

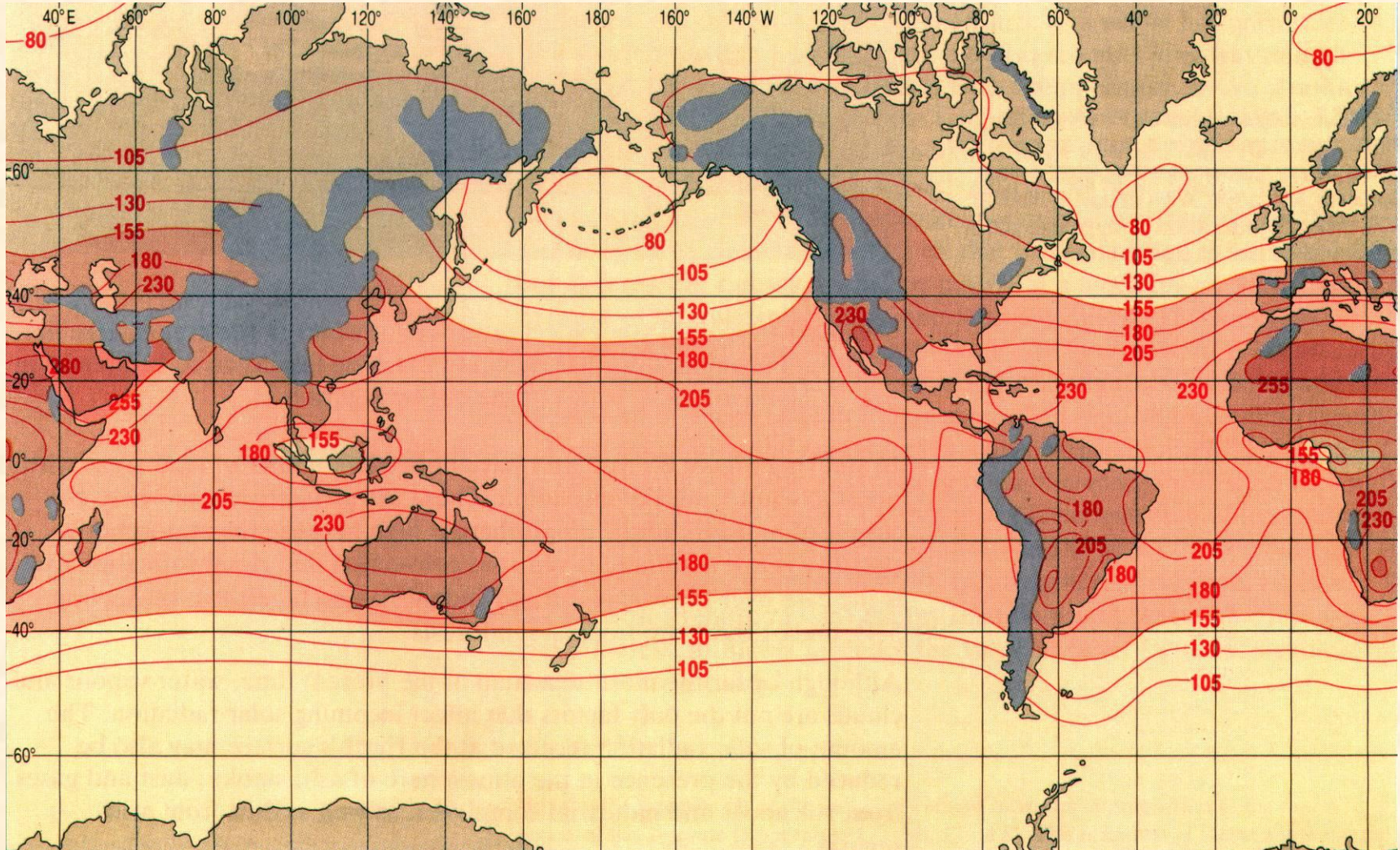
# Φυσική Ωκεανογραφία μία εισαγωγή

θερμοκρασία – αλατότητα – πυκνότητα  
θαλασσινού νερού

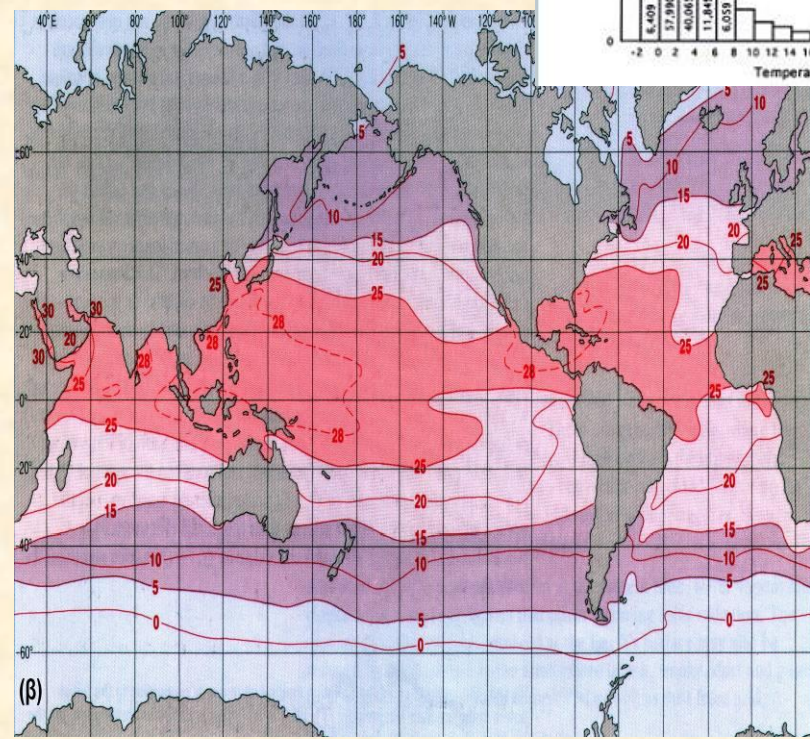
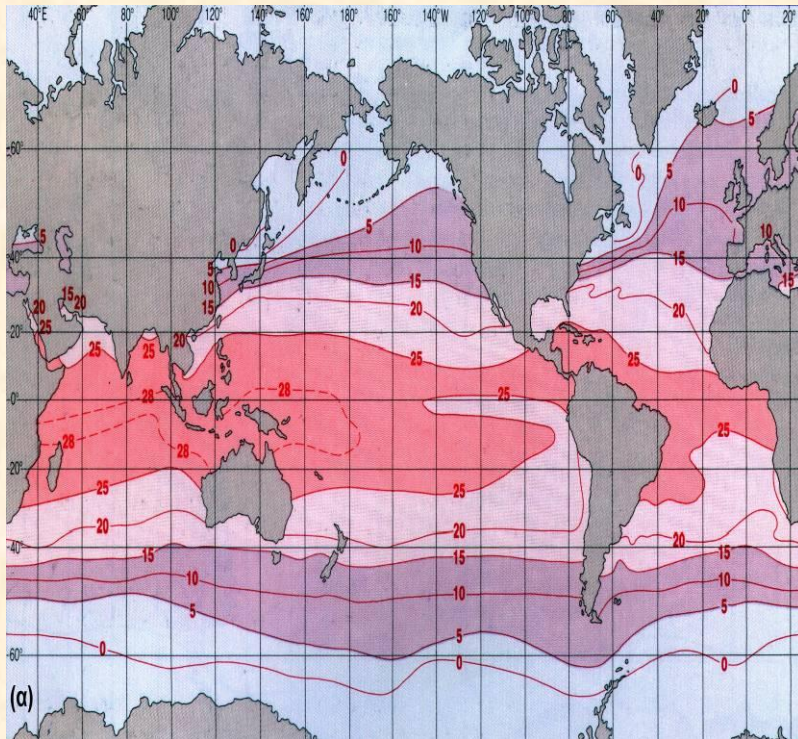
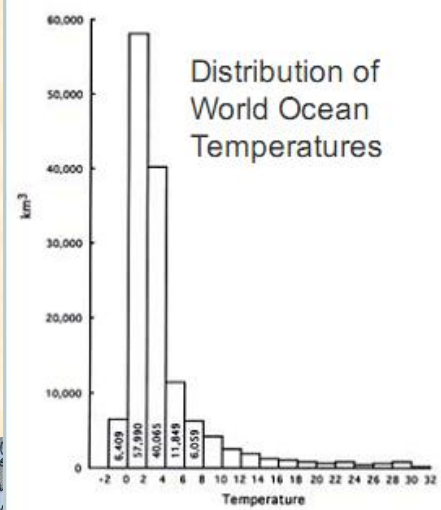
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# ΘΕΡΜΟΚΡΑΣΙΑ ΩΚΕΑΝΩΝ

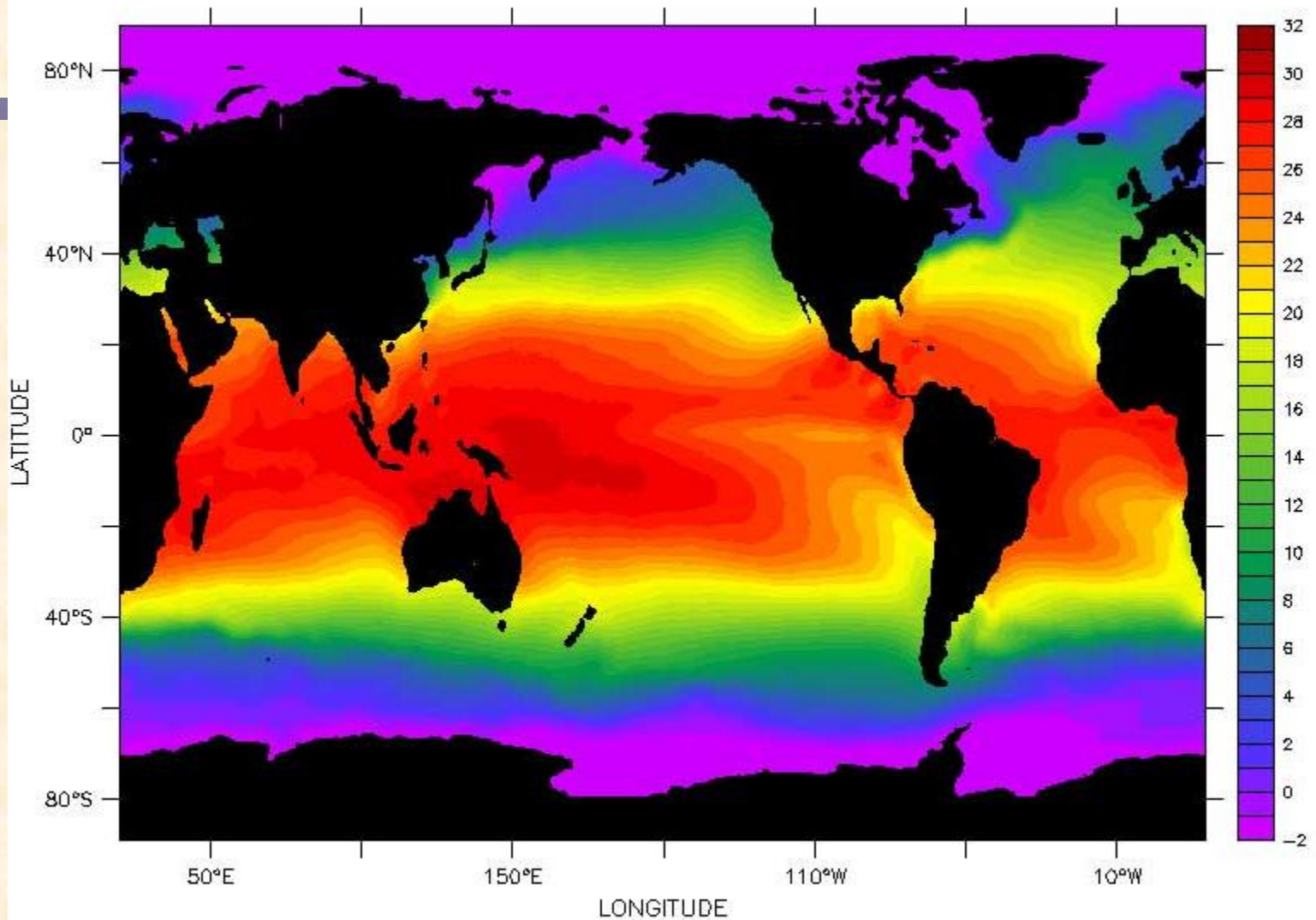
# Η ετήσια ποσότητα της ηλιακής ακτινοβολίας που προσπίπτει στην επιφάνεια της γης σε $J \cdot m^{-2} \cdot yr^{-1}$



# Μέση θερμοκρασία στην επιφάνεια των ωκεανών (α) το Φεβρουάριο και (β) τον Αύγουστο



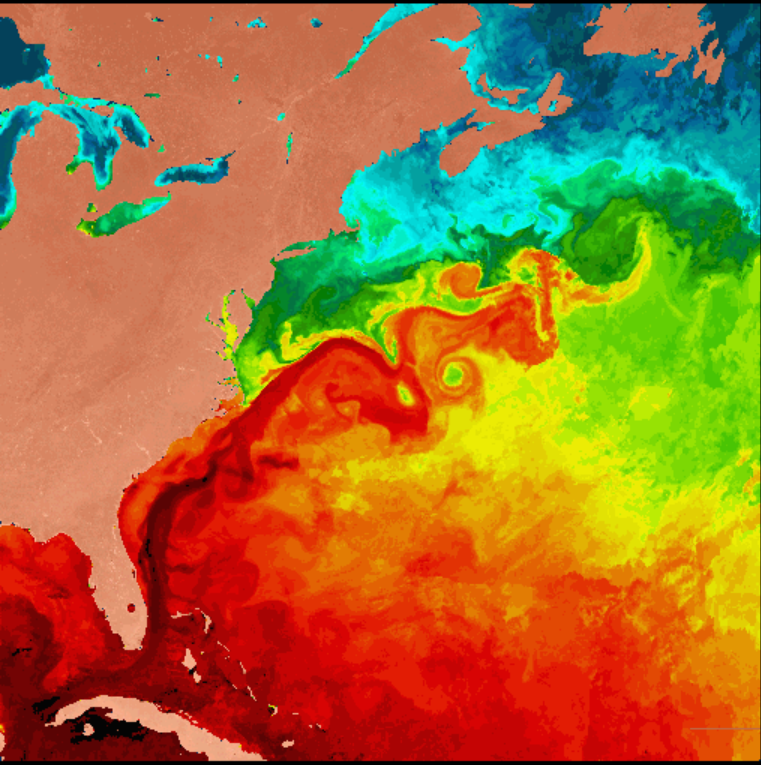
### SST Climatology for January



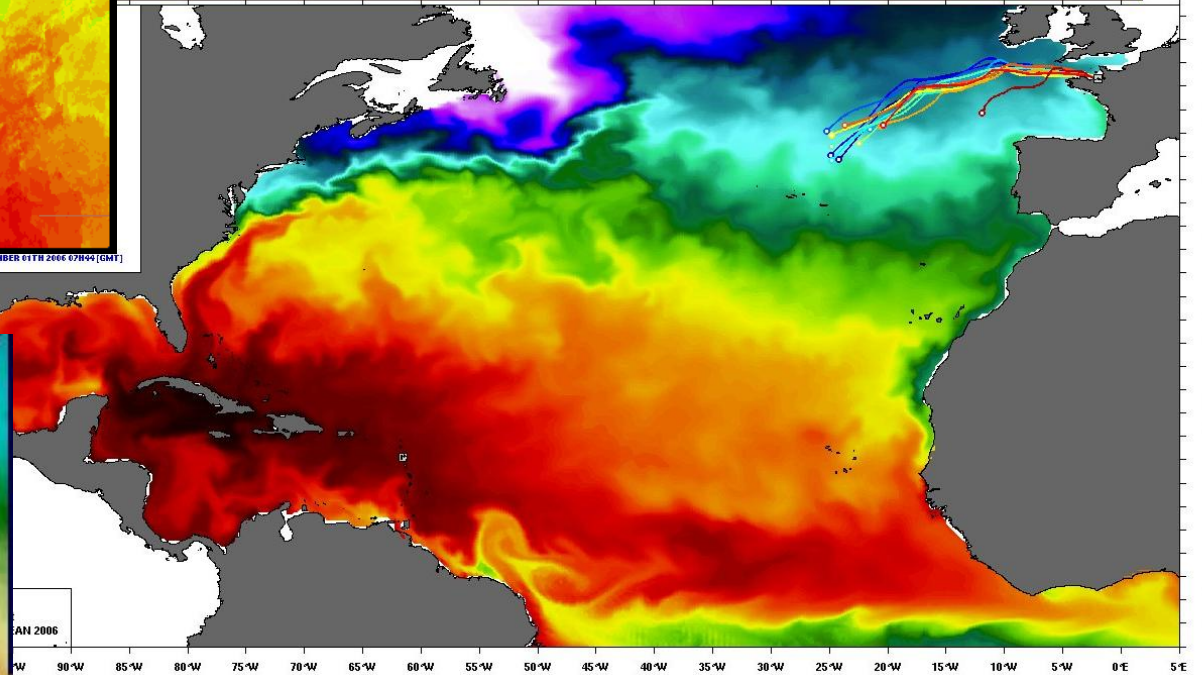
Date file from National Meteorological Center and the Optimal Interpolation based on both satellite observations and ship and buoy observations

Time Sep. 4, 1997

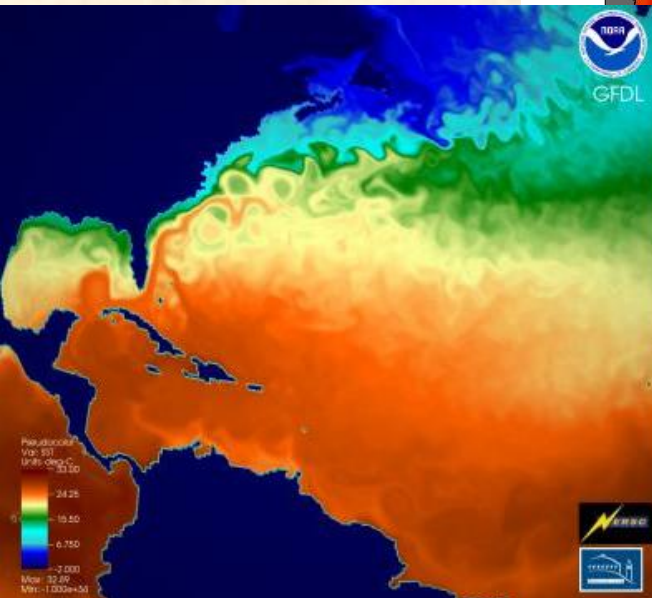
# SST Gulf stream



SEA SURFACE TEMPERATURE [°C] OVER THE ATLANTIC OCEAN ON NOVEMBER 1ST 2006 AT 09H00 [GMT]

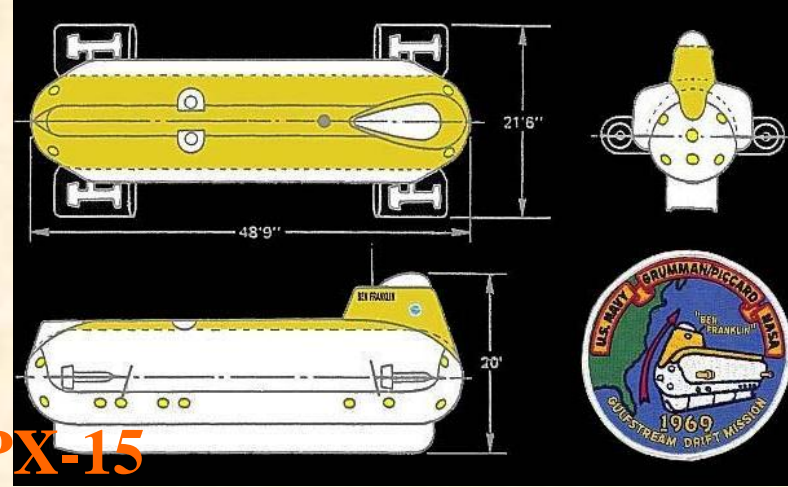


NOVEMBER 01TH 2006 07H00 [GMT]  
32°N  
30°N  
28°N

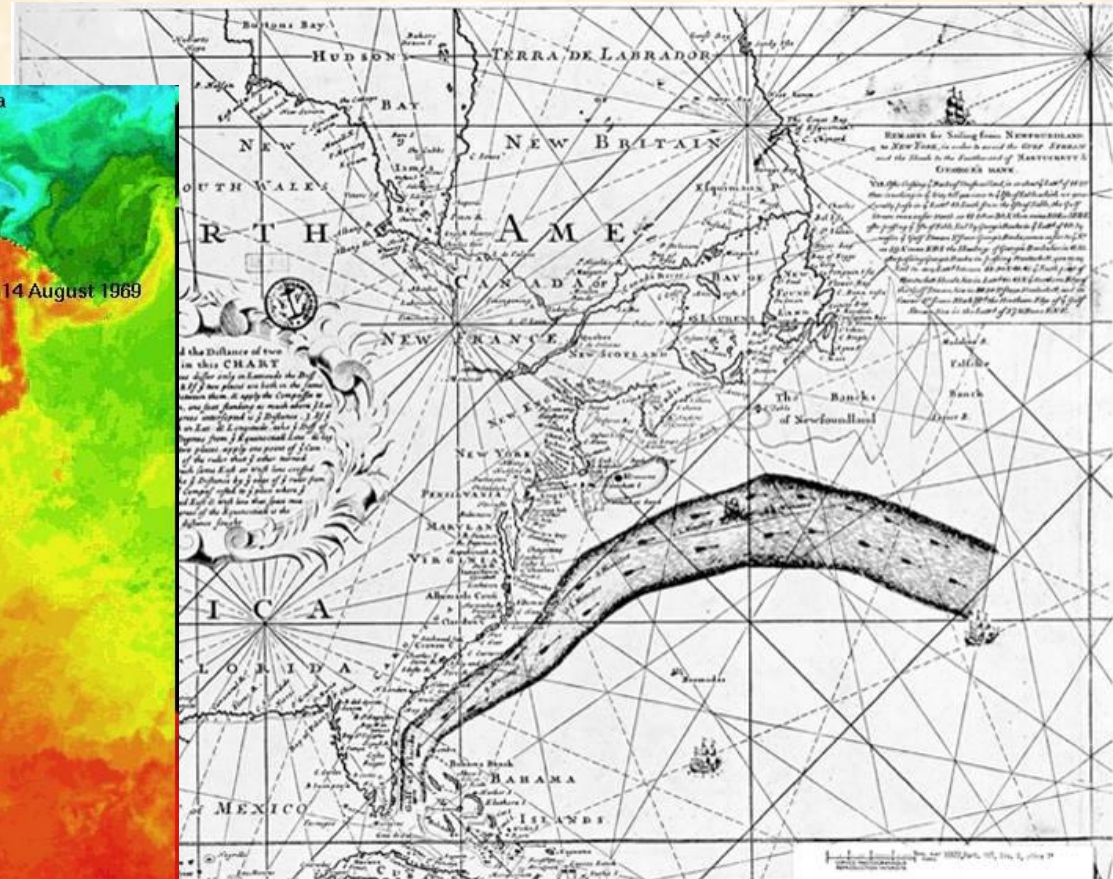
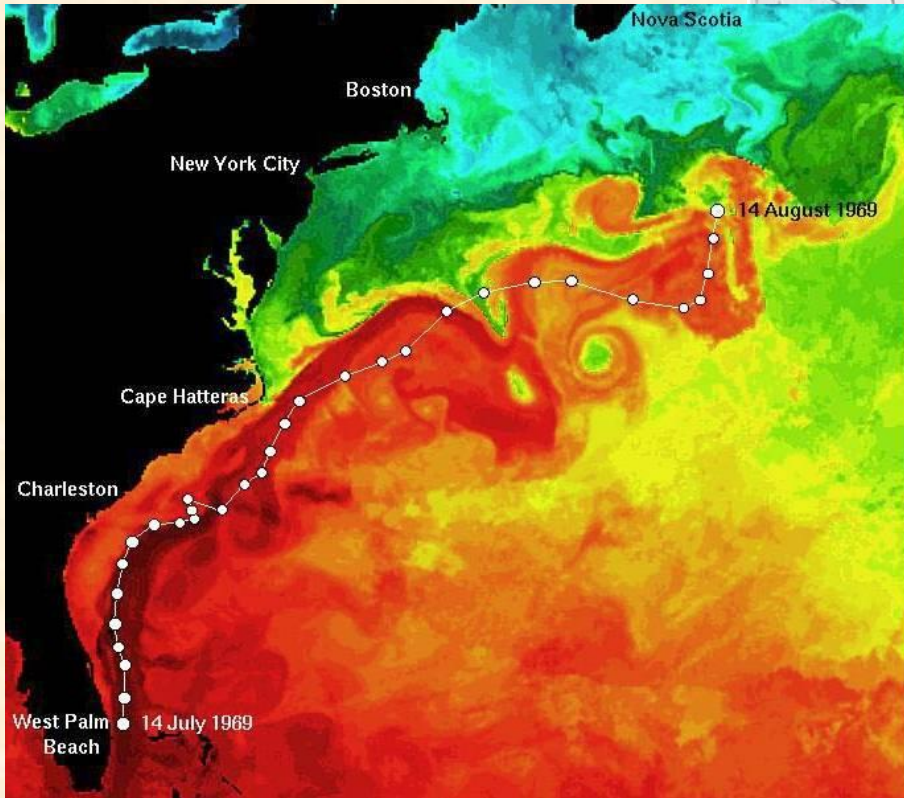


90°W 85°W 80°W 75°W 70°W 65°W 60°W 55°W 50°W 45°W 40°W 35°W 30°W 25°W 20°W 15°W 10°W 5°W 0°E 5°E

# Ben Franklin (1706-1790)

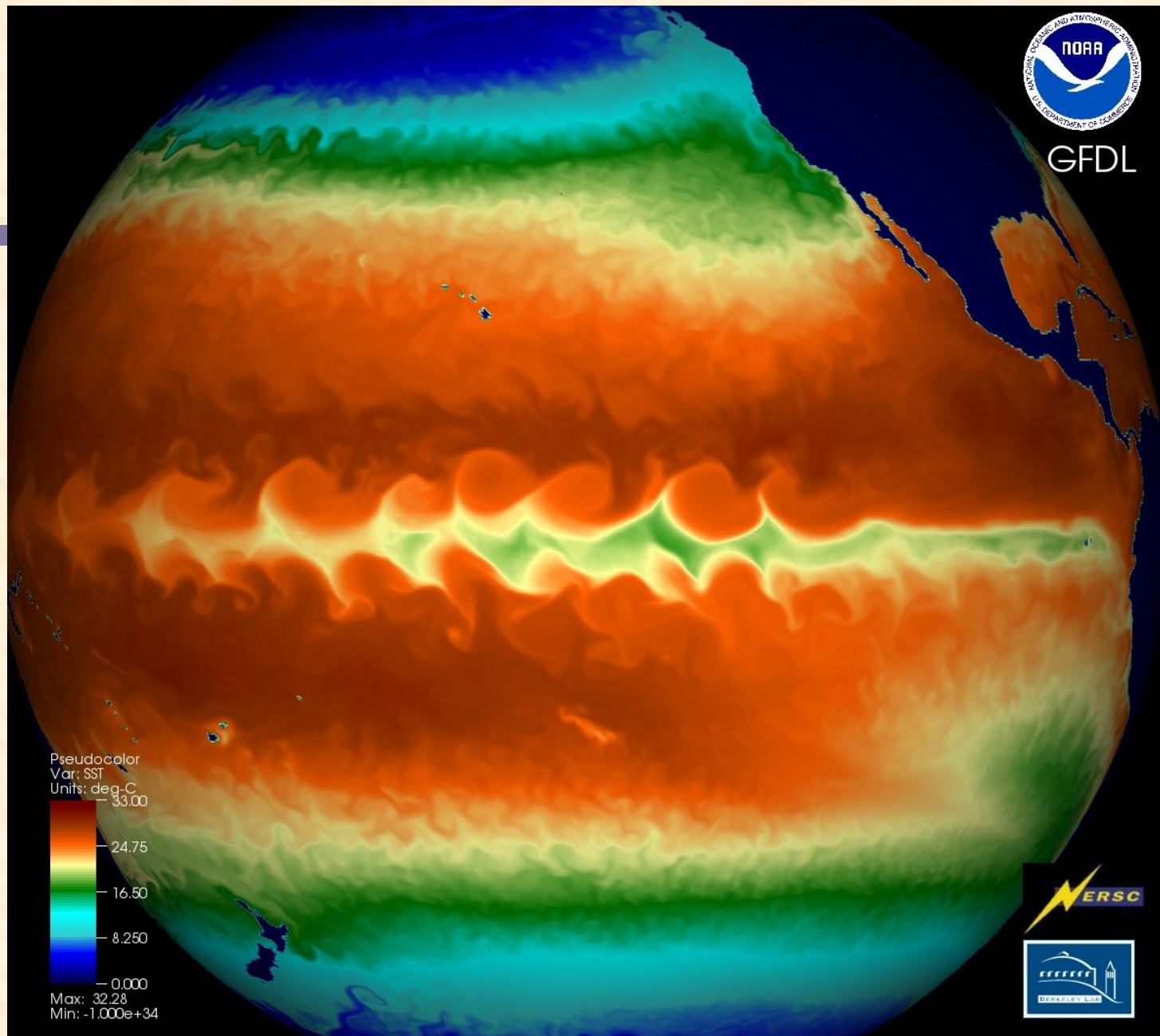


## The Ben Franklin - Grumman/Piccard PX-15





GFDL



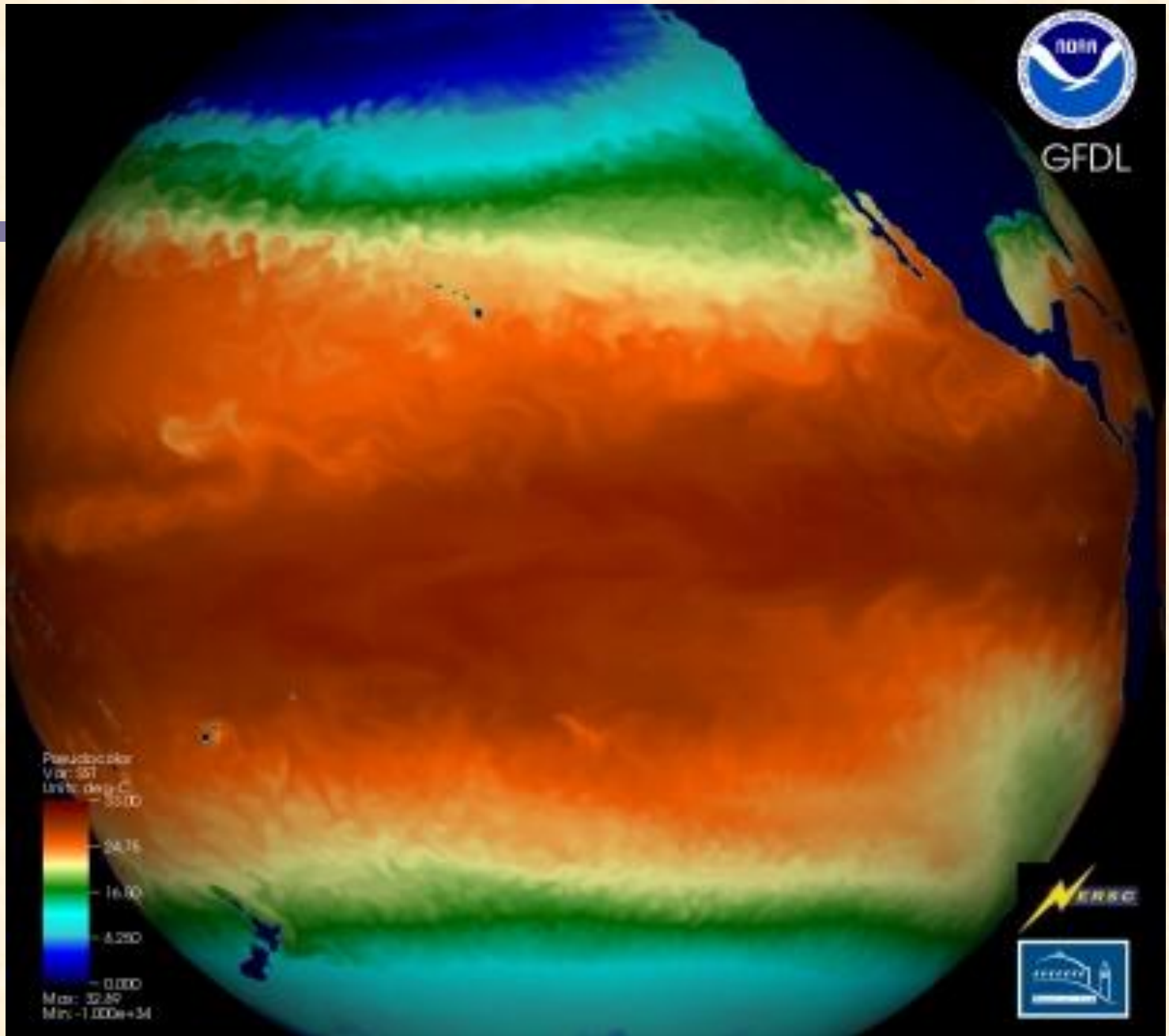
Pseudocolor  
Var: SST  
Units: deg-C  
33.00  
24.75  
16.50  
8.250  
-0.000  
Max: 32.28  
Min: -1.000e+34







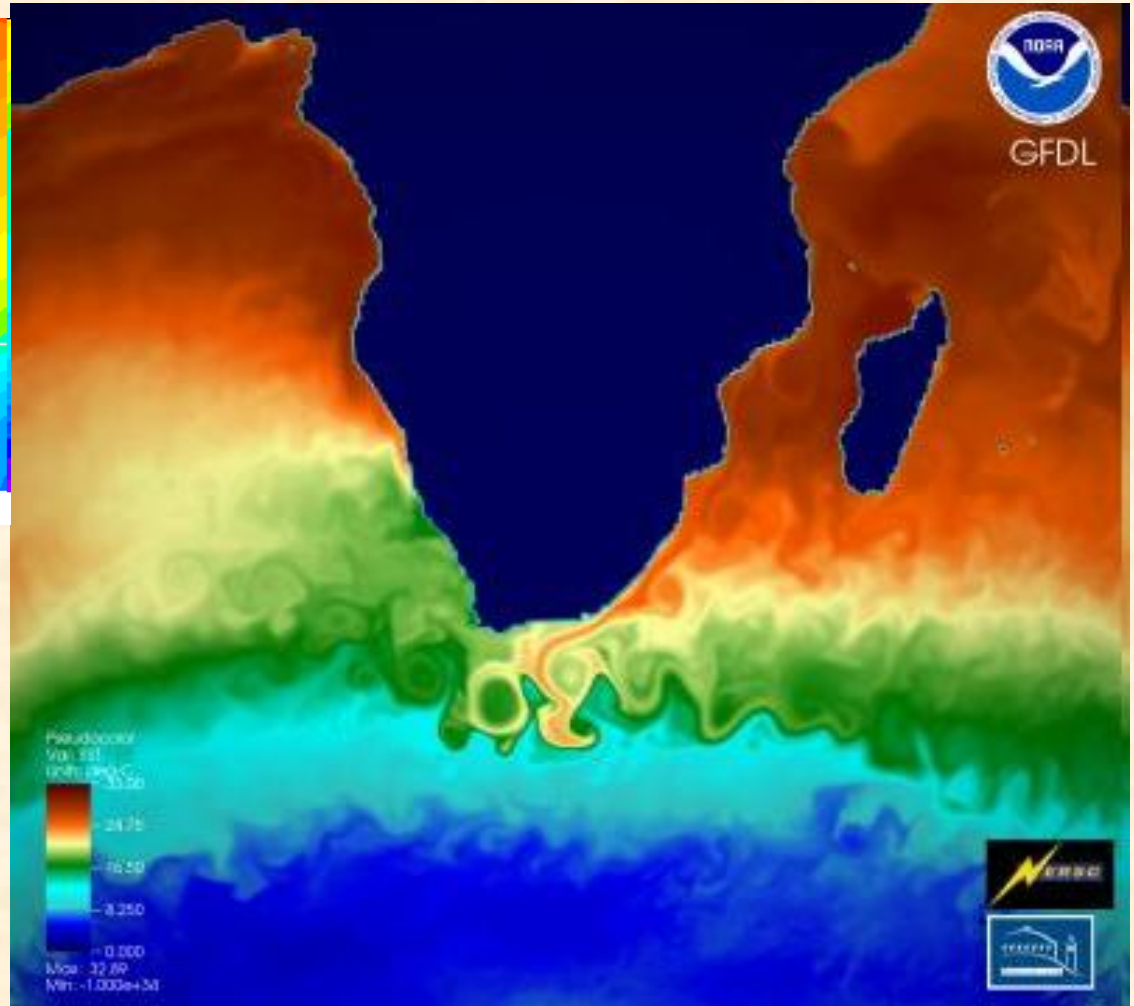
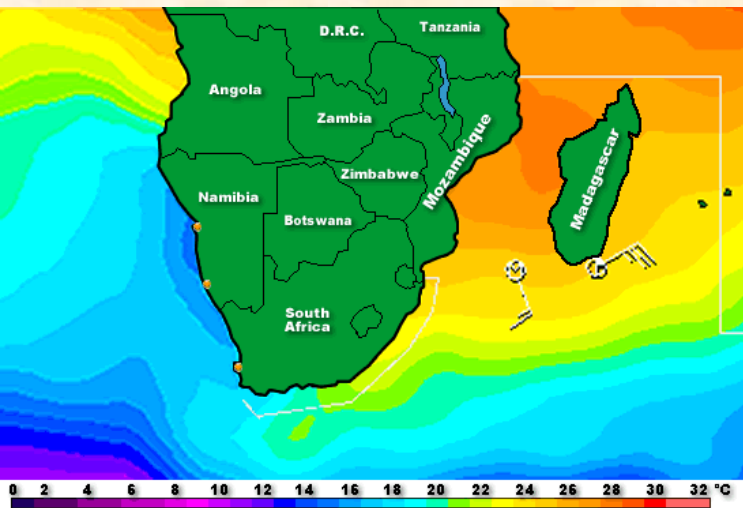
GFDL



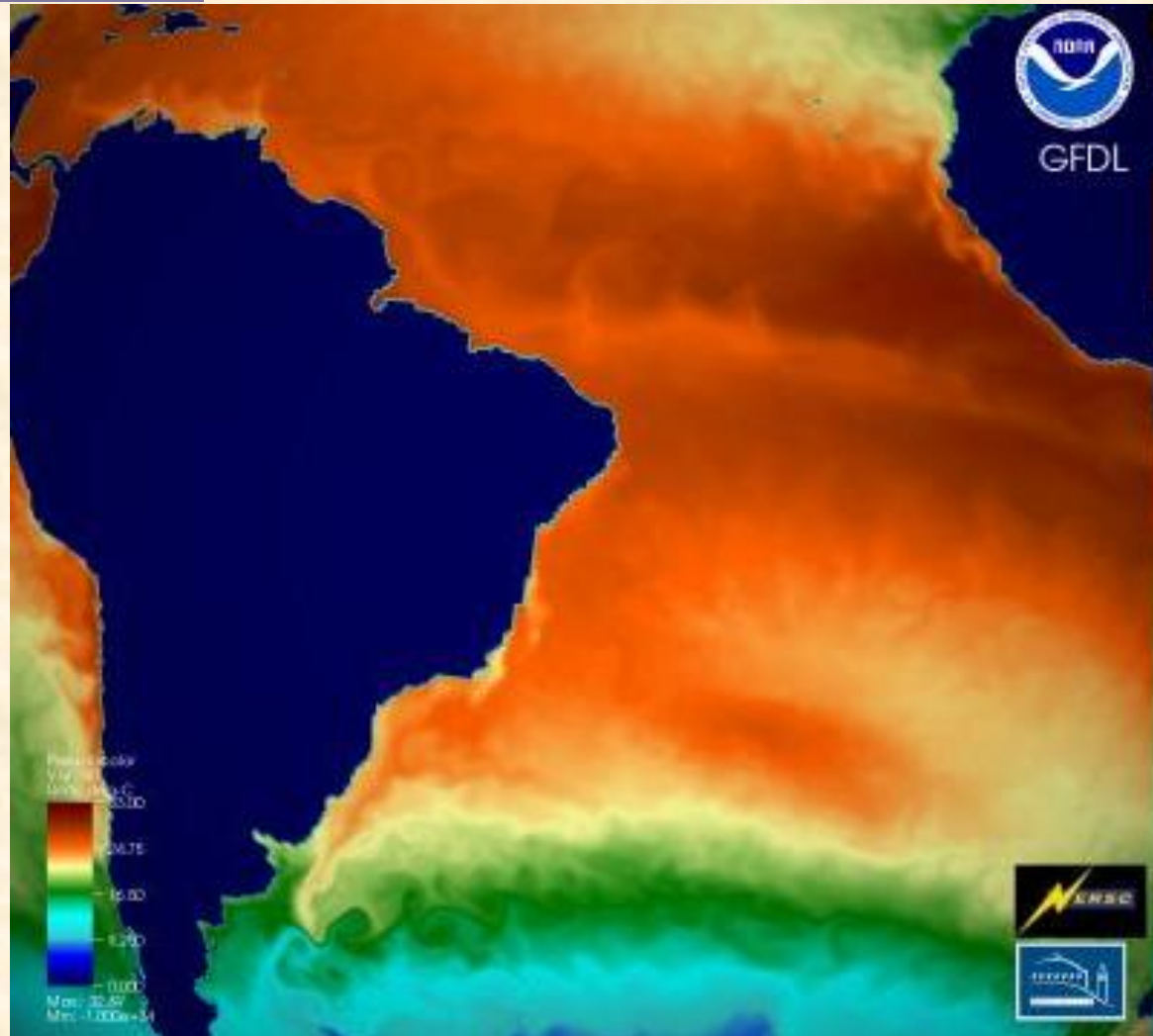
Pseudocolor  
Var: SST  
Units: deg C  
-33.00  
-24.75  
-16.50  
-8.25  
0.000  
Max: 32.89  
Min: -1.000e+34



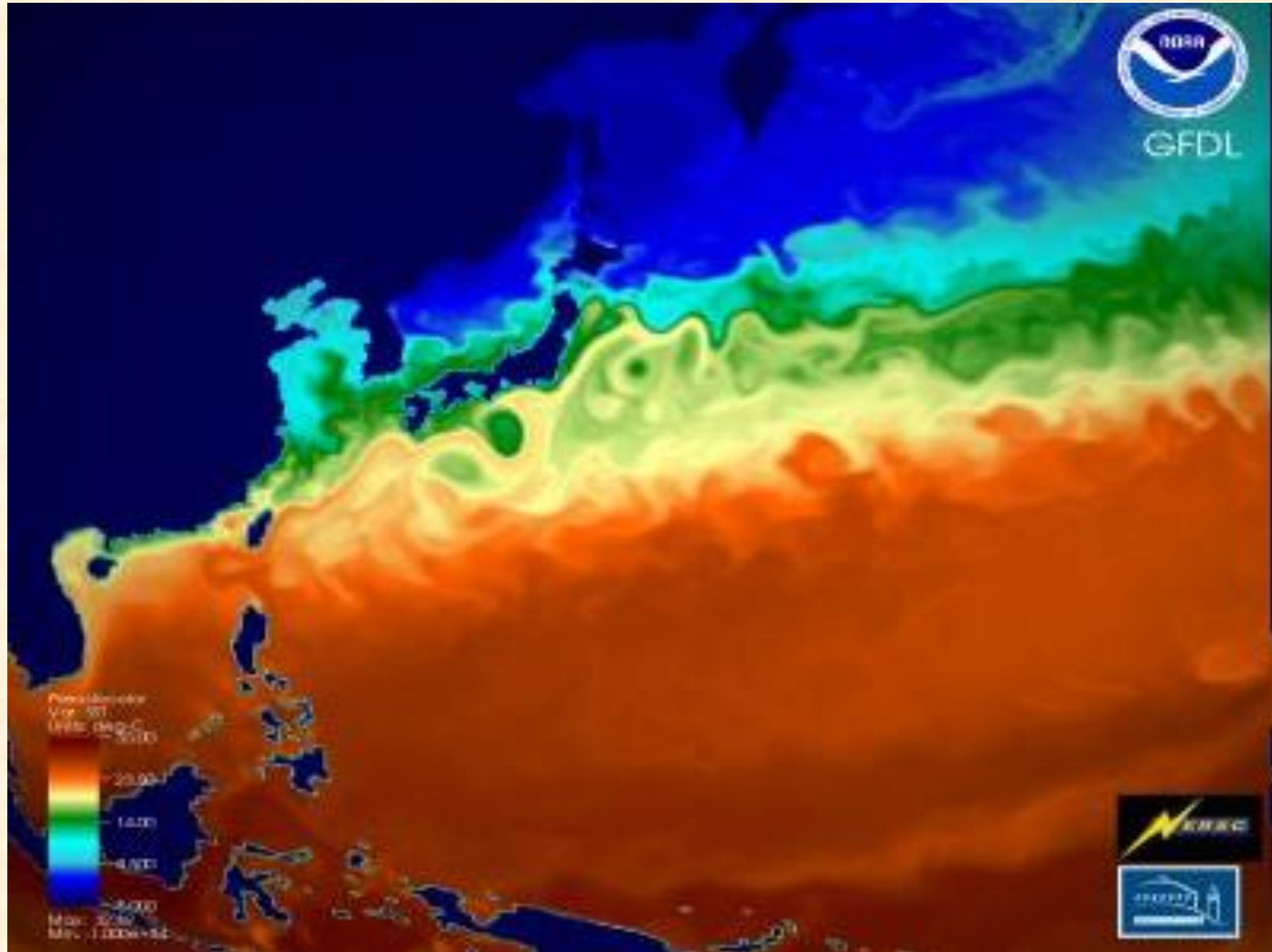
# SST Agulhas current



# SST Brazil current



# SST Kuroshio current



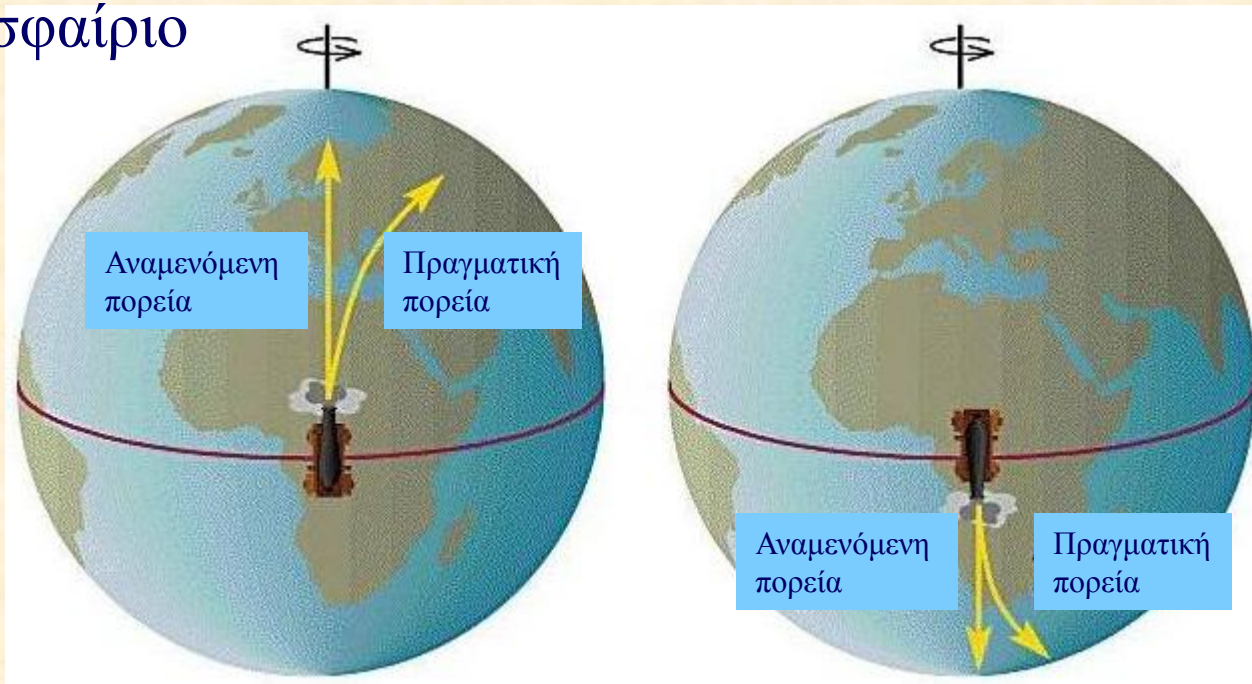
# Μηχανισμοί που πυροδοτούν την ανάβλυση (**upwelling**)

---

- άνεμοι
- Coriolis δύναμη
- Σπειροειδές του Ekman

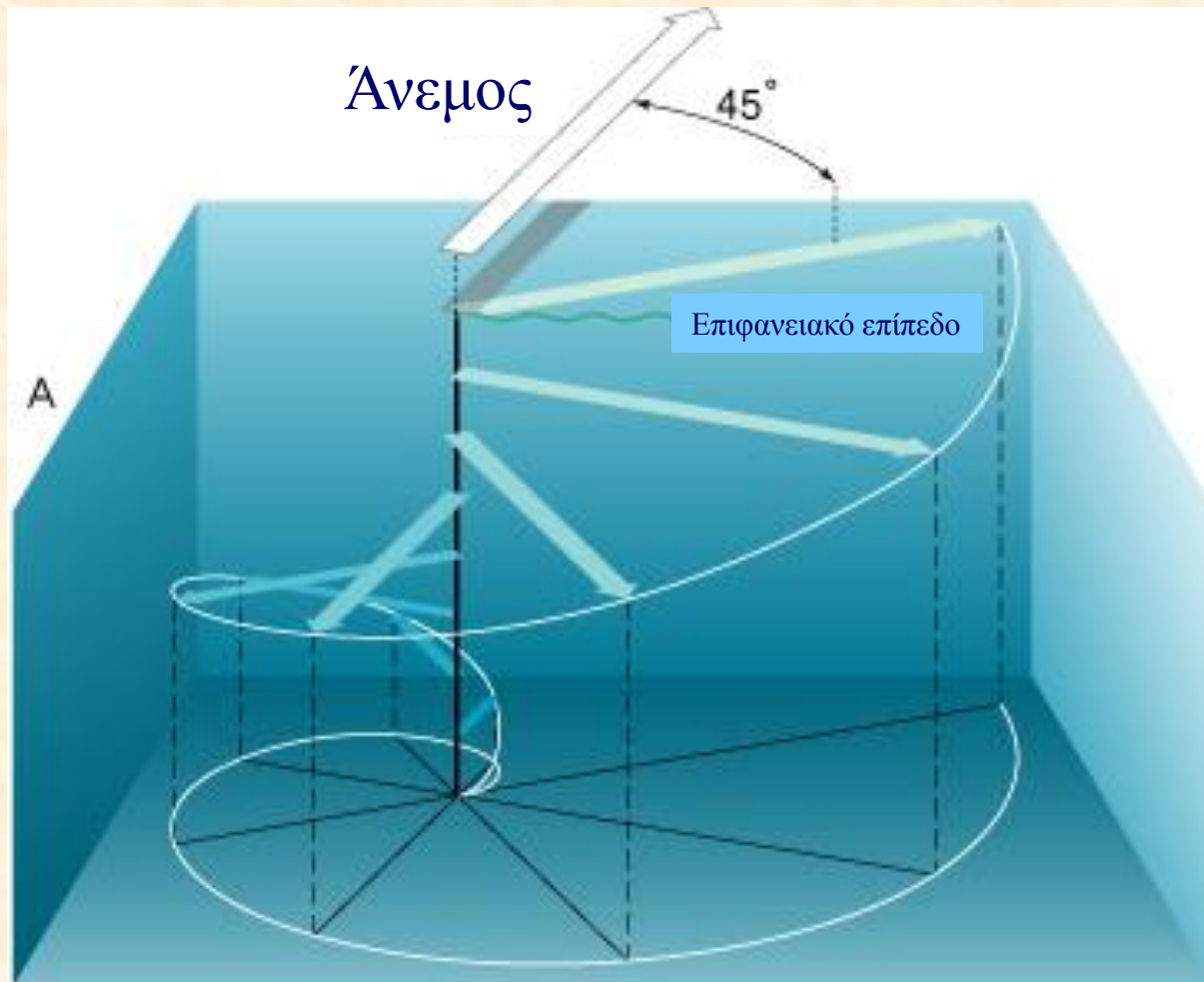
# Δύναμη Coriolis

Β. Ημισφαίριο

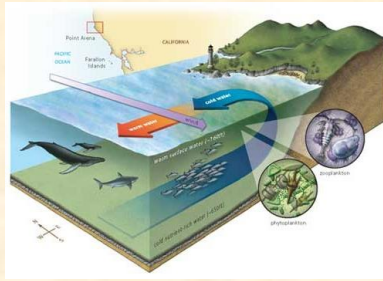


Ν. Ημισφαίριο

# Σπειροειδές του Ekman



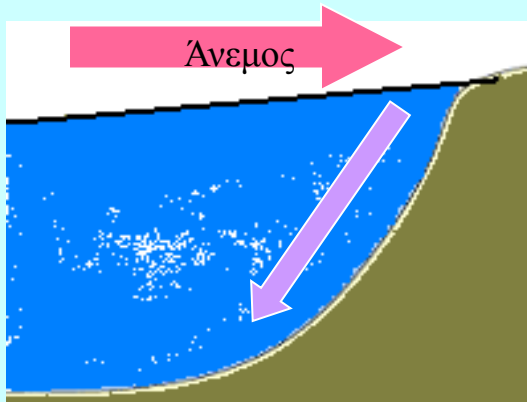
# Ανάβλυση (upwelling)



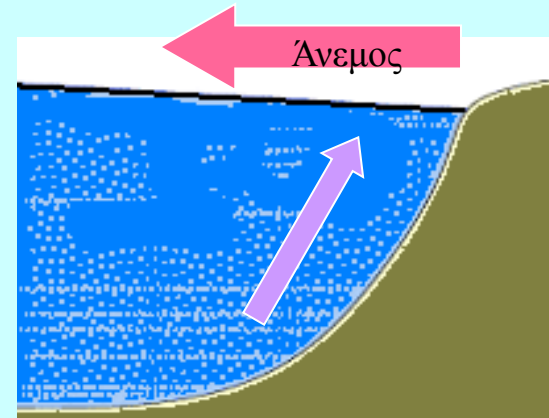


# Εποχική ανάβλυση/κατάβλυση

## Άνεμοι κάθετα στην ακτή

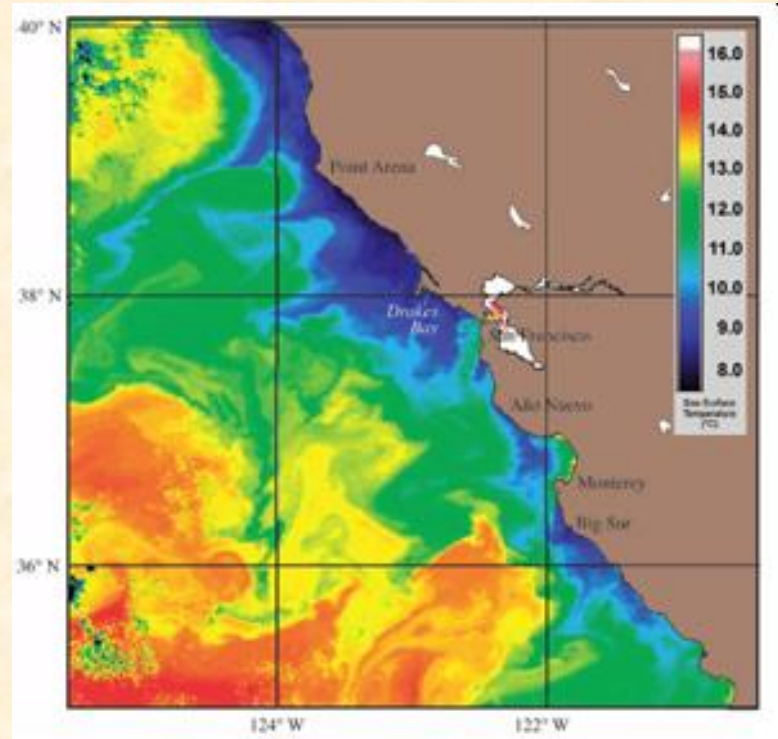
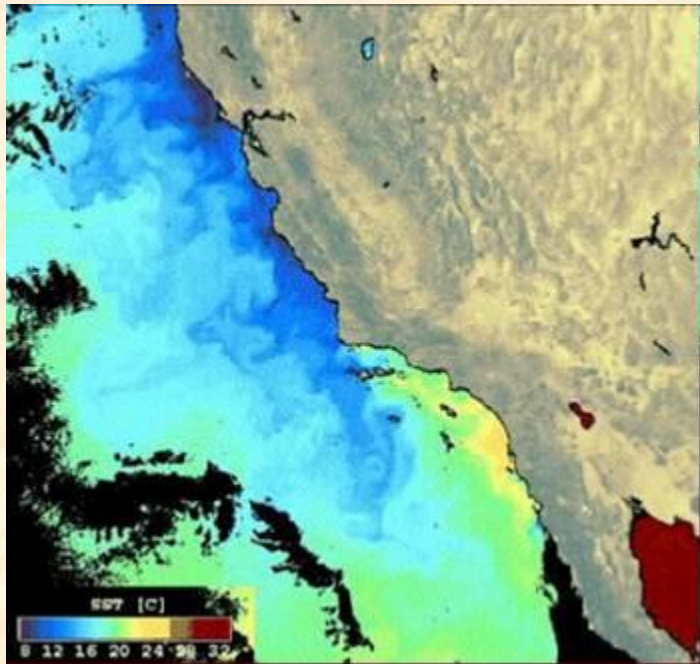


Κατάβλυση 'downwelling'



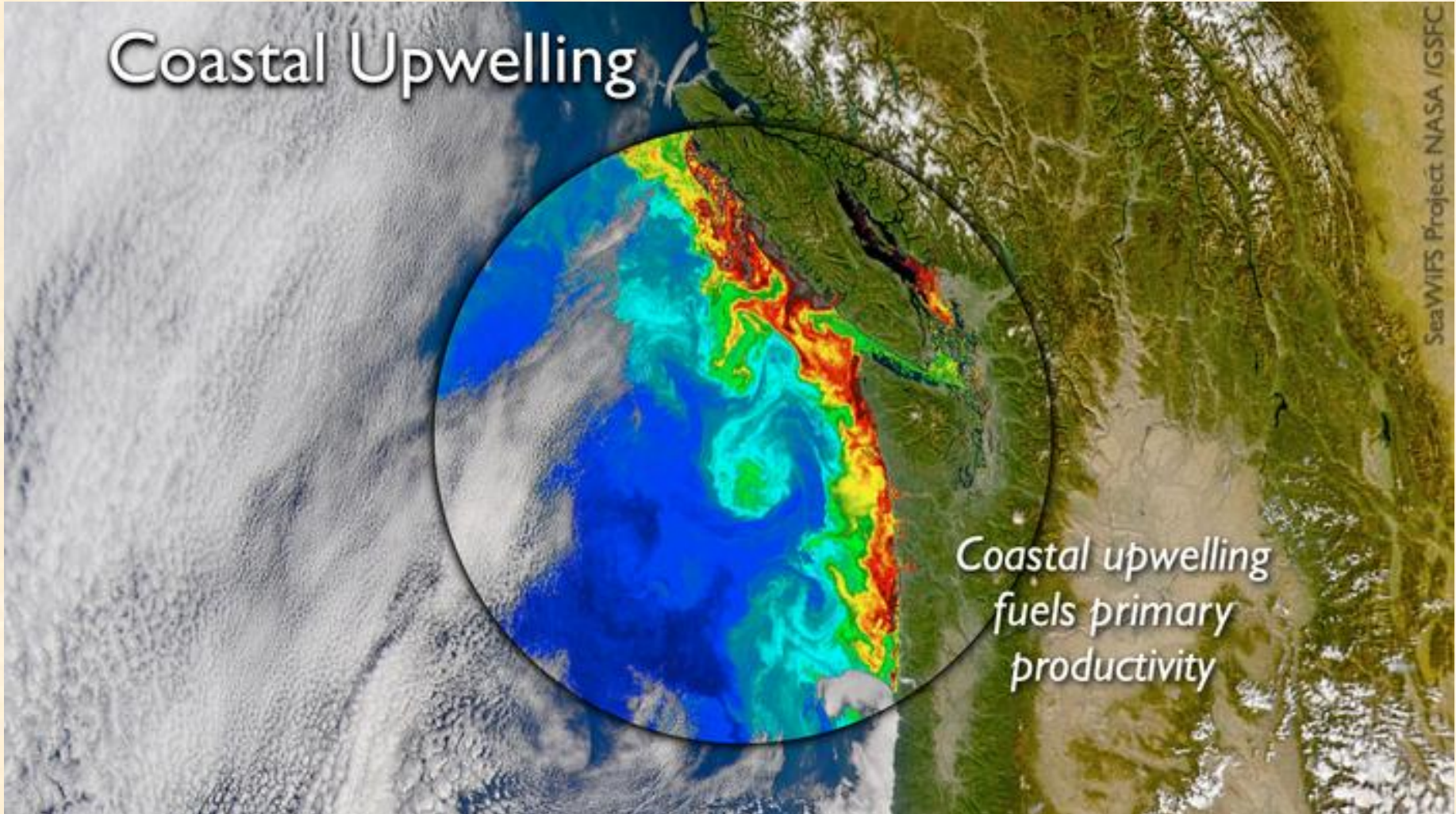
Ανάβλυση upwelling

# Ανάβλυση



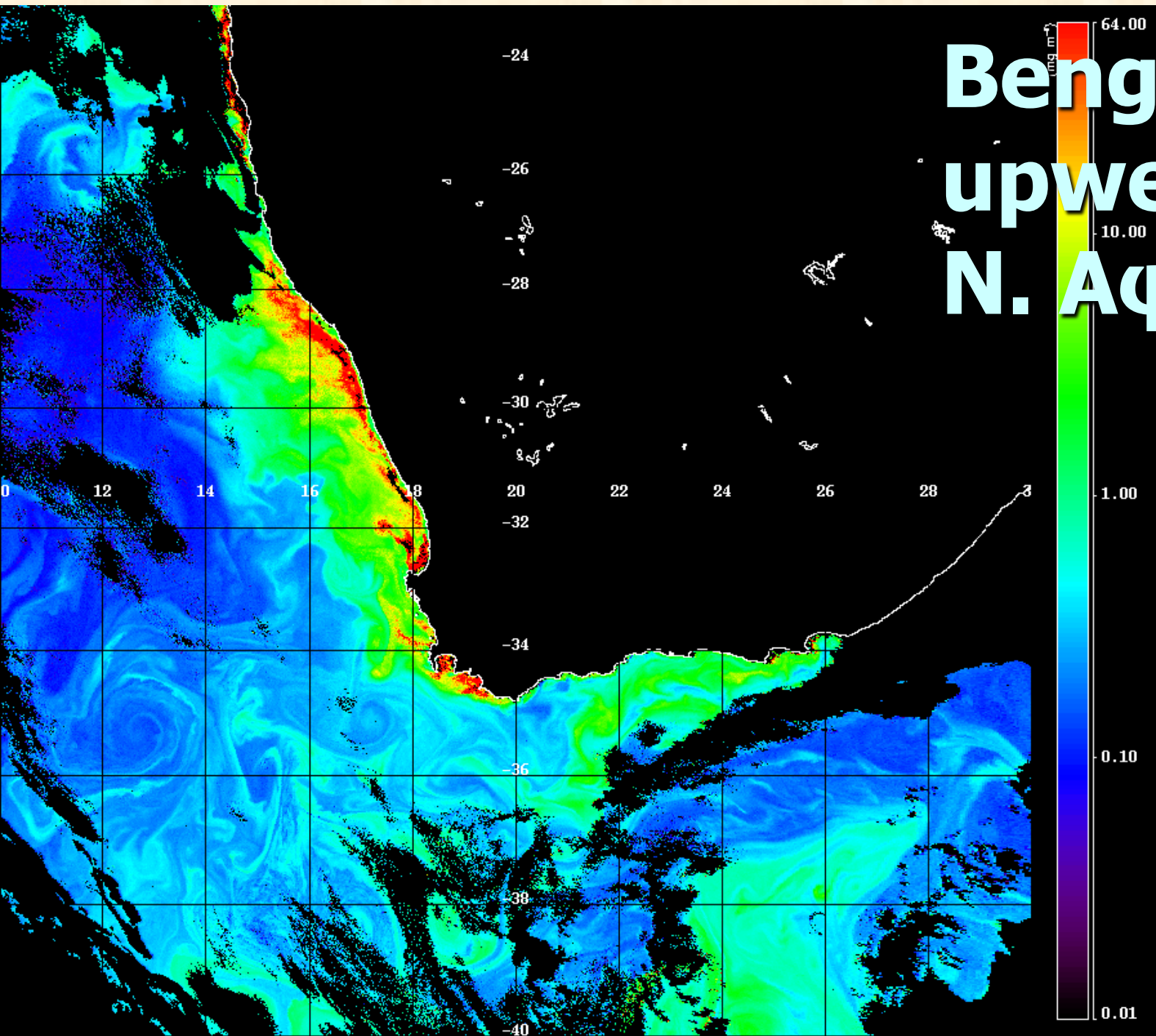
# Ανάβλυση

Coastal Upwelling



Coastal upwelling  
fuels primary  
productivity

# Benguela upwelling N. Αφρική



# Ανθίσεις φυτοπλαγκτού



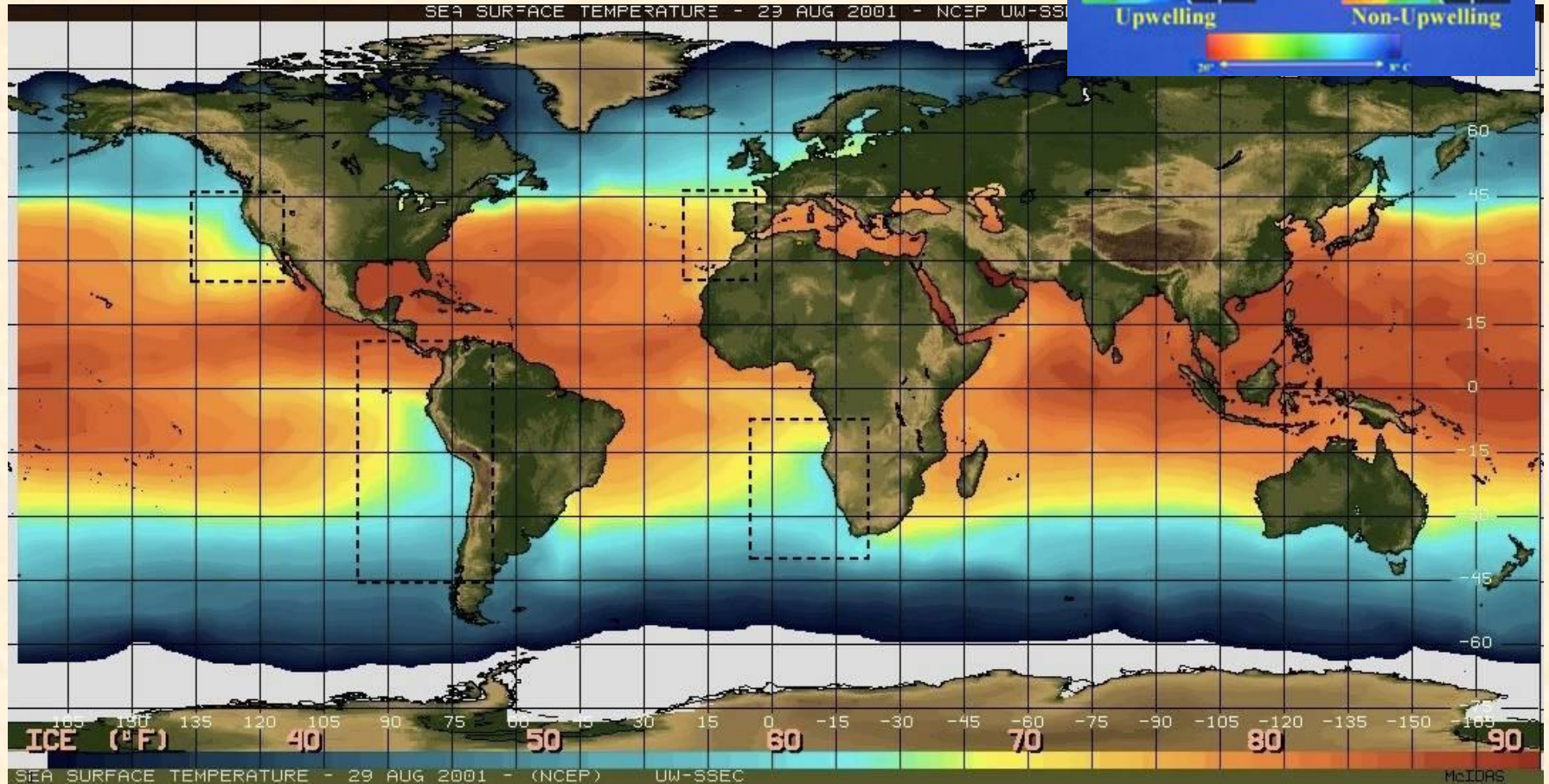
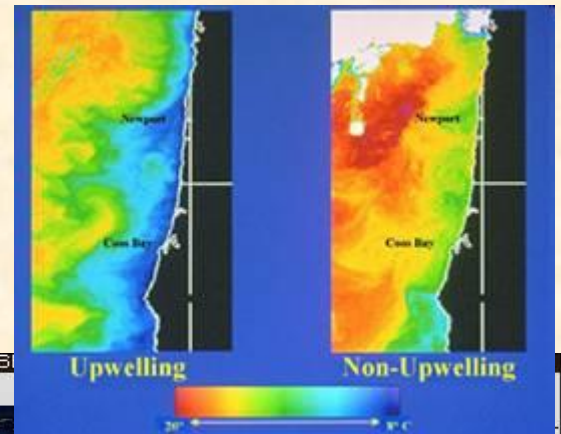
# Ανθίσεις φυτοπλαγκτού



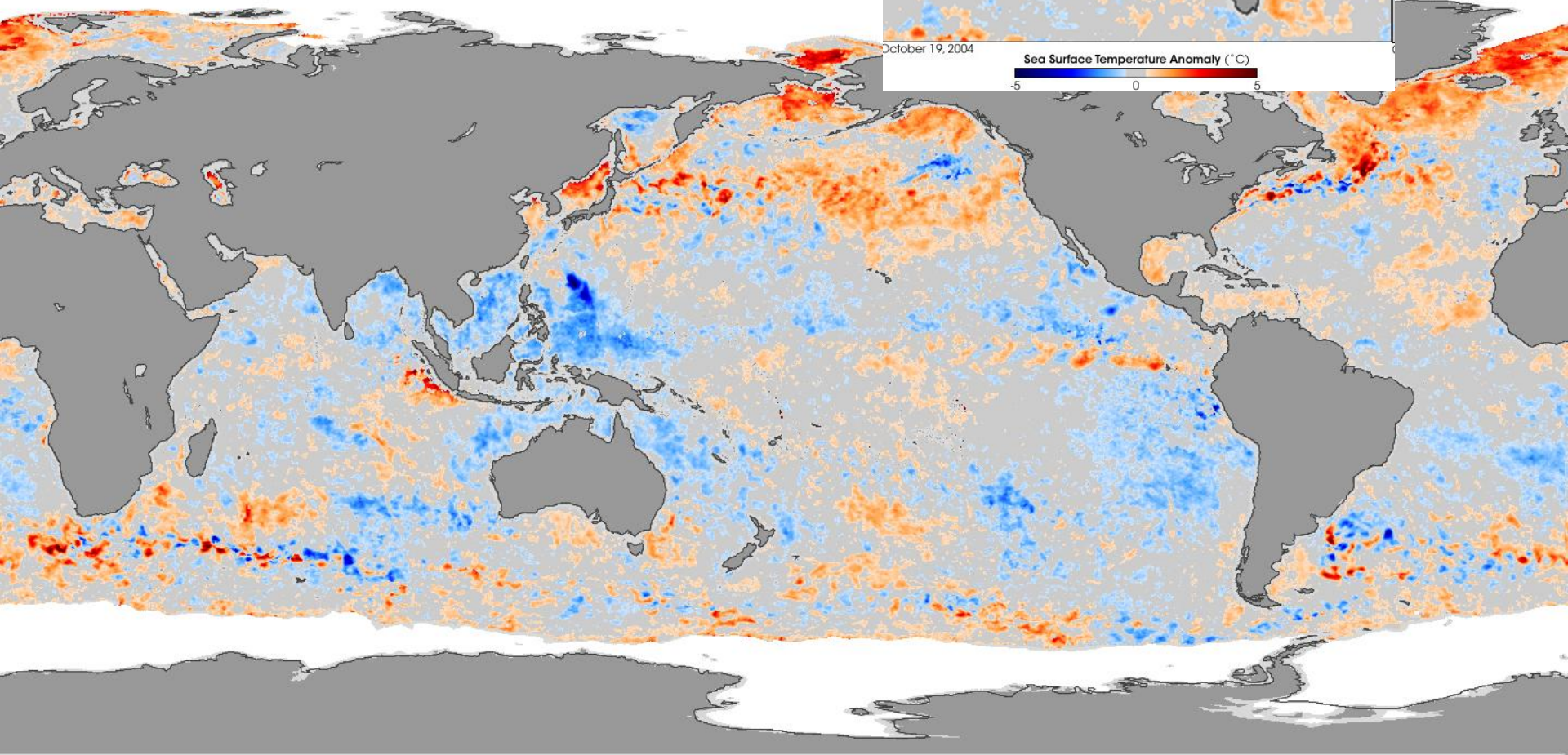
Main Regions of Upwelling in Coastal Regions Around the World



# Ανάβλωση (upwelling)



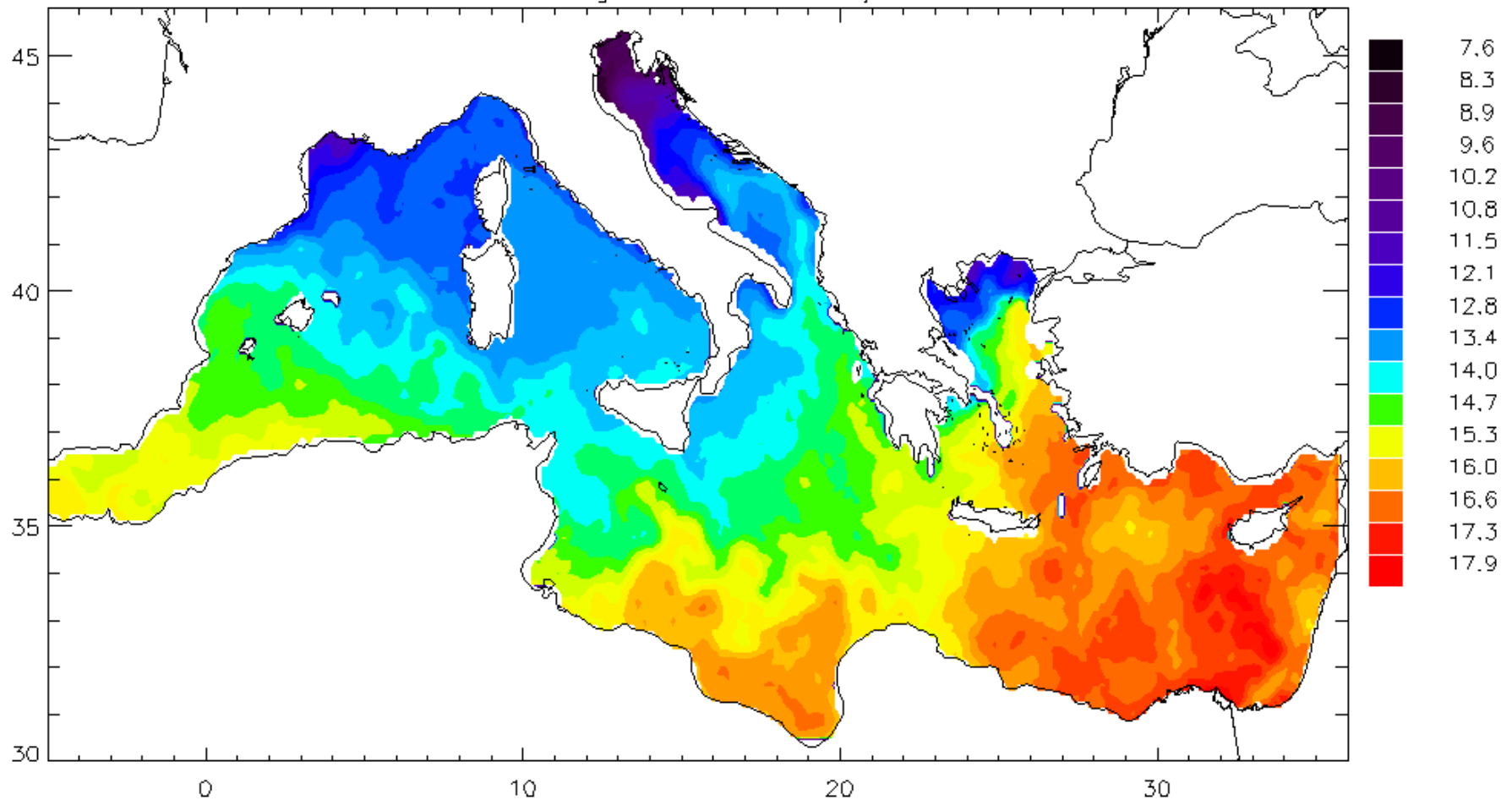
# Θερμοκρασιακές ανωμαλίες



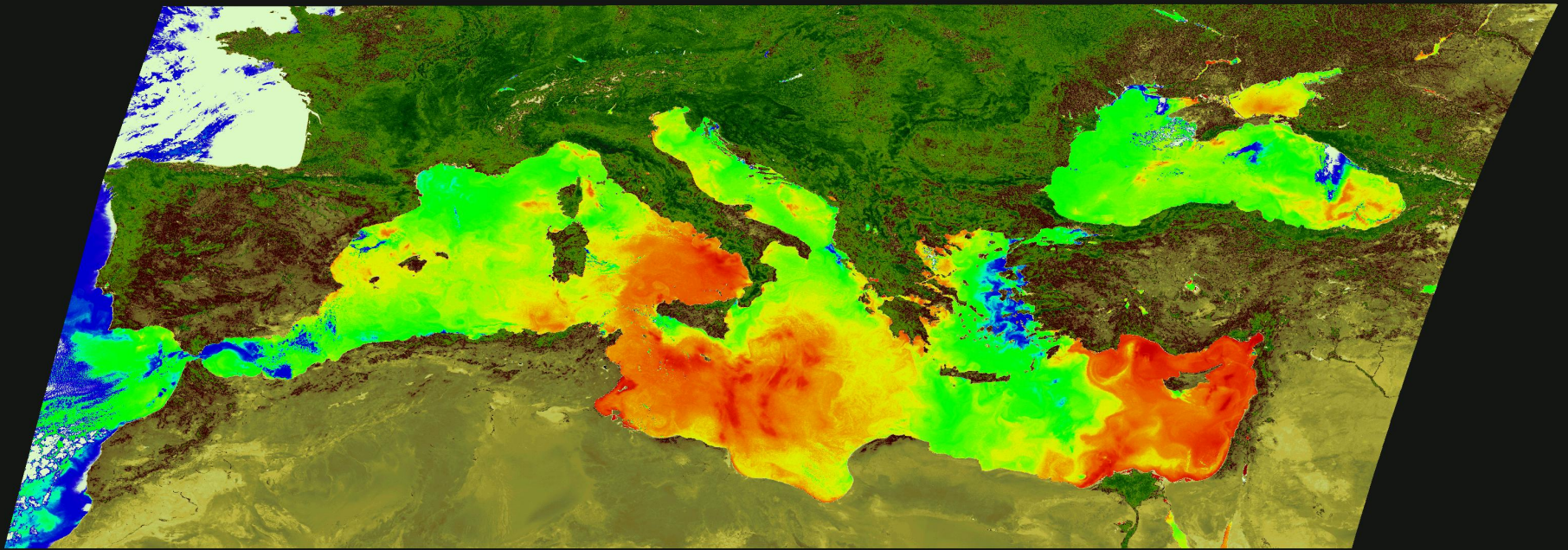


# Μεσόγειος Θάλασσα

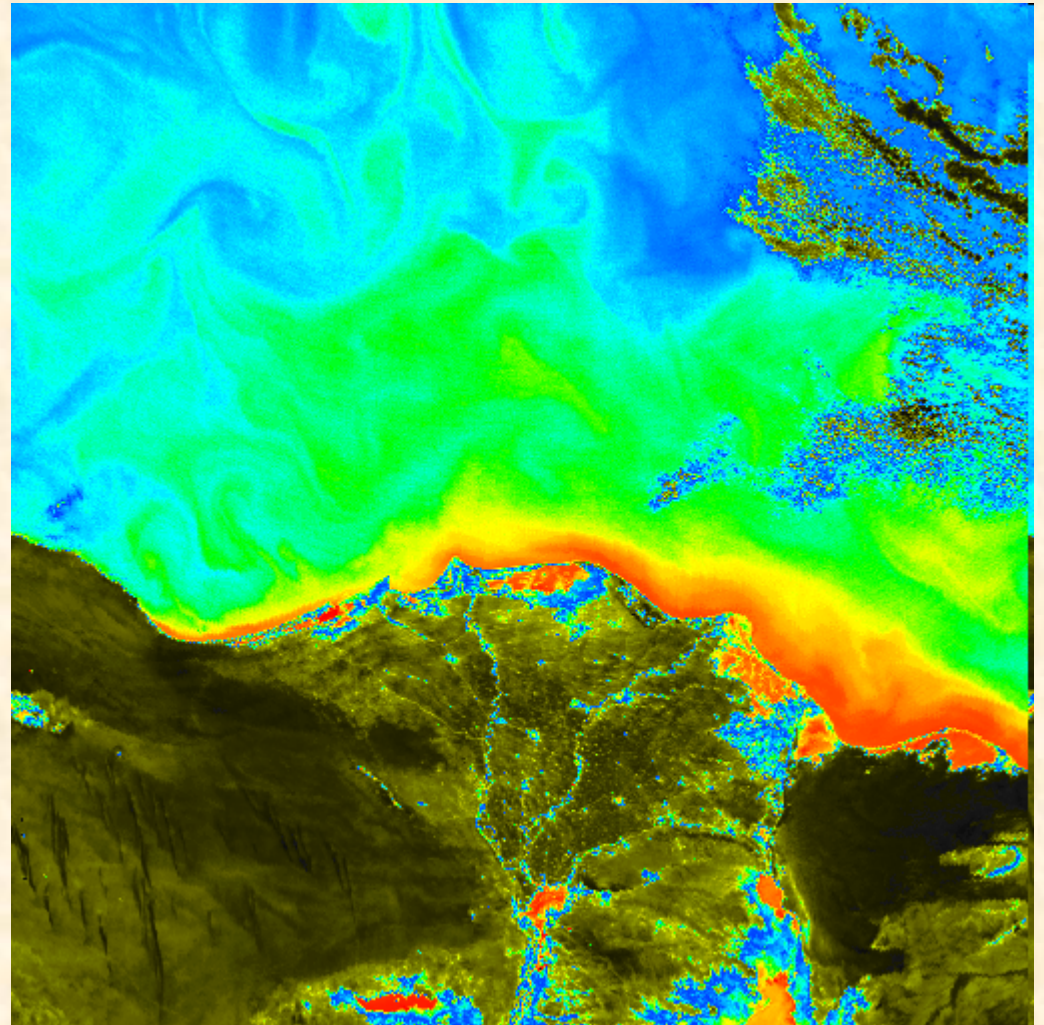
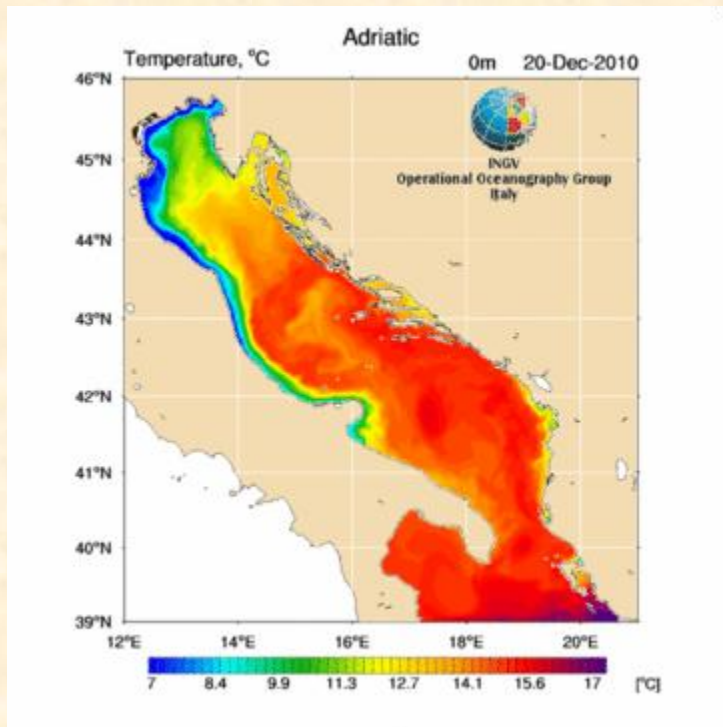
AVHRR averaged SST field Day 17974



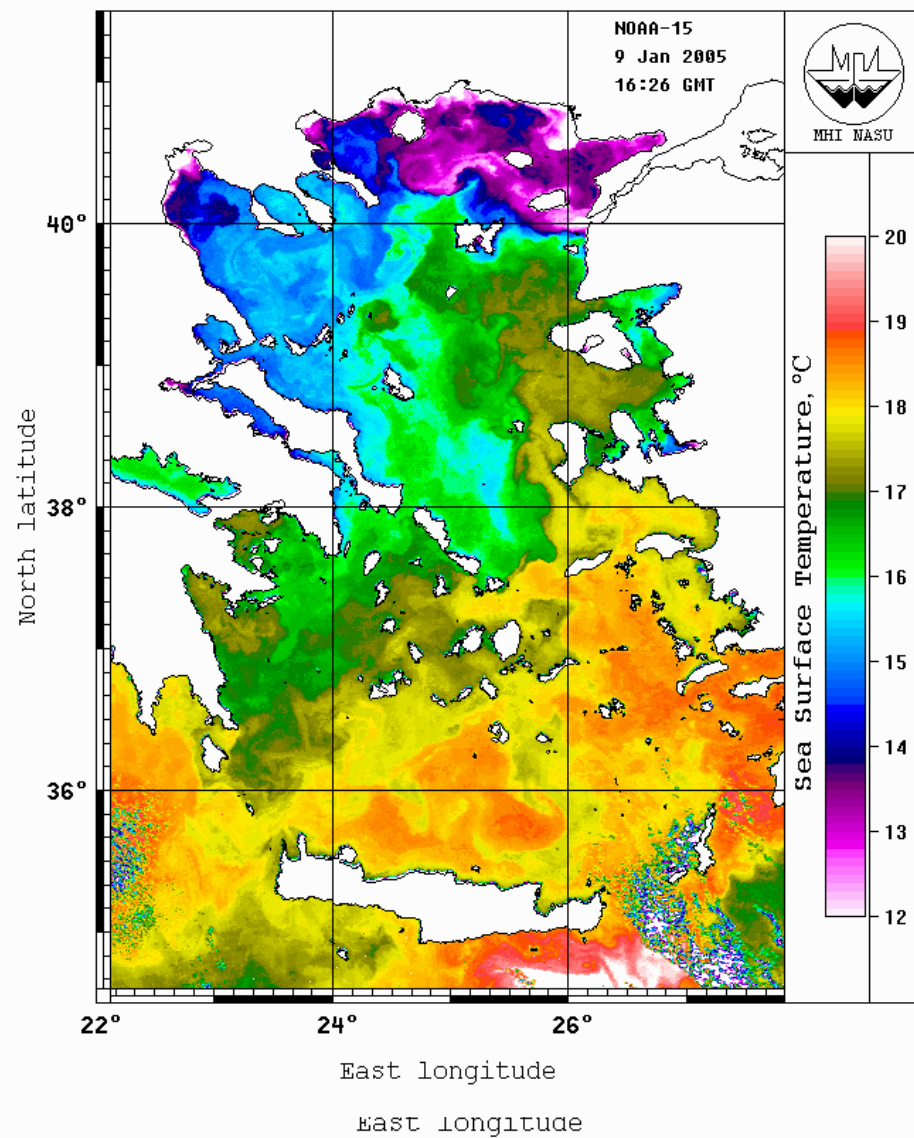
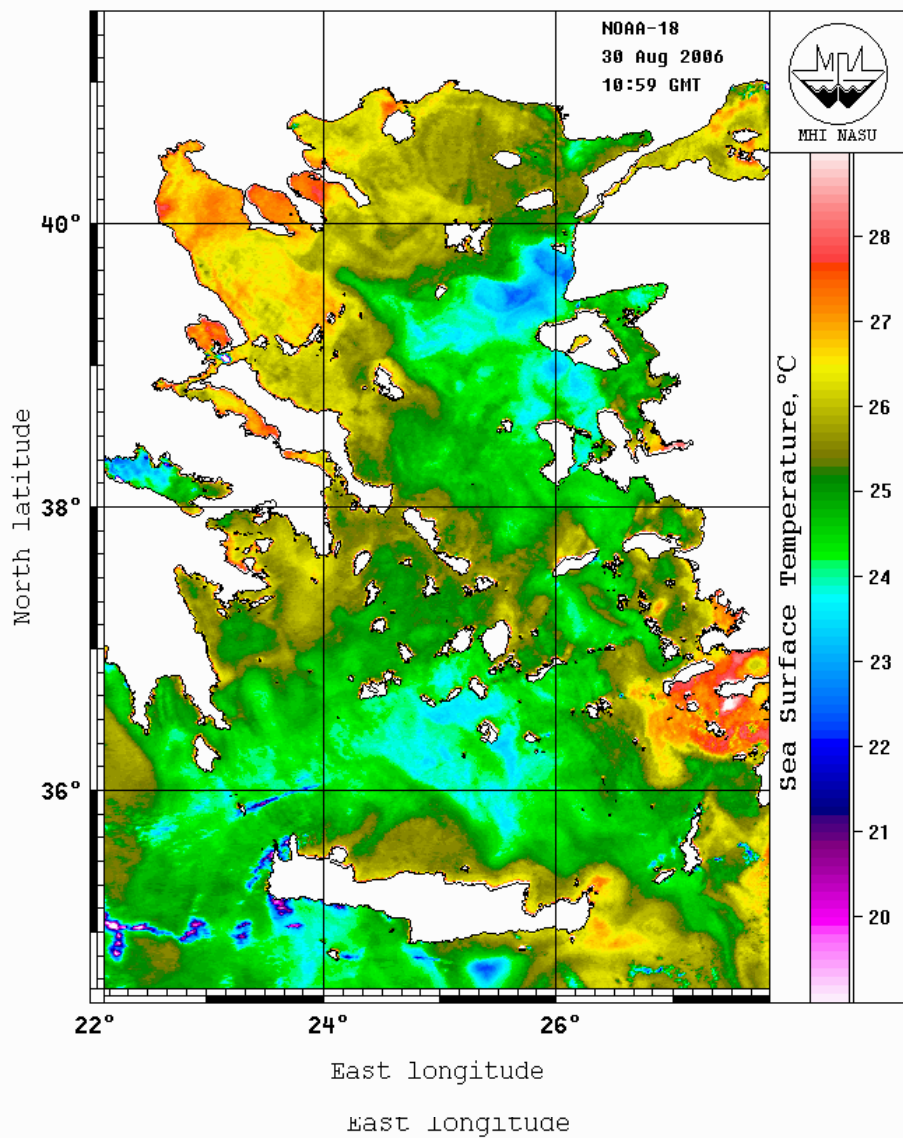
# SST και φυτοκάλυψη



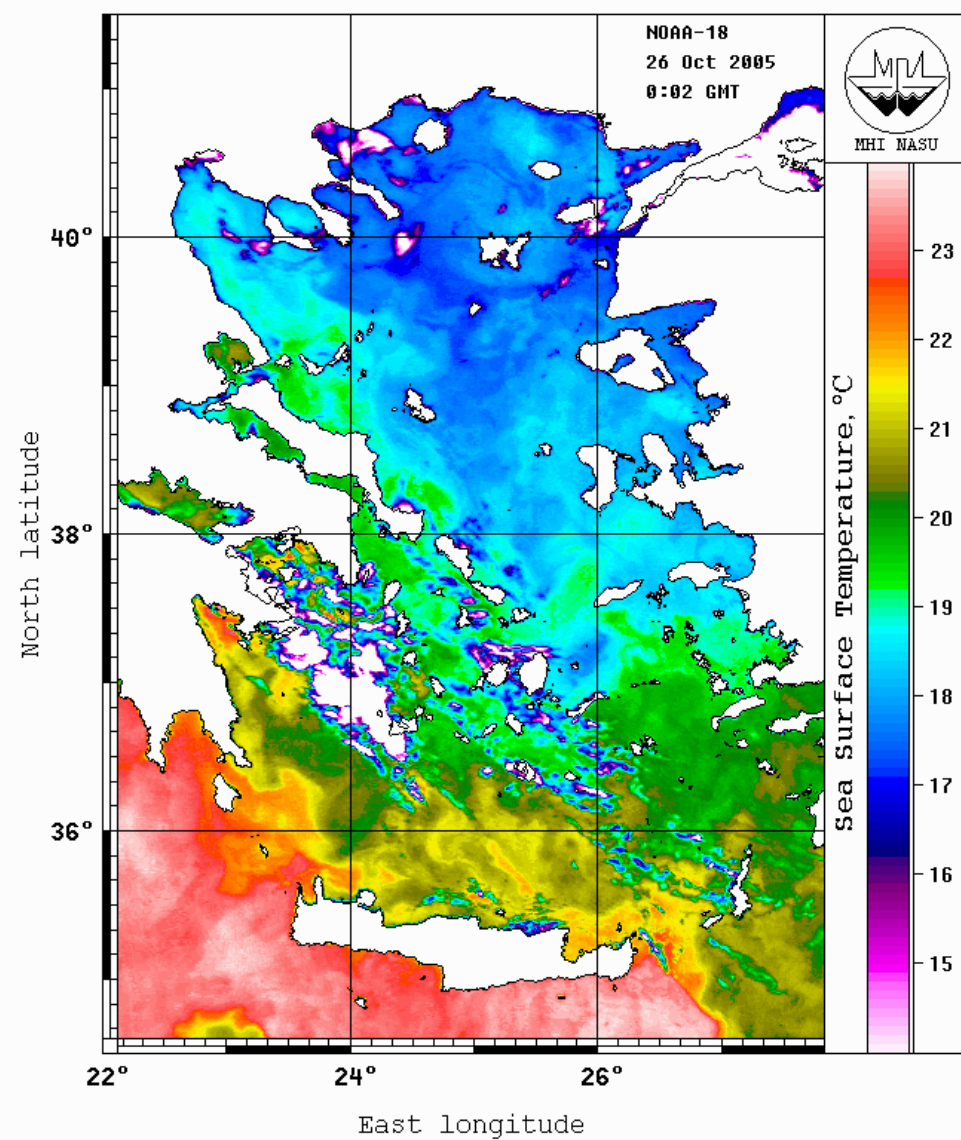
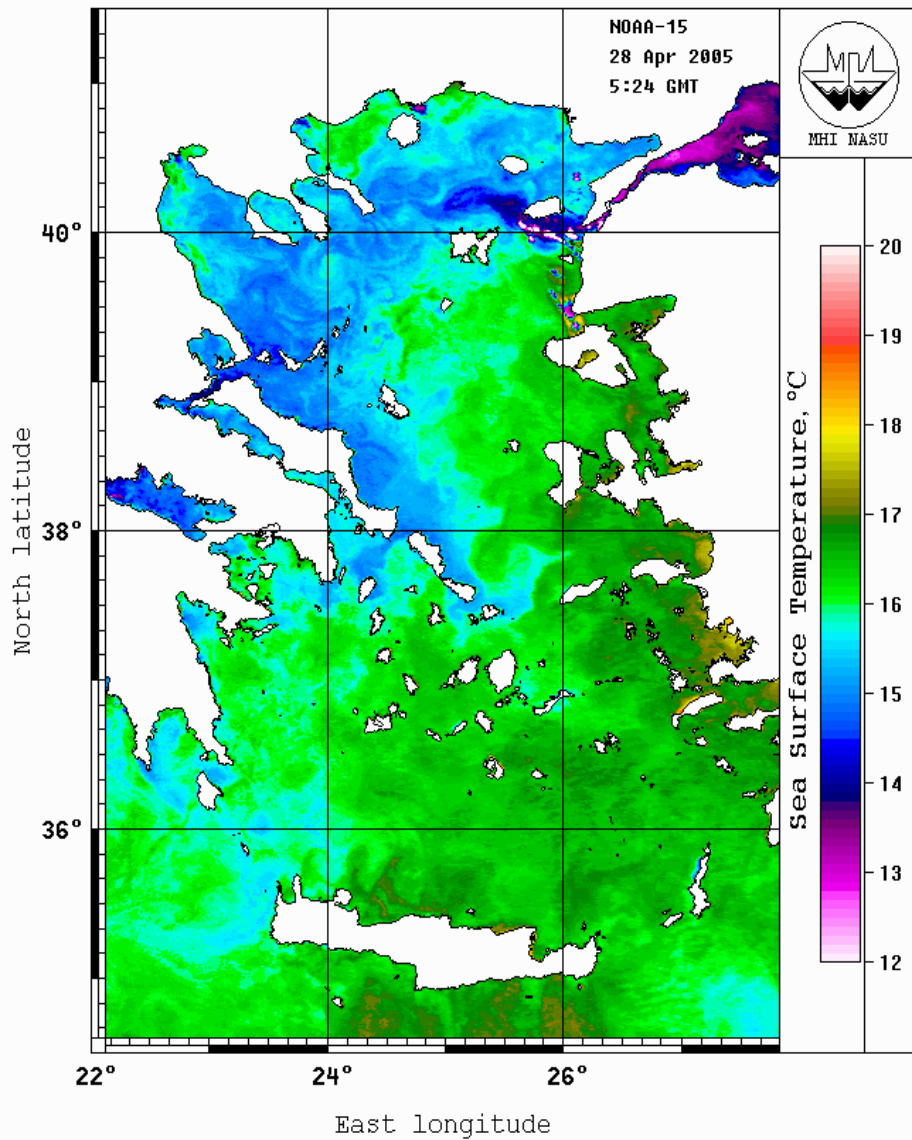
# Επίδραση ποταμών



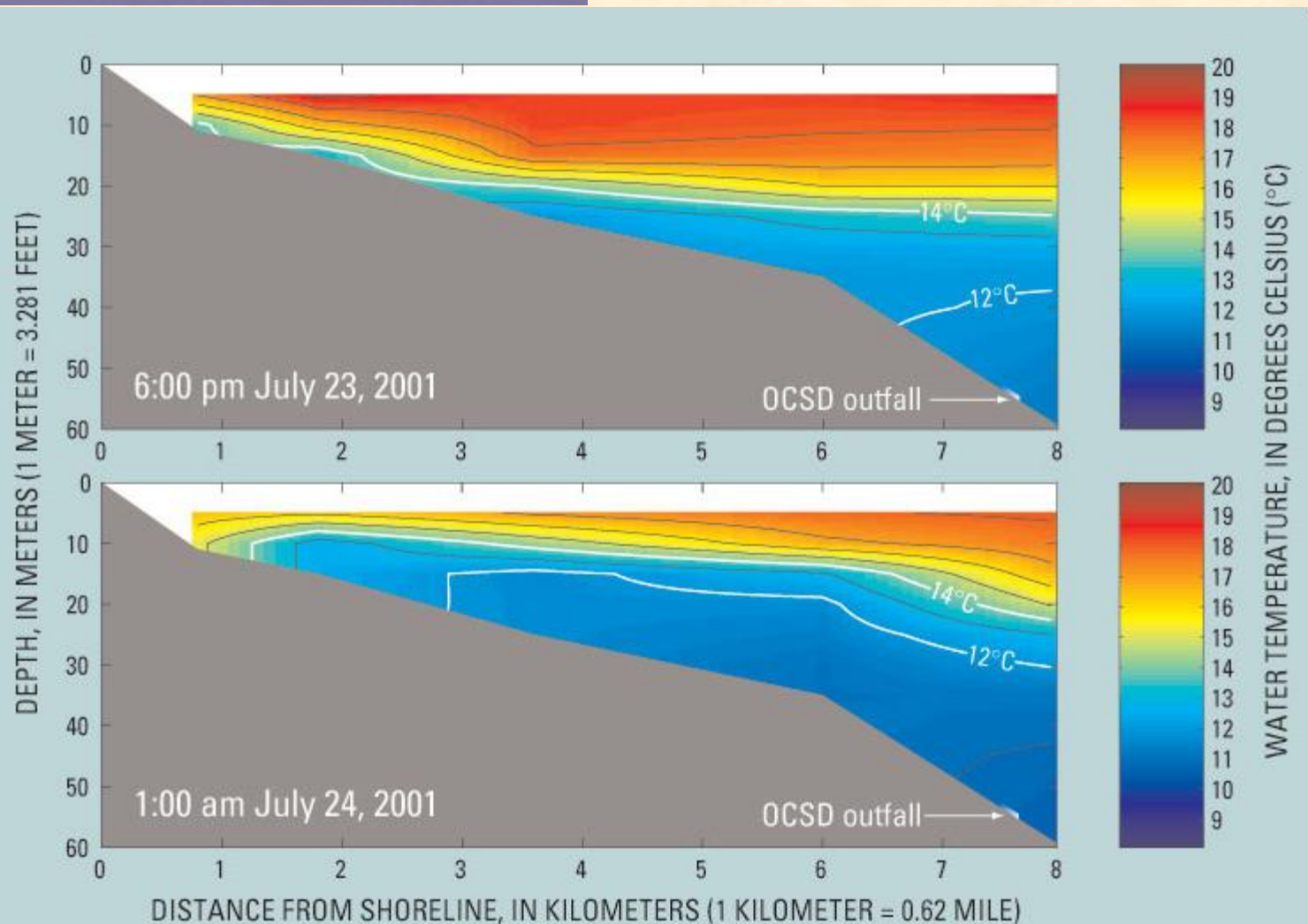
# Αιγαίο πέλαγος

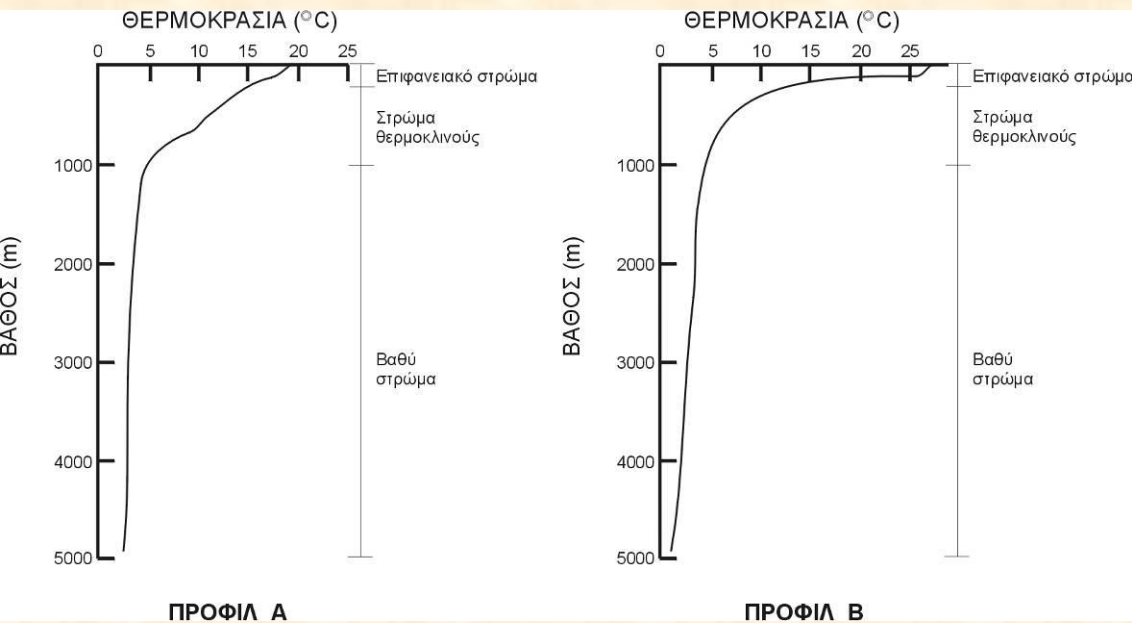
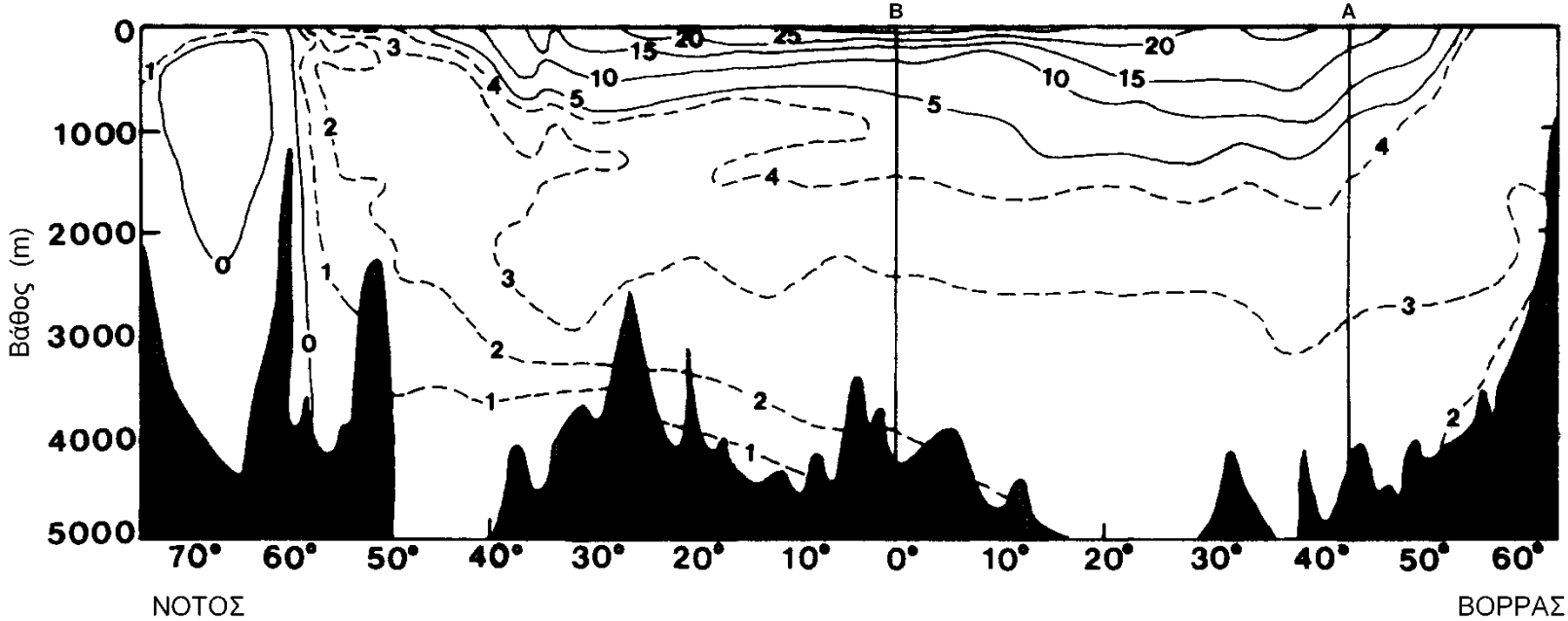


# Αιγαίο πέλαγος



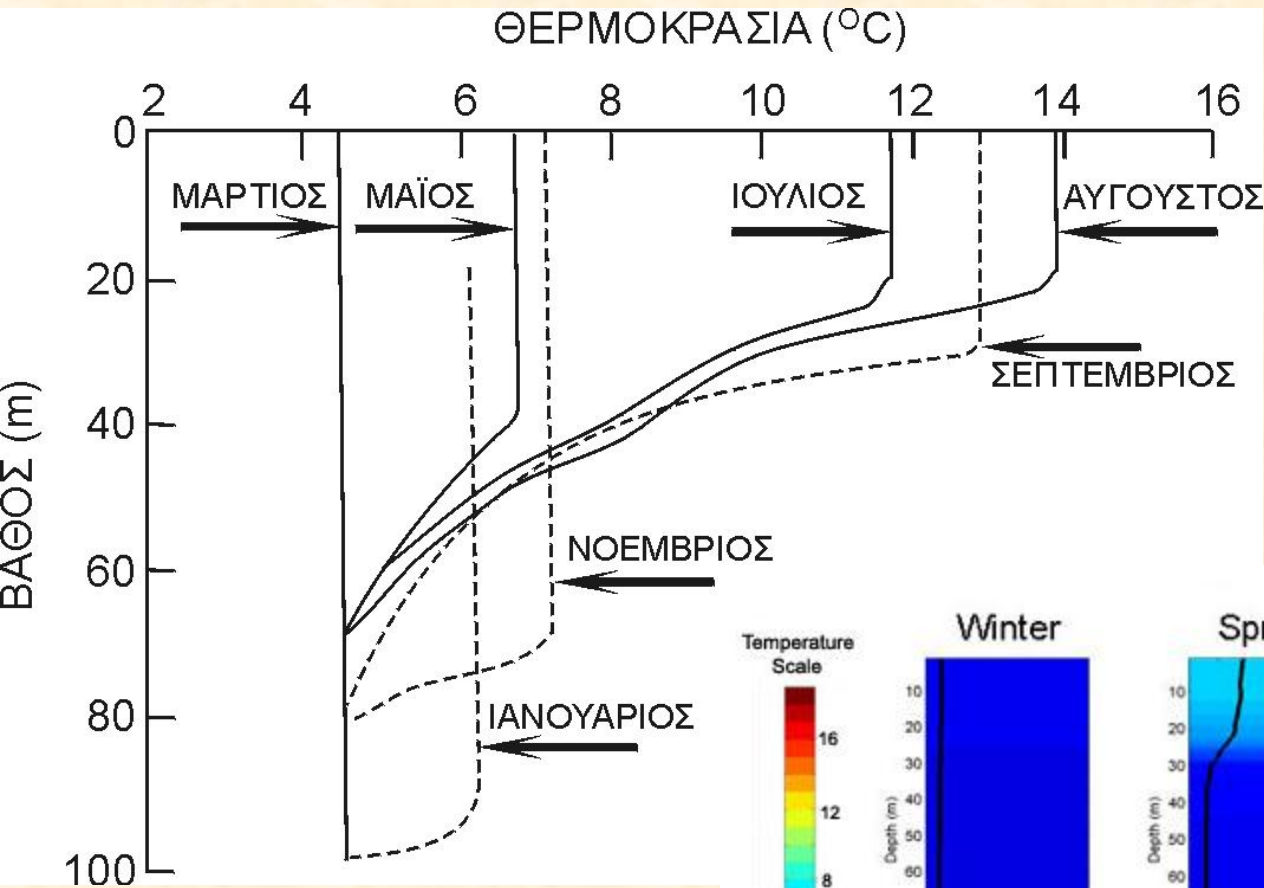
# Κατακόρυφη κατανομή θερμοκρασίας





- το επιφανειακό ή καλά αναμεμειγμένο στρώμα (well mixed layer) εκτείνεται από την επιφάνεια μέχρι ένα βάθος 200m και διακρίνεται από σχετικά ομοιόμορφη θερμοκρασία.
- το στρώμα του μόνιμου θερμοκλινοῦς (permanent thermocline) εκτείνεται από 200 – 1,000m και χαρακτηρίζεται από απότομη πτώση της θερμοκρασίας με το βάθος.
- το βαθύ ή πυθμαίο στρώμα (bottom layer) εκτείνεται από τα 1,000m έως τον πυθμένα και χαρακτηρίζεται από χαμηλή θερμοκρασία, η οποία παραμένει σχεδόν αμετάβλητη.

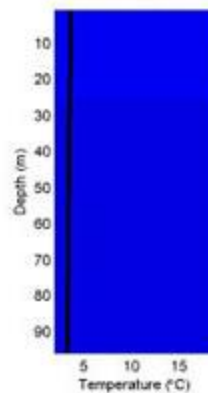
# Εποχιακό θερμοκλινές



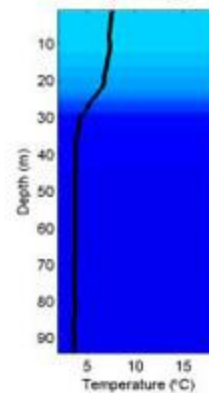
Temperature Scale



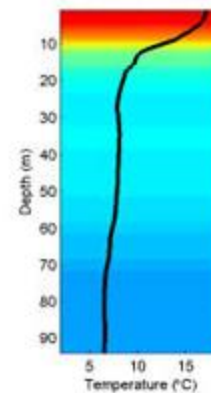
Winter



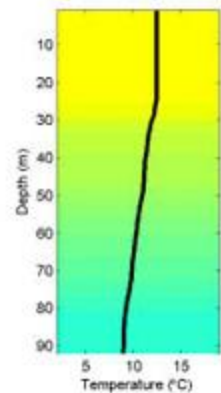
Spring



Summer

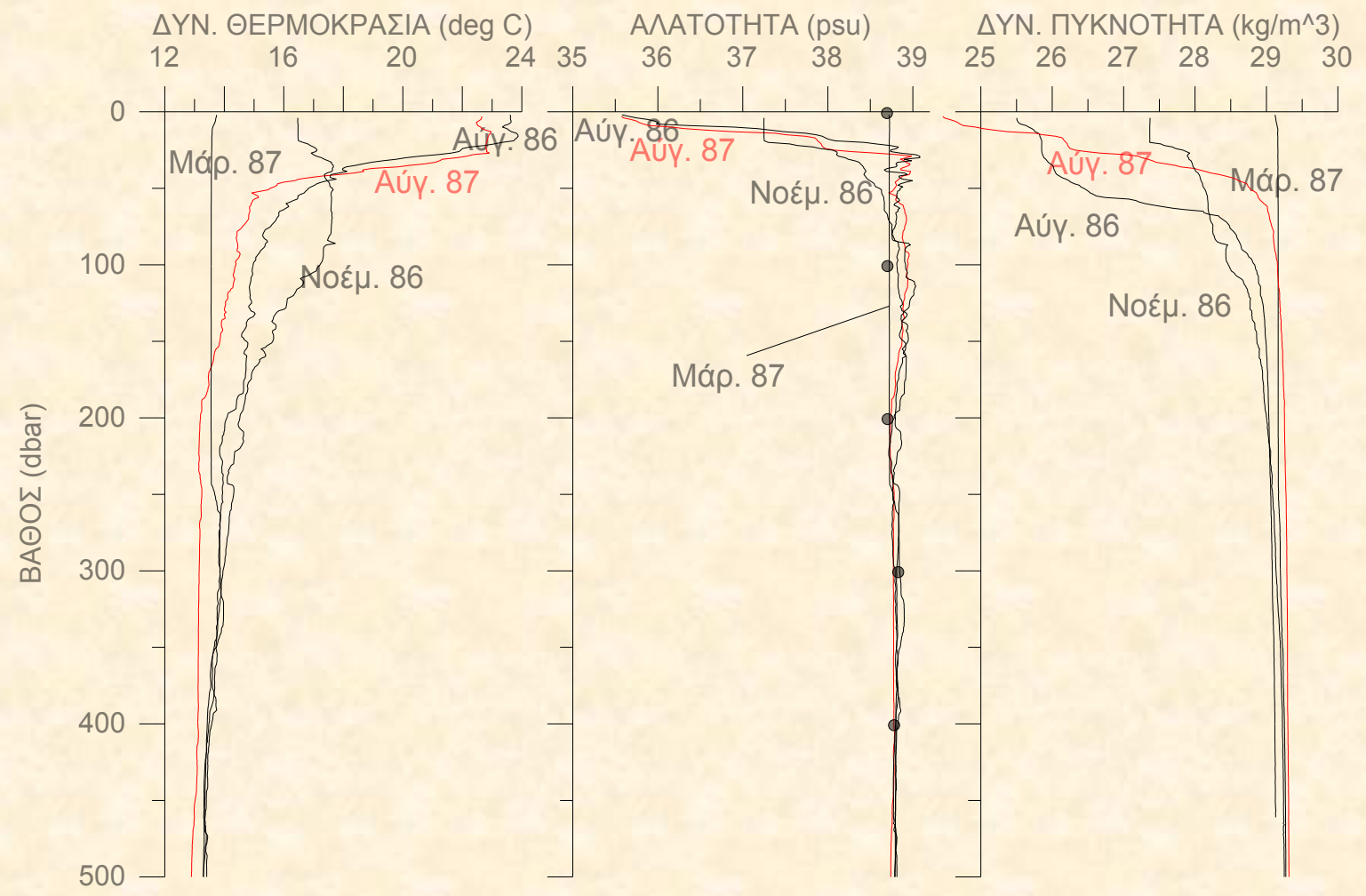


Fall

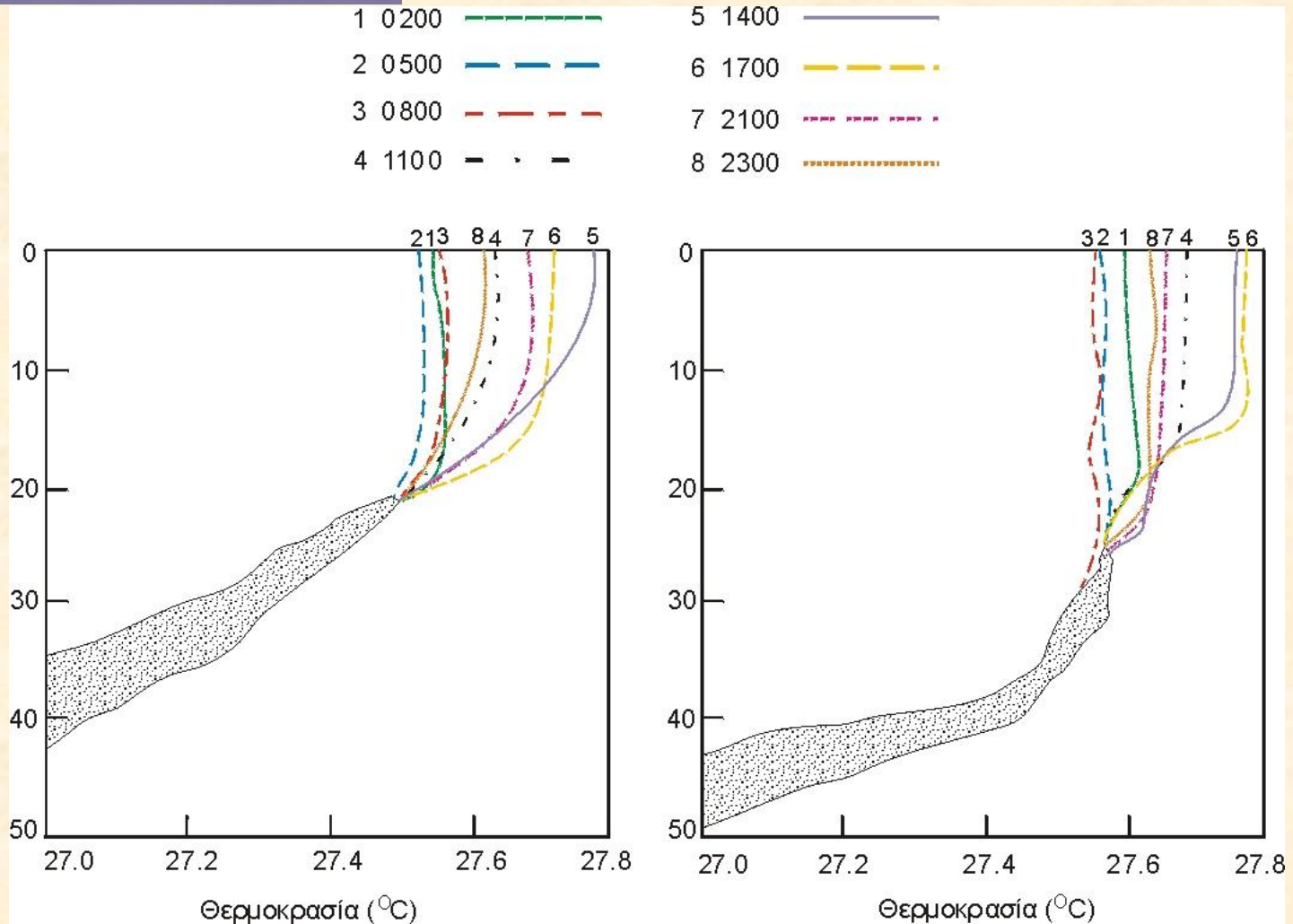




# Εποχιακή μεταβολή της θερμοκρασίας στο επιφανειακό στρώμα

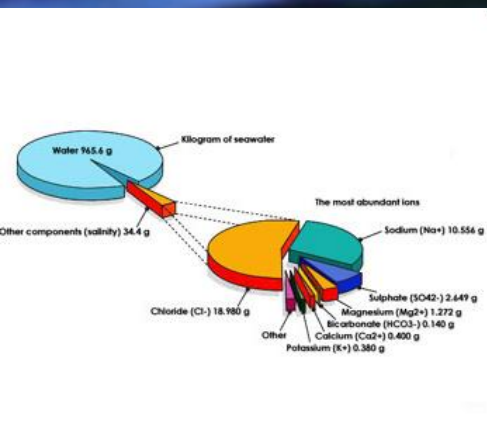


# Ημερήσιο θερμοκλινές



# ΑΛΑΤΟΤΗΤΑ ΩΚΕΑΝΩΝ

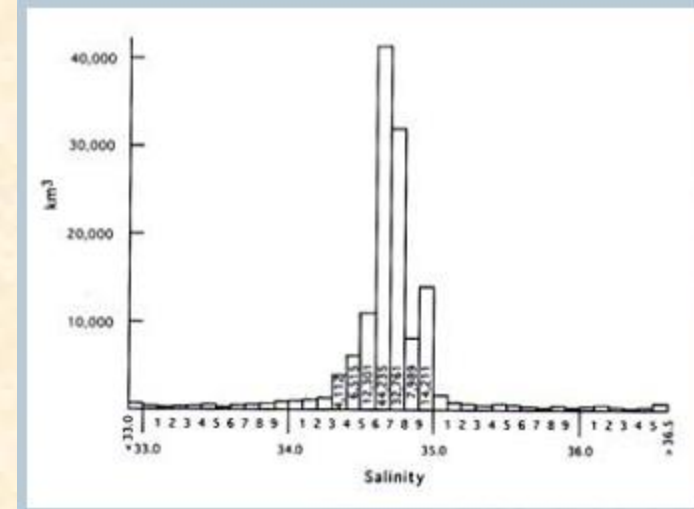
Αν...Στρώμα πάχους 166 m σε όλη τη ξηρά



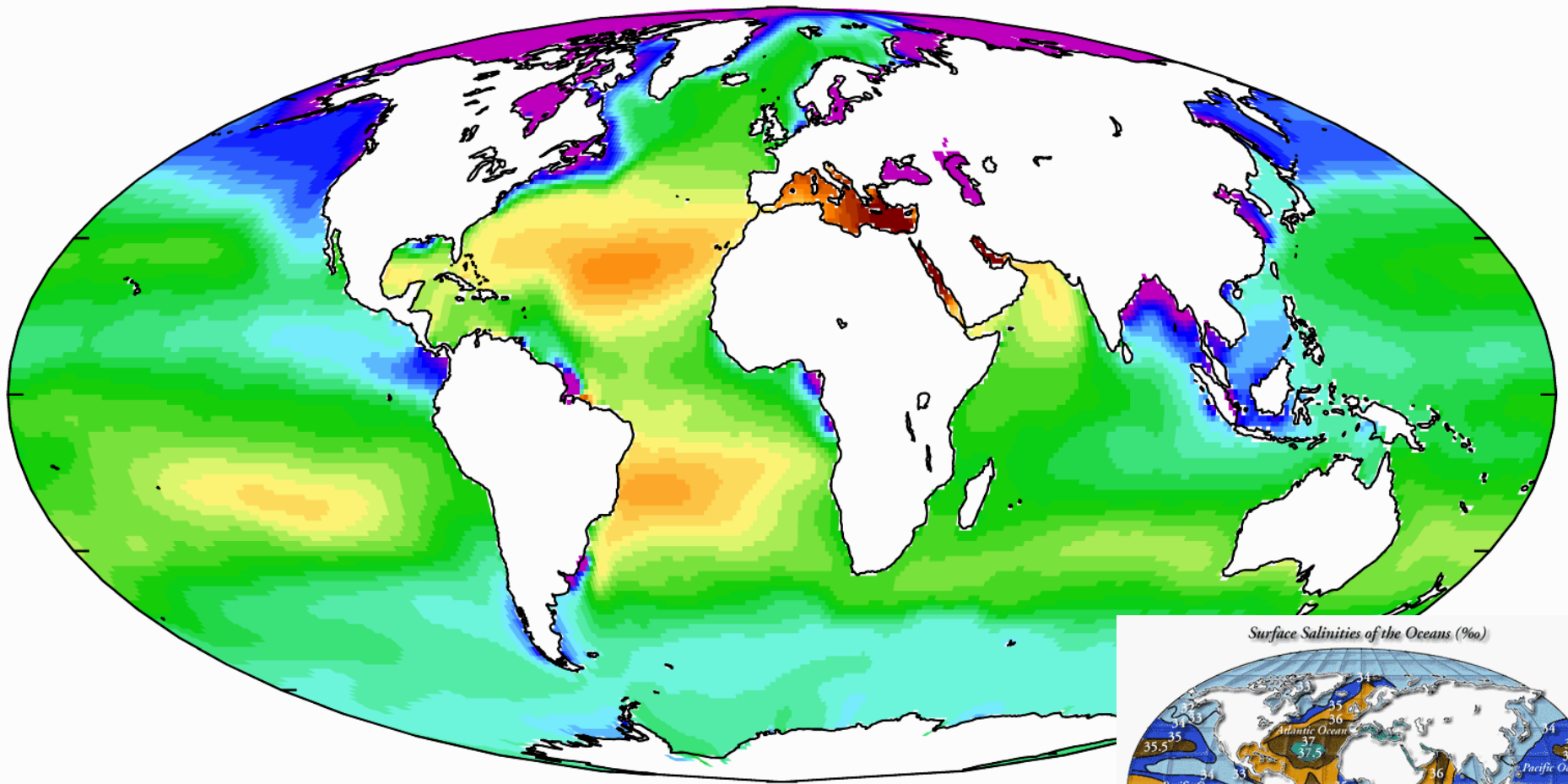
Χημική σύσταση θαλασσινού νερού

# Αλατότητες.....

32 - 37‰, με μέσο όρο 34‰

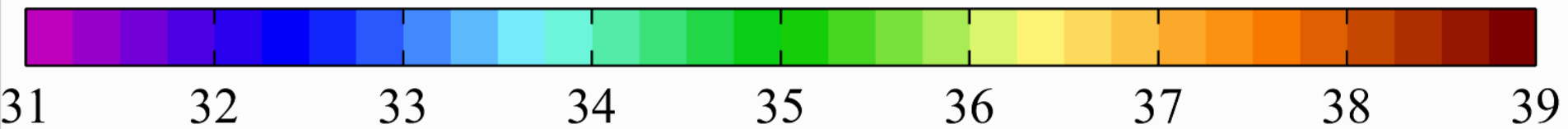
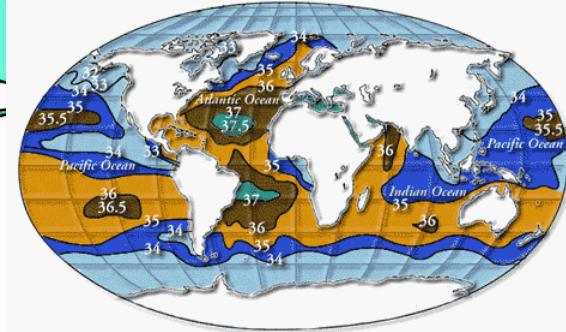


- Στον Β. Ατλαντικό η μέση τιμή της αλατότητας στο επιφανειακό στρώμα είναι 35.5‰,
- στο Ν. Ατλαντικό και Ν. Ειρηνικό είναι 35.2‰,
- στον Ινδικό 35‰ και
- στο Β. Ειρηνικό η μέση τιμή είναι 34.2‰.



Sea-surface salinity [PSU]

Surface Salinities of the Oceans (‰)



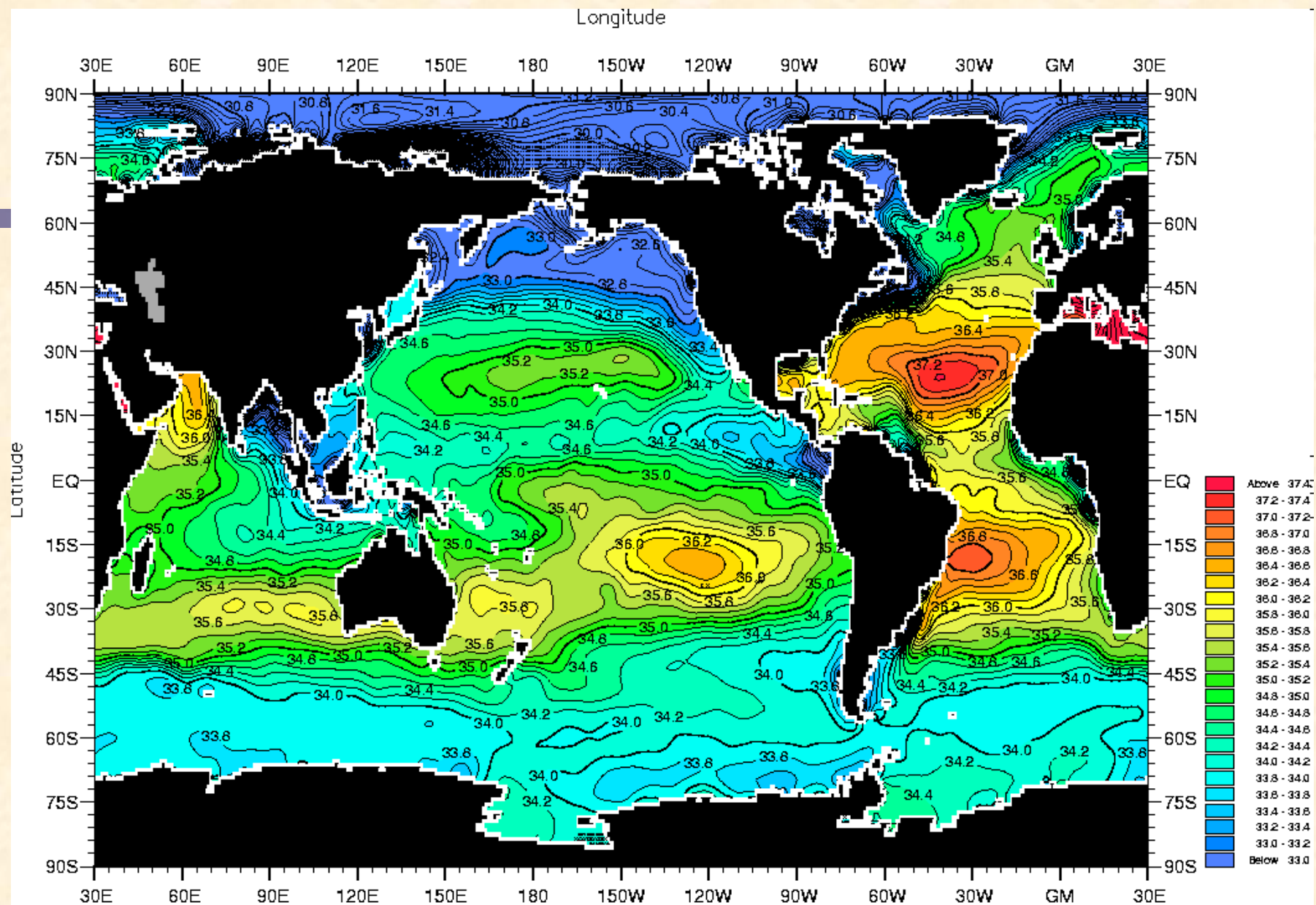


Fig. A2-1. Annual mean salinity (PSS) at the surface .

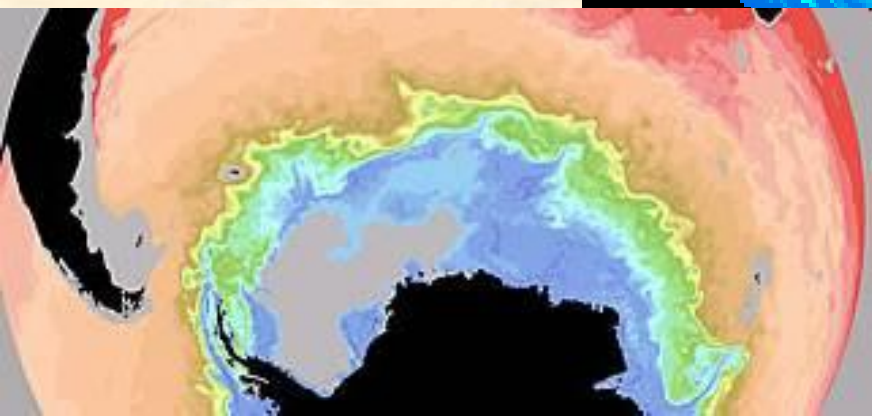
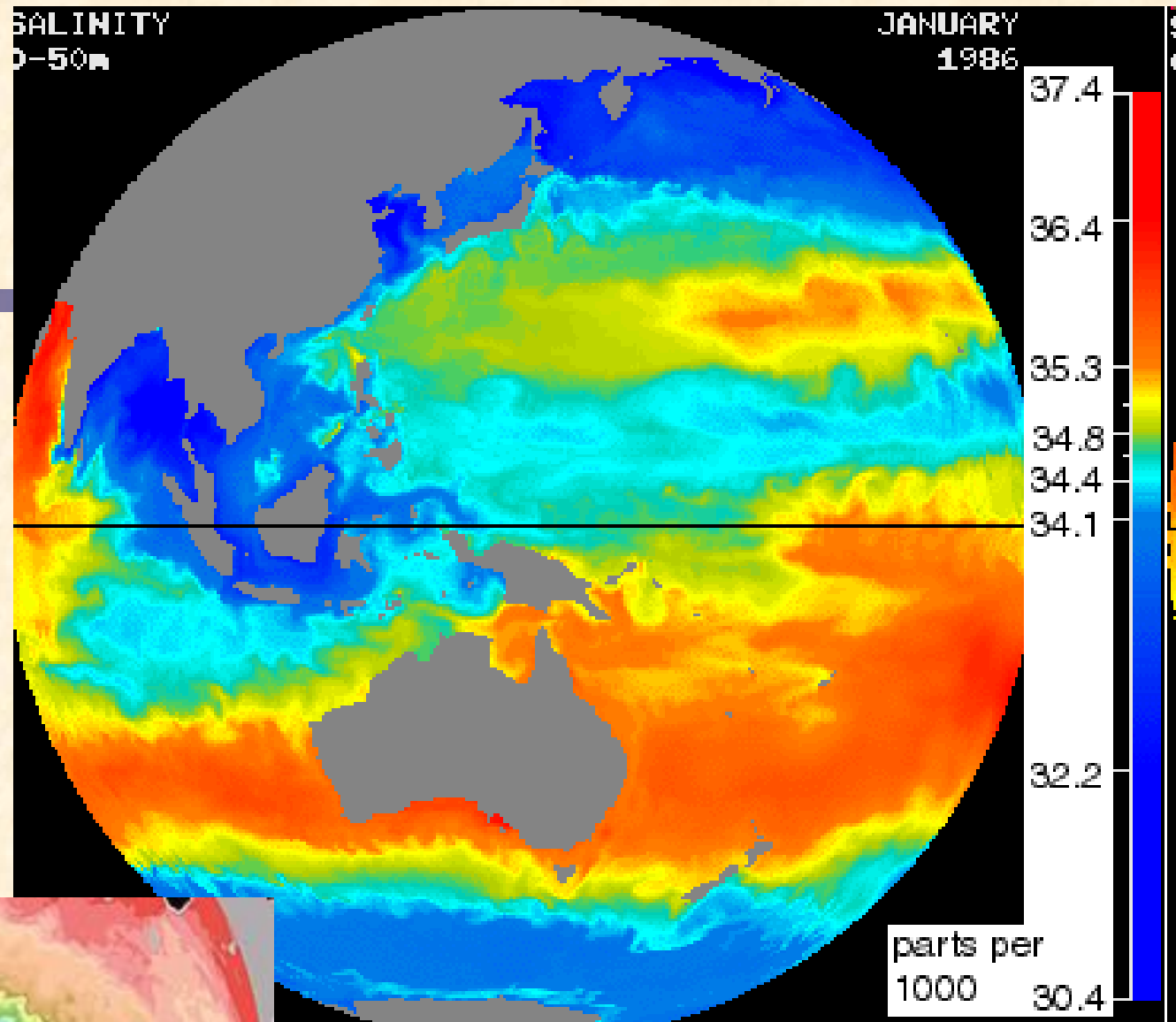
Minimum Value= 3.57

Maximum Value= 40.02

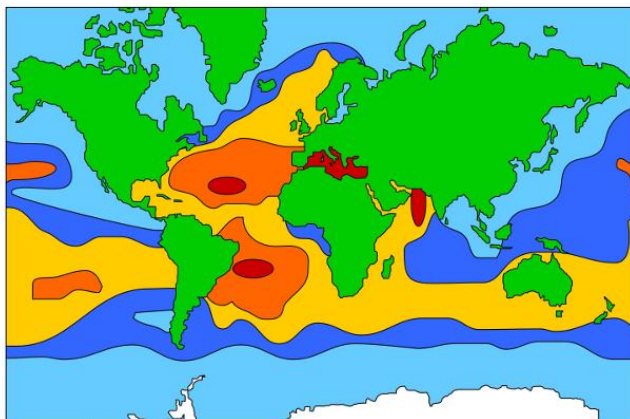
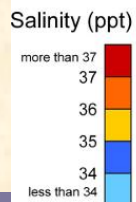
Contour Interval: 0.20

SALINITY  
0-50m

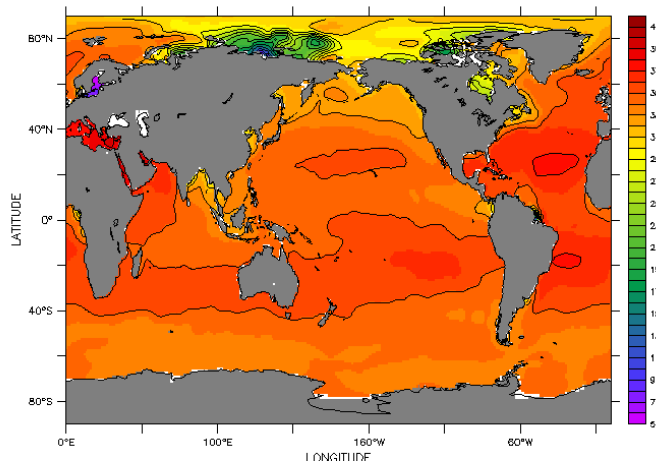
JANUARY  
1986



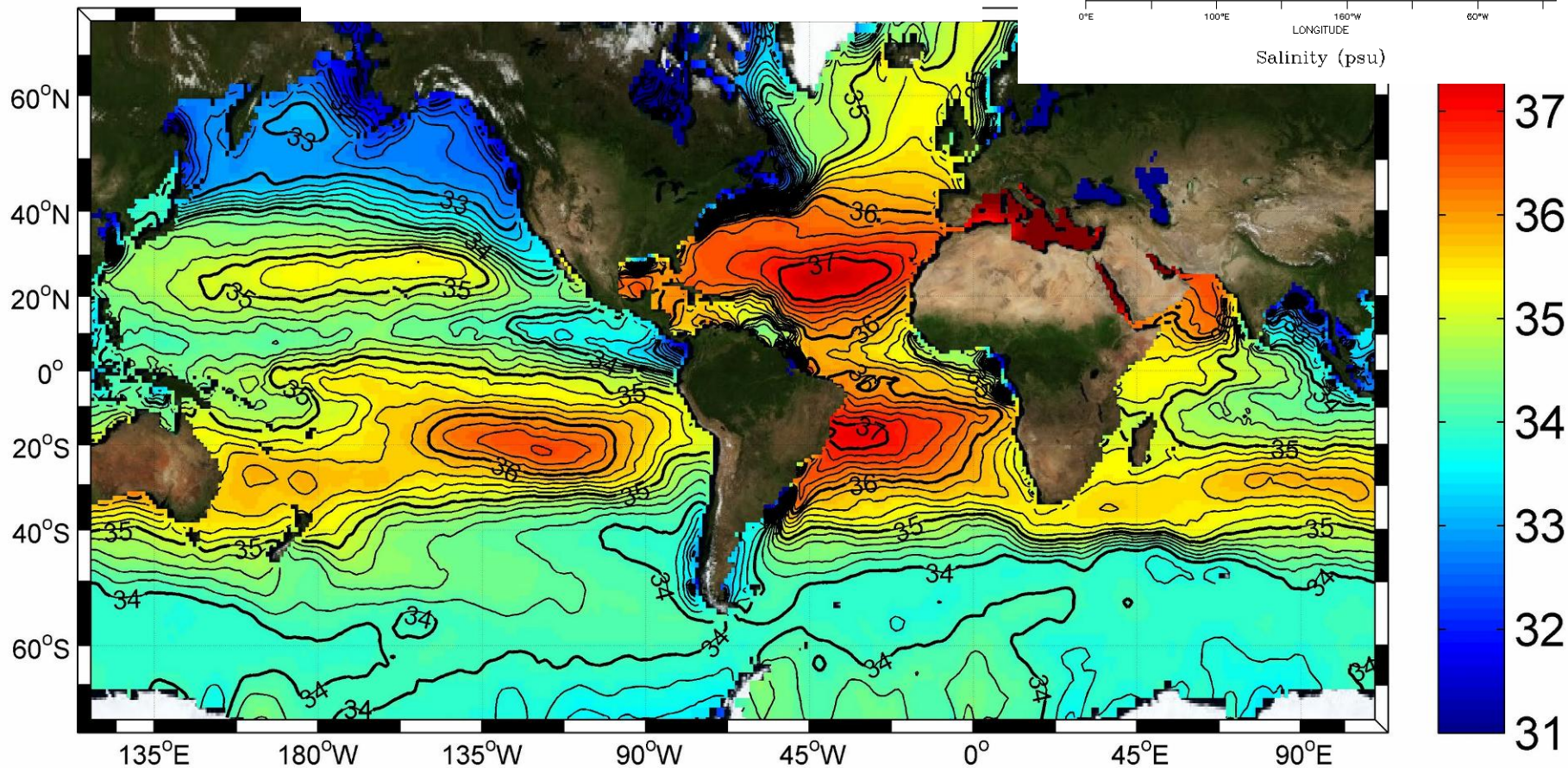
Γιατί ?



NOAA/PMEL TMAP FERRET Ver 4.0  
DEPTH (m) : 0  
DATA SET: ocean-atlas-annual  
World Ocean Atlas 1994 \* 1x1 Degree Annual Means

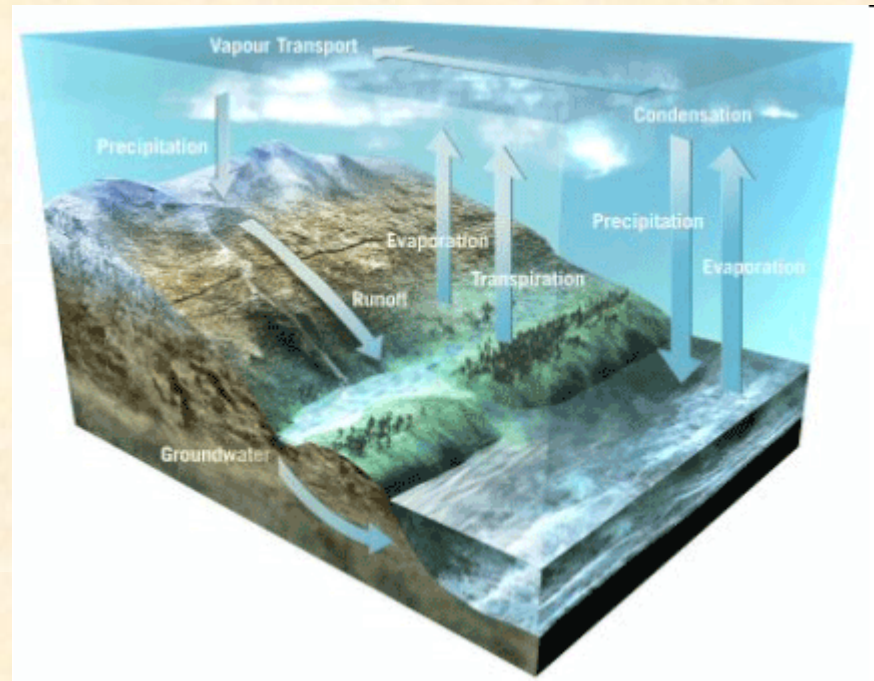
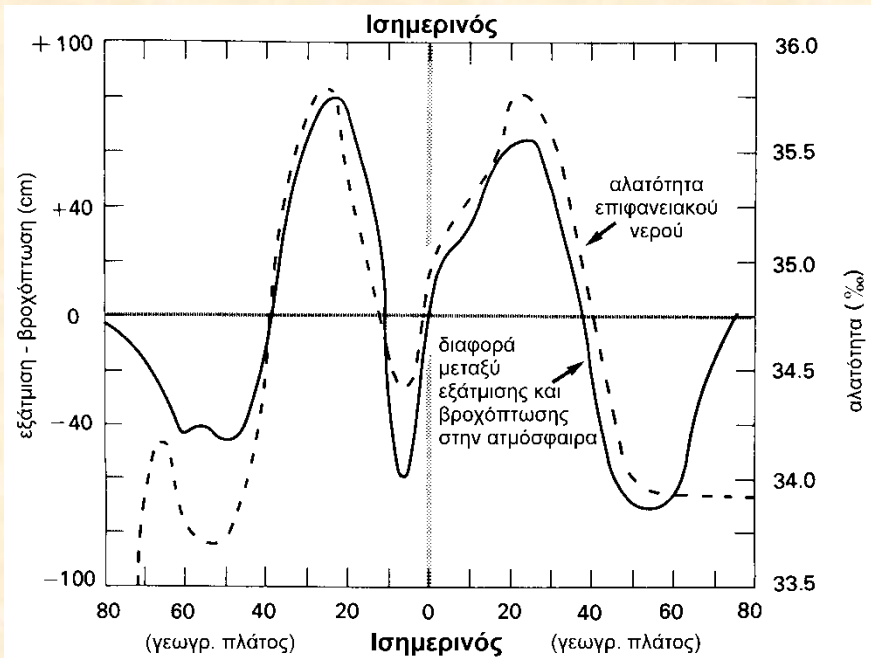


Salinity (psu)





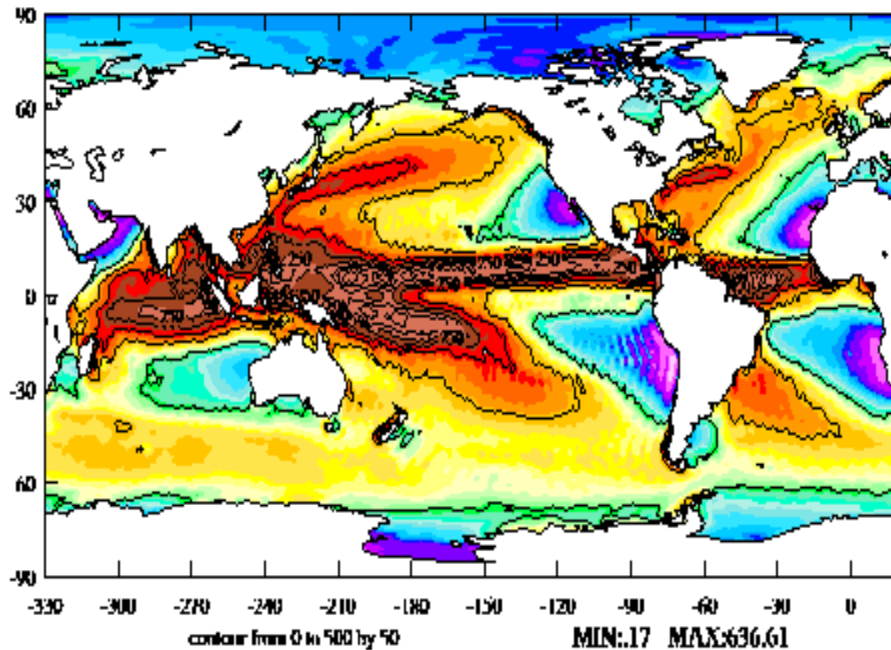
# Εξάτμιση/βροχόπτωση



# Εξάτμιση/βροχόπτωση

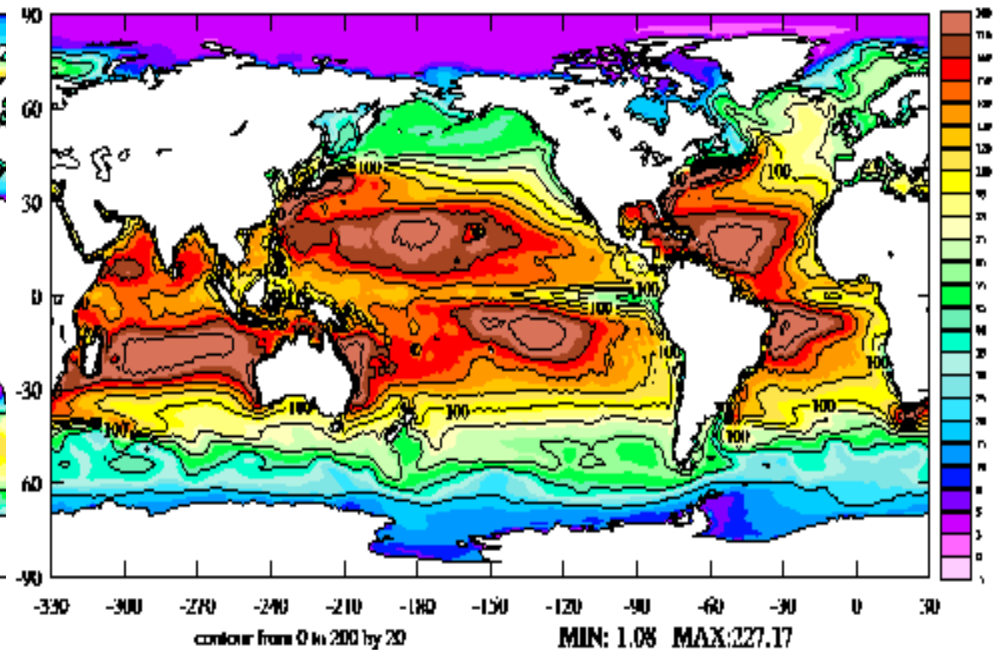
## PRECIPITATION (mm/mois)

TCMWF REANALYSIS, CLIMATOLOGICAL MEAN(1979-93)



## EVAPORATION (mm/mois)

TCMWF REANALYSIS, CLIMATOLOGICAL MEAN(1979-93)

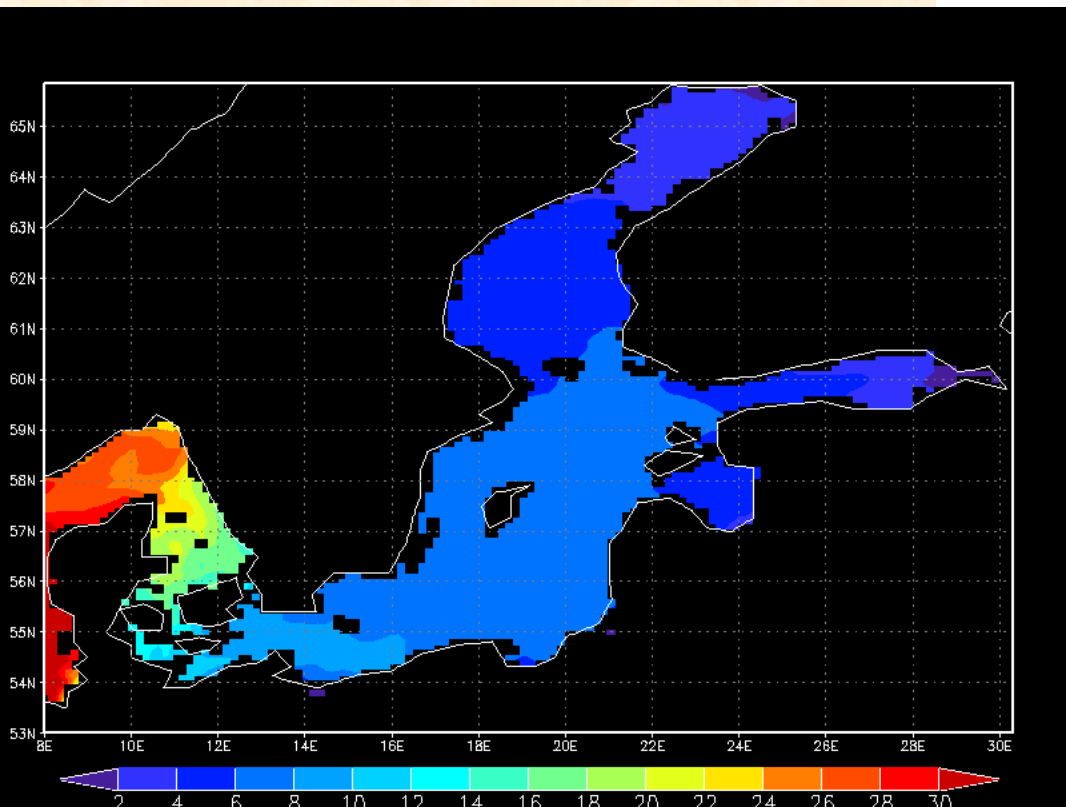
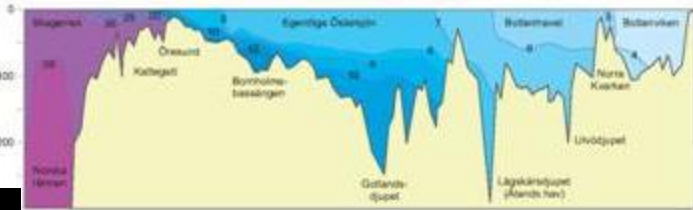


# Βαλτική θάλασσα

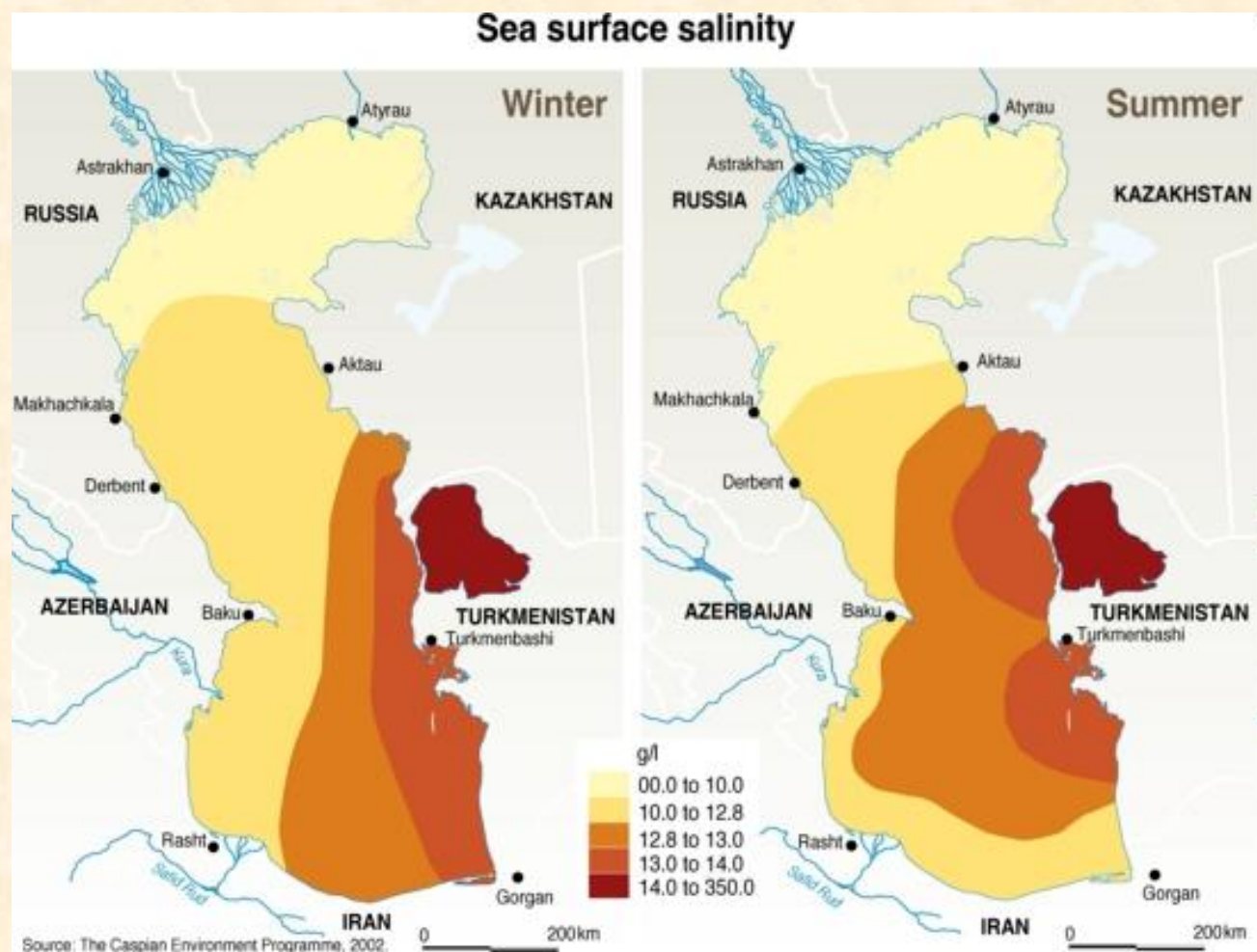
Salthalt i Östersjön och Västerhavet



Från Väner et al (2001), Forselius (1996) och Förändringar under ytan (Monitor 19)

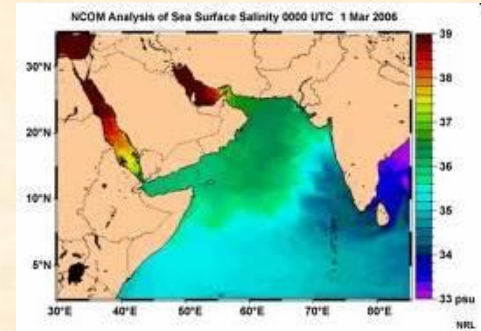


# Κασπία Θάλασσα



# Μεσόγειος θάλασσα

Ερυθρά θάλασσα

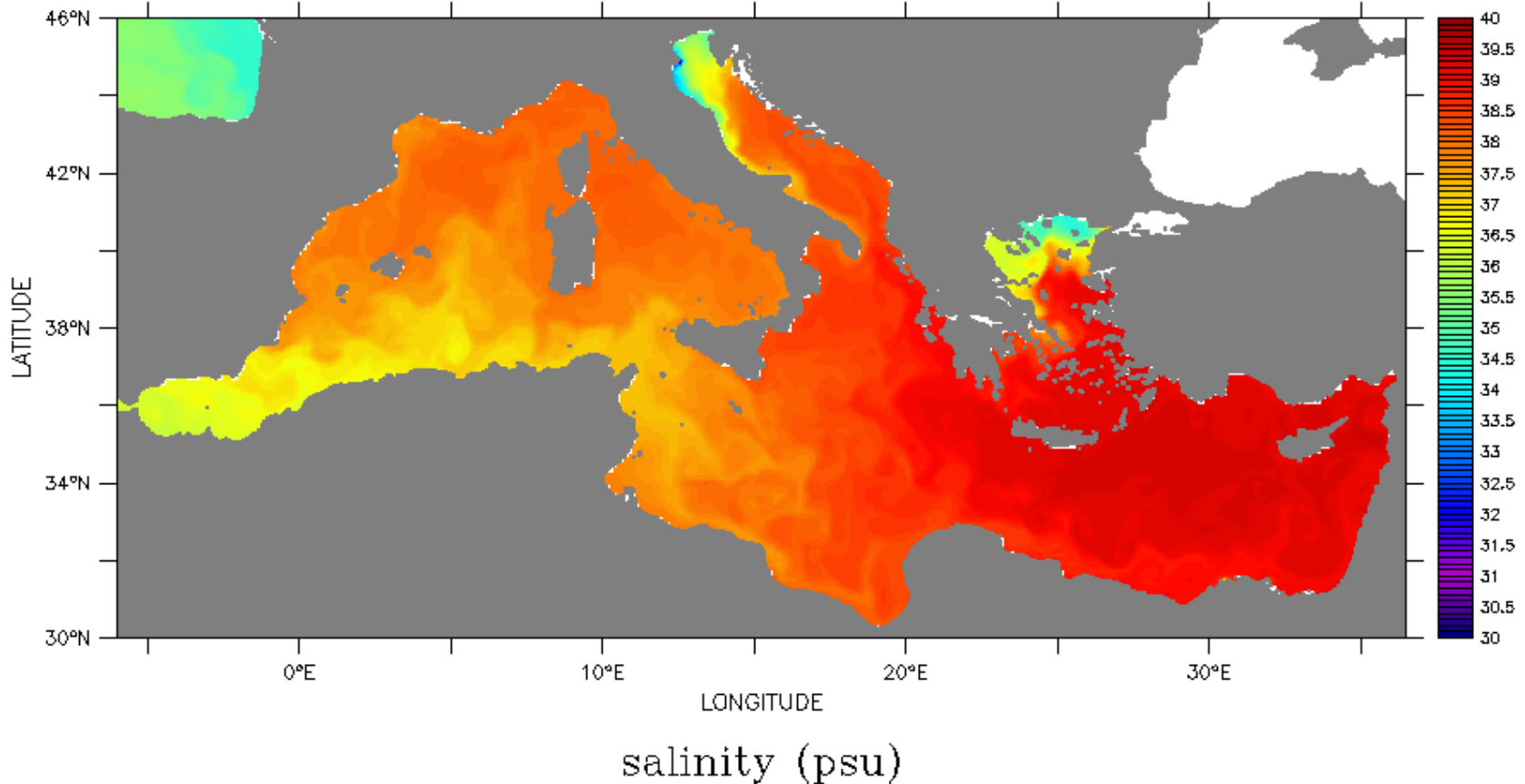


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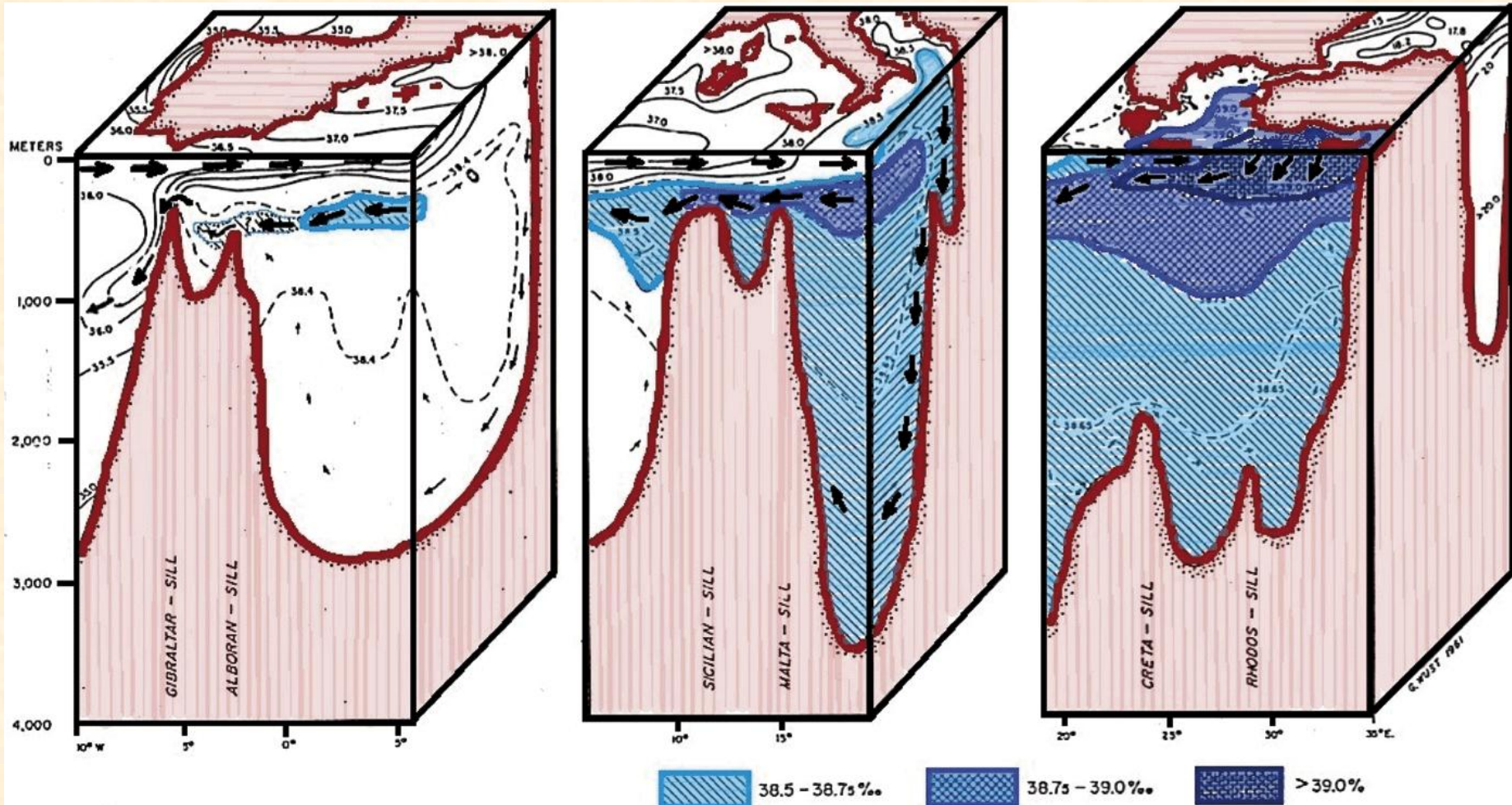
DODS URL: <http://opendap.mercator-ocean.fr/dodsC/>

DATA SET: mercator\_psy2v1\_mersea\_grid1o8\_med\_best\_estimate  
MERCATOR PSY2V1

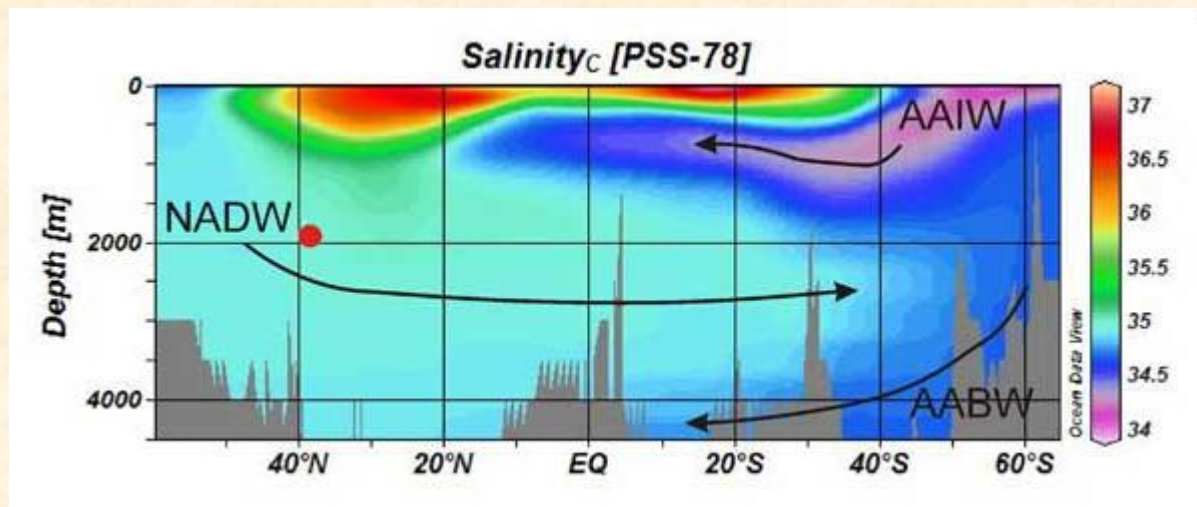
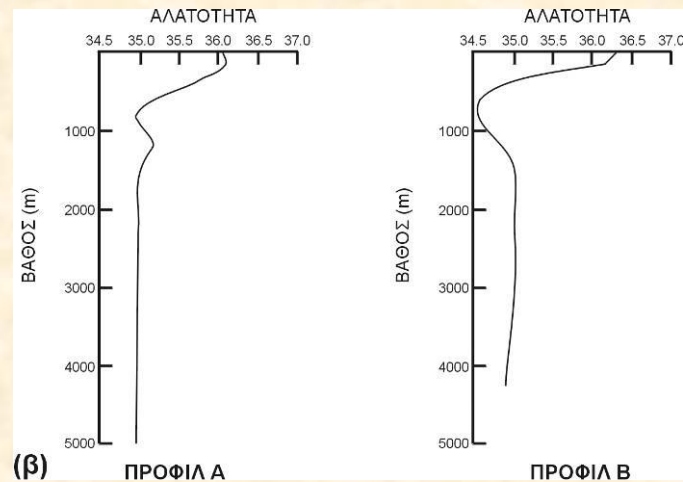
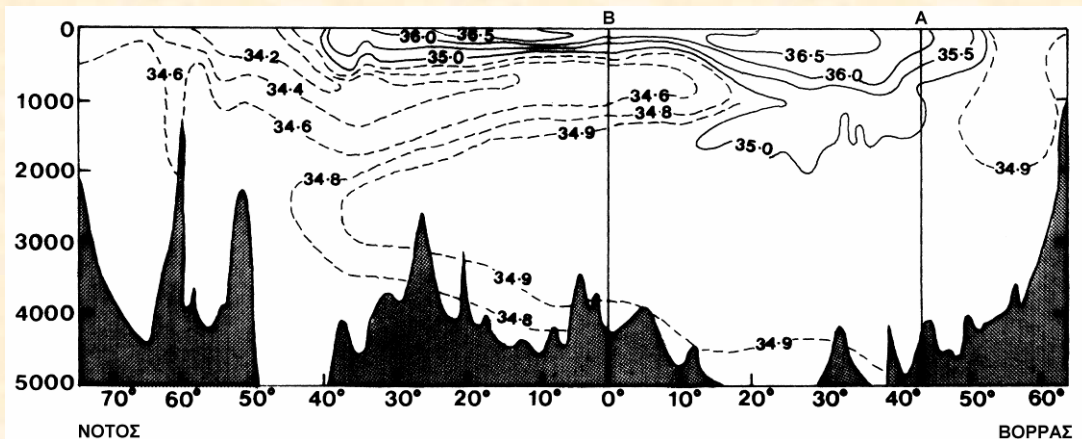
FERRET Ver. 6.50  
NOAA/PNEL THAP  
Oct 29 03 17:19:54



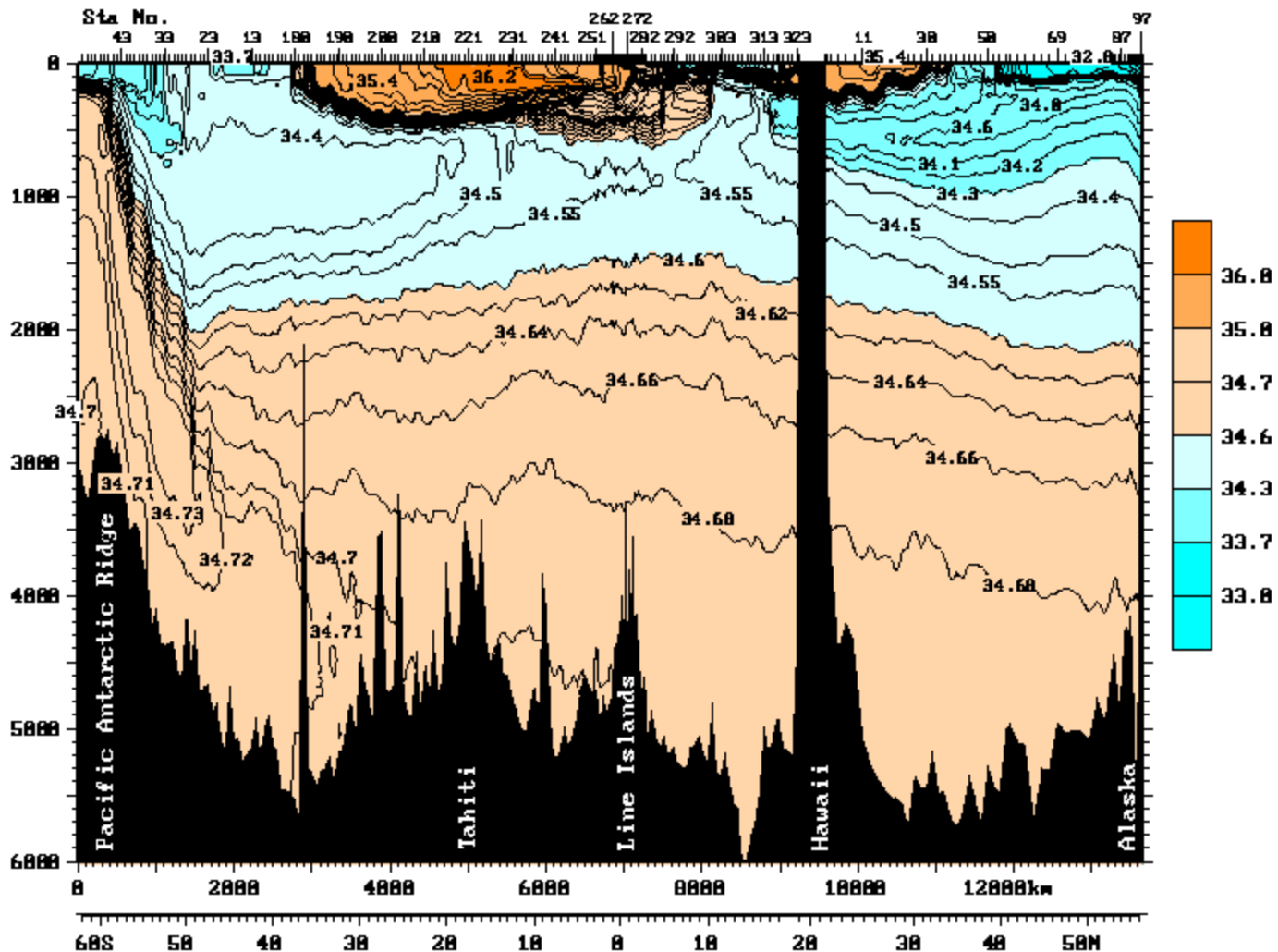
# Μεσόγειος θάλασσα



# Κατακόρυφη κατανομή



# Ειρηνικός Ωκεανός

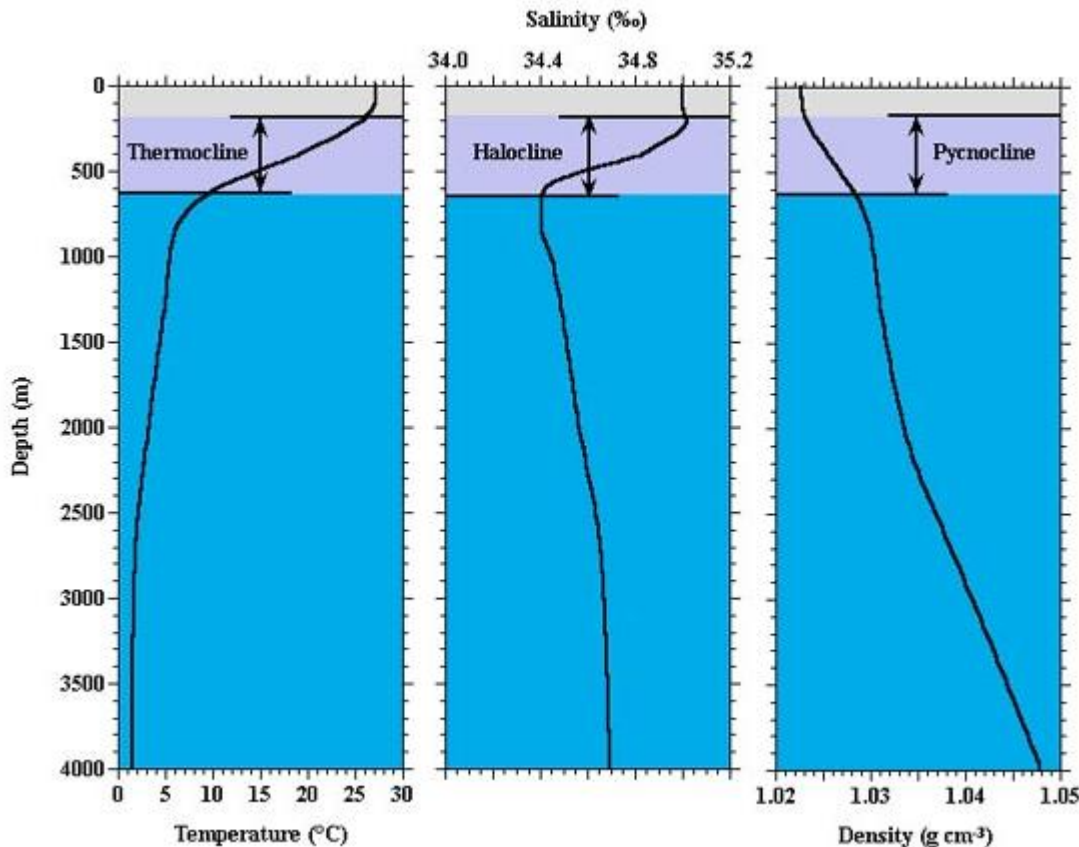




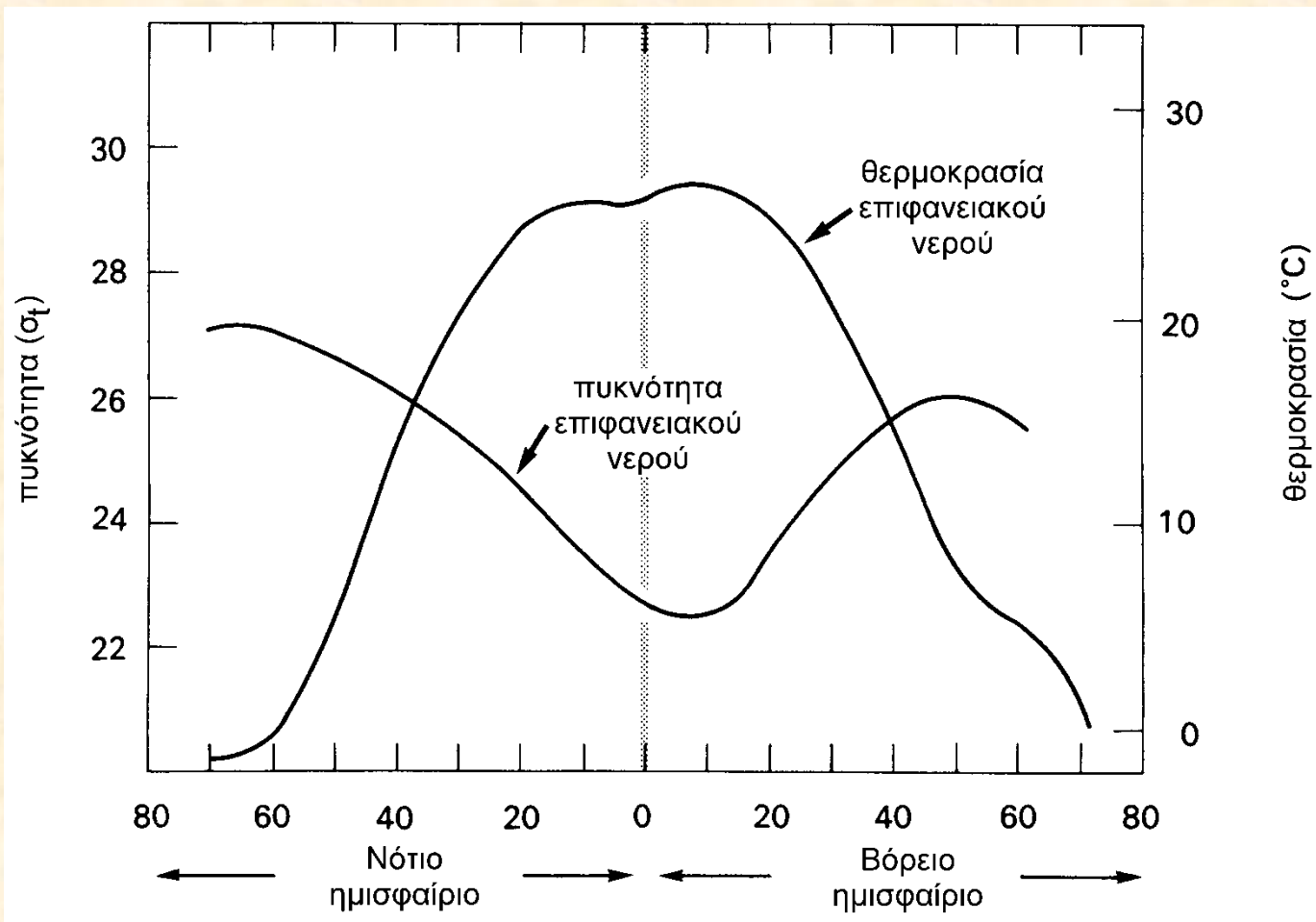
# Πυκνότητα

Πυκνότητα νερού  
 $1000 \text{ kg/m}^3$

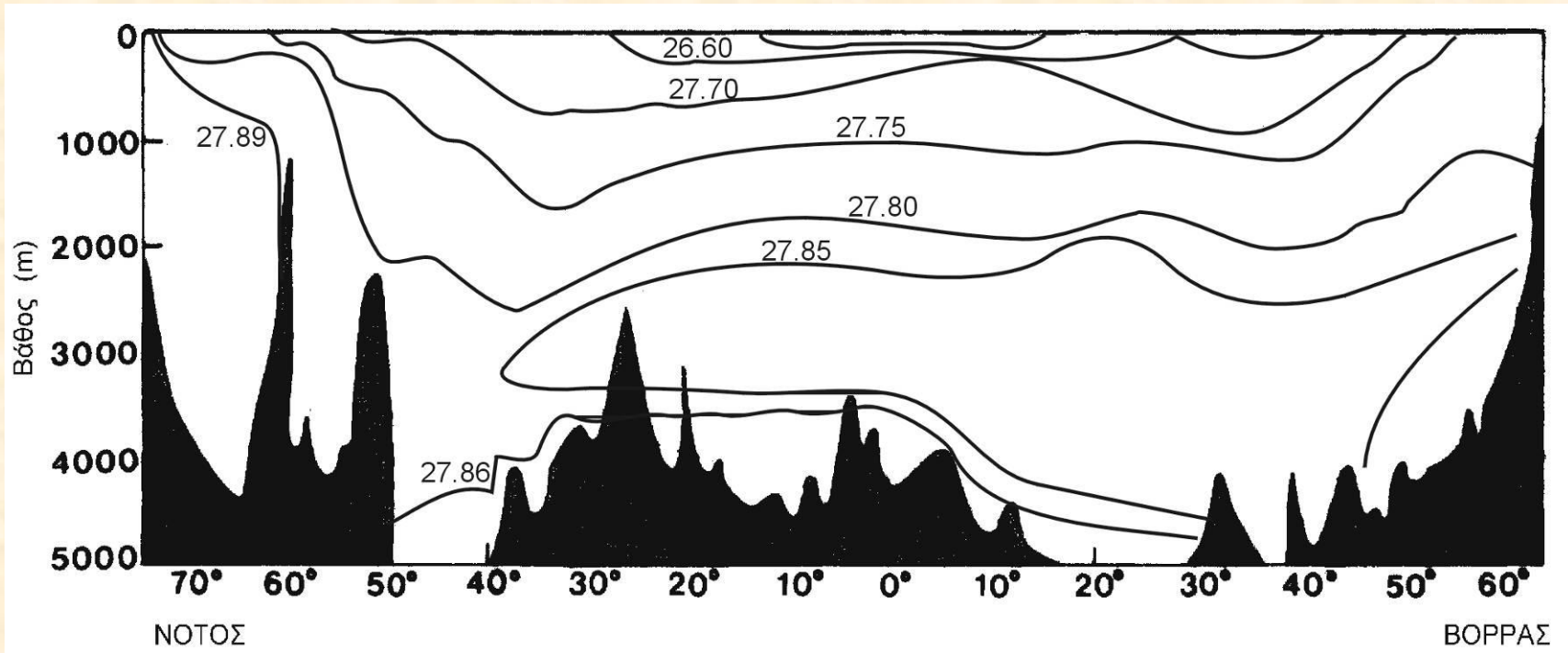
Θαλασσινό νερό  
 $1027 \text{ kg/m}^3$



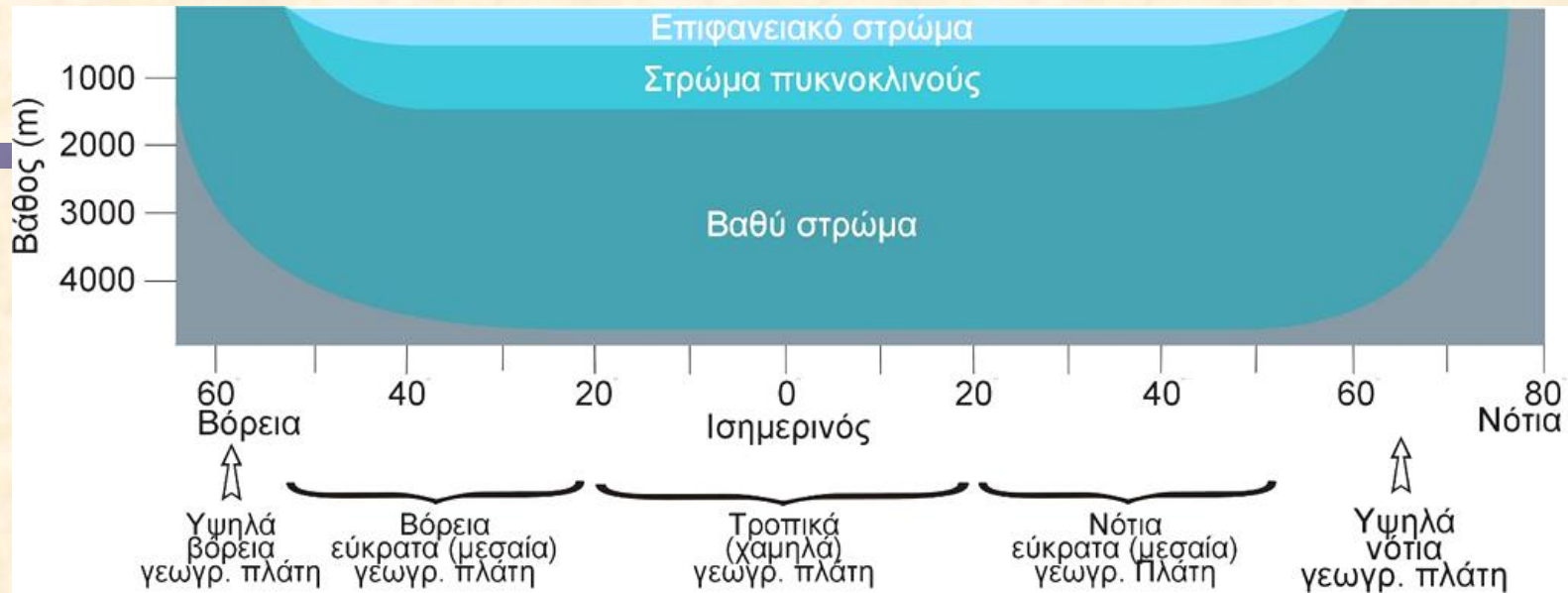
Πυκνότητα **f** θερμοκ.  
αλατότητα



# Ατλαντικός Ωκεανός



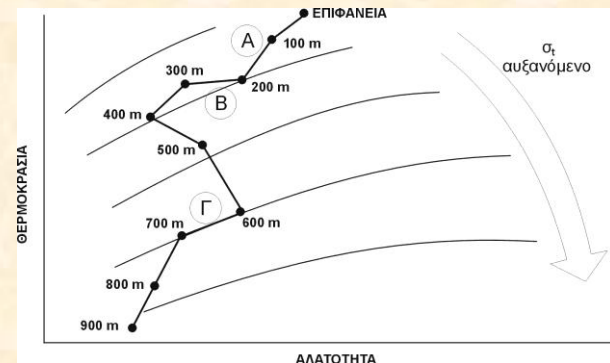
# ΣΤΡΩΜΑΤΟΠΟΙΗΣΗ



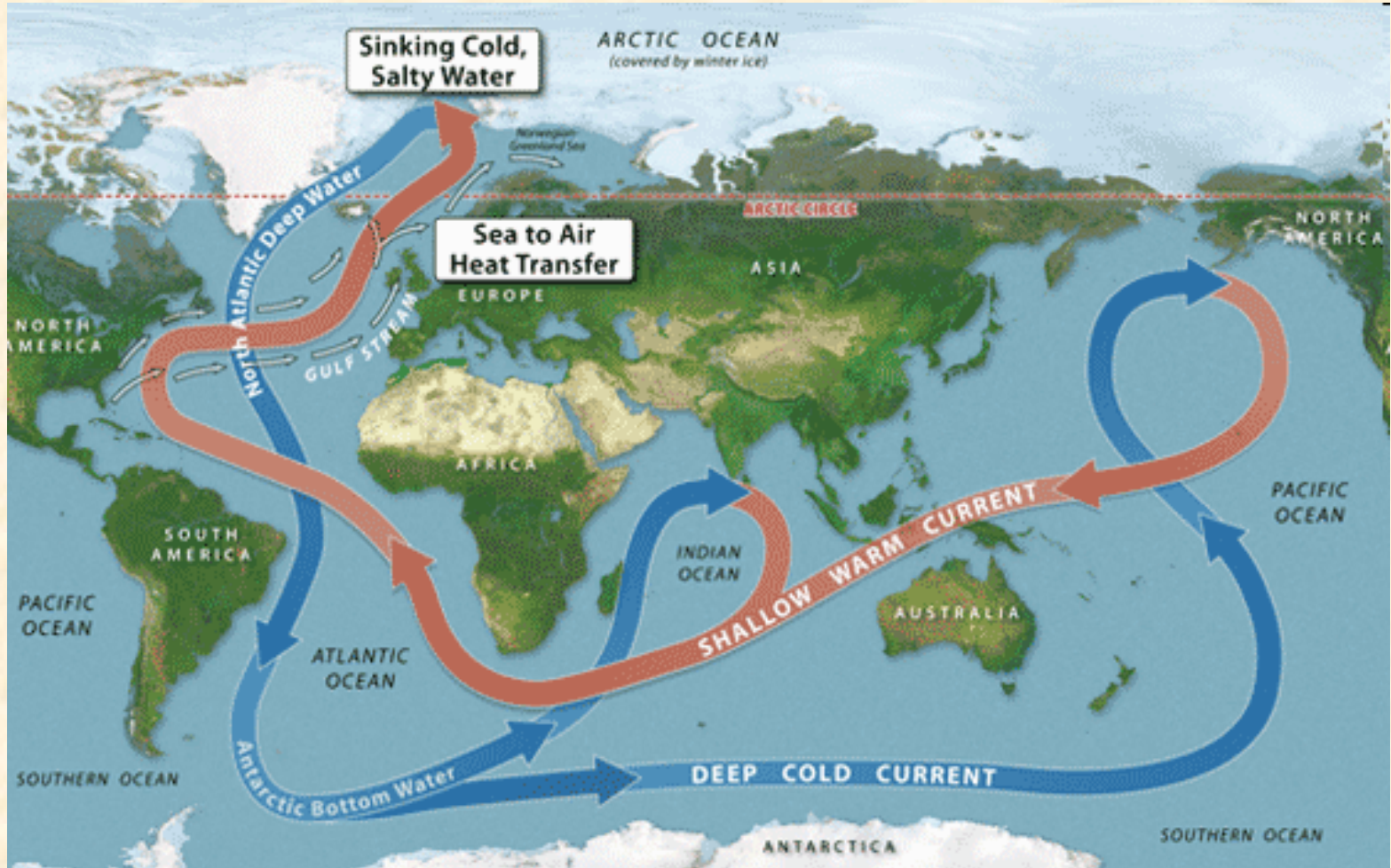
Το επιφανειακό στρώμα έχει μέσο πάχος περίπου 100m έως 200m και συνιστά το 2%

Το στρώμα του πυκνοκλινούς έχει μέσο πάχος 700-800m και συνιστά το 18%

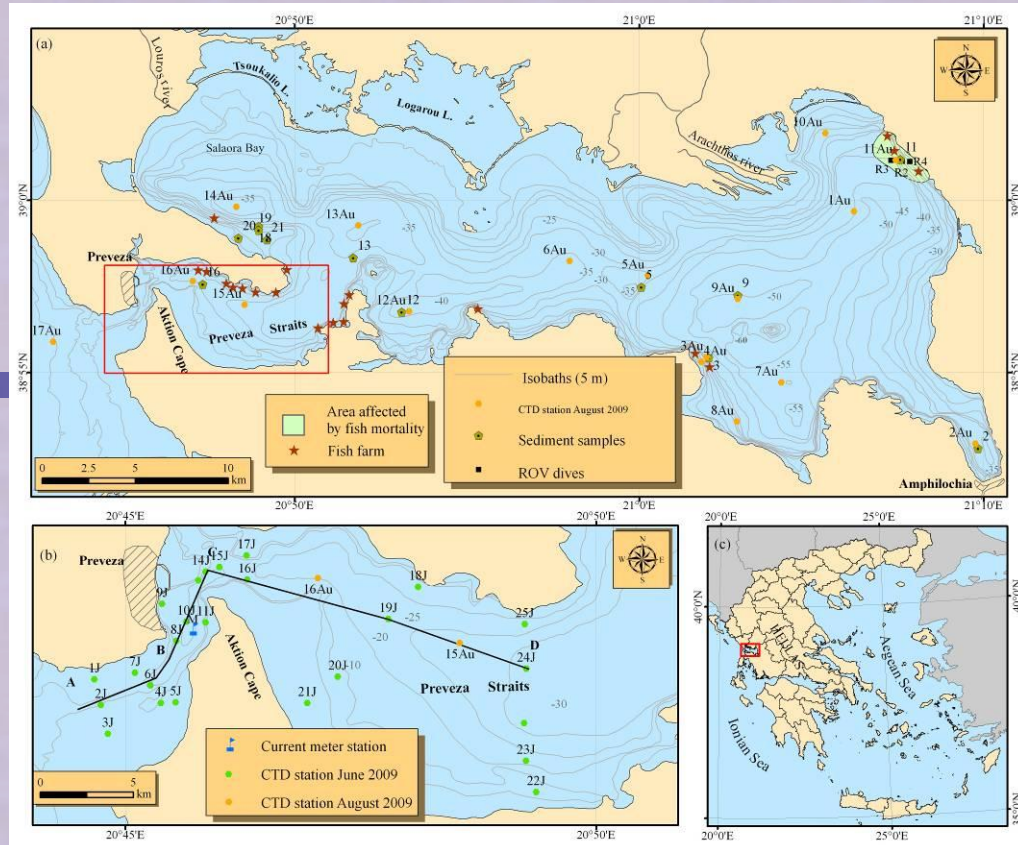
Το βαθύ στρώμα (deep layer) συνιστά το 80%



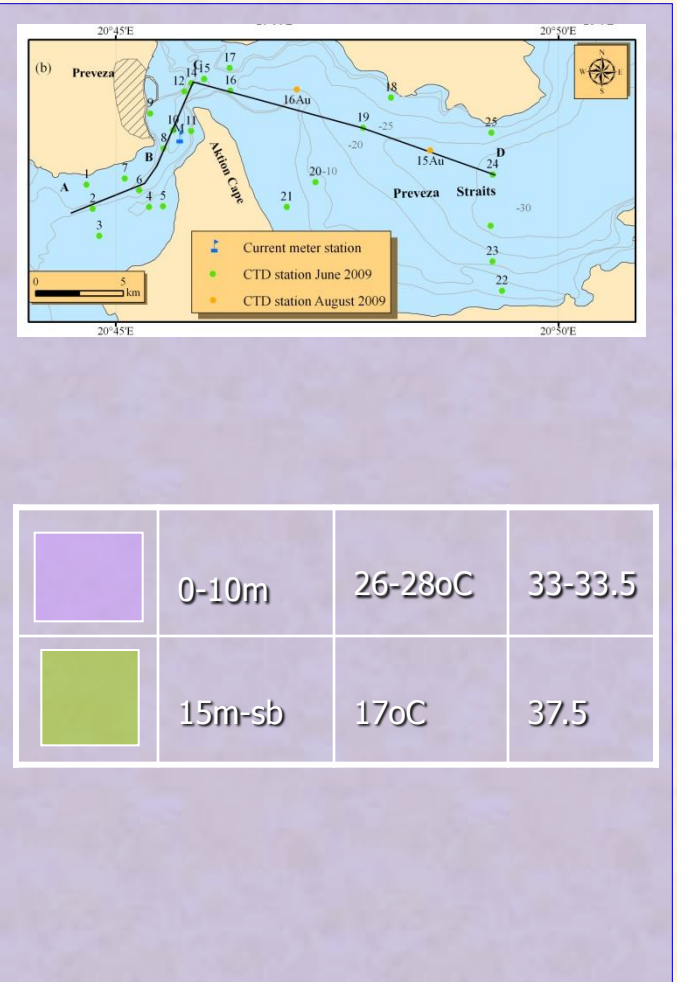
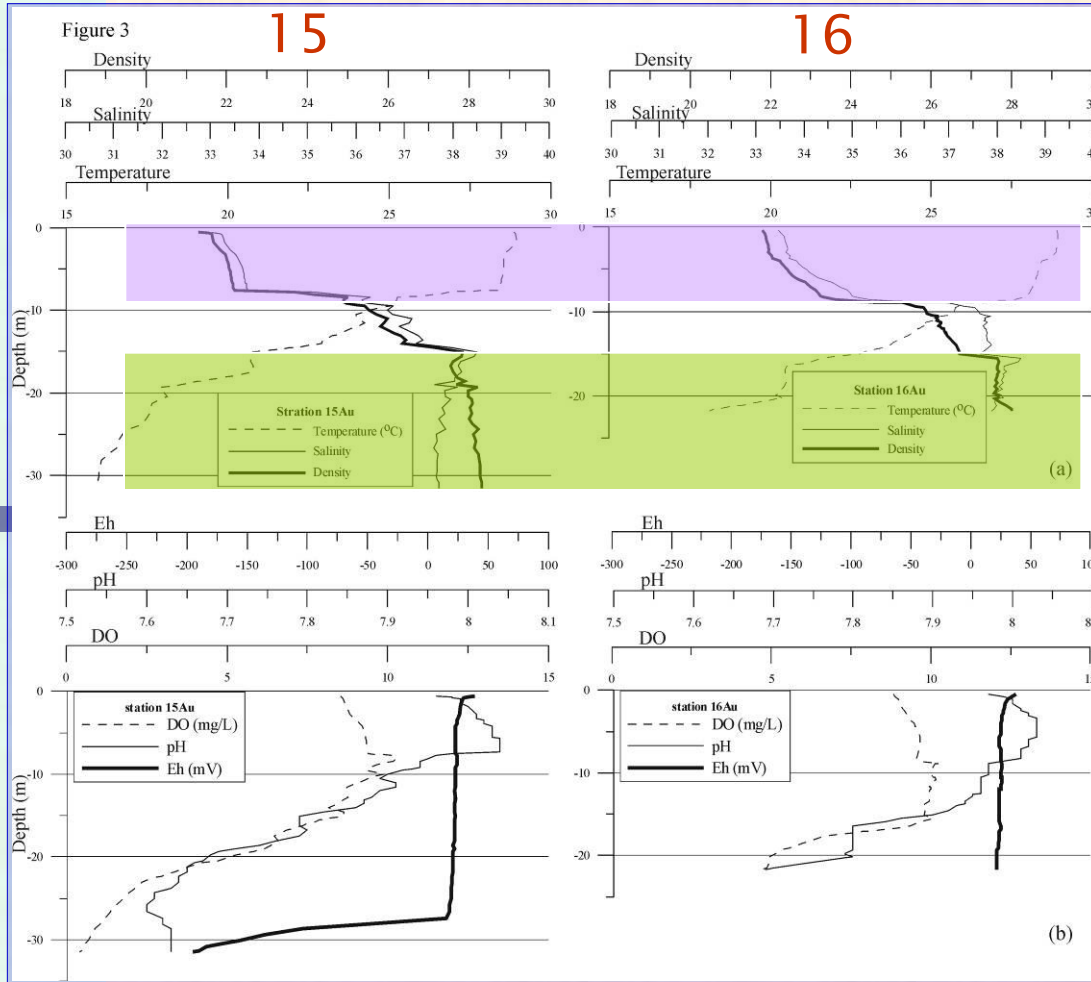
# Παγκόσμια (ζωτική) κυκλοφορία.....



# Amvrakikos Gulf



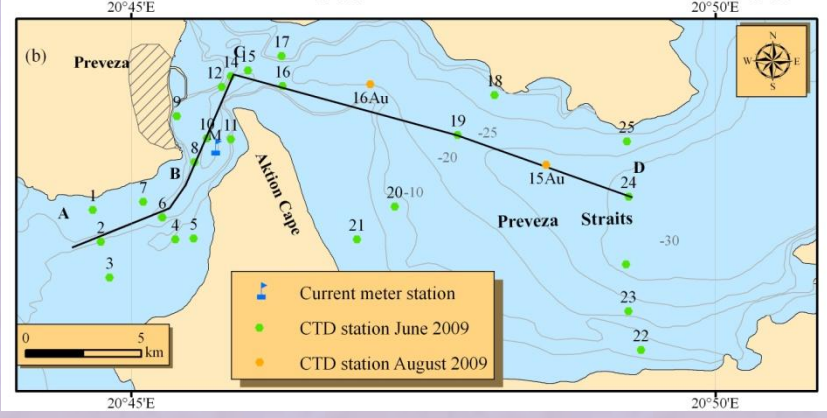
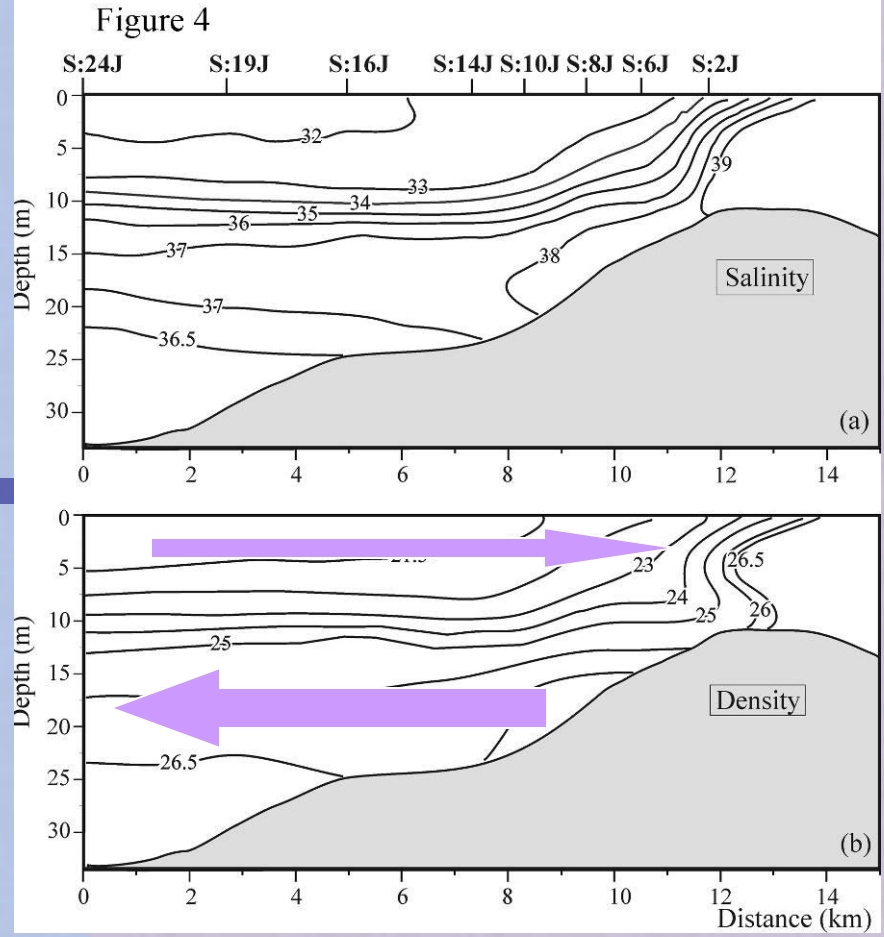
## Inner part Preveza Straits



## Outer part Preveza Straits

Amvrakikos

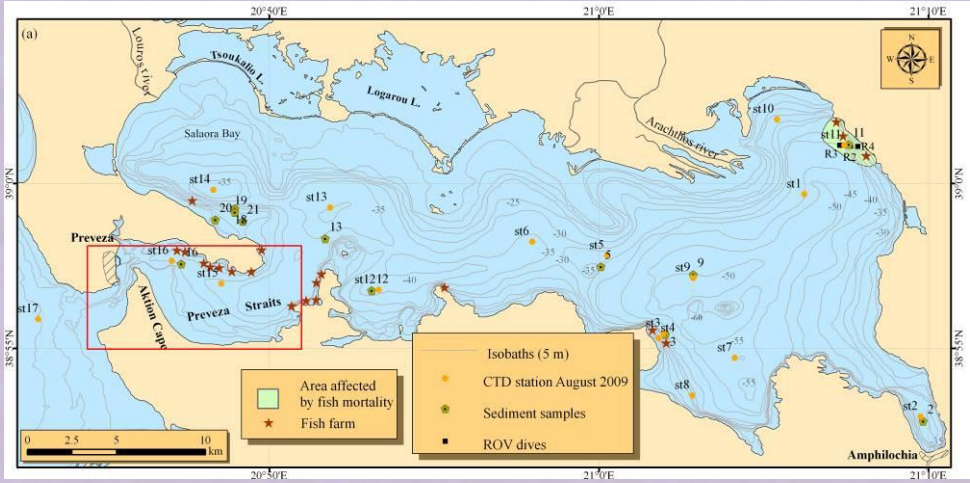
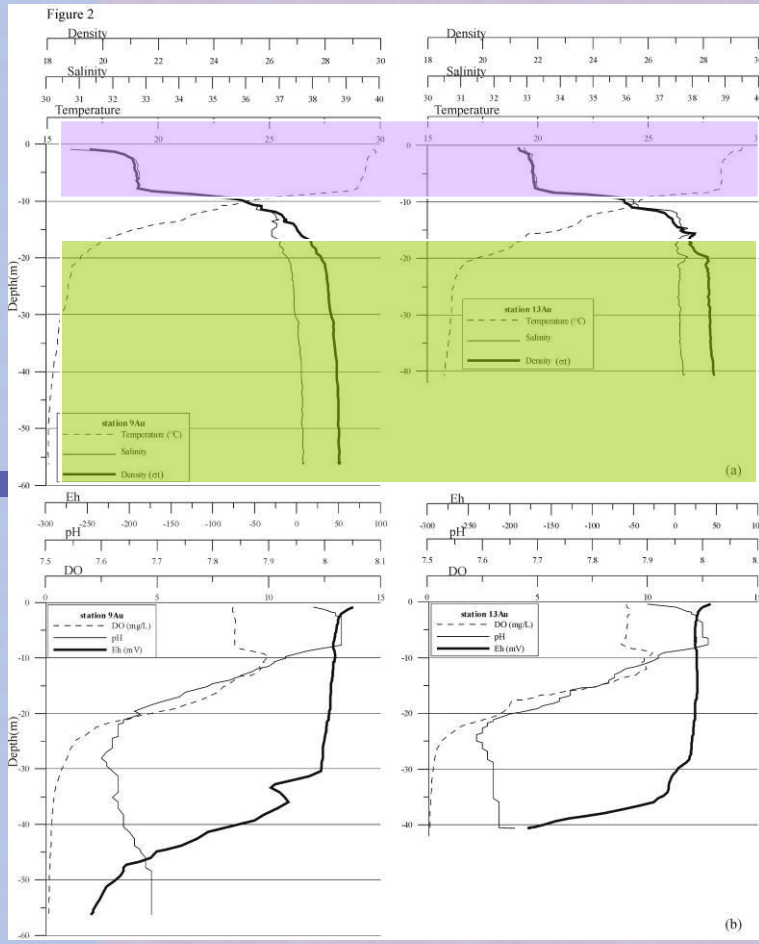
Ionian



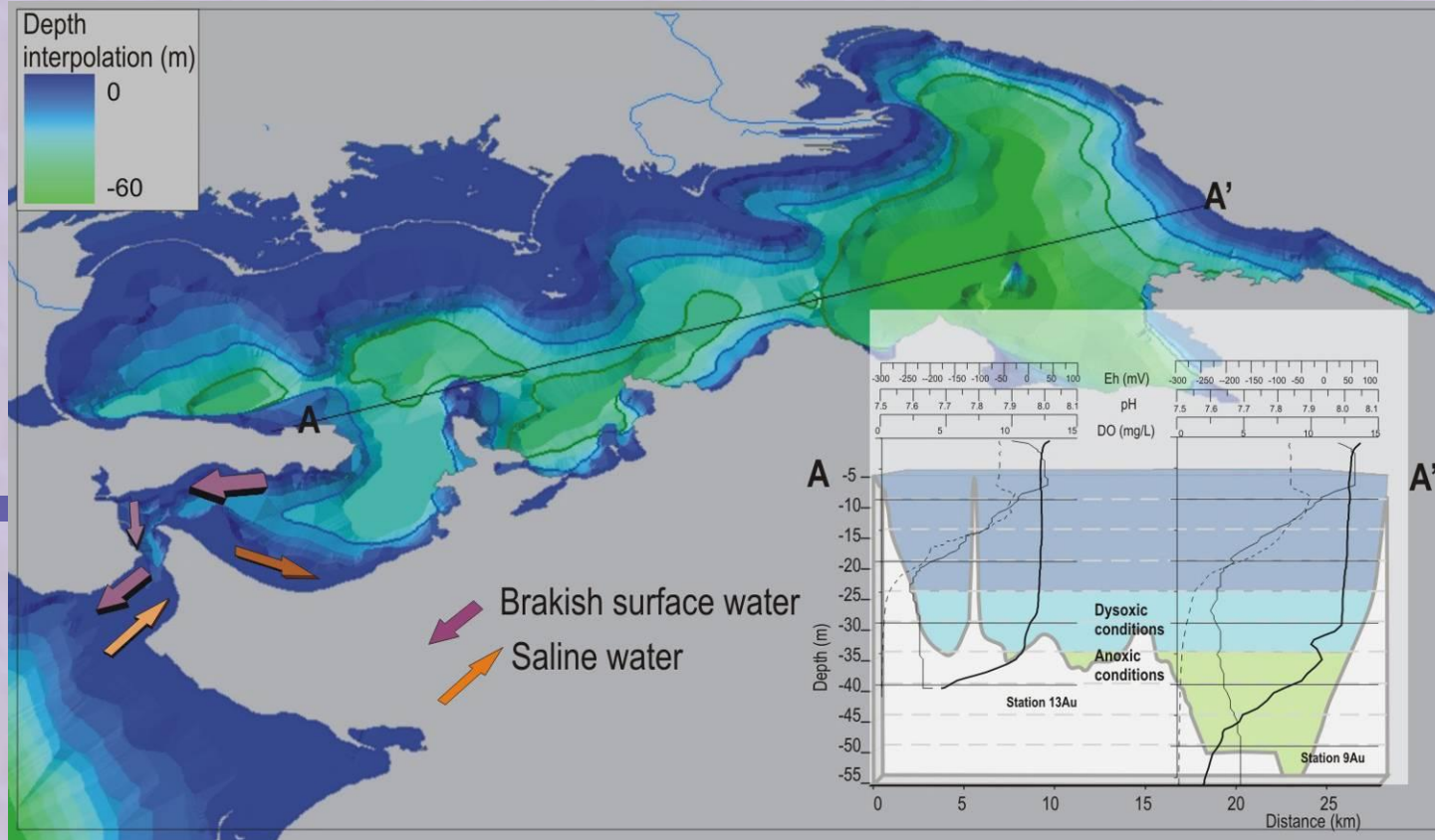
- salinity and density gradient which extends from the surface to the bottom,
- 
- indicates the presence of a well developed front
  - due to the **outflowing brackish water of the Gulf** and the **inflowing saline open sea water**
  - Speeds up to 60 and 80cm/s



# Amvrakikos Gulf



	0-10m	29-30 oC	32-33
	15m-sb	15-16 oC	37-39



an area of 217.5km<sup>2</sup> of the total 411.4km<sup>2</sup> (50%)  
 in the water column 2.9 × 10<sup>9</sup>m<sup>3</sup> of the total 7.4 × 10<sup>9</sup>m<sup>3</sup> (28.5%)