



# The Atlantic Meridional Overturning in the ocean reanalysis

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# Different reanalyses

Reanalysis	Production centre	COMMON	Main differences between the individual members		
			Model version	Surface Forcing	ASSIMILATION
GLORYS2V4	Mercator Océan	NEMO, ORCA1/4° 75 vertical levels	NEMO3.1 LIM2	No surface nudging precipitation, flux correction Climatological runoff + ice shelf and iceberg melting	SAM2 (SEEK) Large scale bias correction 7-day assimilation window Merge MDT (obs+model) Reynolds SST, CORA
FOAM-GLOSEA5v13 (hereafter FOAM)	UK Met Office	TKE Altimetry ERA : 1993-2015 ERAinterim and bulk formulae	NEMO3.4 CICE4.1 Non linear free surface	SST, SSS surface nudging	NEMOVAR (3Dvar) Bias correction 1-day assimilation window EN4
C-GLORS	CMCC	Assimilated Observations : SST, SLA, T/S profiles, SIC Multivariate assimilation, monovariate for the SIC	NEMO3.4 LIM2	SST, SSS, SIC surface nudging	OceanVar (3Dvar) Large scale bias correction 7-day assimilation window Model MDT Reynolds SST, EN4
ORAS5	ECMWF		NEMO3.4.1 LIM2	Surface waves forcing SST, SSS surface nudging	NEMOVAR (3Dvar) 5-day assimilation window HadISSTv2 SST, EN4

**GLORYS- free run**  
Same configuration and forcing as GLORYS2V4 but without assimilation

GLORYS2V4 <http://marine.copernicus.eu/documents/QUID/CMEMS-GLO-QUID-001-025-011-017.pdf>, and description of Mercator Ocean's ocean analysis system: Lellouche et al (2013)  
 GLOSEA5v13: MacLachlan et al (2014), and description of FOAM: Blockley et al (2014)  
 C-GLORS: Storto et al (2016)  
 ORAS5: is an upgrade of ORAP5 (Zuo et al 2015, Tietsche et al 2015)

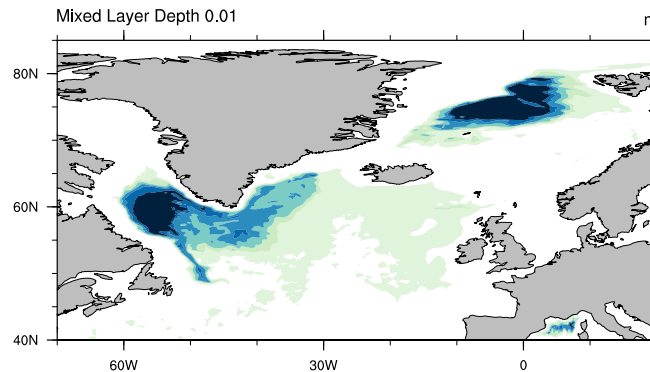


# Max MLD (JFM) 1993-2015

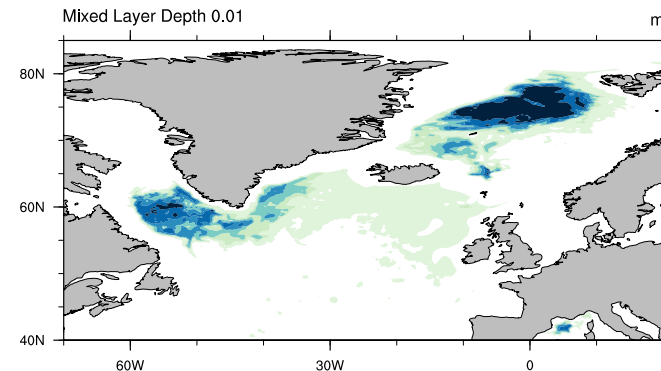


- Large difference between the difference reanalyses
- Deep convection occurs in GLORYS2V4 and ORAS5 in the GIN seas
- Weaker convection in FOAM/CGLORS

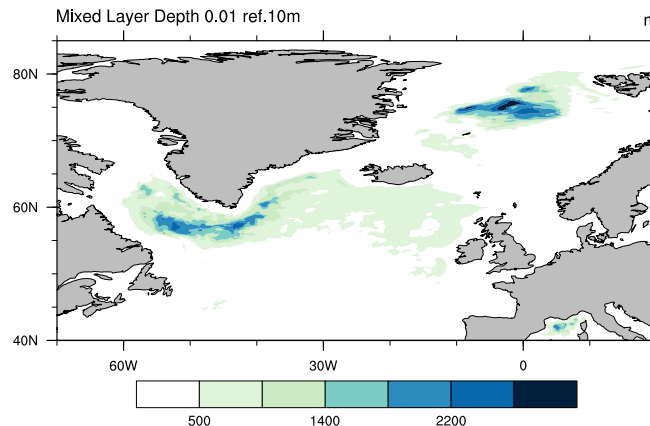
### ORAS5



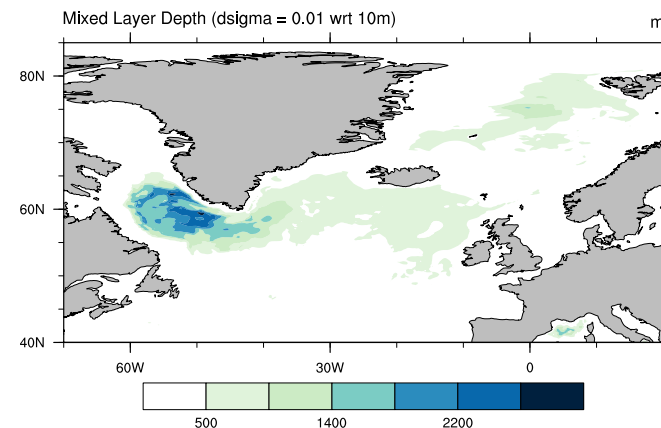
### GLORYS2V4



### FOAM



### CGLORS







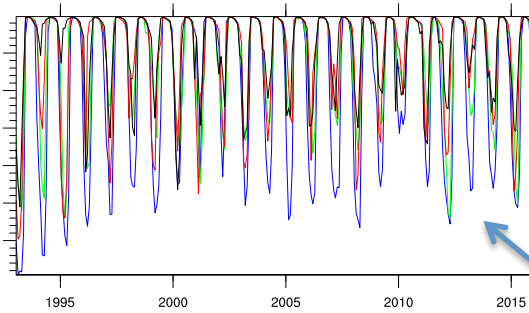
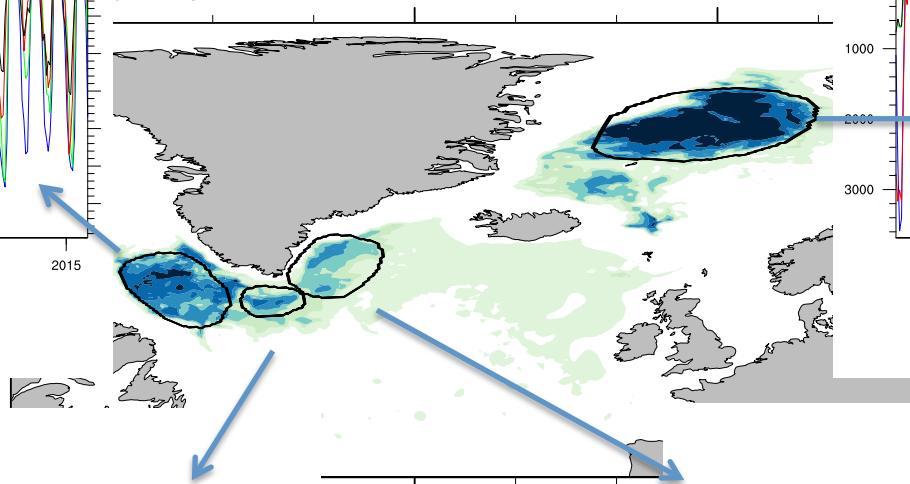
# Max MLD (JFM) 1993-2015



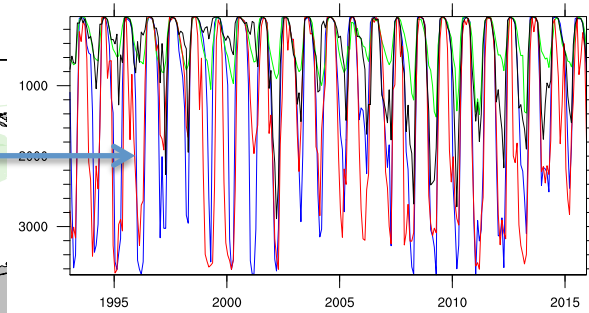
ORAS5: blue, CGLORS: green, GLORYS2V4: red, FOAM: grey

## Mixed Layer Depth

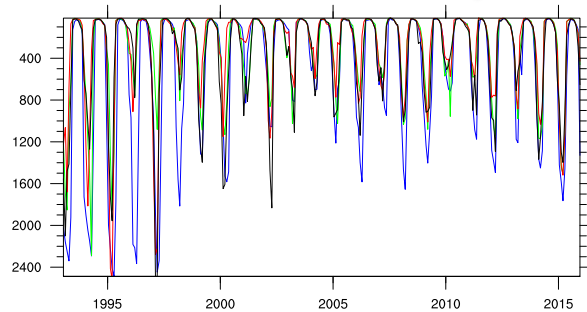
Layer Depth 0.01



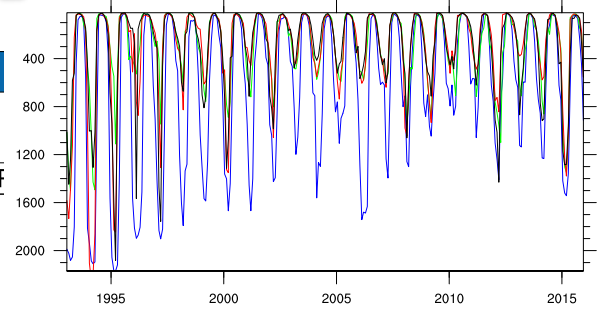
LABRADOR



NORDIC SEAS



CAP FAREWELL



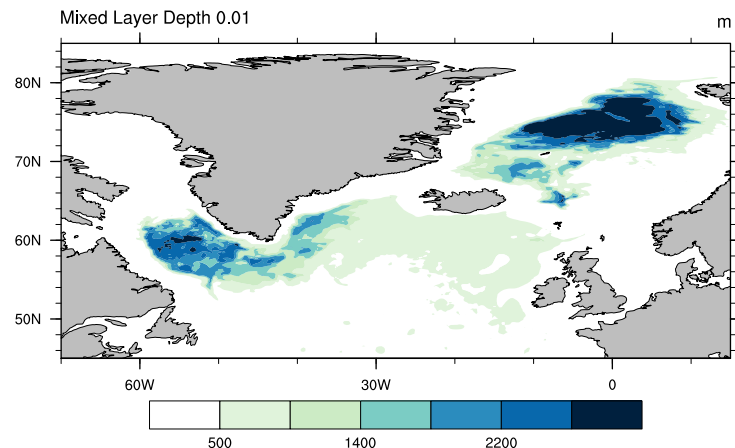
IRMINGER



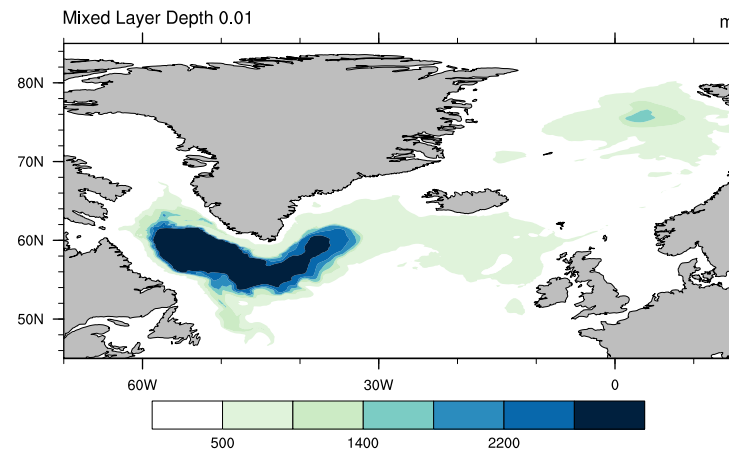
# Glorys2v4 / No assimilation



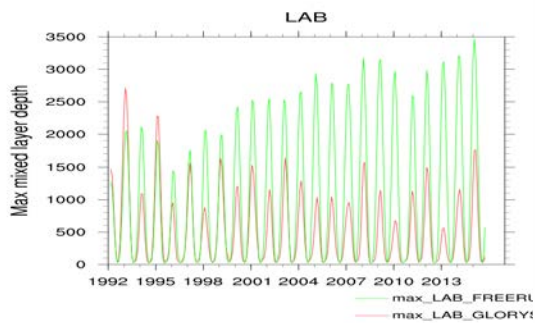
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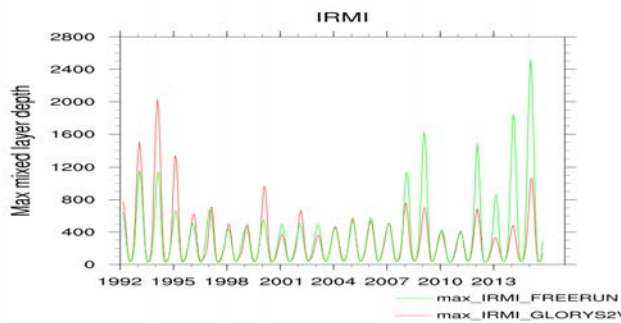
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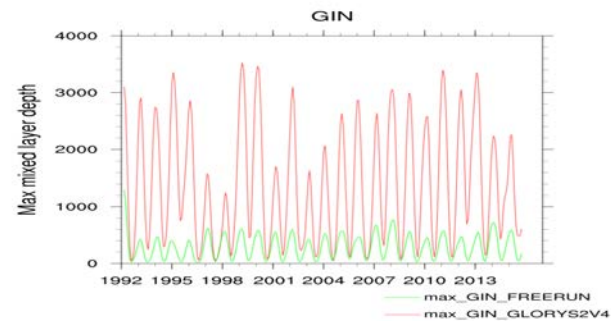
### LABRADOR



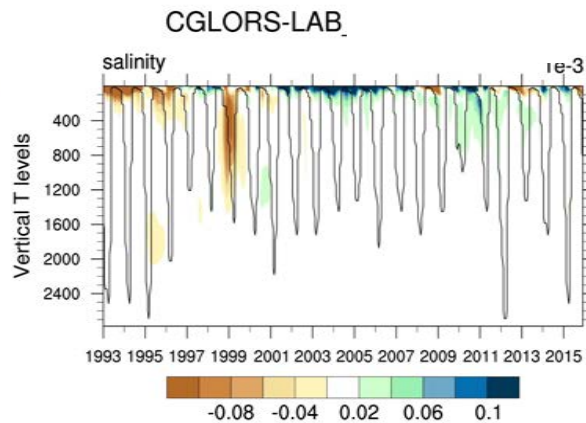
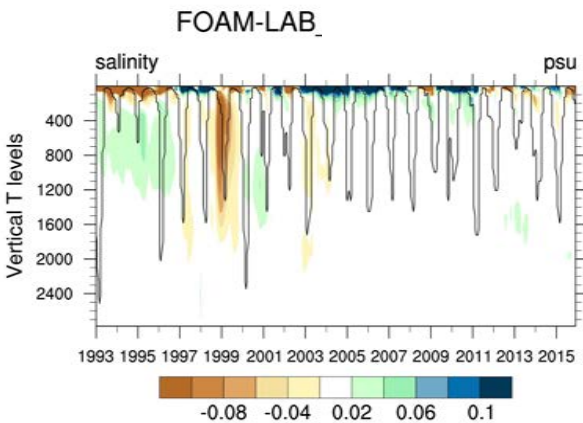
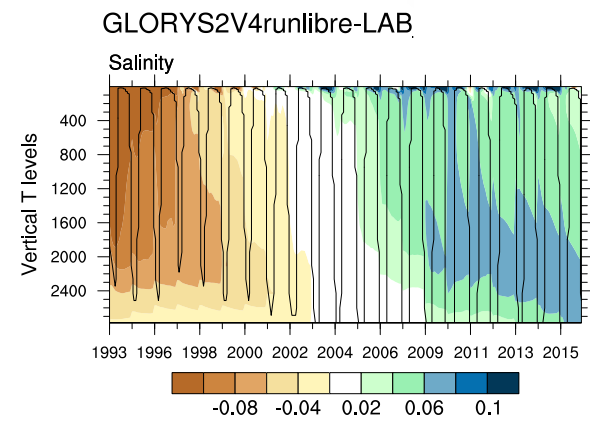
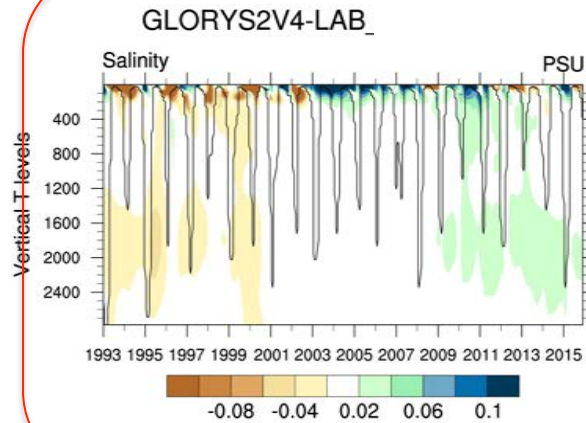
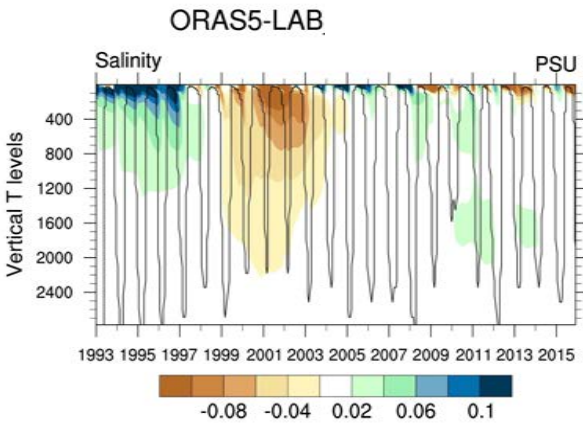
### IRMINGER



### NORDIC SEAS



# Salinity anomalies in Labrador sea

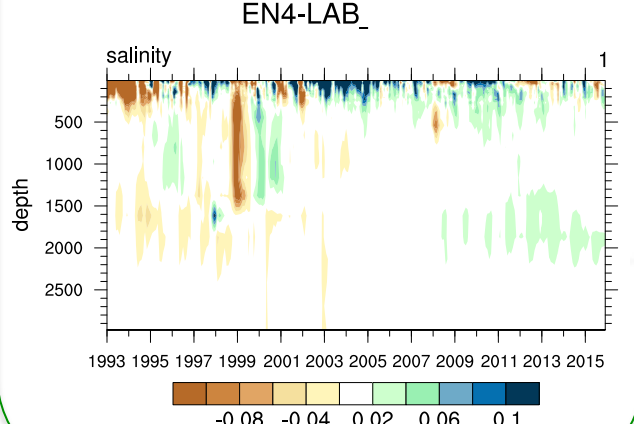
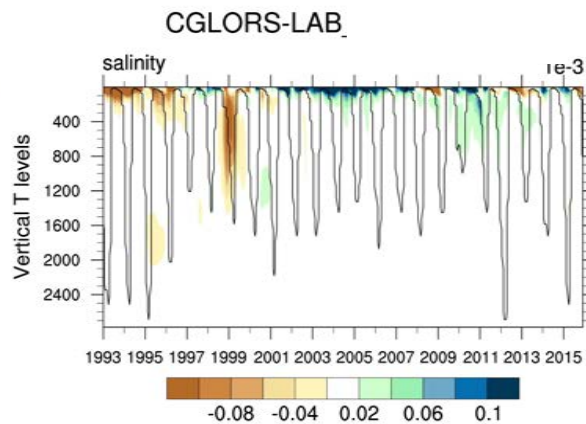
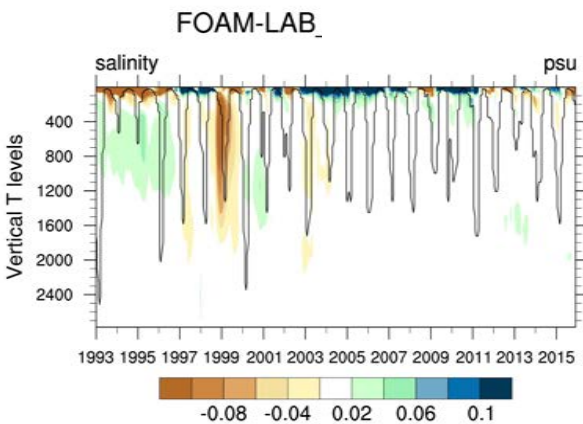
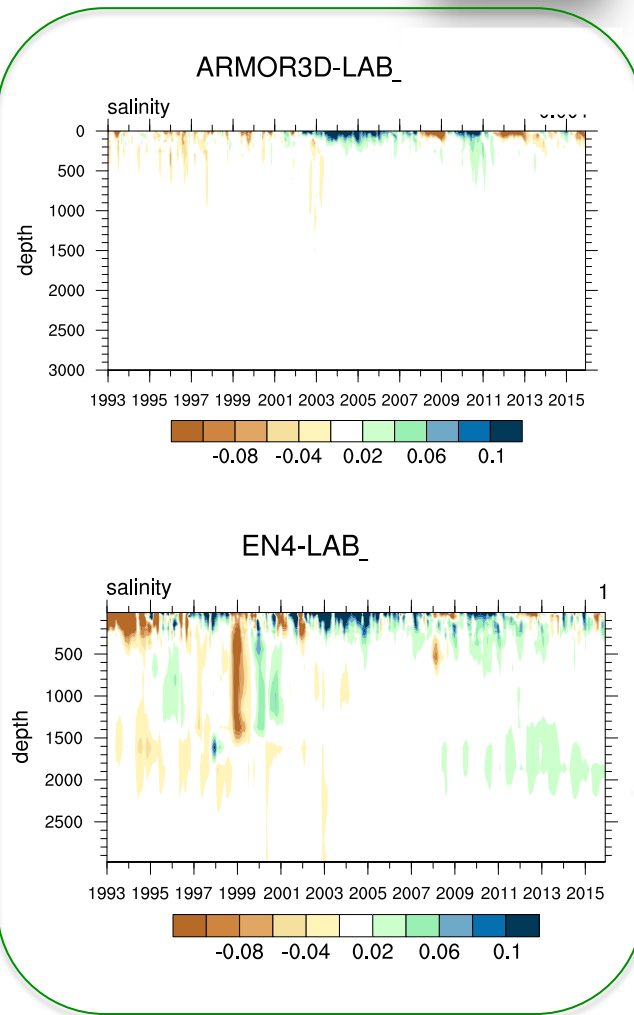
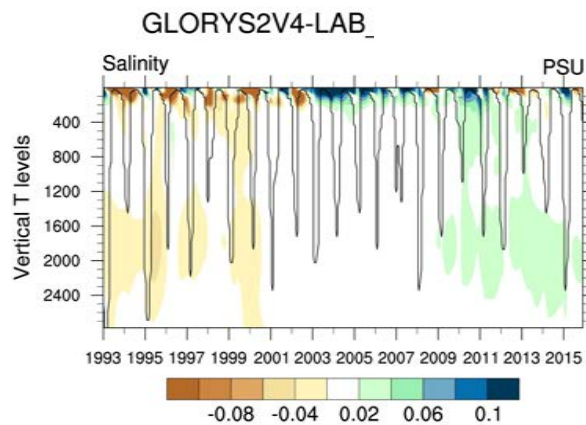
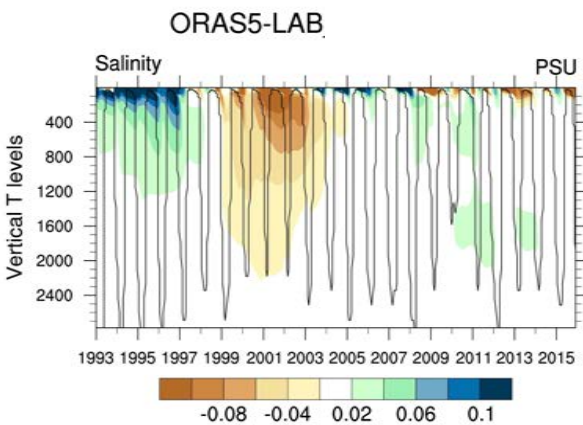




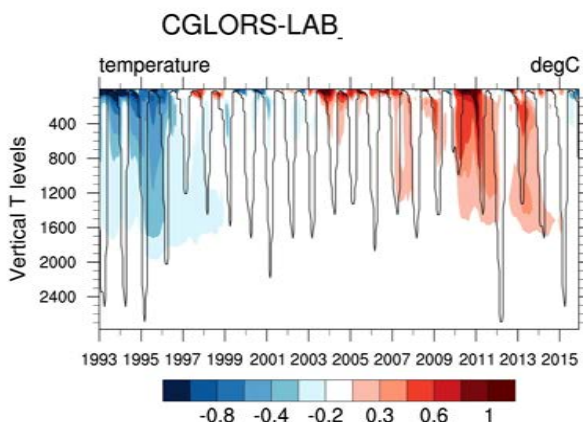
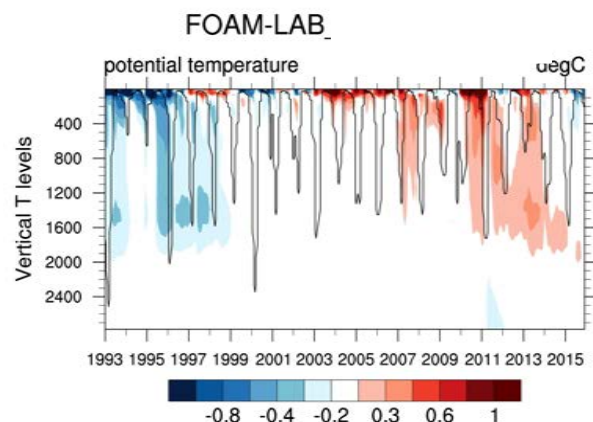
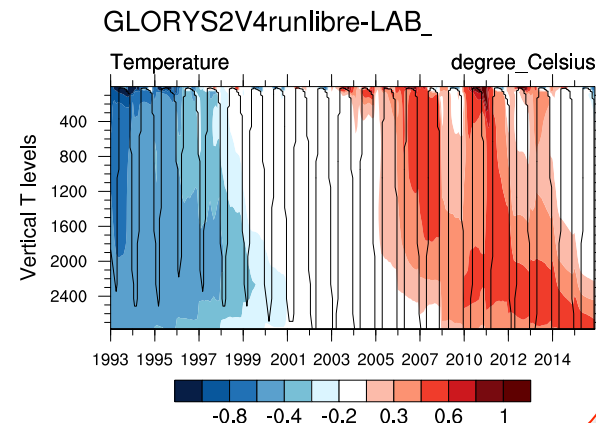
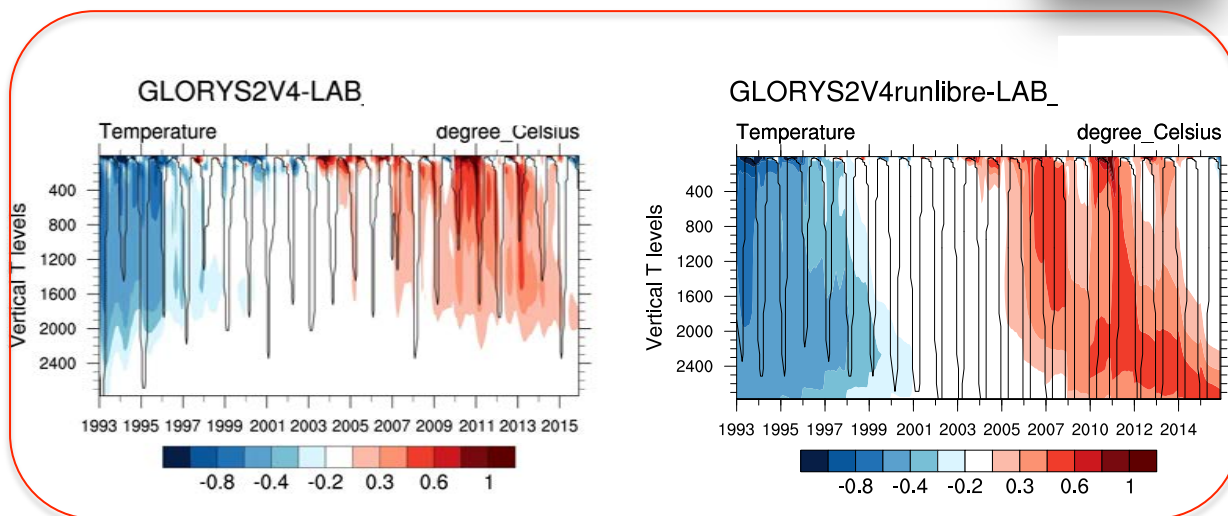
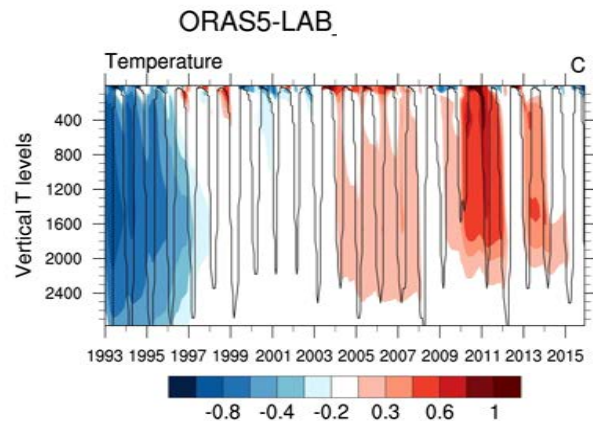
# Salinity anomalies in Labrador sea



## Observations



# Temperature anomalies in Labrador sea

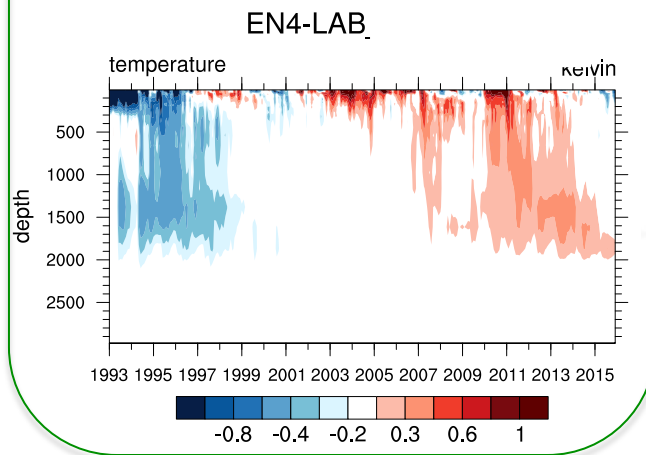
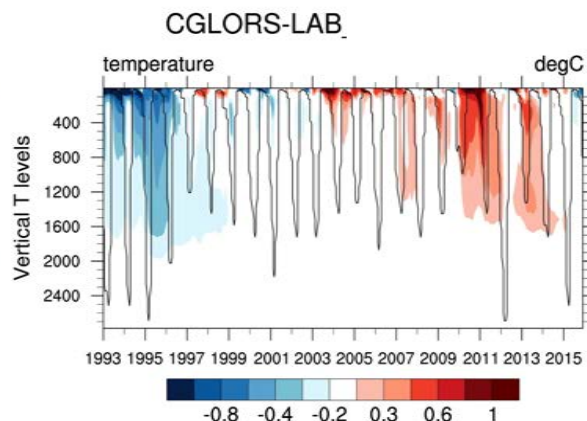
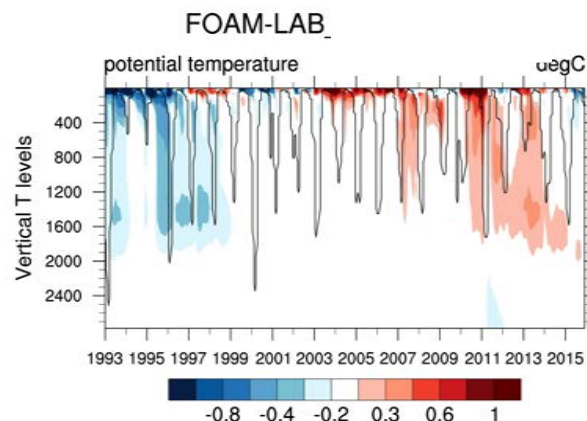
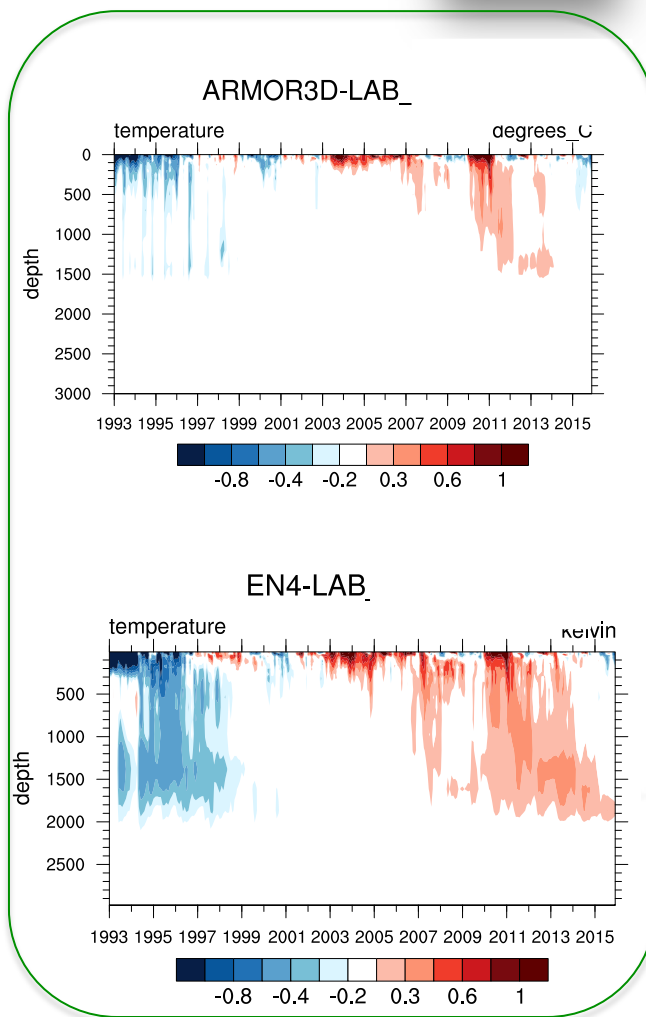
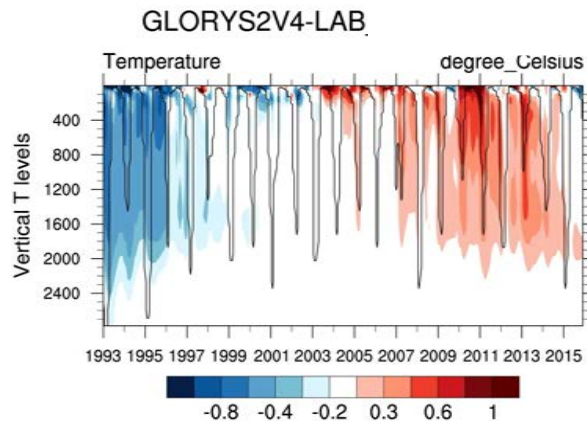
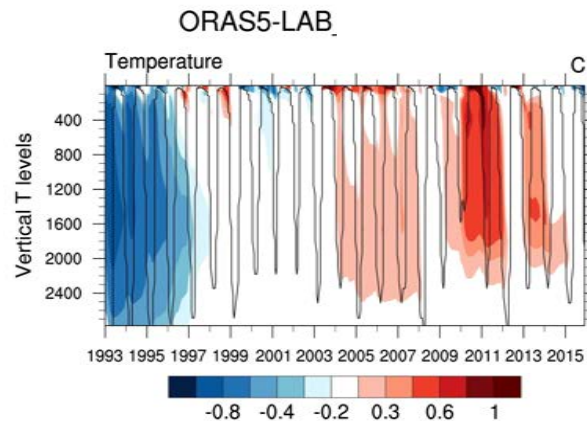




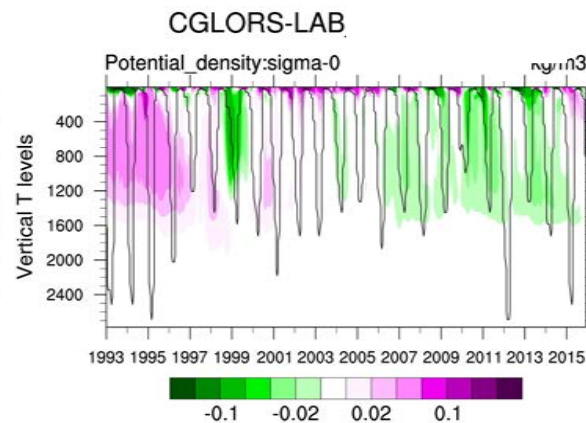
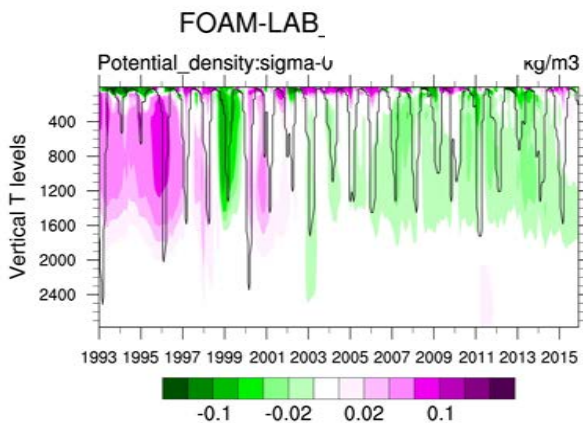
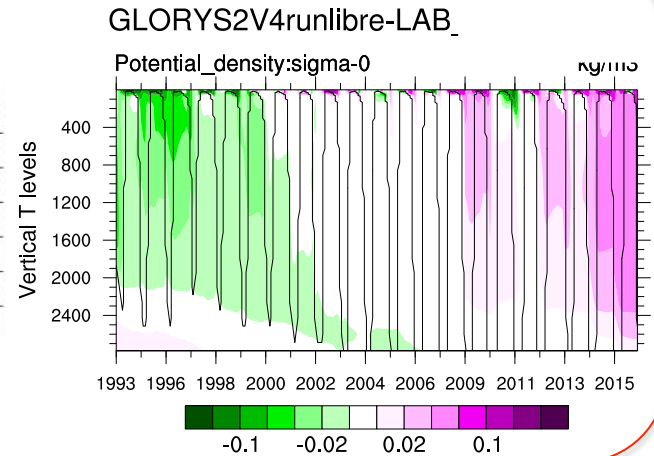
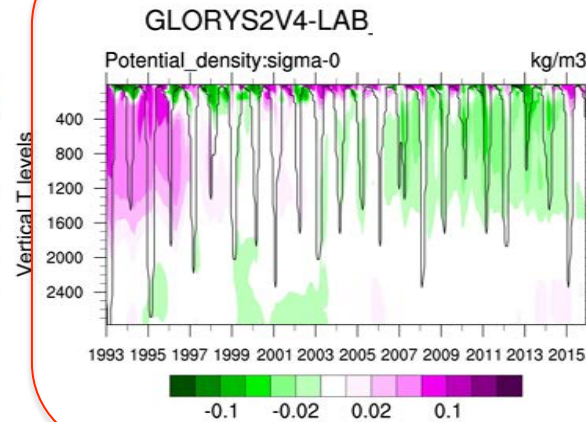
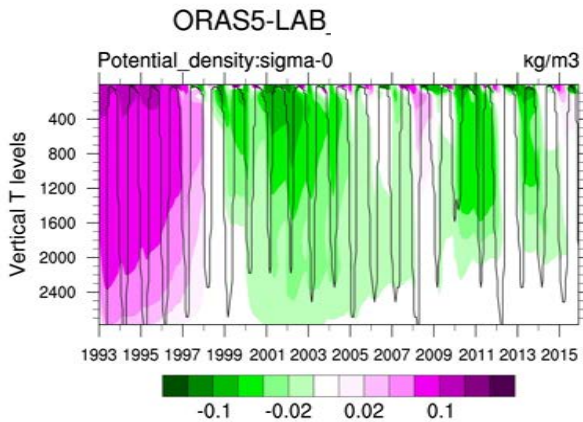
# Temperature anomalies in Labrador sea



## Observations



# Density anomalies in Labrador sea

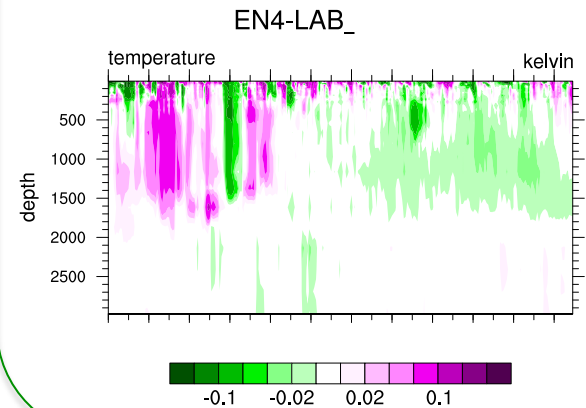
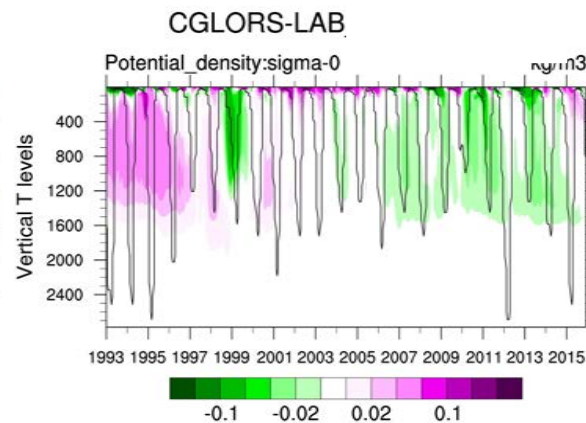
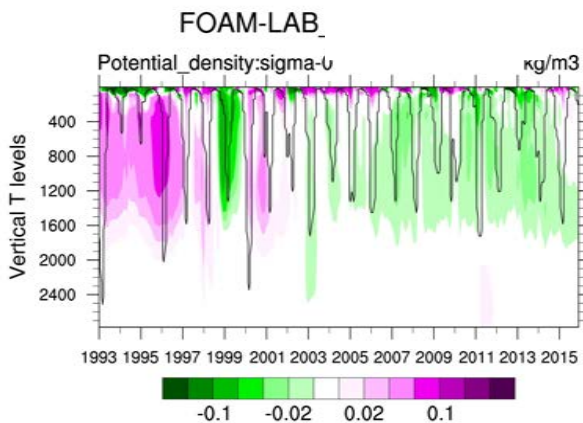
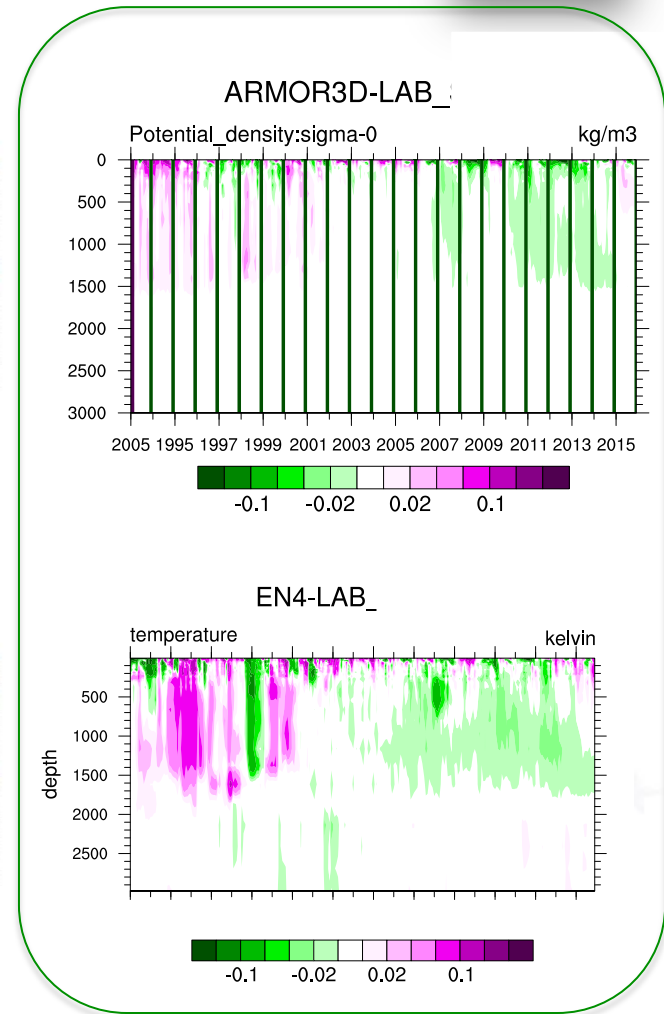
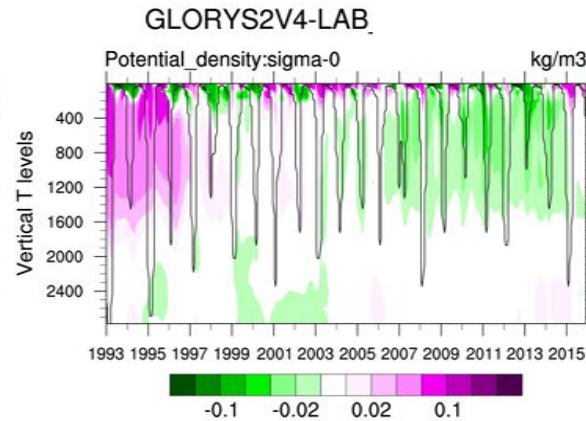
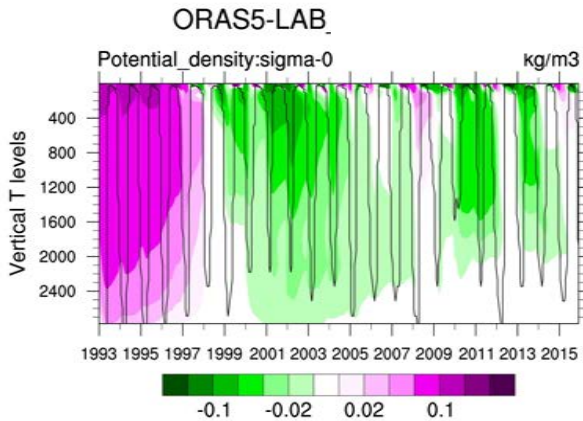




# Density anomalies in Labrador sea



## Observations

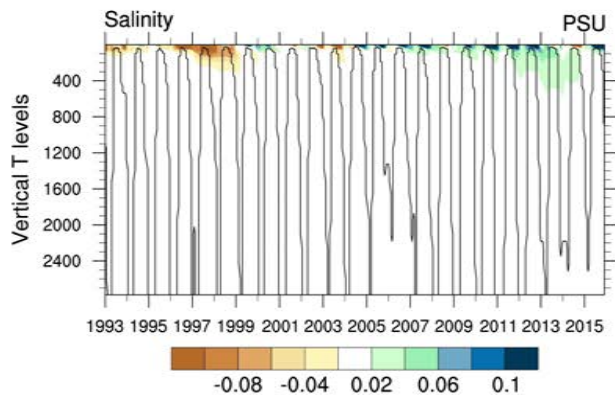




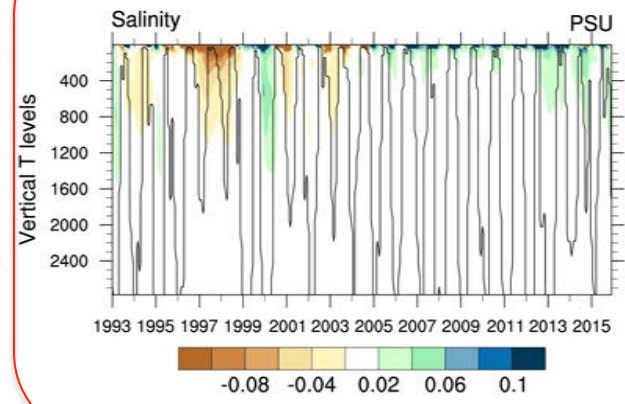
# Salinity anomalies in Nordic seas



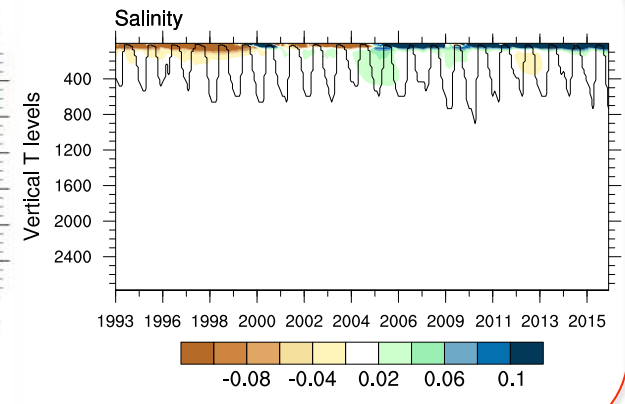
ORAS5-GIN



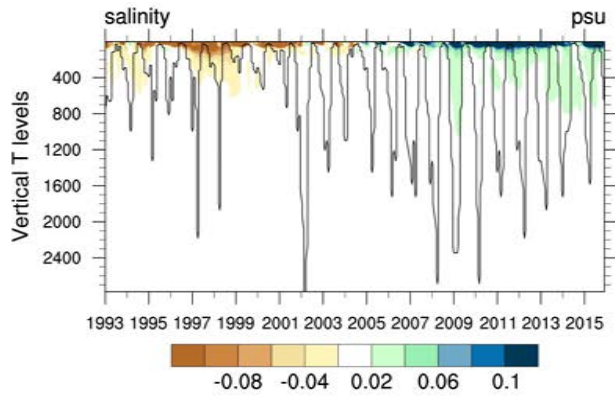
GLORYS2V4-GIN



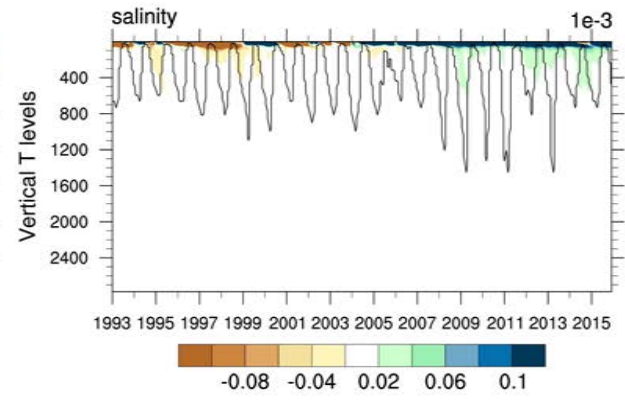
GLORYS2V4runlibre-GIN



FOAM-GIN



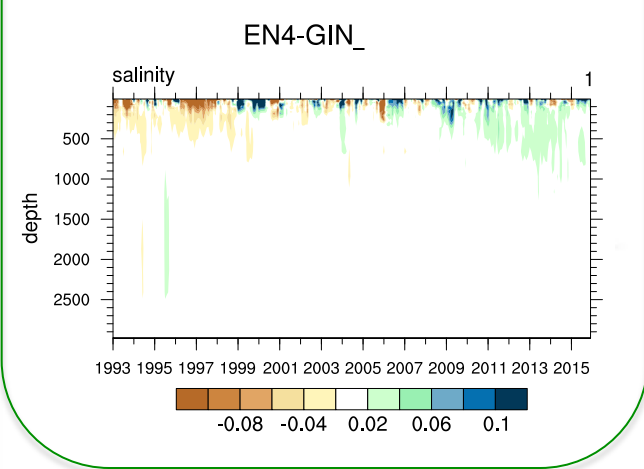
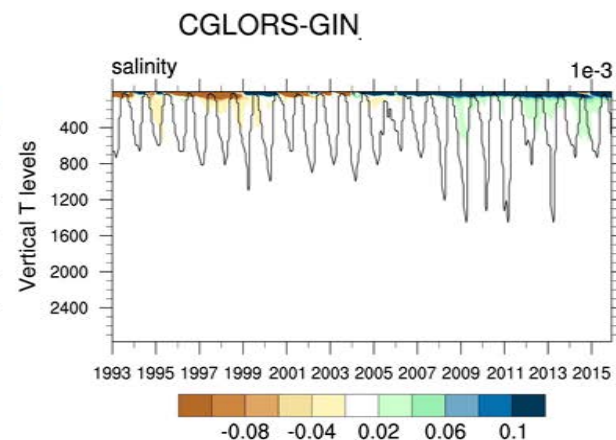
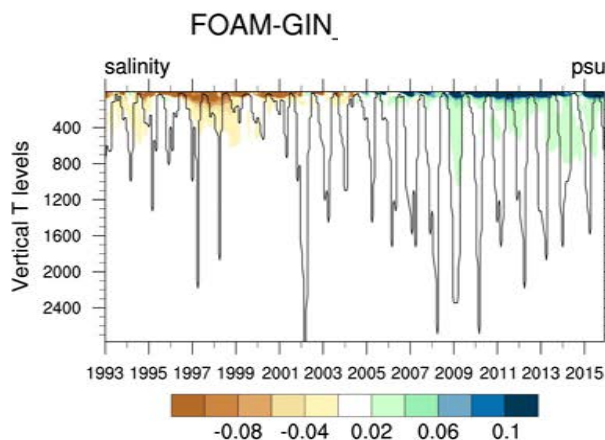
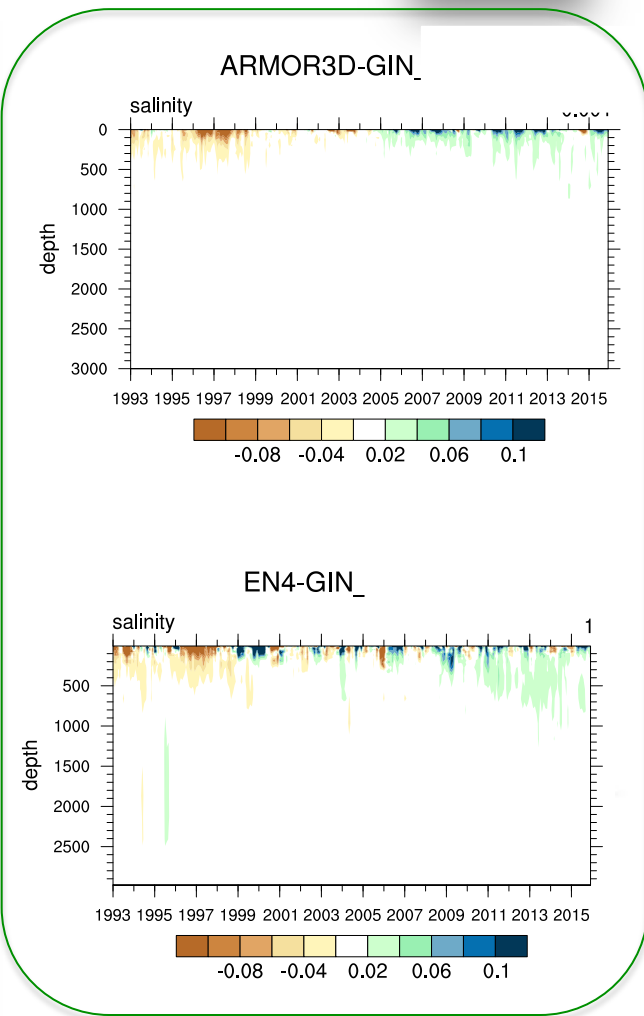
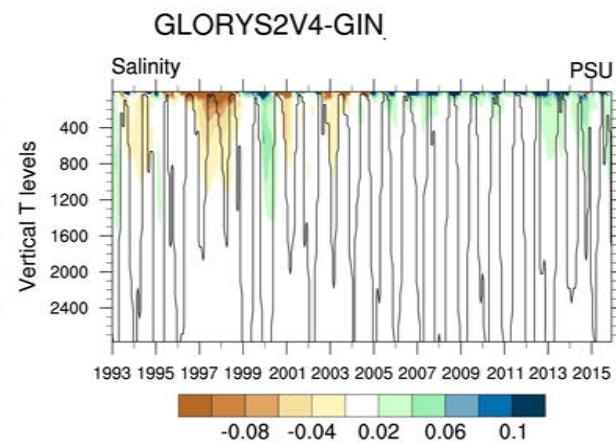
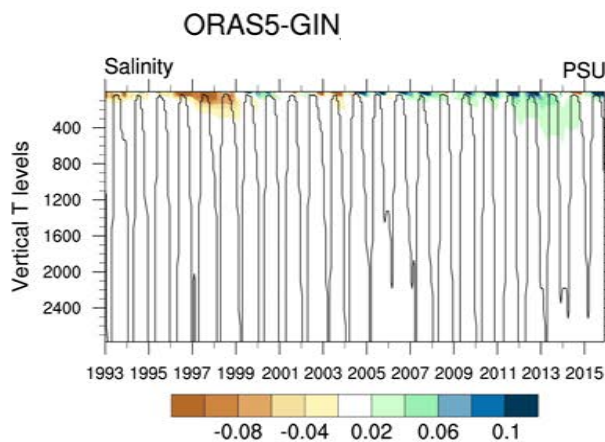
CGLORS-GIN



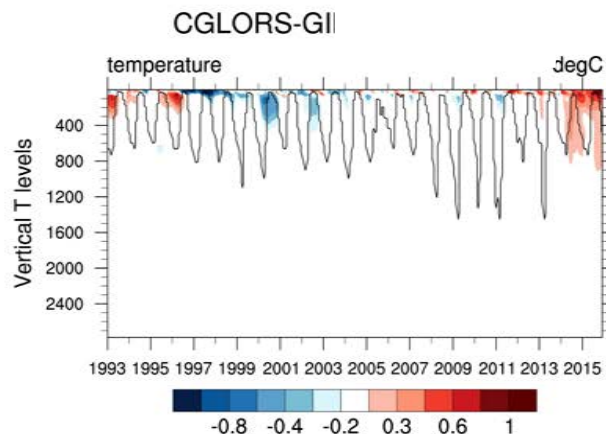
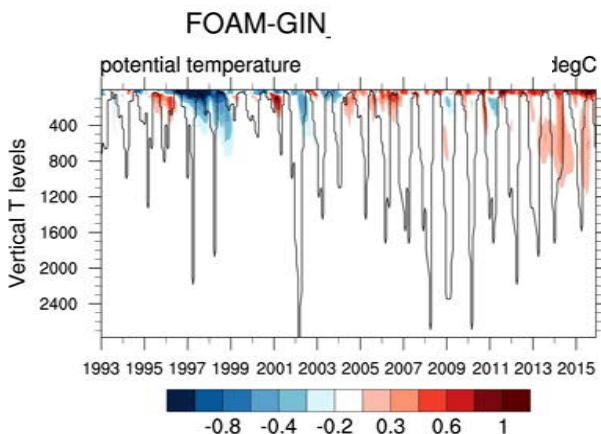
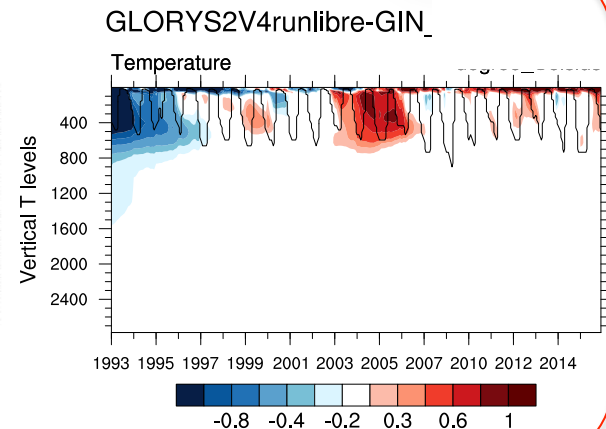
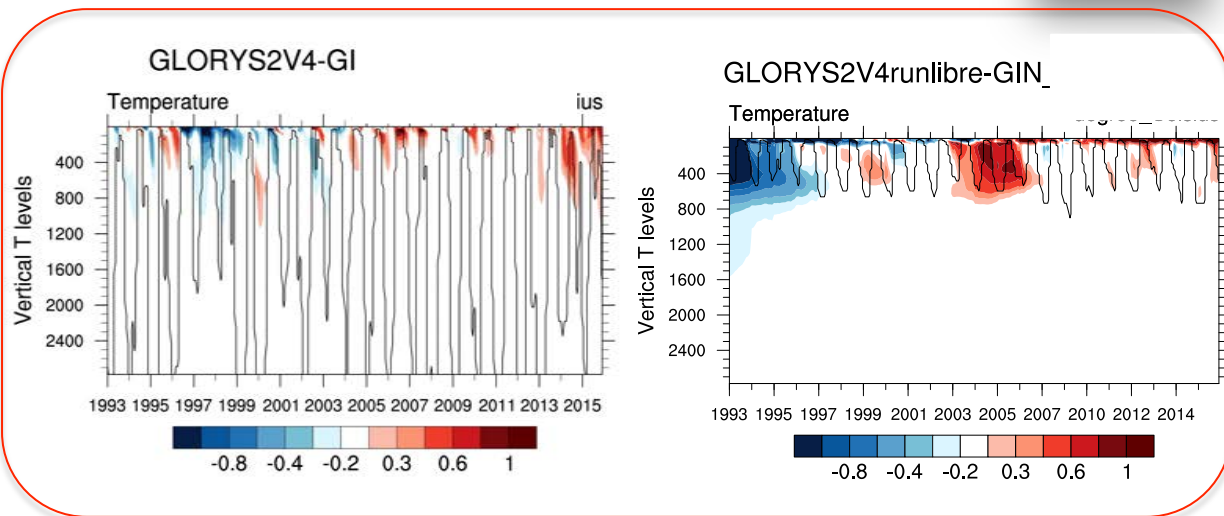
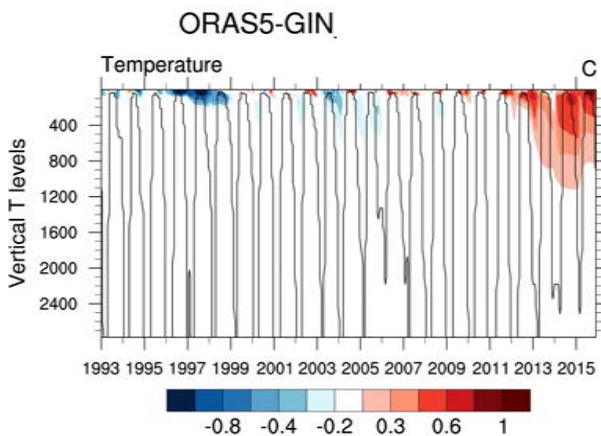
# Salinity anomalies in Nordic seas



## Observations



# Temperature anomalies in Nordic seas

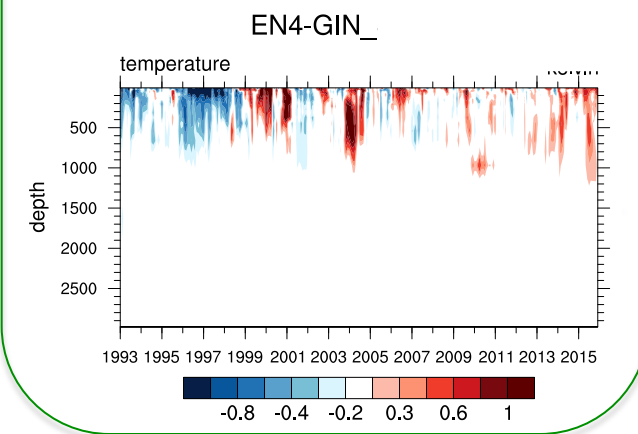
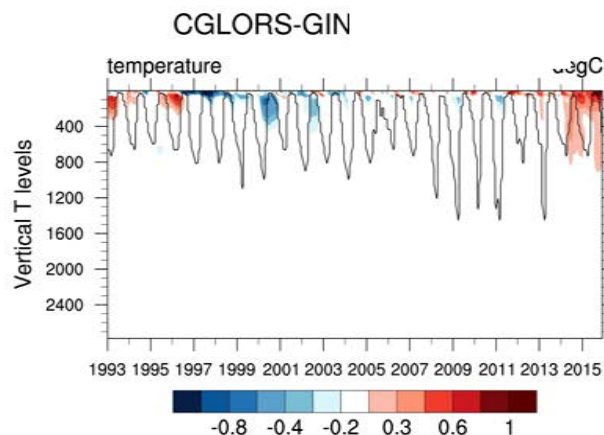
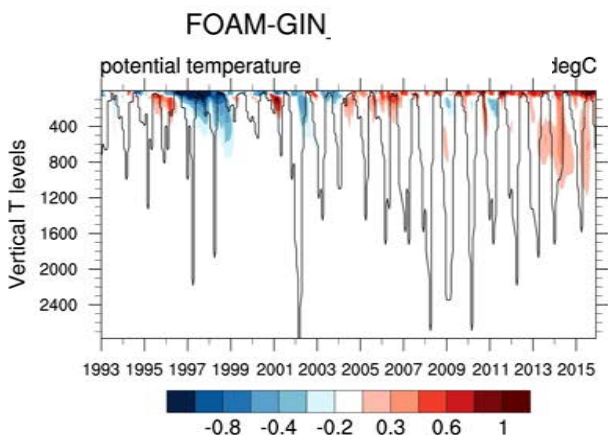
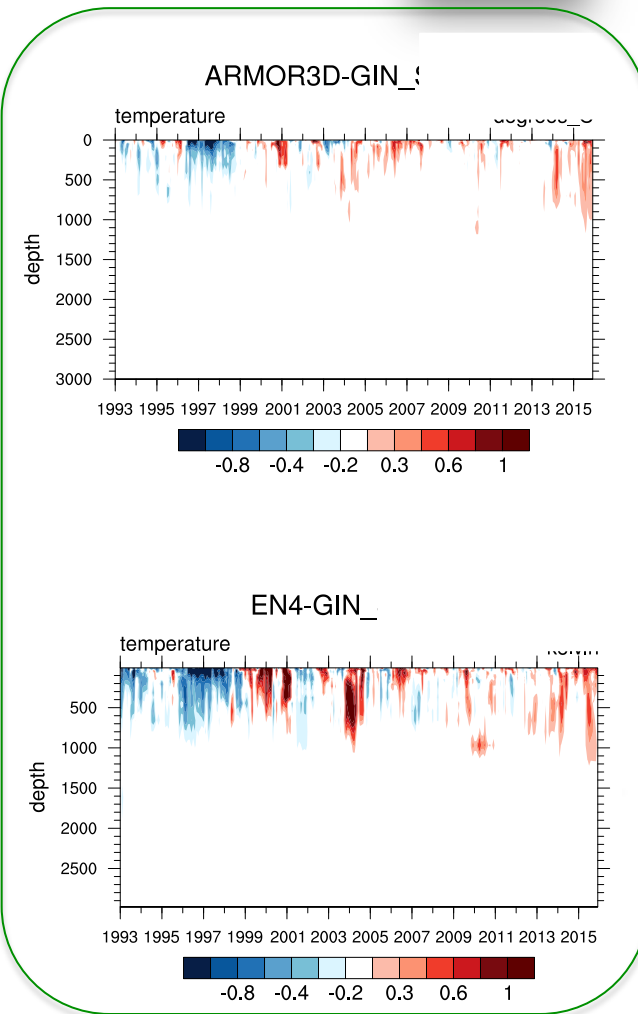
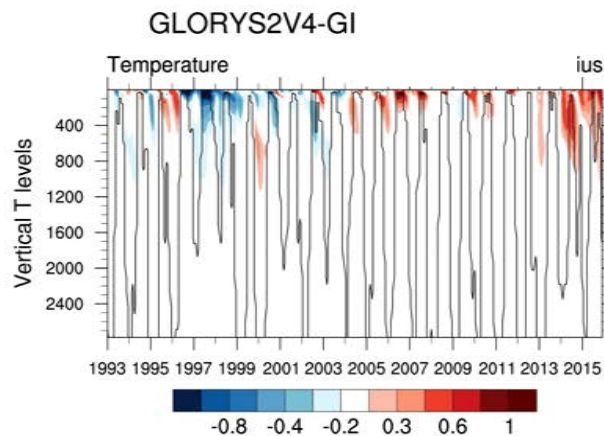
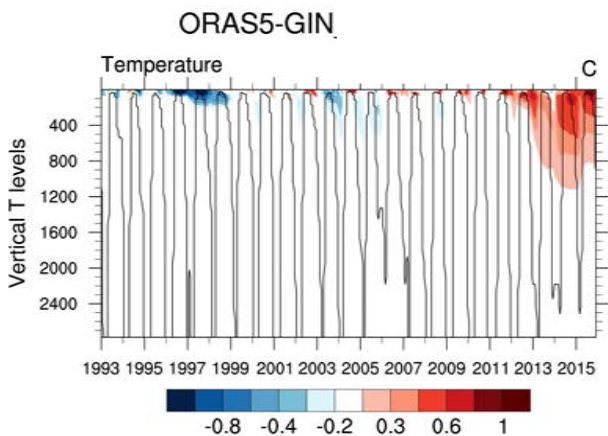




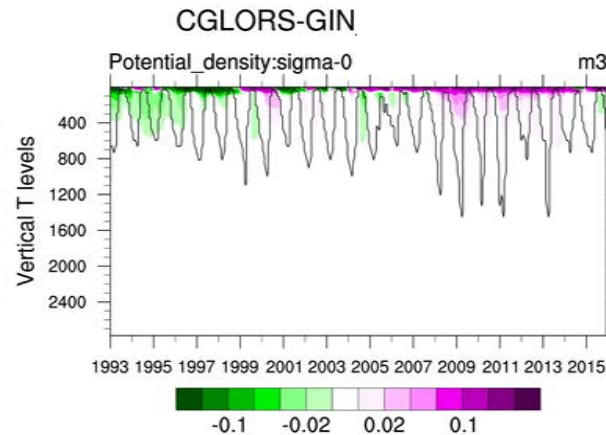
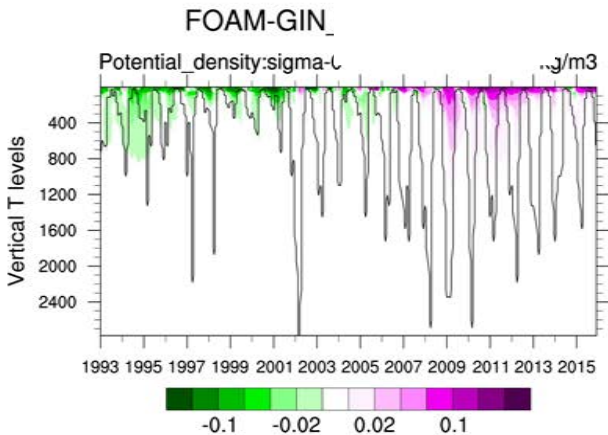
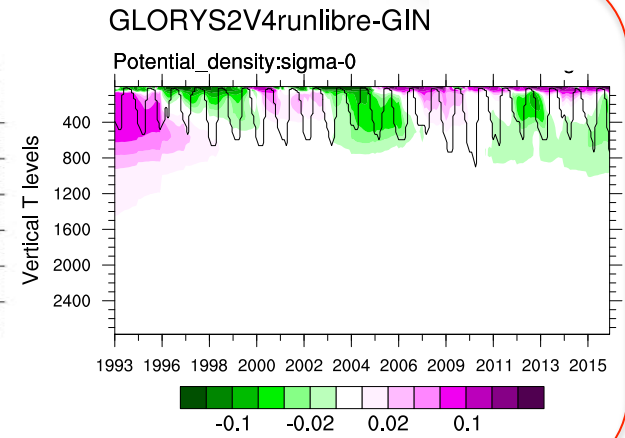
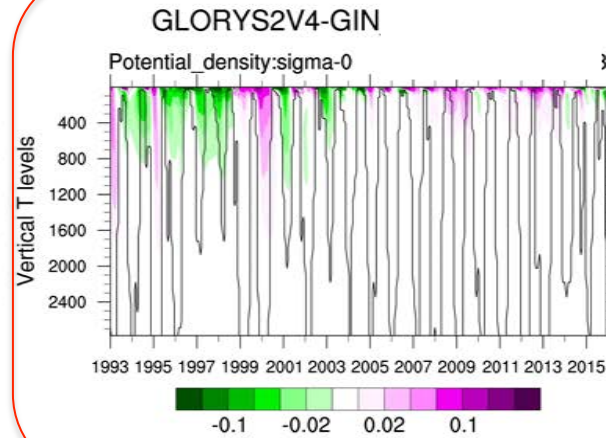
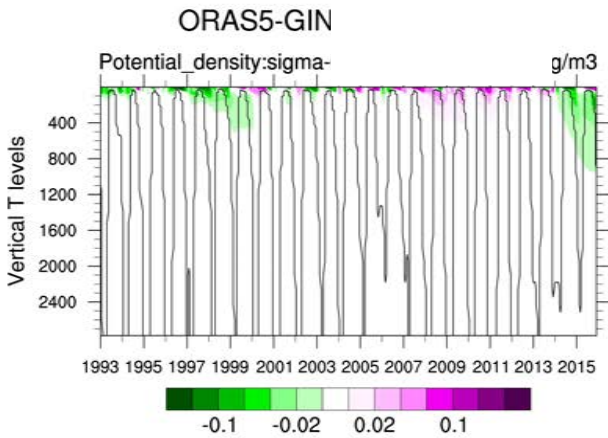
# Temperature anomalies in Nordic seas



## Observations



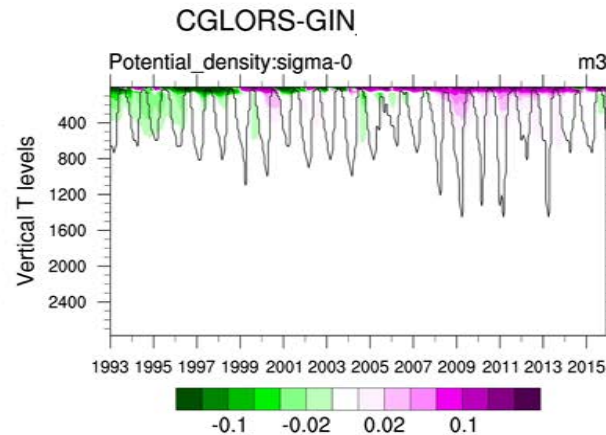
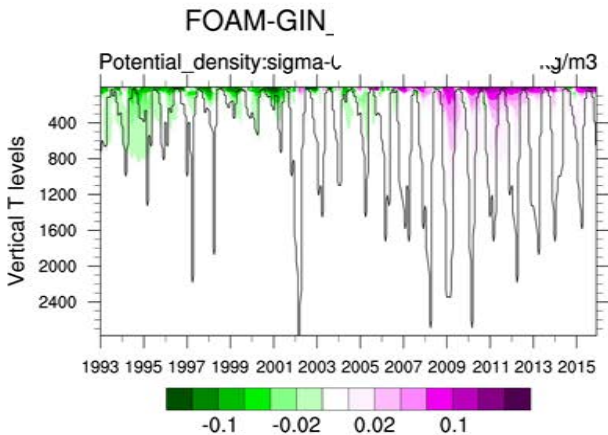
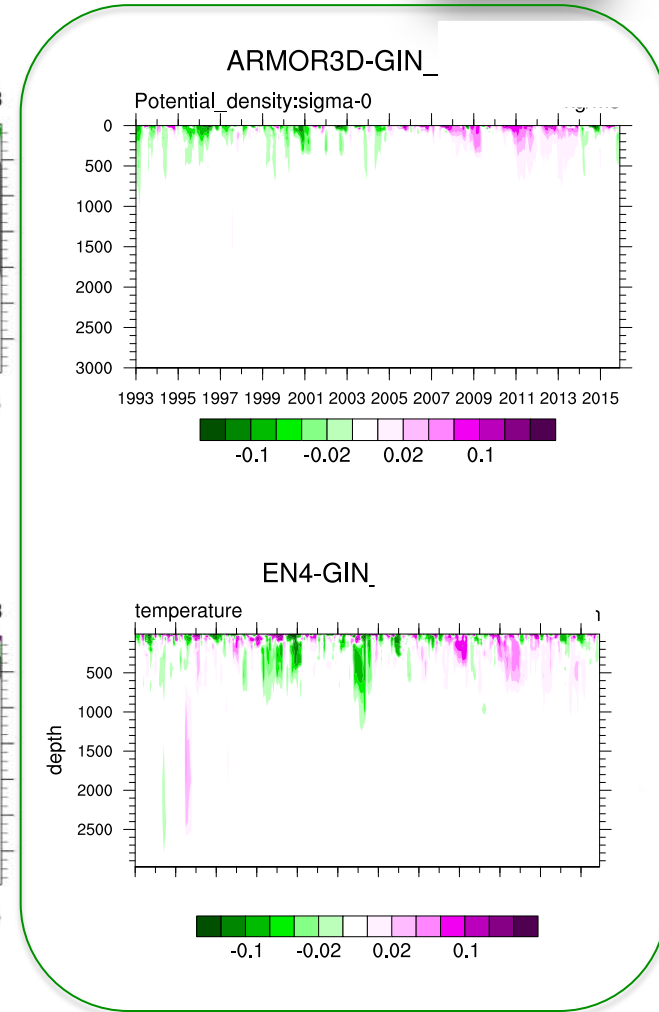
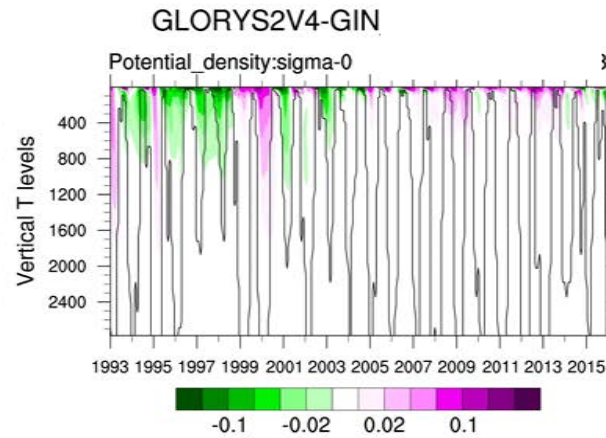
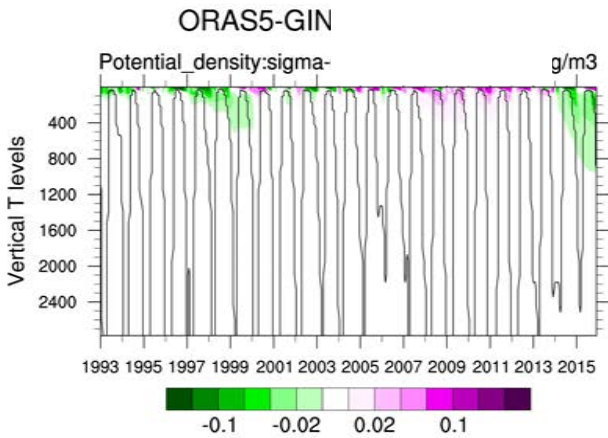
# Density anomalies In Nordic seas



# Density anomalies In Nordic seas



## Observations



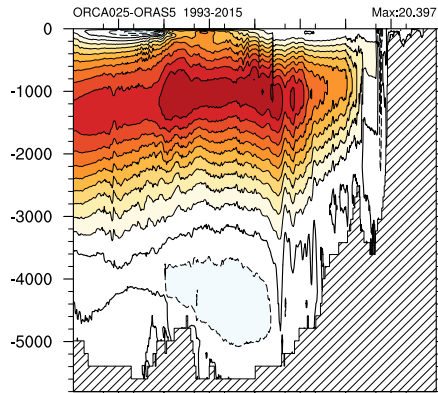


# Stream function

Averaged over the 1993-2015

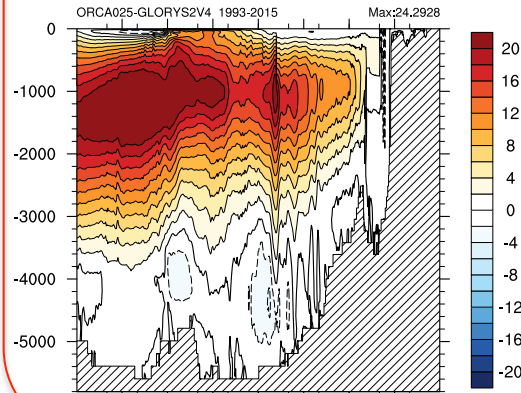
**ORAS5**

MOC Atl (Sv)



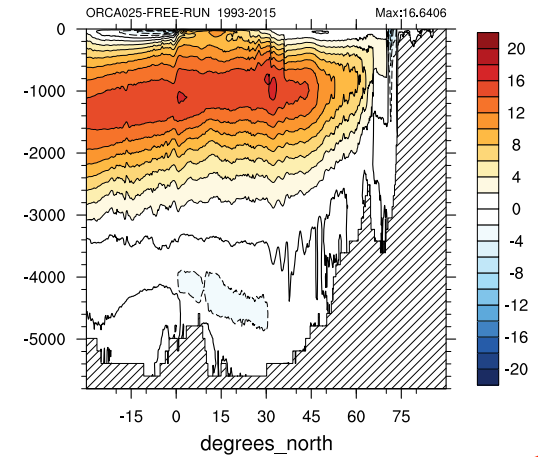
**GLORYS2V4**

MOC Atl (Sv)



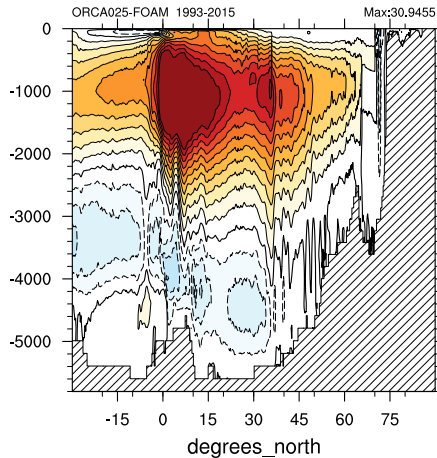
**GLORYS2V4 – Free run**

MOC Atl (Sv)



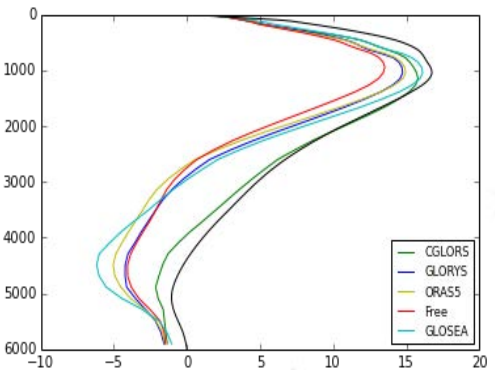
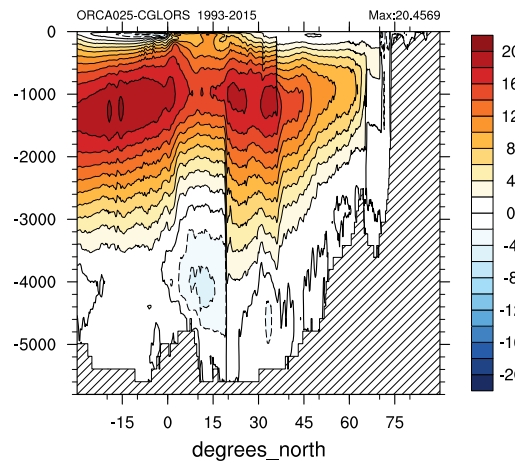
**FOAM**

MOC Atl (Sv)



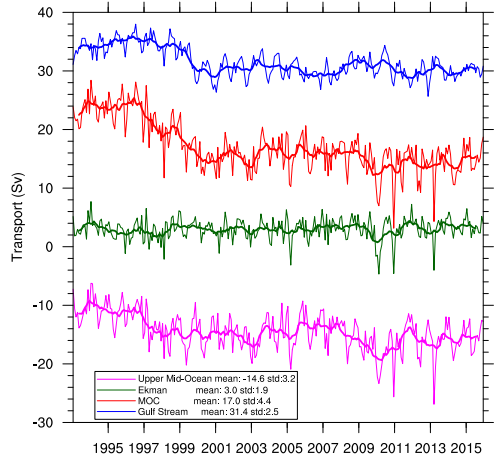
**CGLORS**

MOC Atl (Sv)

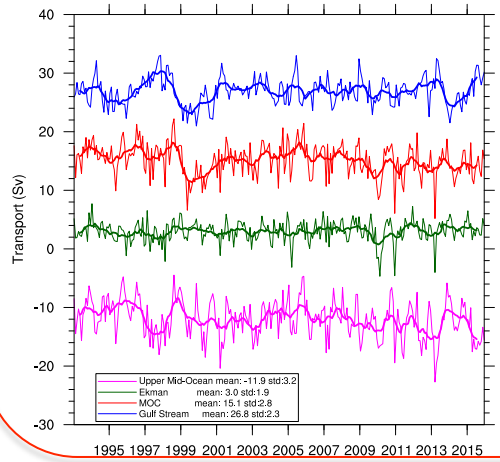


# AMOC decomposition

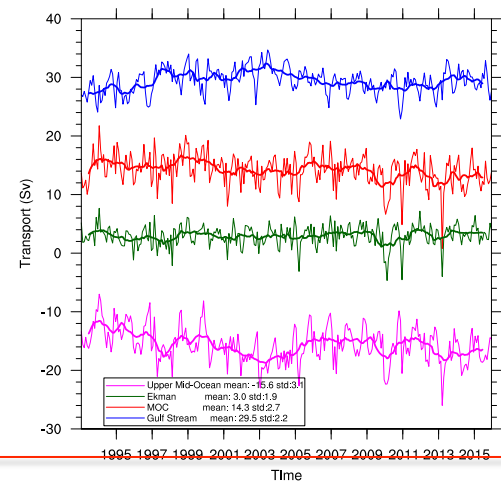
**ORAS5**  
ORAS5 MOC @ RAPID



**GLORYS2V4**  
GLORYS2V4 MOC @ RAPID

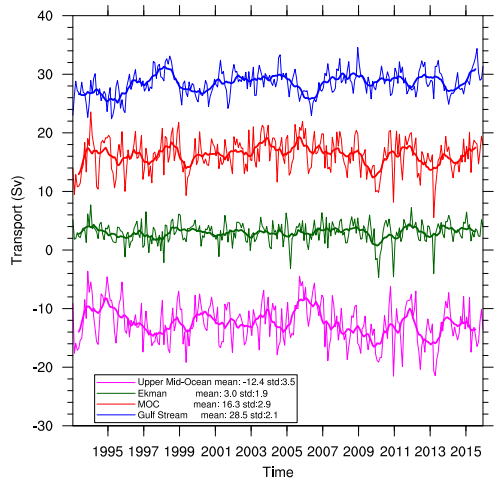


**GLORYS2V4 – Free run**  
FREE-RUN MOC @ RAPID



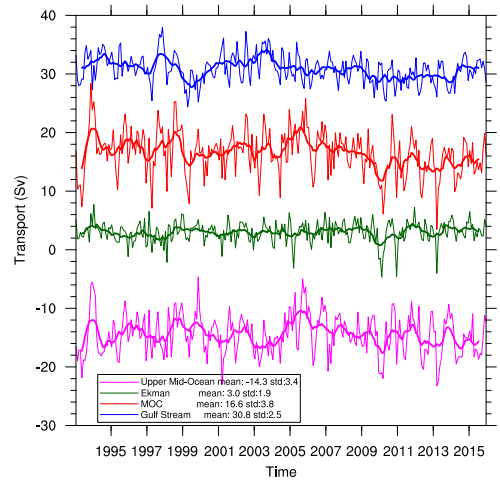
**FOAM**

FOAM MOC @ RAPID

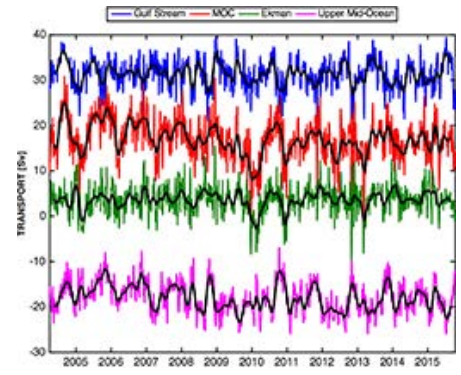


**CGLORS**

CGLORS MOC @ RAPID

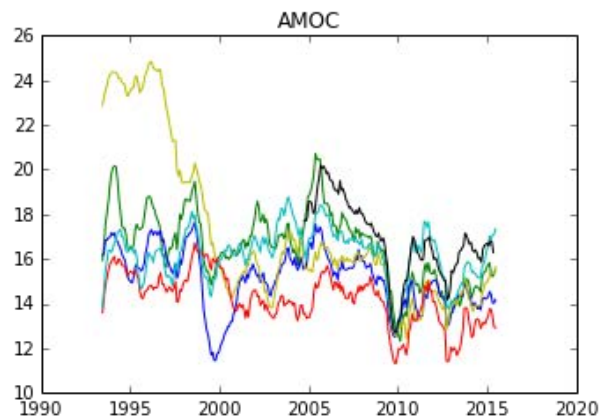


**RAPID array**

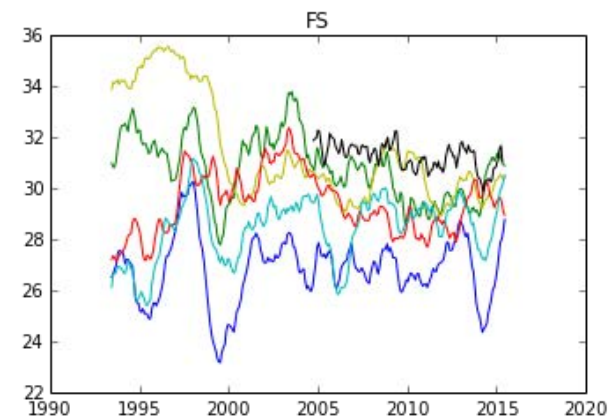


Model	Trend 04-15	Trend 00-06	RMS error
RAPID	-0.33 (0.02)		
GLOSEA	-0.21 (0.07)	0.45 (0.05)	1.1
CGLORS	-0.44 (0.01)	0.62 (0.01)	0.9
GLORYS	-0.23 (0.01)	0.80 (0.01)	2.2
ORASS	-0.25 (0.02)	0.11 (0.63)	2.4
GREP	-0.28 (0.01)	0.49 (0.01)	1.5

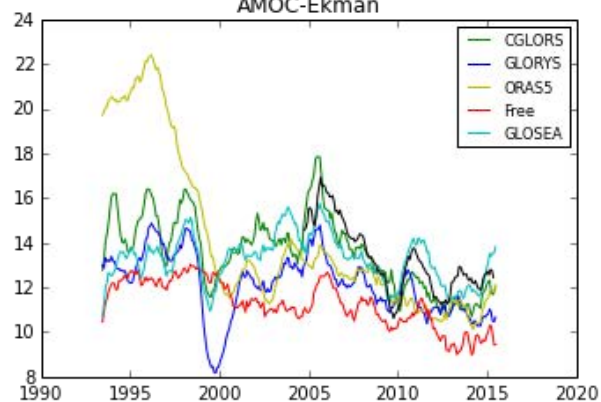
## AMOC



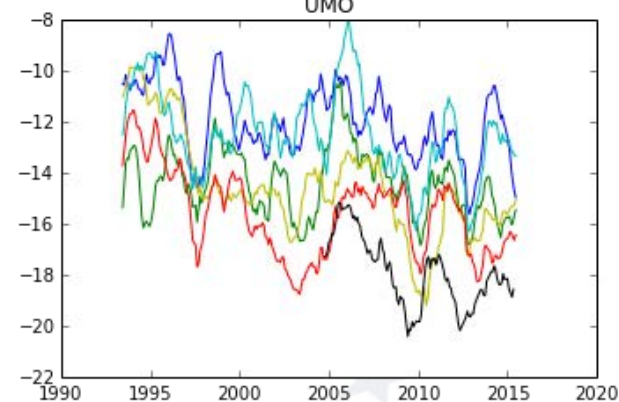
## Florida Strait



## AMOC-Ekman



## UMO



Black: RAPID array

Upper mid-ocean





# Conclusions



- **Opposite physical properties between the reanalysis and the free run can be found, especially in the Labrador sea**
- **Large differences are found between reanalysis but also in the data that they are assimilating**
- **Which are the impacts on the seasonal or decadal forecasts depending of the reanalysis used?**



# Thank for your attention

