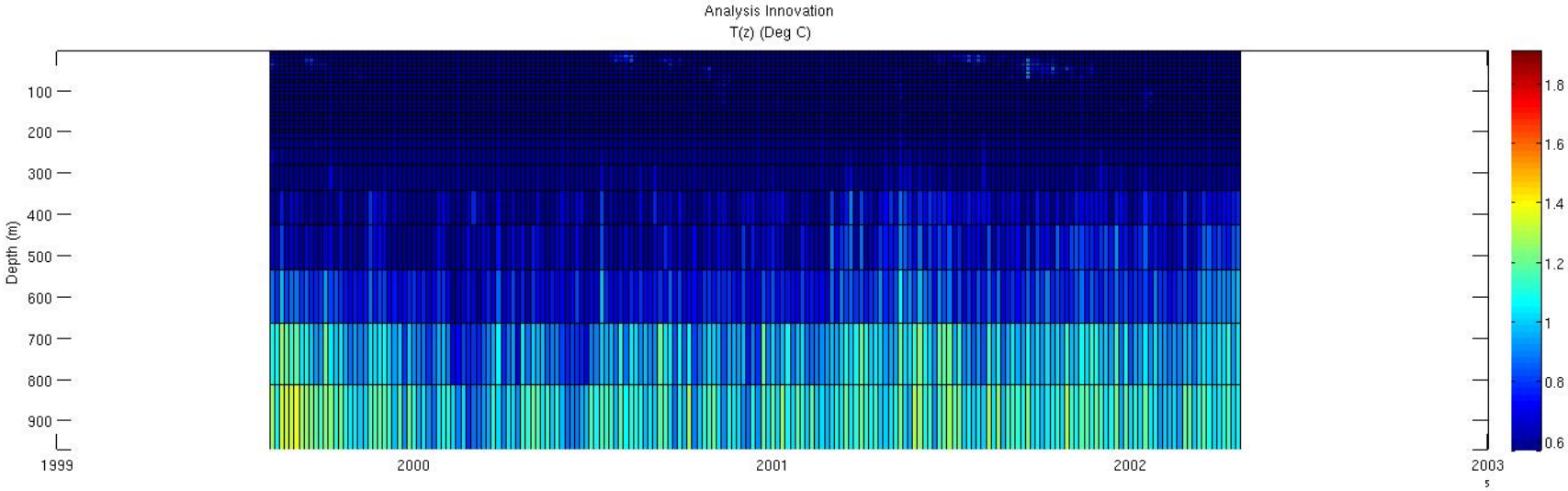
Argo impact: Global assimilation statistics
Background innovation: difference between 6 day forecast and observations



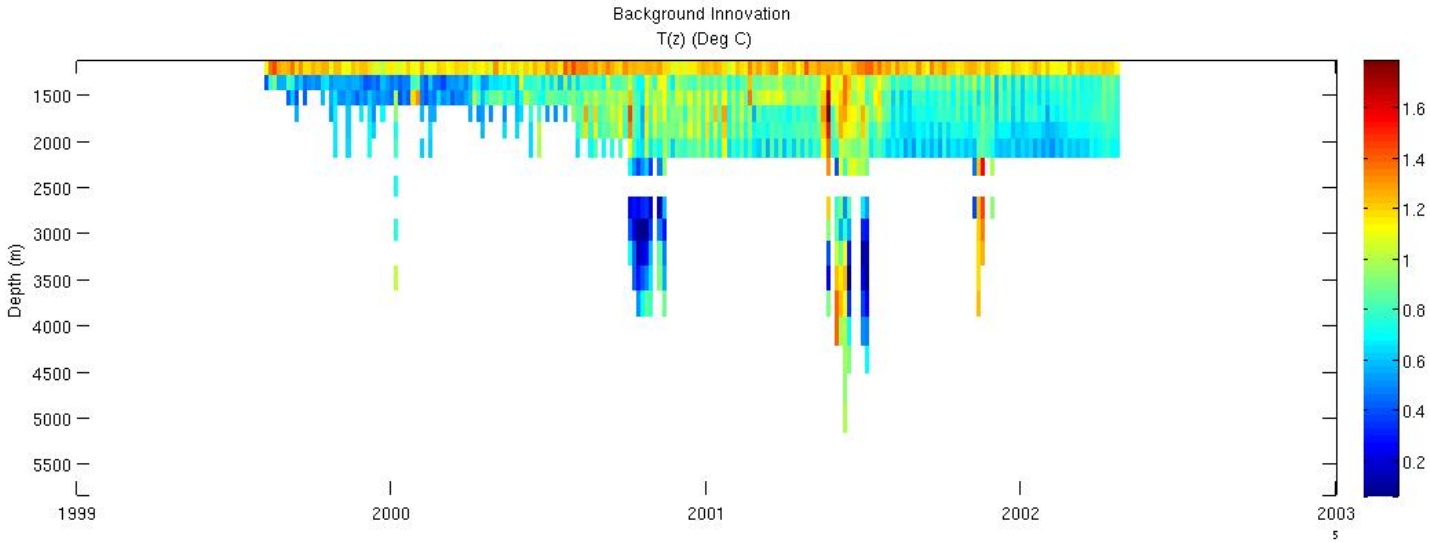
From 2004 onward we see a dramatic reduction in forecast errors as Argo comes online.
Better constrained model = forecast error reduction

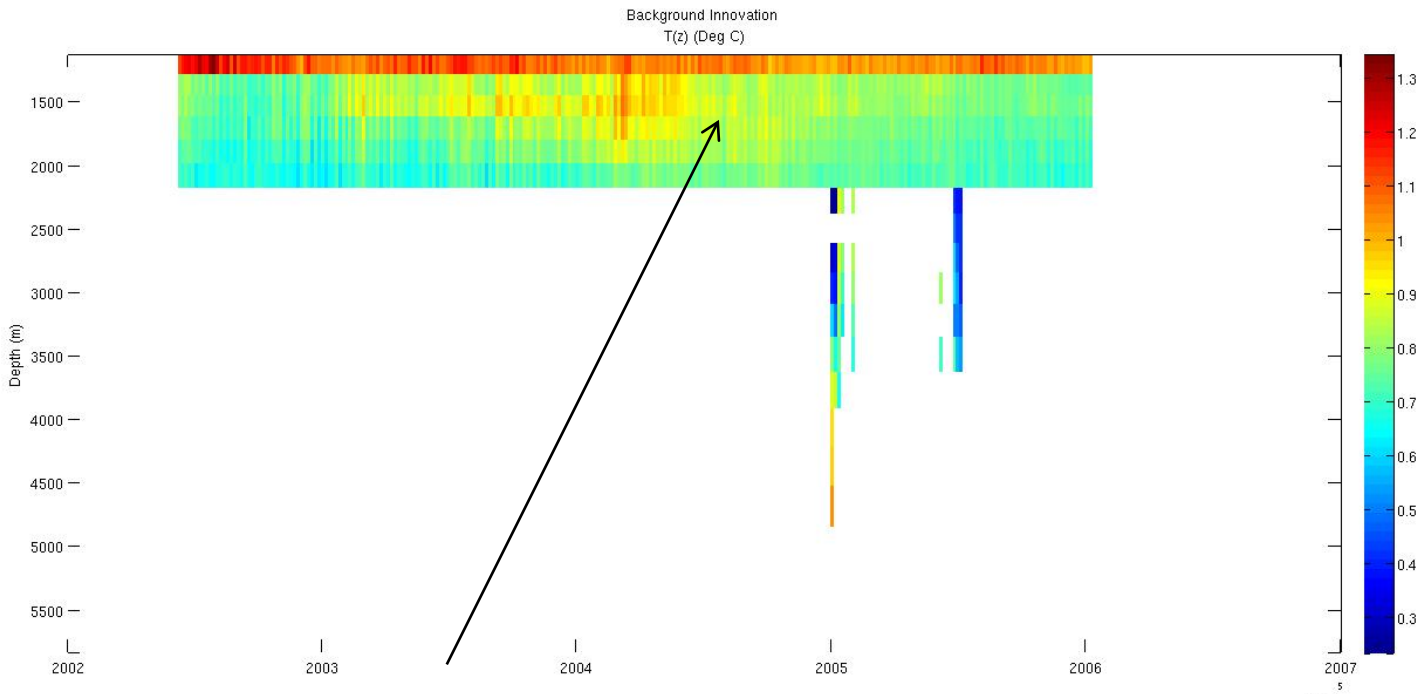
Analysis innovation: difference between analysis and observations

Note : This statistic only applies where we have observations but shows that our assimilation is fitting well to the observations



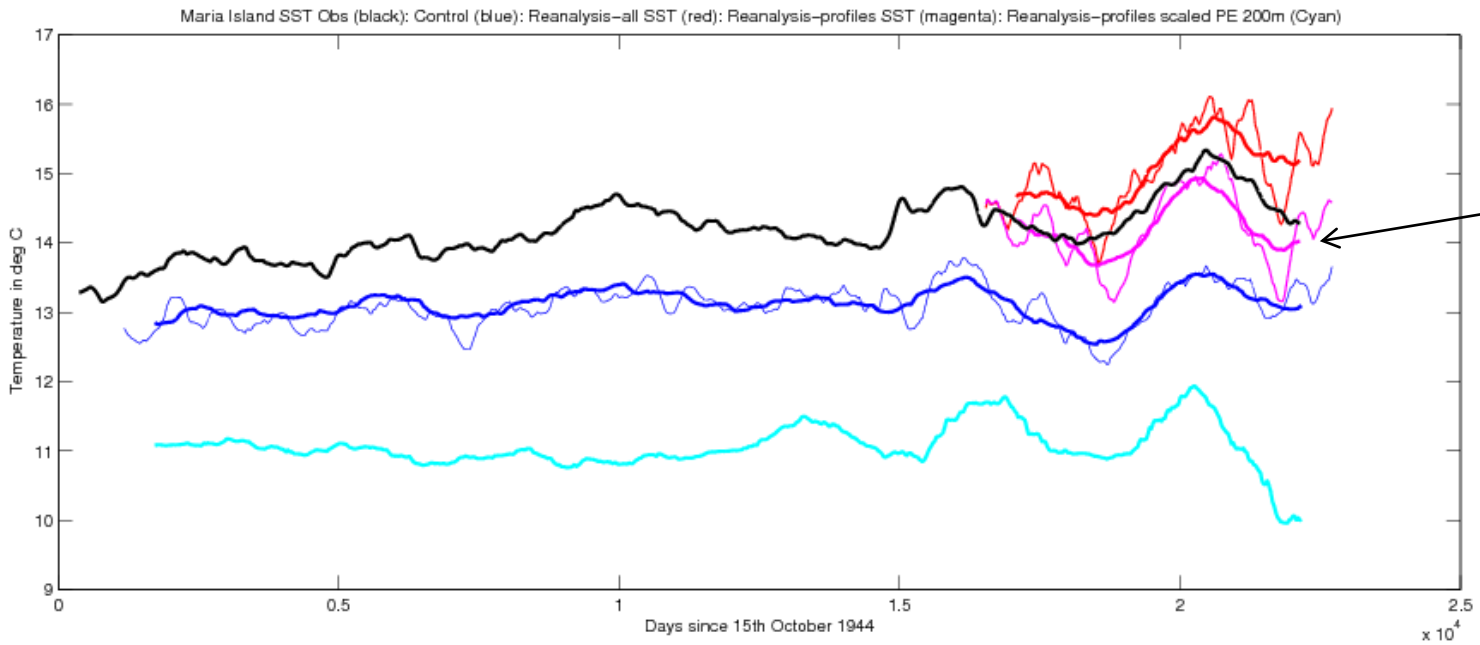
Argo impact: Global assimilation statistics
Background innovation 1999-2007
Clear impact of Argo to 2000m





As obs become available the model undergoes a large systematic correction up to ~2004 after which we see evidence of systematic error reduction as the model is better constrained even below 1500m.

Maria Island SST timeseries: Black
Control 1948-2008: Blue
(Argo, XBT, CTD) Reanalysis 1990-2008: Magenta
(Argo, XBT, CTD, Sat SST, Altimetry) Reanalysis 1990-2008: Red
Scaled baroclinic Instability at thermocline from control: Cyan

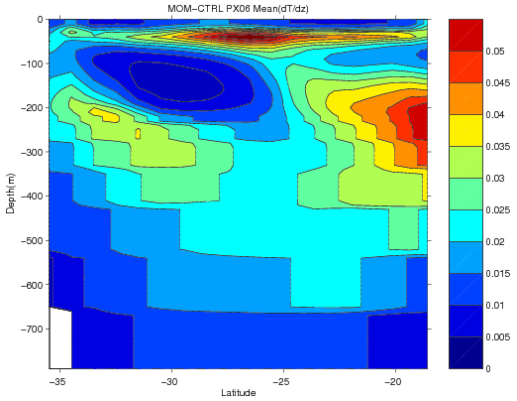


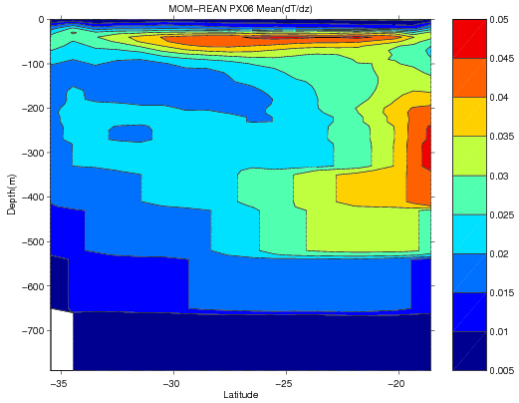
Argo impact

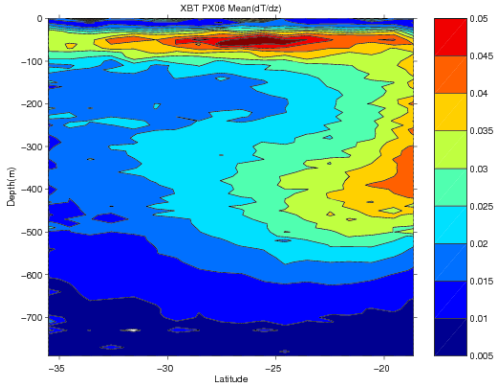
Thick lines are 4 year running average

Time mean thermocline position

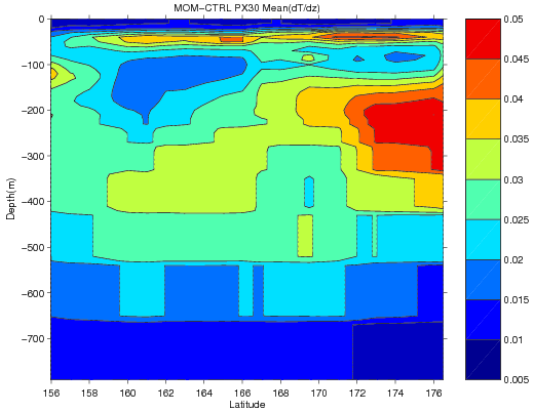
Control | Reanalysis(Argo, XBT, CTD) | XBT

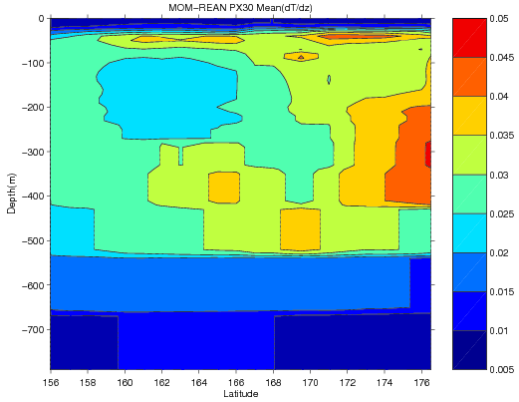


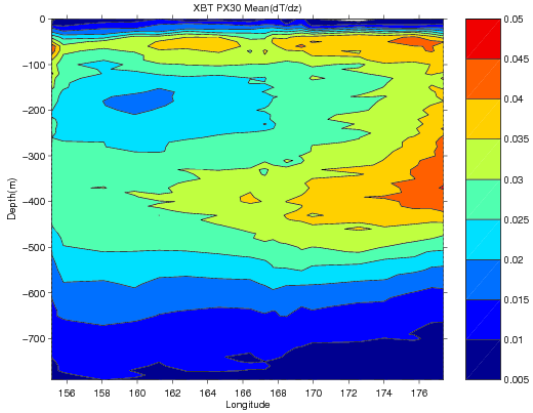




PX06

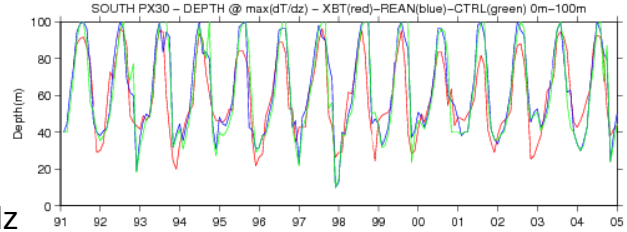


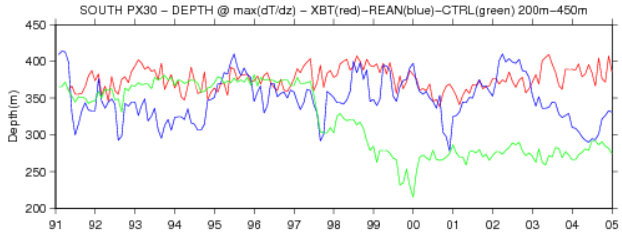


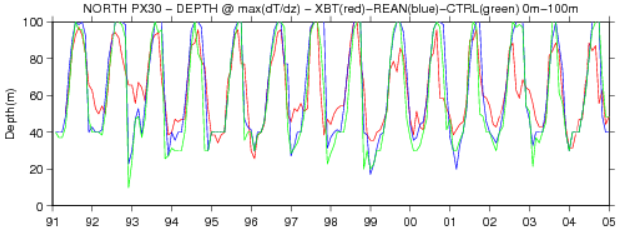


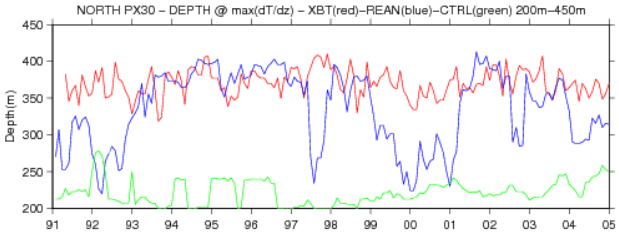
PX30

Timeseries of dT/dz
For PX30 South







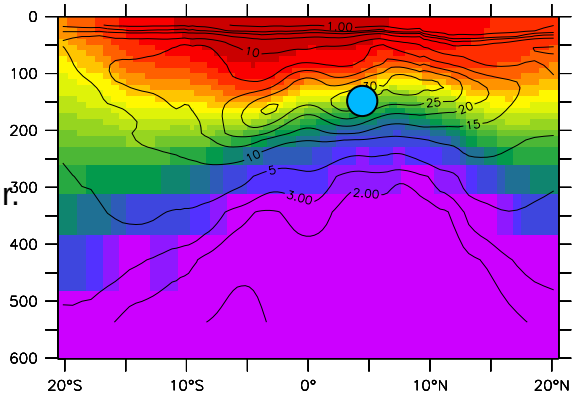


Timeseries of dT/dz
For PX30 North

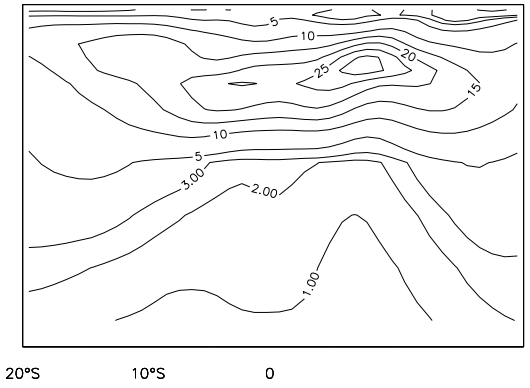
Reanalysis: Blue
Control: Green
XBT: Red

Reanalysed Eq, Pacific (left)

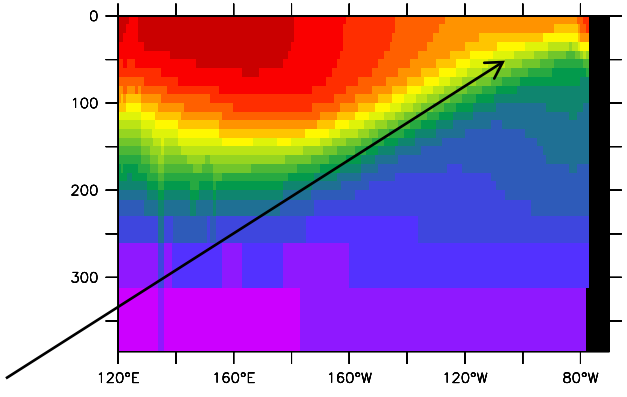
Significant correction to 25 N^2 contour. Blue dot indicates control central position of 25 N^2 contour.



WOCE09

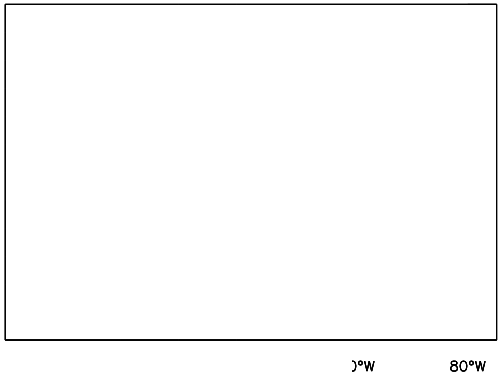


MOMRA−const1−reanalysis



MOMRA−const1−reanalysis

Significant reduction in cold tongue relative to control (not shown).

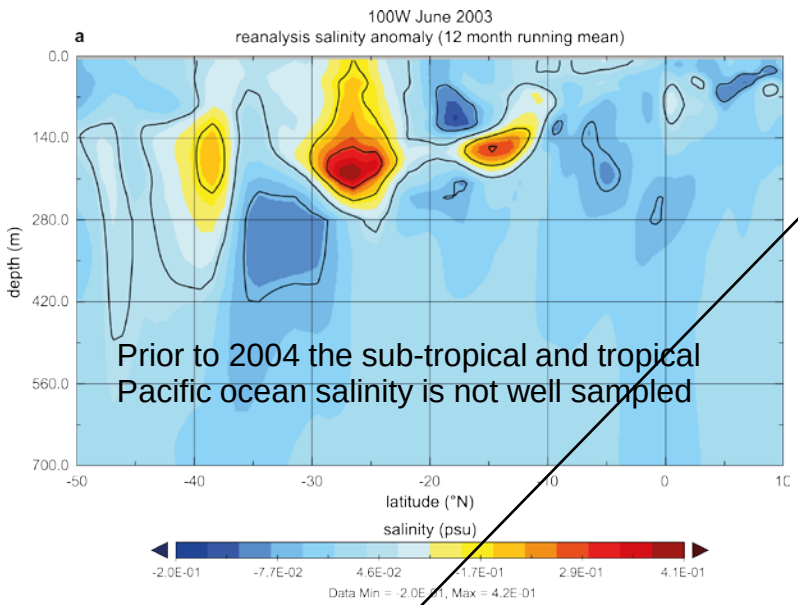
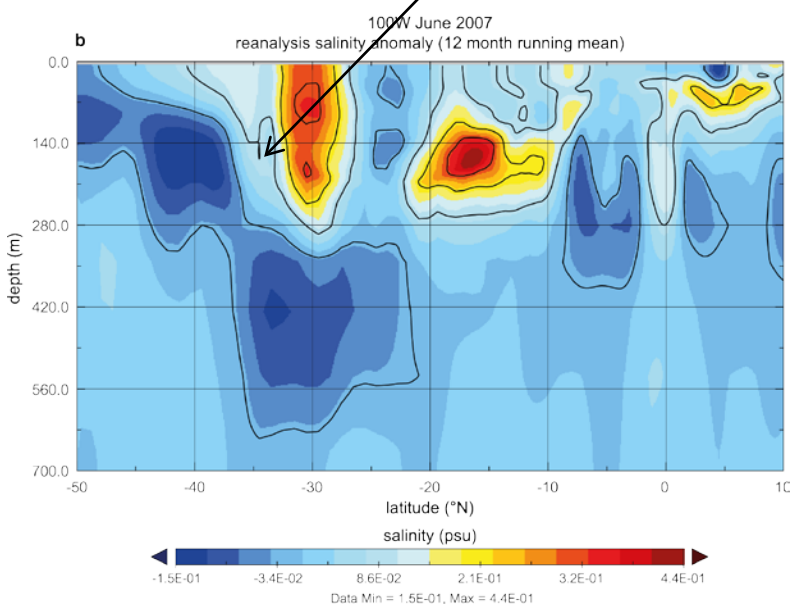
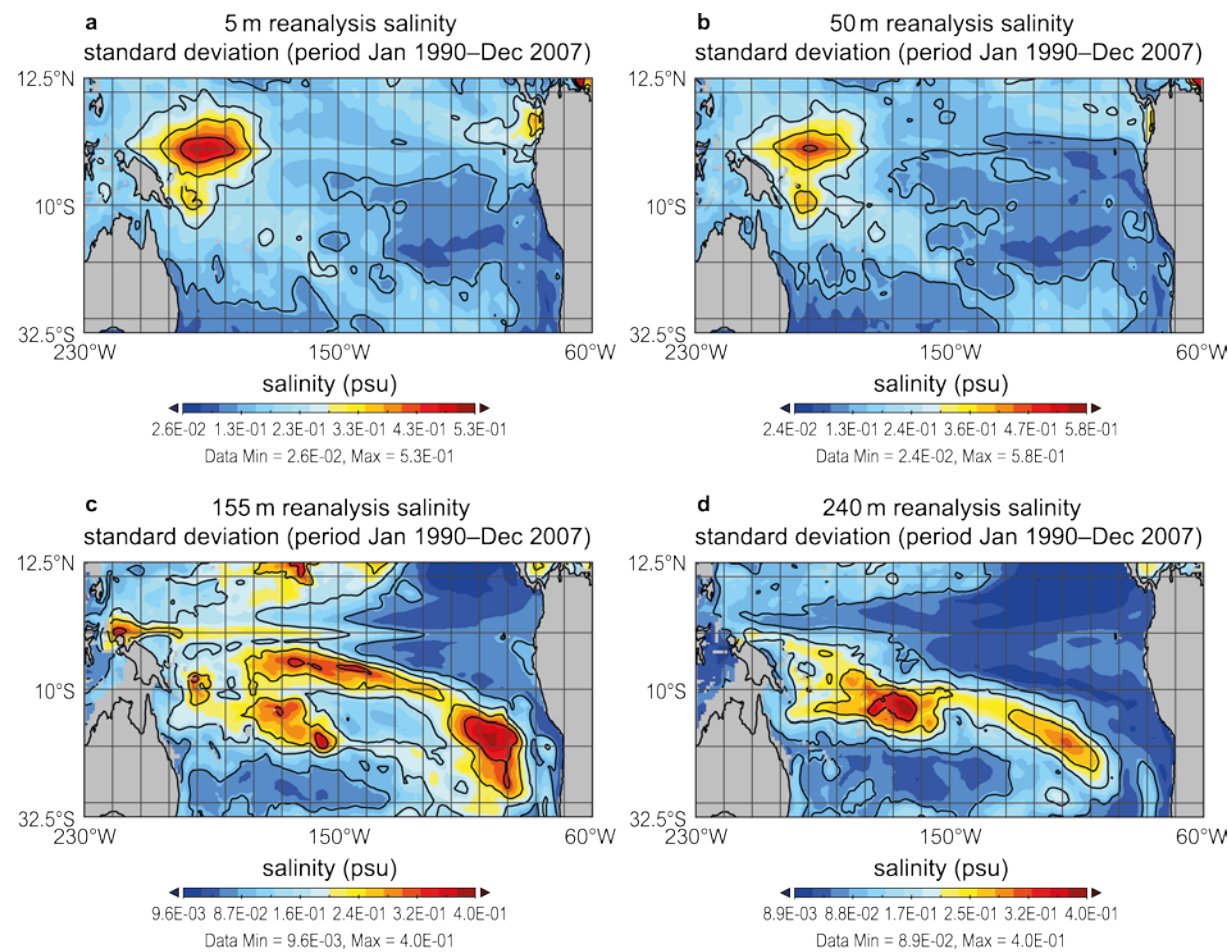


Ocean Reanalysis 1990-2008 (O'Kane, Oke & Fiedler)

Nonaka and Sasaki (2007) found spiciness anomaly subduction from the surface to the internal thermocline along a given isopycnal is correlated to the meridional displacement of the outcropping isopycnal ($\sigma_\theta = 25.3$) across the SST and SSS gradients i.e. winter surface buoyancy loss can force the outcrop line to migrate anomalously equatorward in warmer SST and saltier SSS.

Kolodziejczyk and Gaillard (JGR 2012) examined the interannual variability of SH intrapycnocline spiciness anomalies in Argo data identifying a large negative anomaly in 2007.

This event is not only well captured in reanalysis but shows that the cold-fresh anomalies originate from higher latitudes (50S) whereas spicy anomalies are subducted at 30S. Pior to Argo his detail is absent.



Prior to 2004 the sub-tropical and tropical Pacific ocean salinity is not well sampled