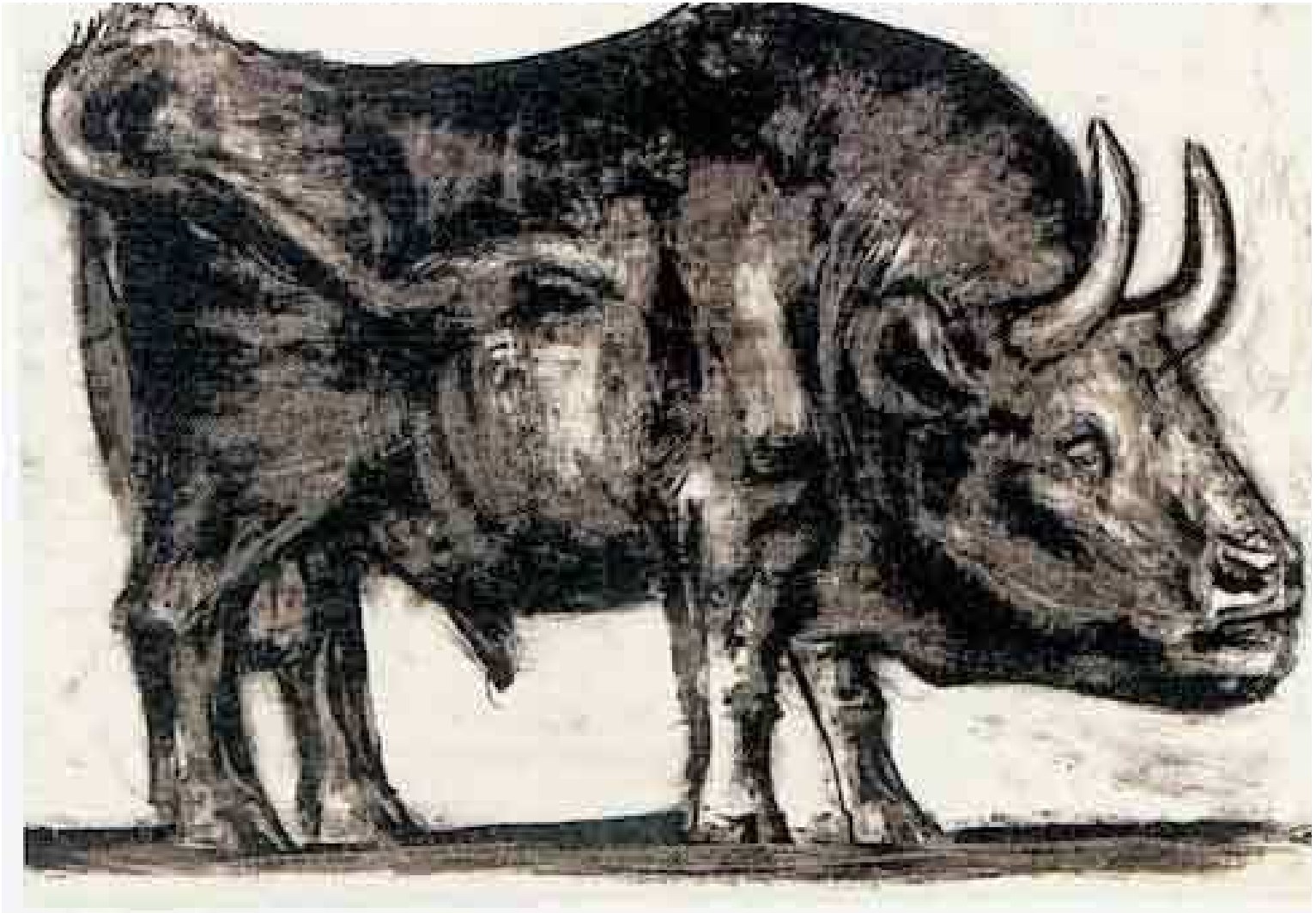
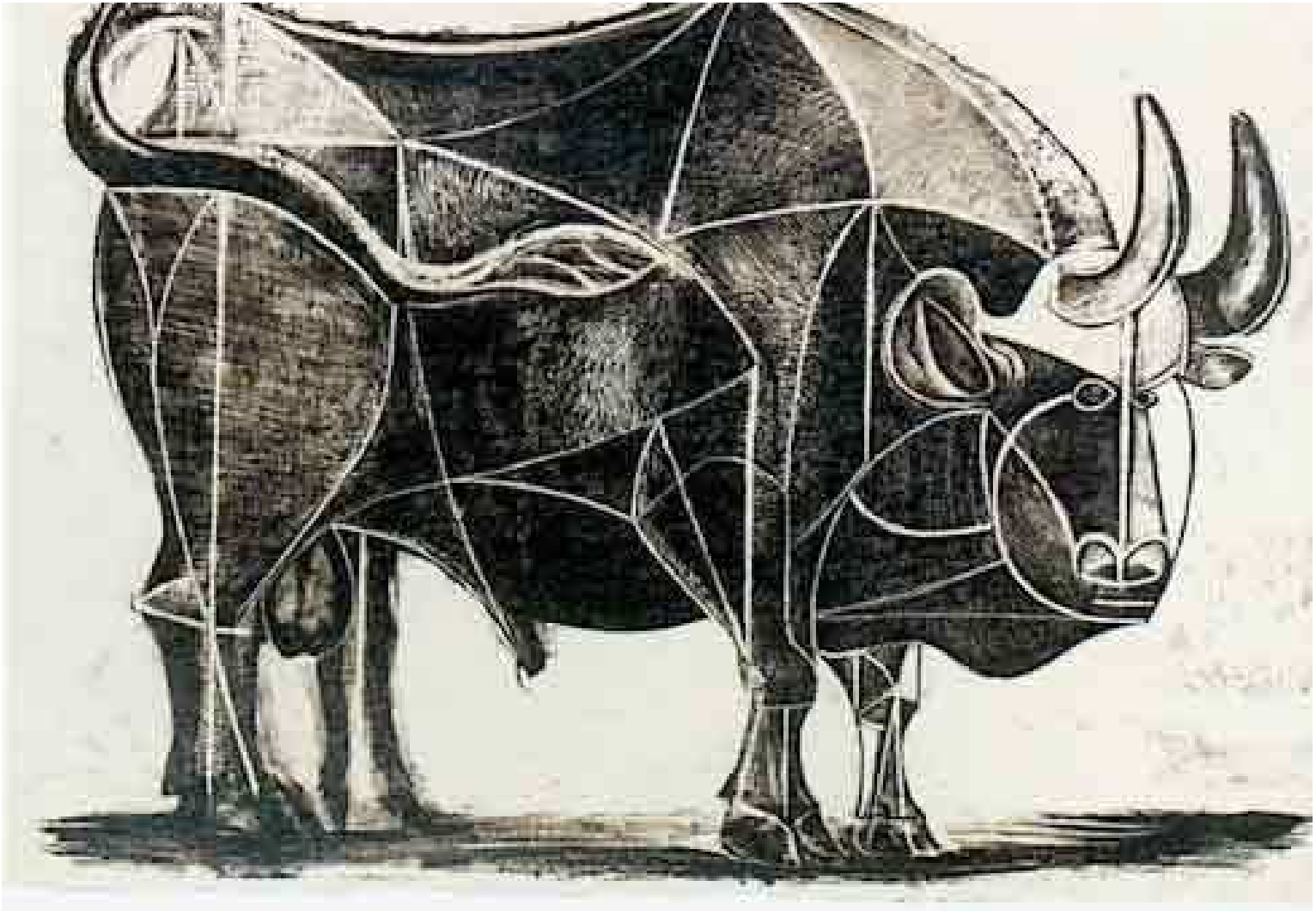
Demarche Scientifique

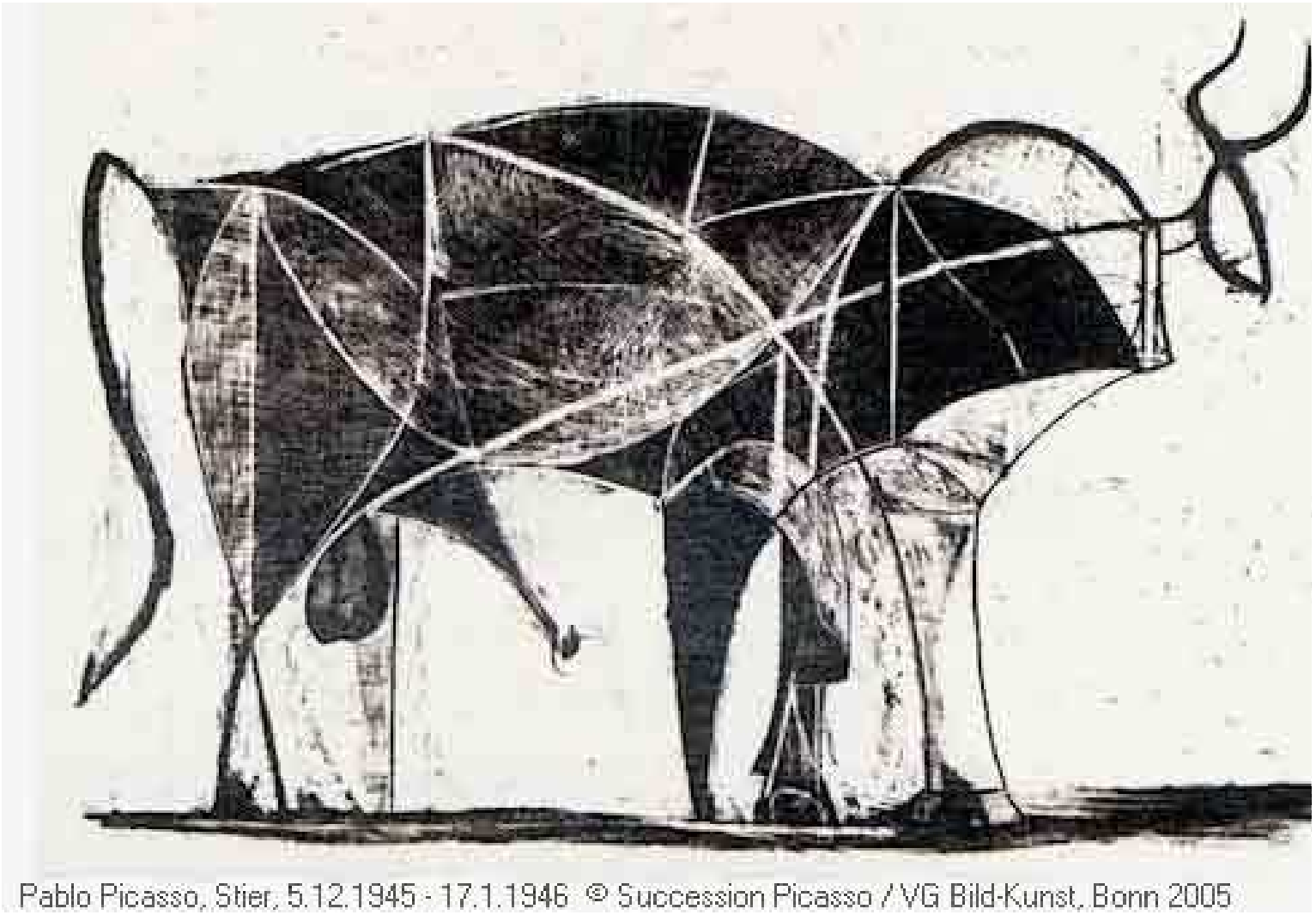
Demarche Scientifique



Demarche Scientifique

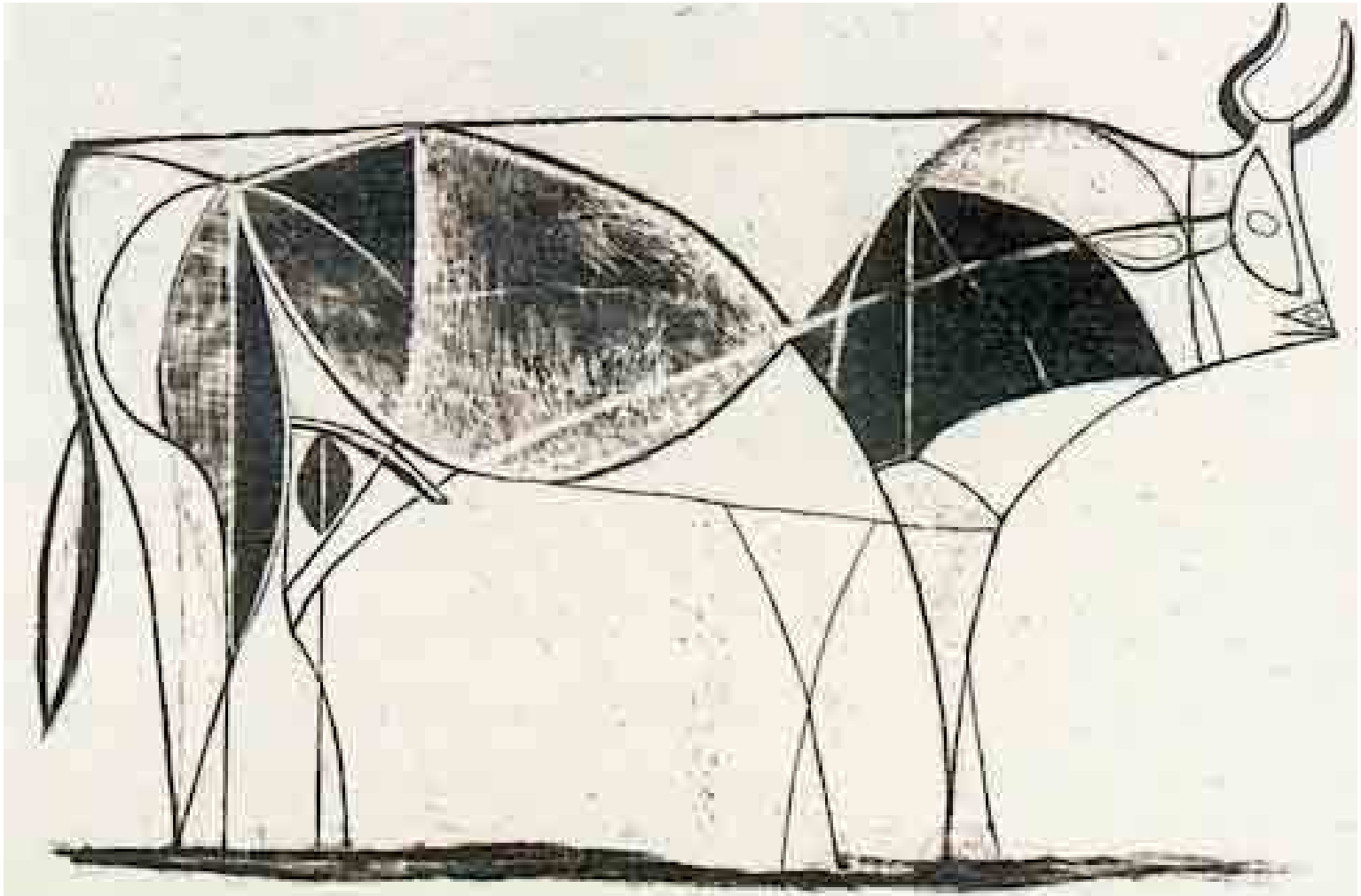


Demarche Scientifique



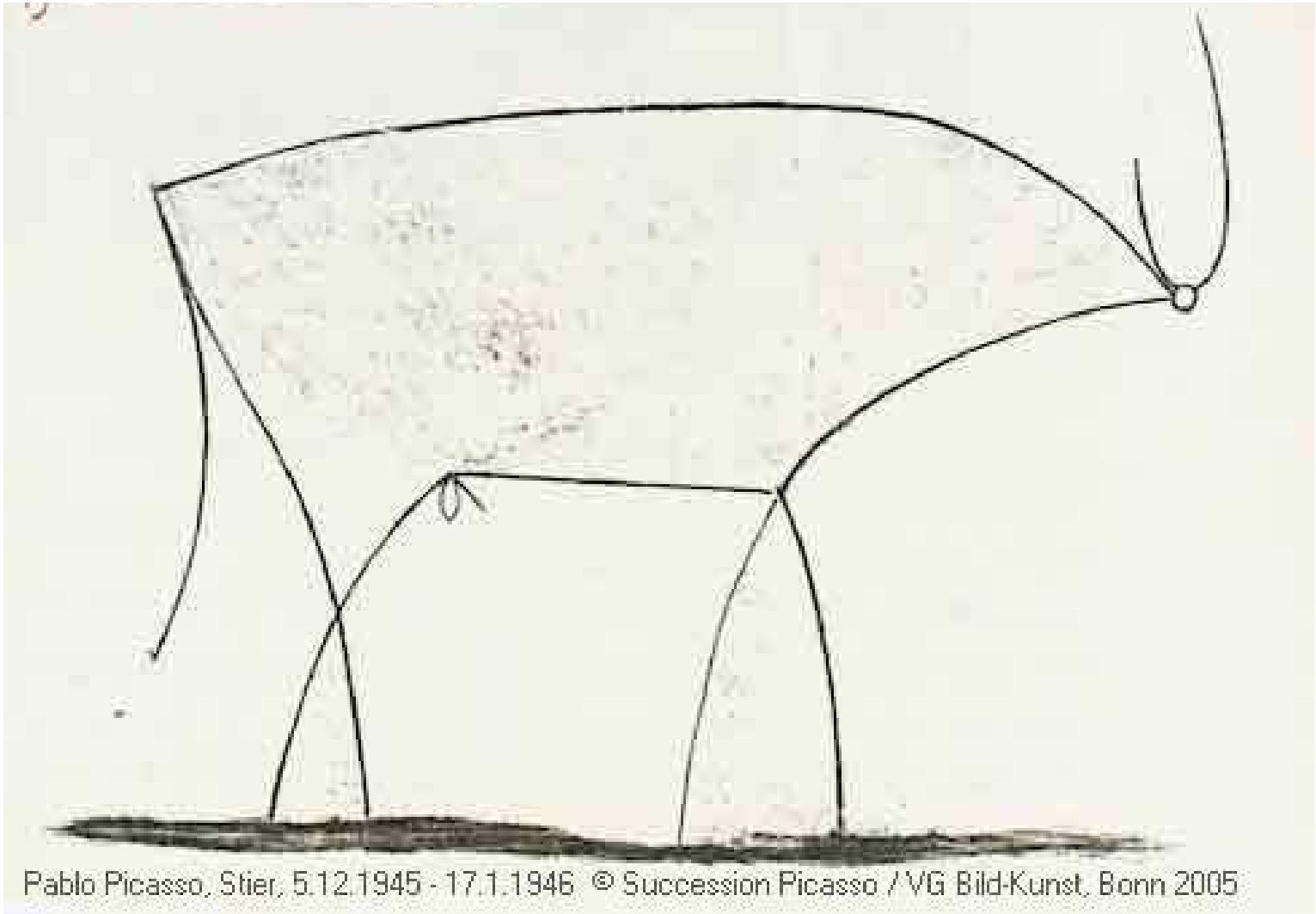
Pablo Picasso, Stier, 5.12.1945 - 17.1.1946 © Succession Picasso / VG Bild-Kunst, Bonn 2005

Demarche Scientifique



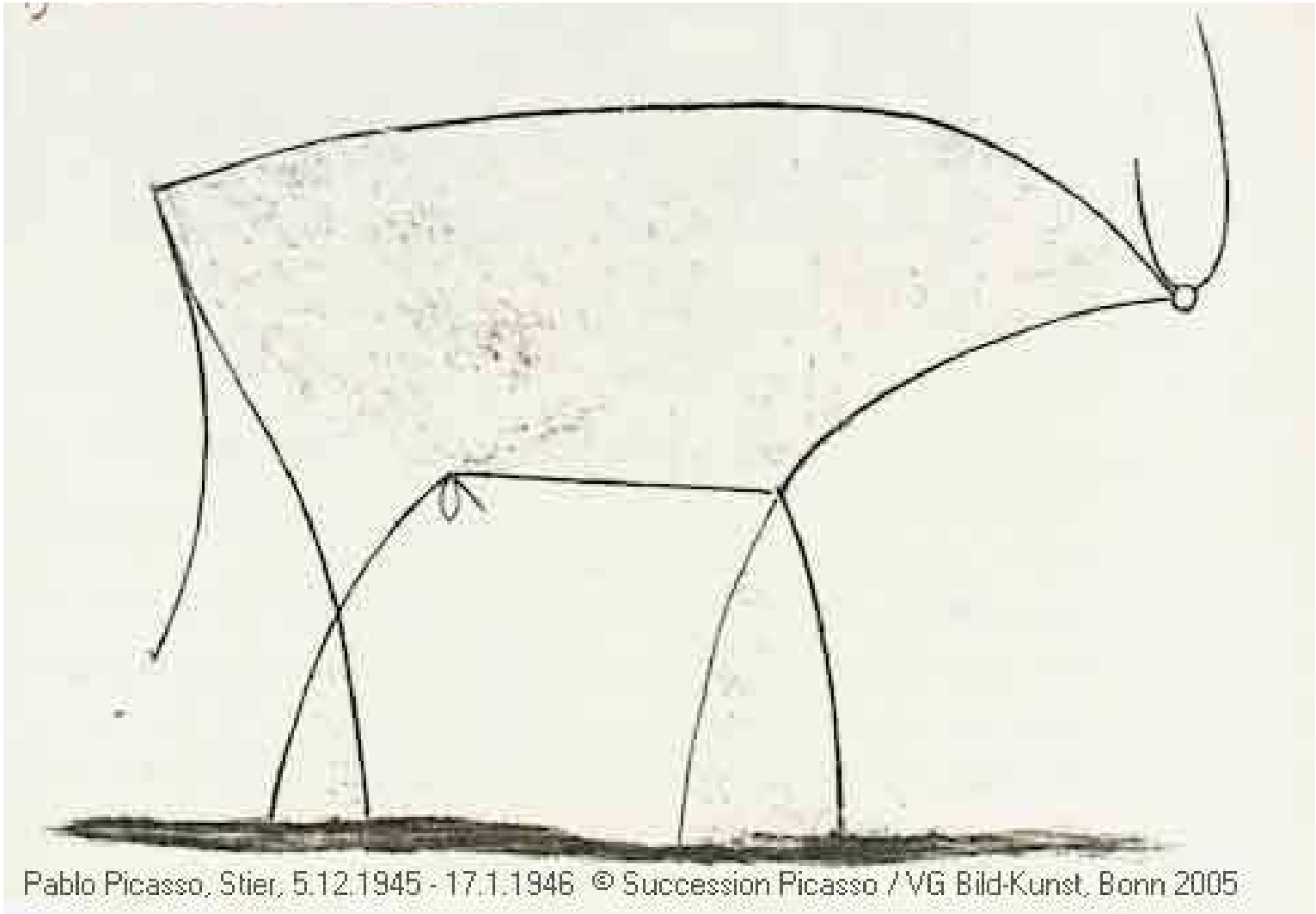
Pablo Picasso. Stier. 5.12.1945 - 17.1.1946 © Succession Picasso / VG Bild-Kunst. Bonn 2005

Demarche Scientifique



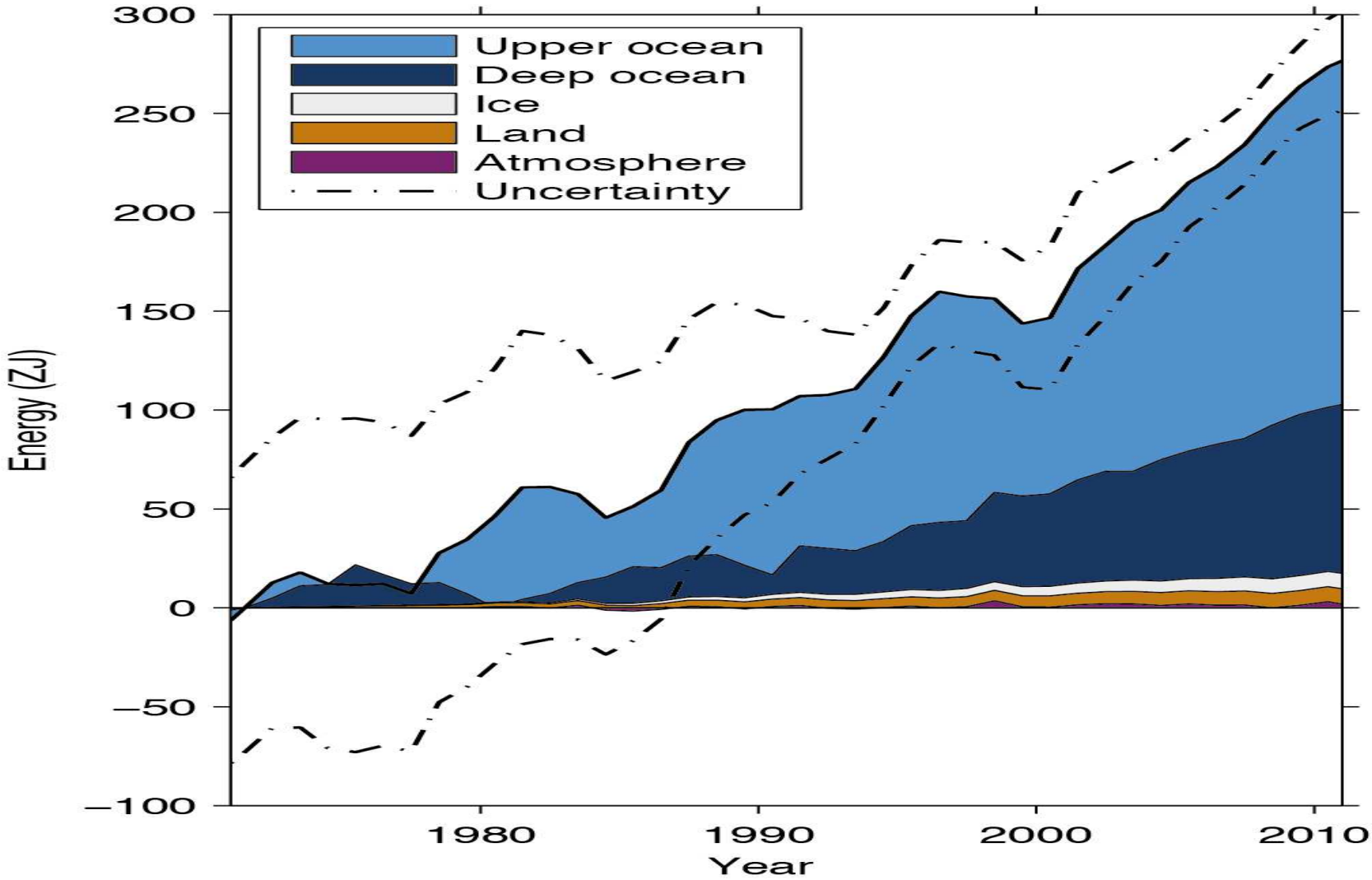
Pablo Picasso, Stier, 5.12.1945 - 17.1.1946 © Succession Picasso / VG Bild-Kunst, Bonn 2005

Demarche Scientifique



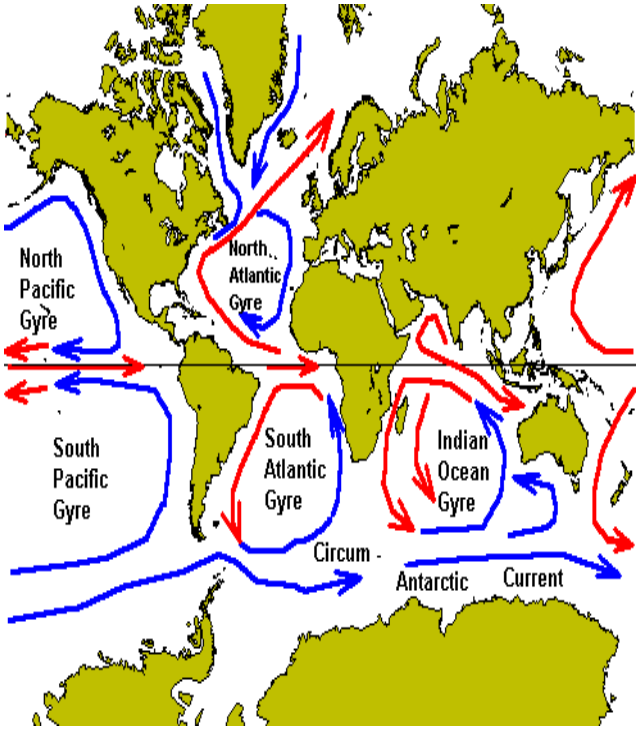
Pablo Picasso, Stier, 5.12.1945 - 17.1.1946 © Succession Picasso / VG Bild-Kunst, Bonn 2005

Heat content (IPCC)

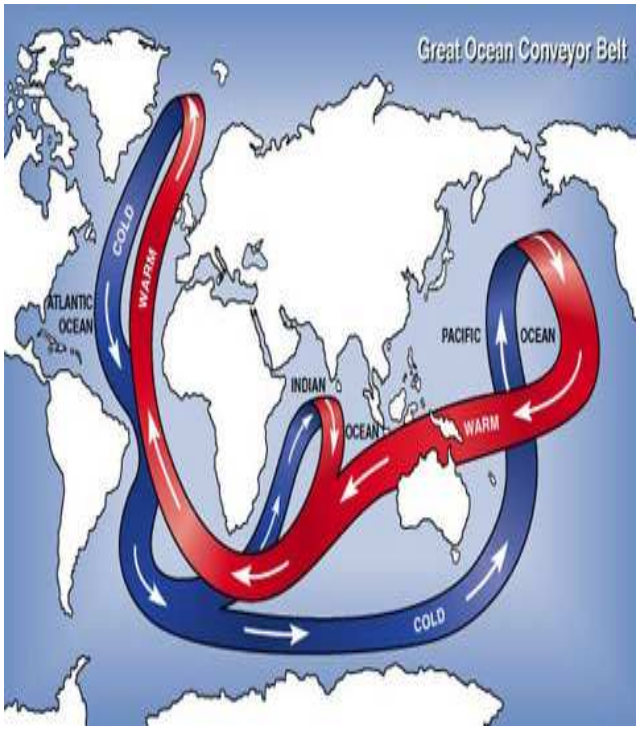


Ocean Circulation

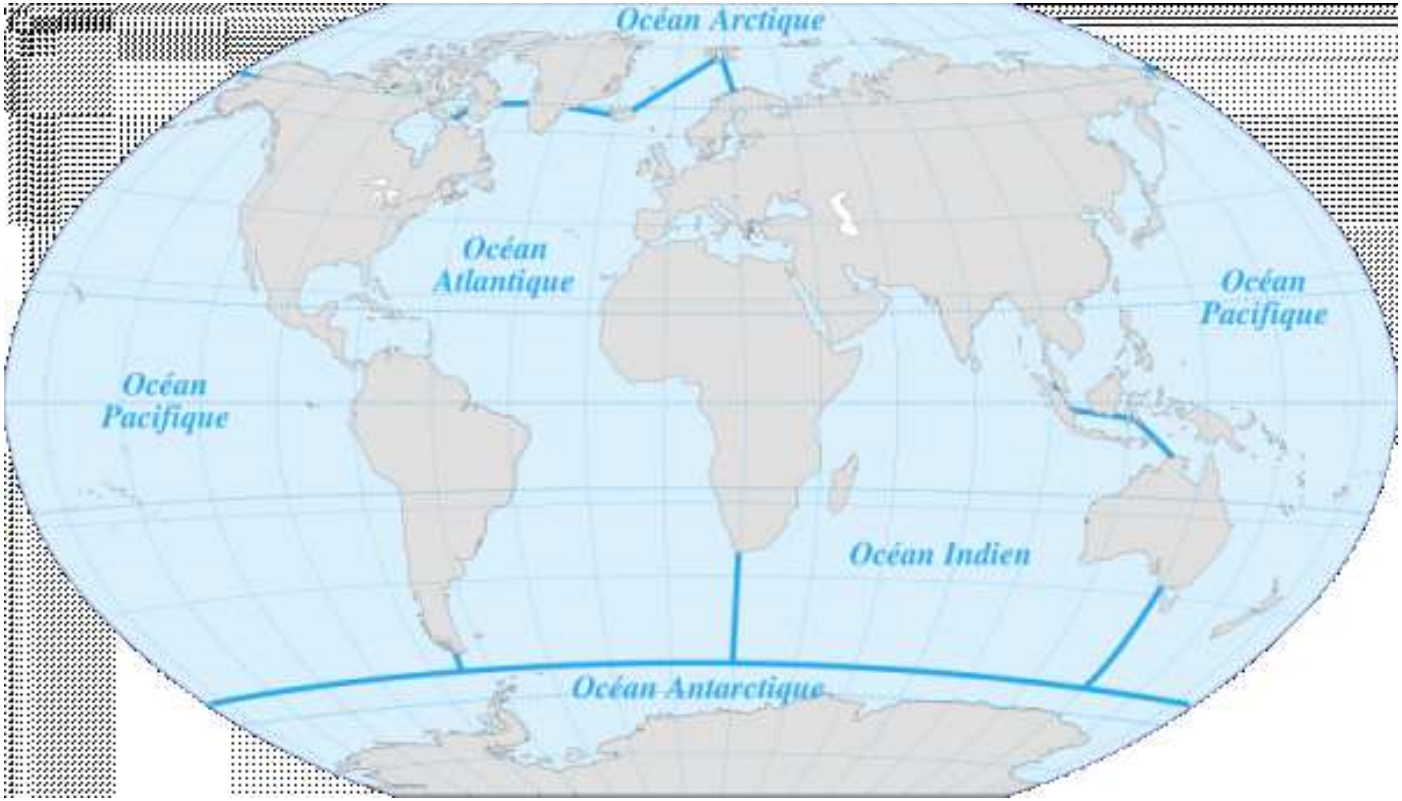
Gyre
"weather"



Overturning
"climat"

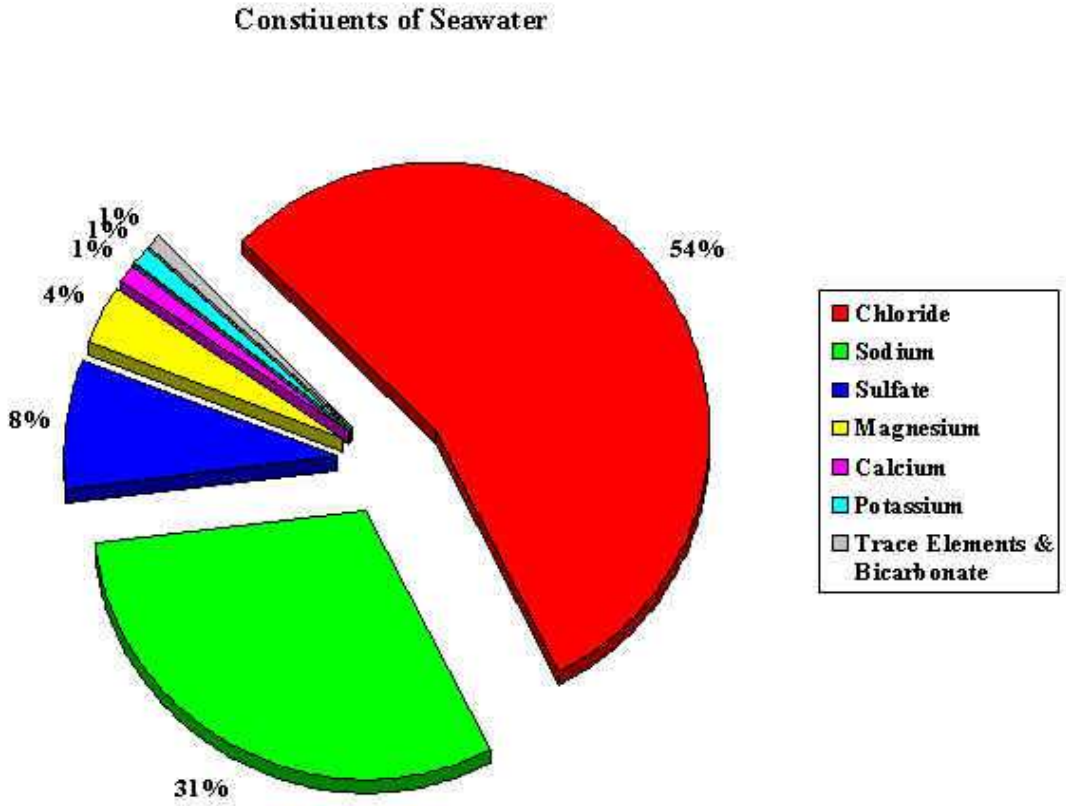


Les Océans

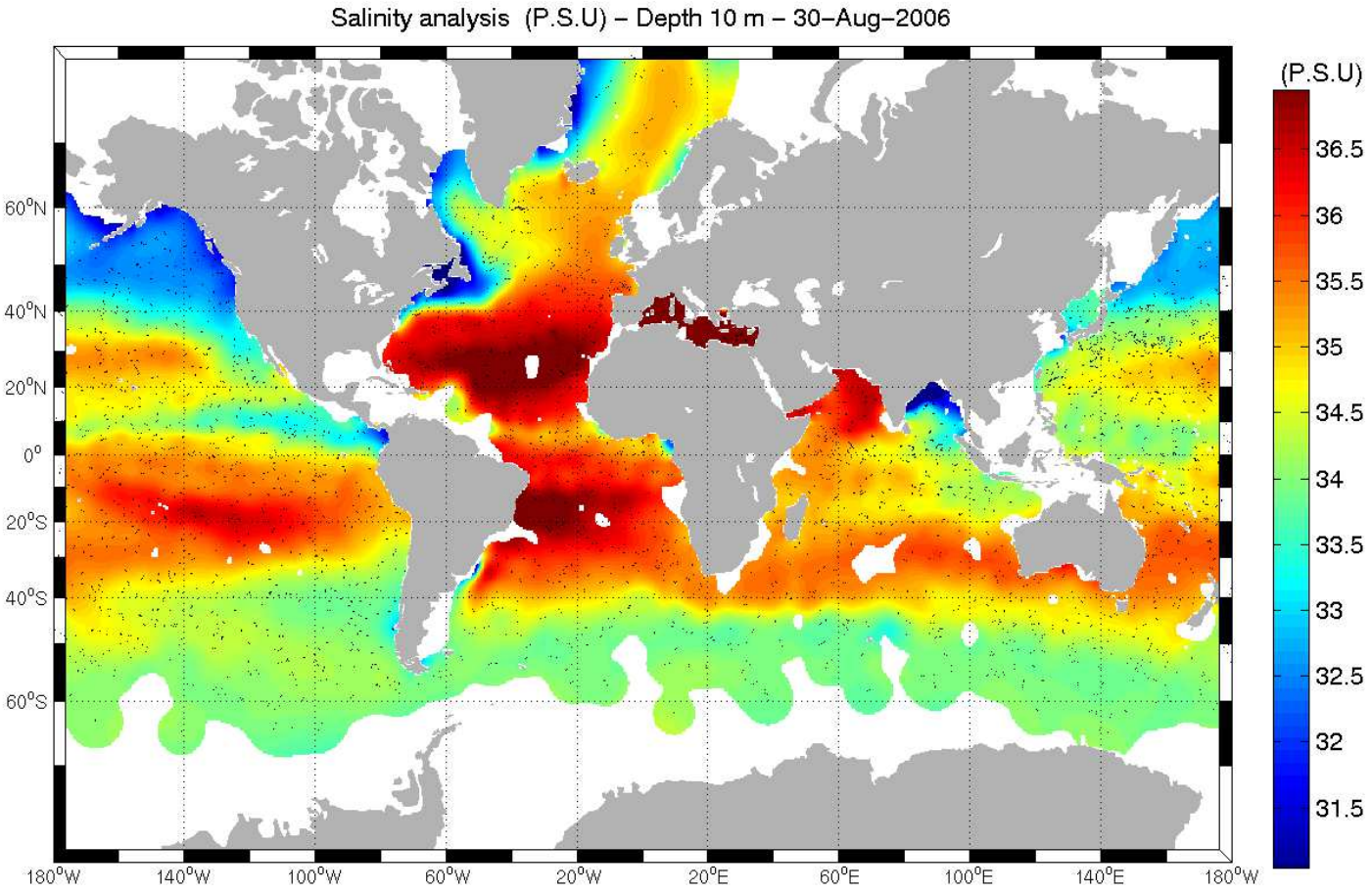

Océan Arctique
Océan Atlantique
Océan Pacifique
Océan Pacifique
Océan Indien
Océan Antarctique

H.M.S. Challenger 1872 – 1876

Principe de Marcet ; Loi de Dittmar

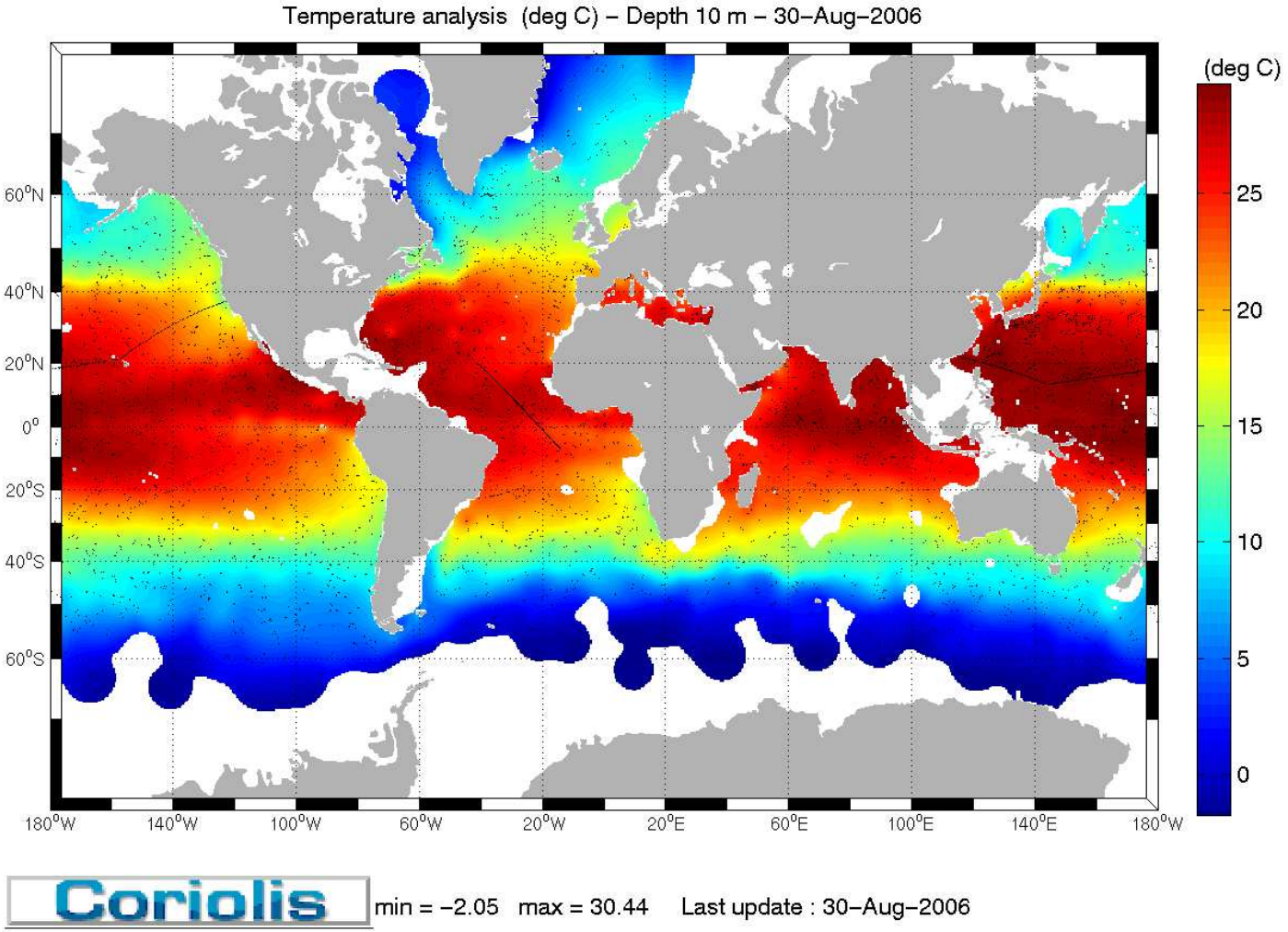


Salinité à 10m



Coriolis min = 18.17 max = 39.58 Last update : 30–Aug–2006

Temp. à 10m


Temperature analysis (deg C) – Depth 10 m – 30–Aug–2006
(deg C)
25
20
15
10
5
0
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
140°W
100°W
60°W
20°W
20°E
60°E
100°E
140°E
180°W
Coriolis
min = –2.05 max = 30.44 Last update : 30–Aug–2006

Temp. vs Temp. potentielle

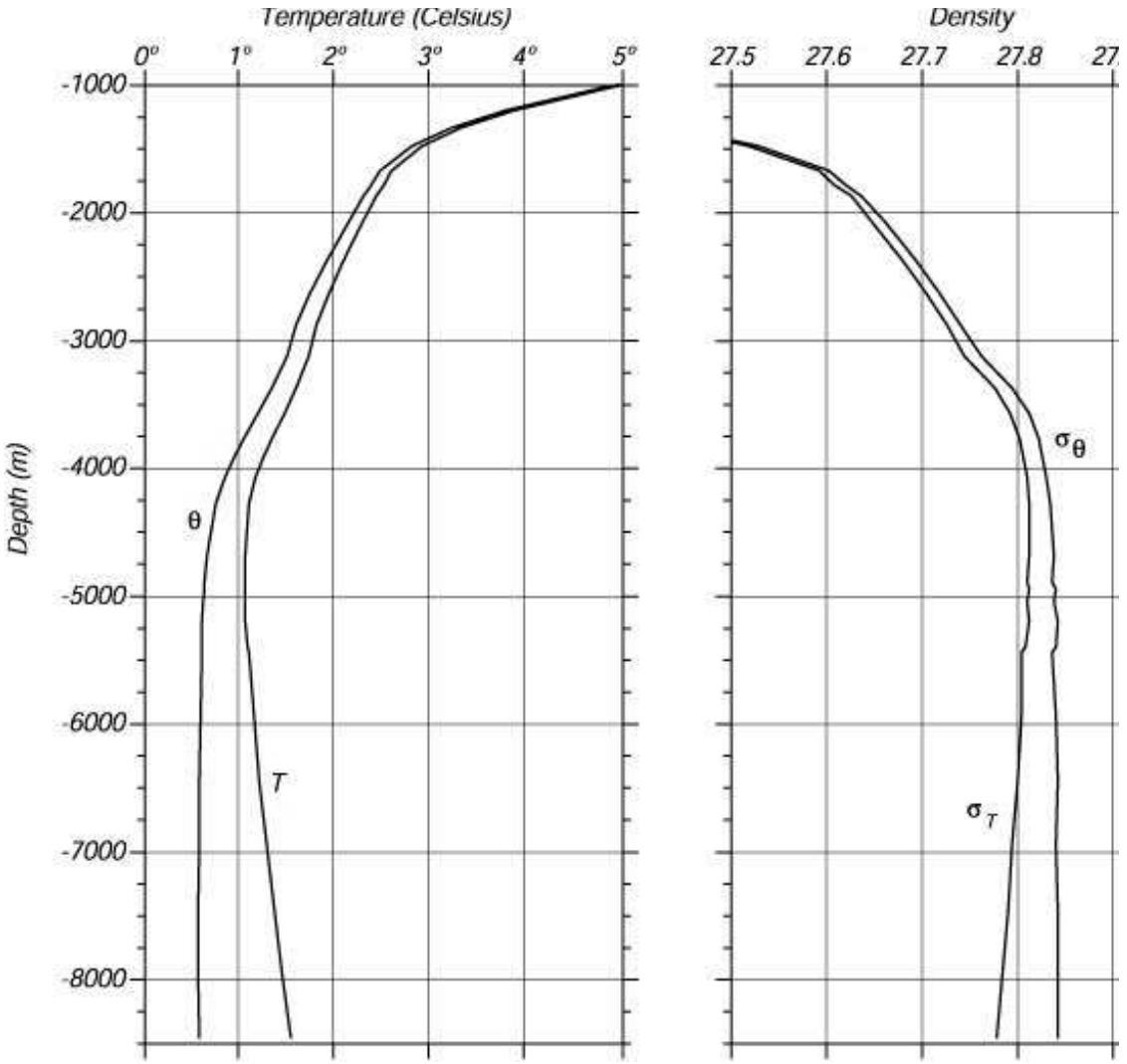
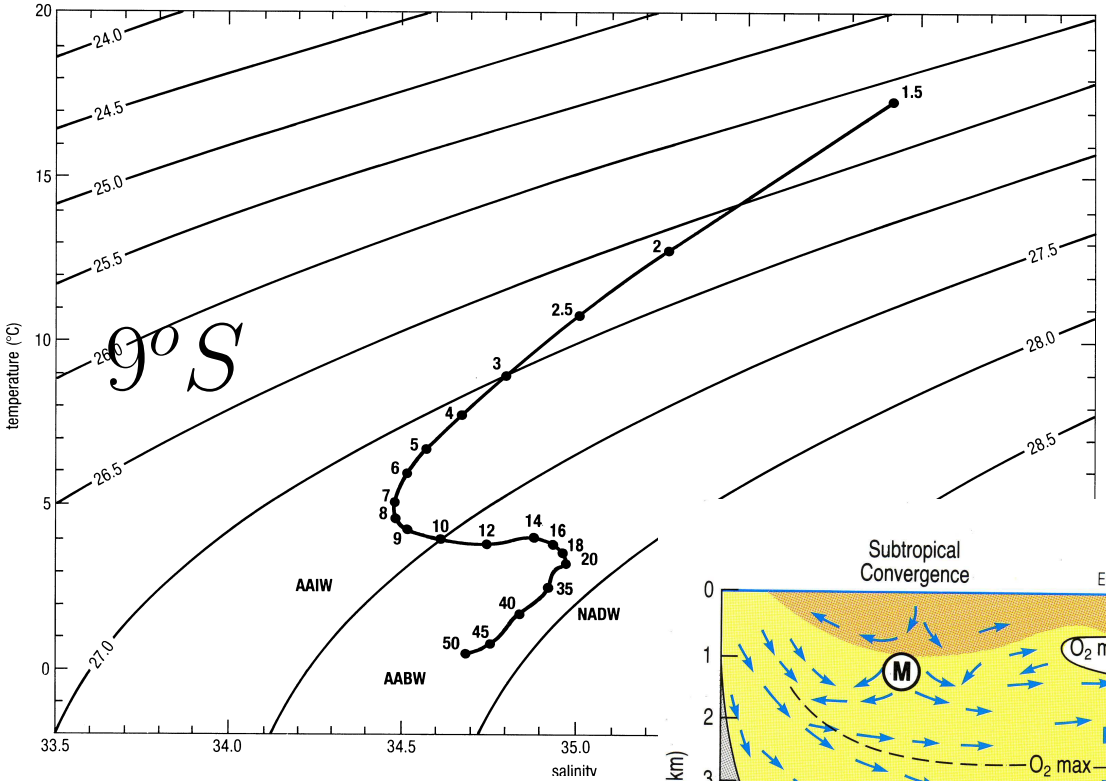


Diagram TS


9° S
temperature (°C)
salinity
24.0
24.5
25.0
25.5
26.0
26.5
27.0
27.5
28.0
28.5
AAIW
AABW
NADW
1.5
2
2.5
3
4
5
6
7
8
9
10
12
14
16
18
20
35
40
45
50

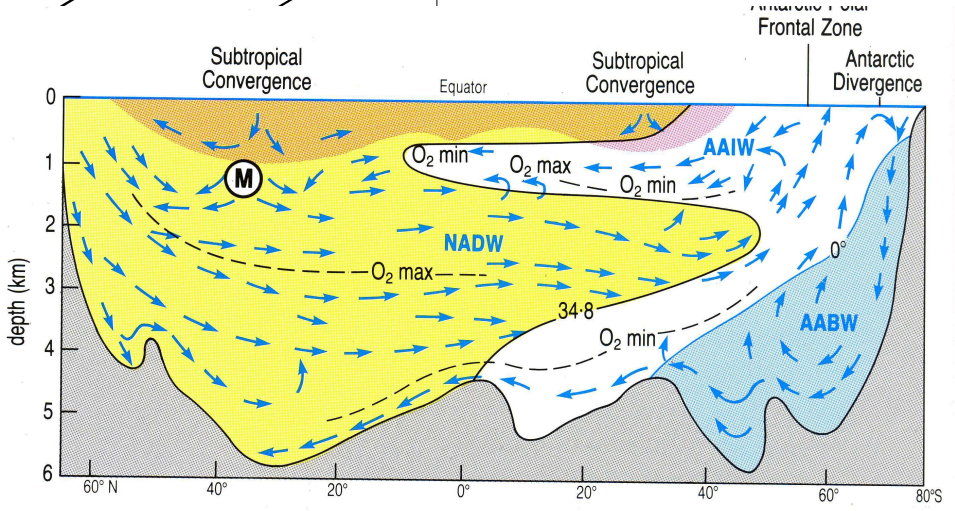

Subtropical Convergence
Equator
Subtropical Convergence
Antarctic Divergence
Frontal Zone
M
O2 min
O2 max
O2 min
AAIW
NADW
O2 max
34·8
0°
O2 min
AABW
depth (km)
60° N
40°
20°
0°
20°
40°
60°
80°S

Diagram TS

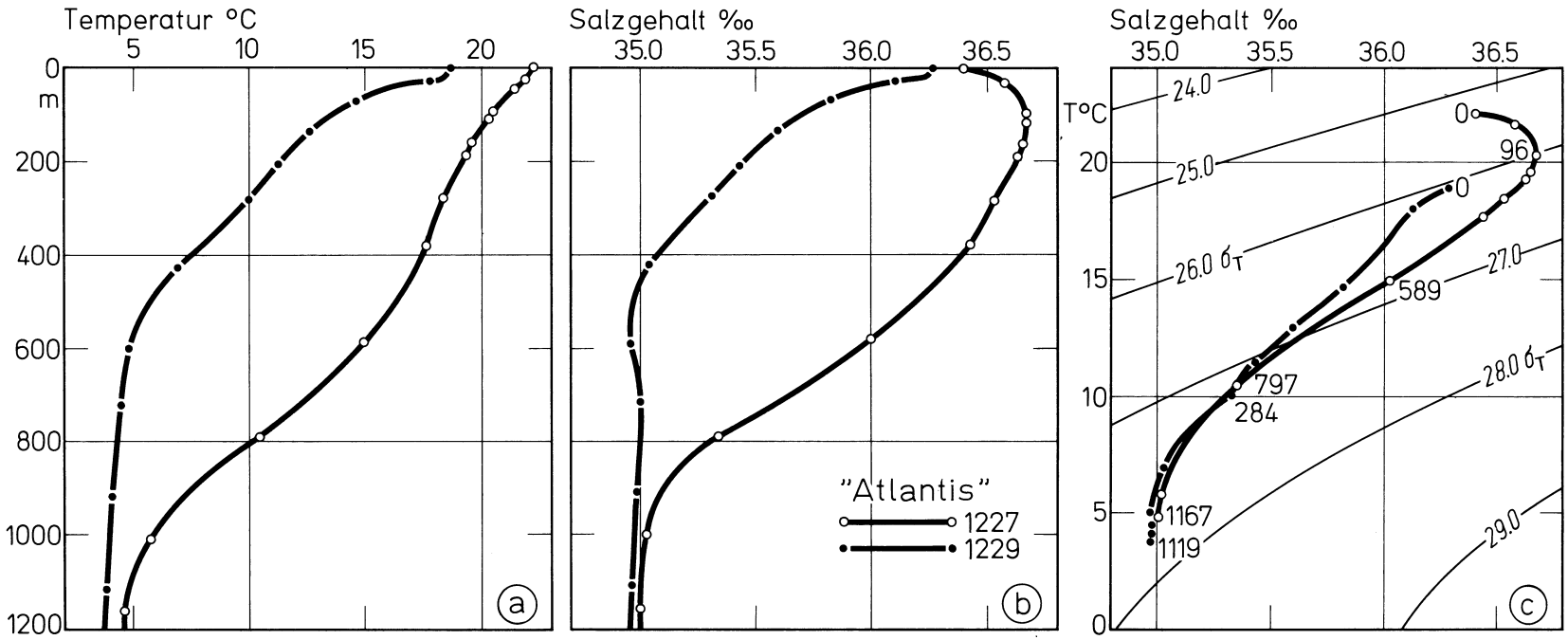


Abb. 5.16. Beziehung zwischen Temperatur und Salzgehalt auf den beiden benachbarten Stationen

Diagram TS-Volumique

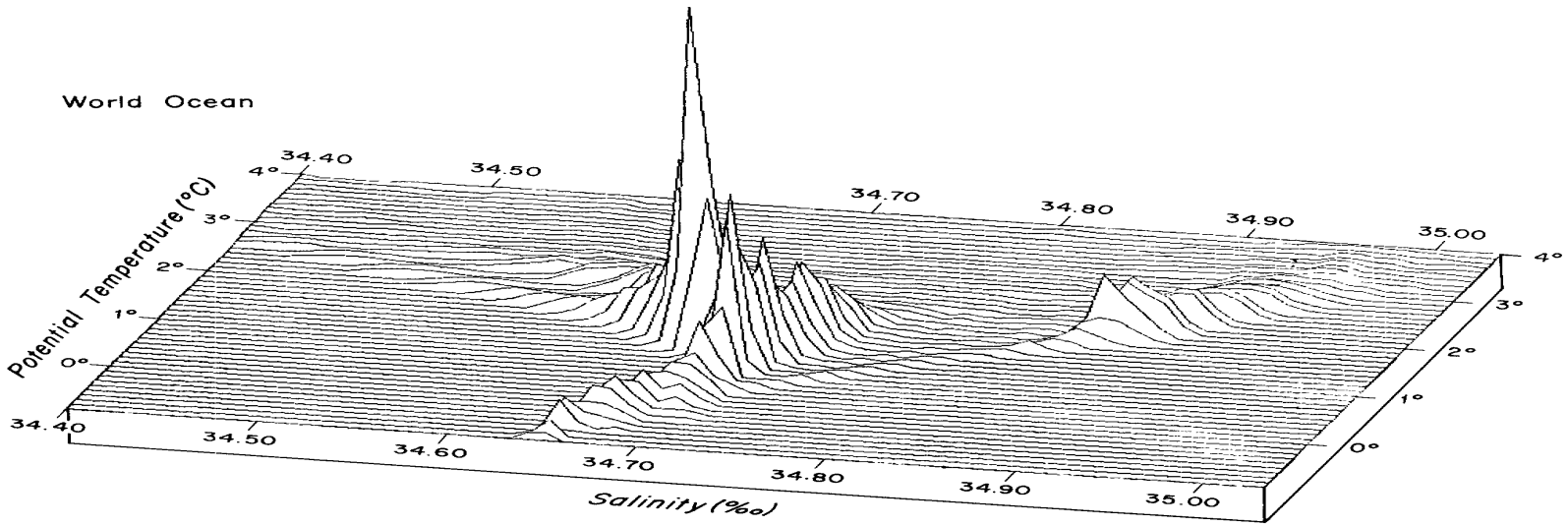


Diagram TS-Volumique

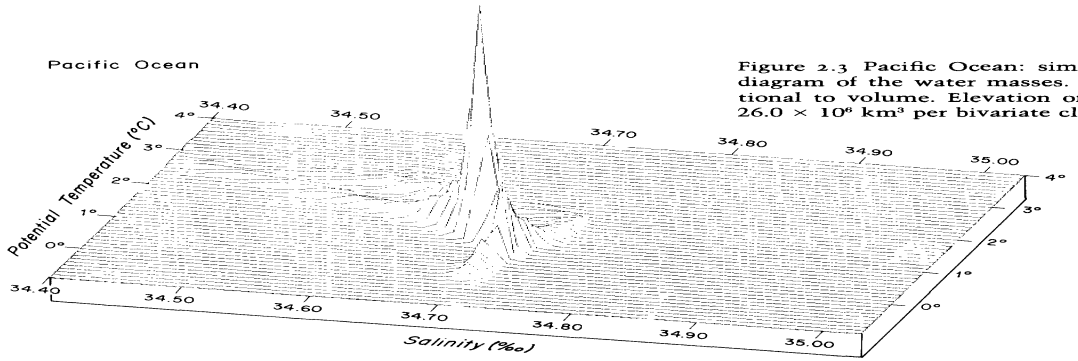


Figure 2.3 Pacific Ocean: simulated three-dimensional T–S diagram of the water masses. Apparent elevation is proportional to volume. Elevation of highest peak corresponds to 26.0×10^6 km^3 per bivariate class 0.1°C $\times$ 0.01‰.

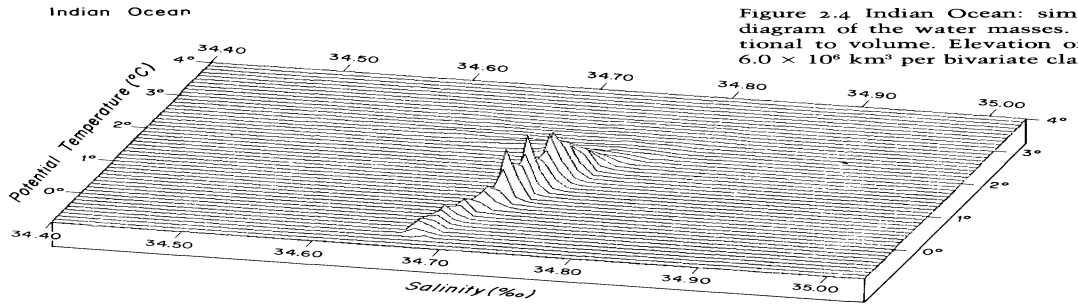


Figure 2.4 Indian Ocean: simulated three-dimensional T–S diagram of the water masses. Apparent elevation is proportional to volume. Elevation of highest peak corresponds to 6.0×10^6 km^3 per bivariate class 0.1°C $\times$ 0.01‰.

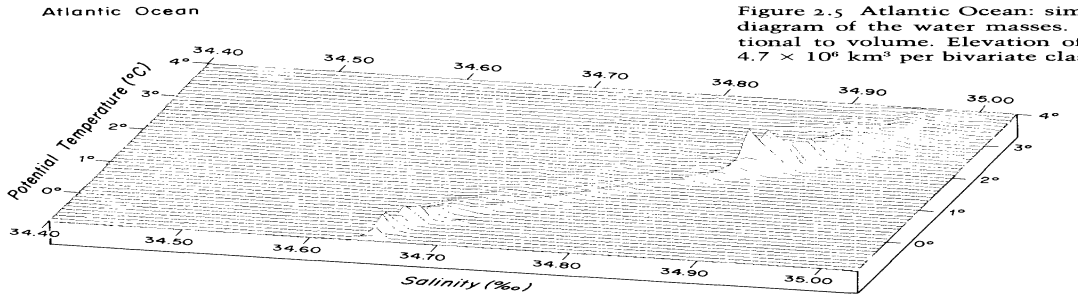
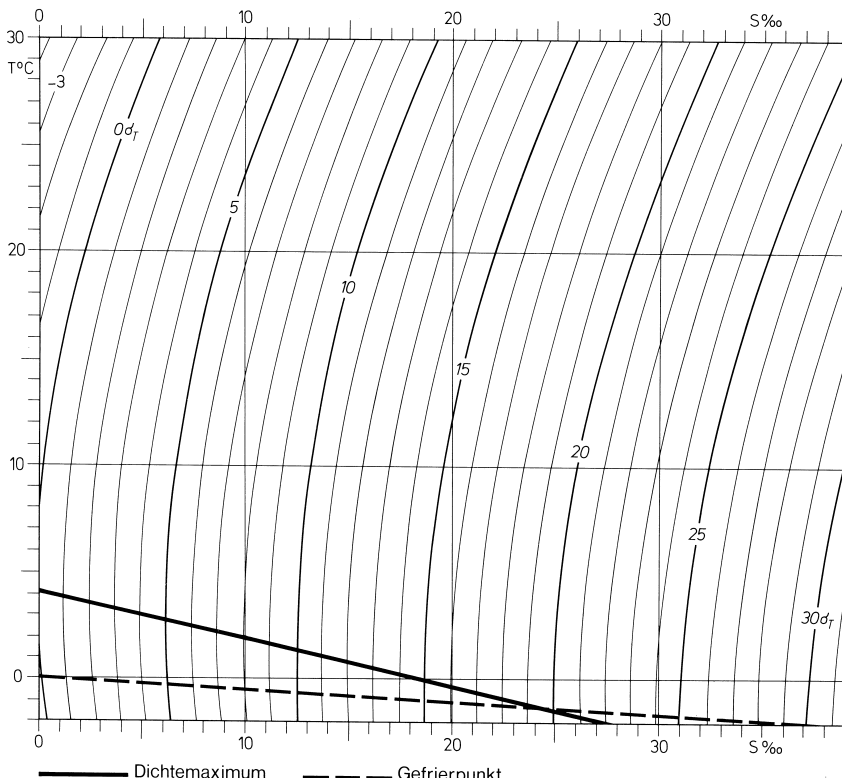


Figure 2.5 Atlantic Ocean: simulated three-dimensional T–S diagram of the water masses. Apparent elevation is proportional to volume. Elevation of highest peak corresponds to 4.7×10^6 km^3 per bivariate class 0.1°C $\times$ 0.01‰.

Densité et Congélation



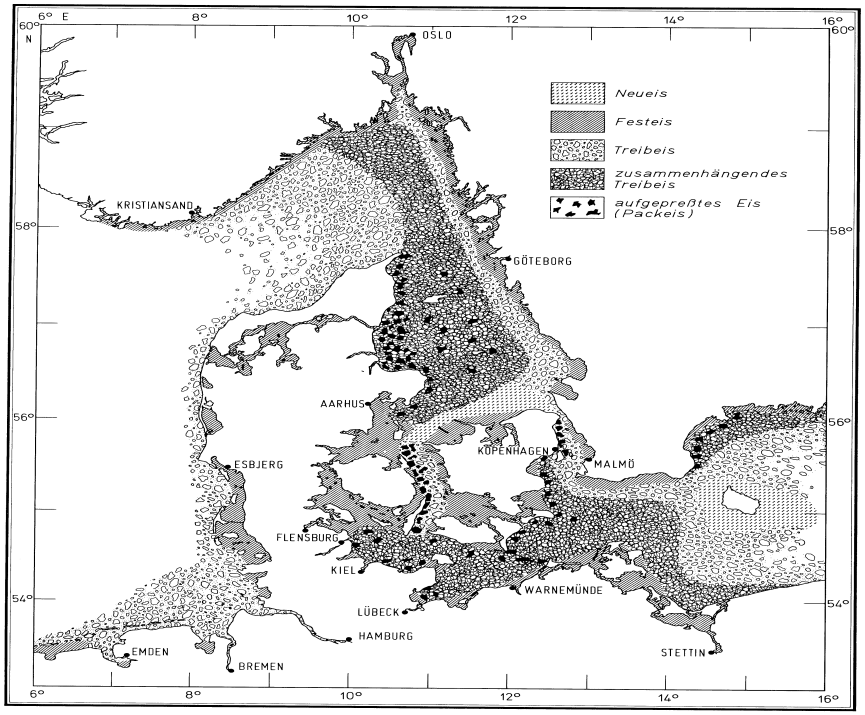


Abb. 5.32. Eisverhältnisse in der östlichen Nordsee und westlichen Ostsee am 20. Februar 1963 (nach Eisübersichtskarte des Deutschen Hydrographischen Instituts, Hamburg). Stellt maximale Eisbedeckung im Zeitraum 1896–1971 dar.

Equation d'état (UNESCO)

The One Atmosphere International Equation of State of Seawater, 1980

Definition

The density (ρ, kg m^{-3}) of seawater at one standard atmosphere ($p = o$) is to be computed from the practical salinity (S) and the temperature (t, °C) with the following equation :

$$\rho(S,t,o) = \rho_w + (8.244\ 93 \times 10^{-1} - 4.0899 \times 10^{-3}\ t + 7.6438 \times 10^{-5}\ t^2 - 8.2467 \times 10^{-7}\ t^3 + 5.3875 \times 10^{-9}\ t^4)S + (-5.724\ 66 \times 10^{-3} + 1.0227 \times 10^{-4}\ t - 1.6546 \times 10^{-6}\ t^2)S^{3/2} + 4.8314 \times 10^{-4}\ S^2$$

where ρ_w, the density of the Standard Mean Ocean Water (SMOW) taken as pure water reference, is given by

$$\rho_w = 999.842\ 594 + 6.793\ 952 \times 10^{-2}\ t - 9.095\ 290 \times 10^{-3}\ t^2 + 1.001\ 685 \times 10^{-4}\ t^3 - 1.120\ 083 \times 10^{-6}\ t^4 + 6.536\ 332 \times 10^{-9}\ t^5$$

The one atmosphere International Equation of State of Seawater, 1980 is valid for practical salinity from 0 to 42 and temperature from −2 to 40°C.

The High Pressure International Equation of State of Seawater, 1980

Definition

The density (ρ, kg m^{-3}) of seawater at high pressure is to be computed from the practical salinity (S), the temperature (t, °C) and the applied pressure (p, bars) with the following equation :

$$\rho(S,t,p) = \frac{\rho(S,t,o)}{1 - p/K(S,t,p)}$$

where $\rho(S,t,o)$ is the one atmosphere International Equation of State 1980, given on the preceding front page and $K(S,t,p)$ is the secant bulk modulus given by

$$K(S,t,p) = K(S,t,o) + Ap + Bp^2$$

where

$$K(S,t,o) = K_w + (54.6746 - 0.603\ 459\ t + 1.099\ 87 \times 10^{-2}\ t^2 - 6.1670 \times 10^{-5}\ t^3)S + (7.944 \times 10^{-2} + 1.6483 \times 10^{-2}\ t - 5.3009 \times 10^{-4}\ t^2)\ S^{3/2},$$

$$A = A_w + (2.2838 \times 10^{-3} - 1.0981 \times 10^{-5}\ t - 1.6078 \times 10^{-6}\ t^2)S + 1.910\ 75 \times 10^{-4}\ S^{3/2}$$

$$B = B_w + (-9.9348 \times 10^{-7} + 2.0816 \times 10^{-8}\ t + 9.1697 \times 10^{-10}\ t^2)S$$

the pure water terms K_w, A_w and B_w of the secant bulk modulus are given by

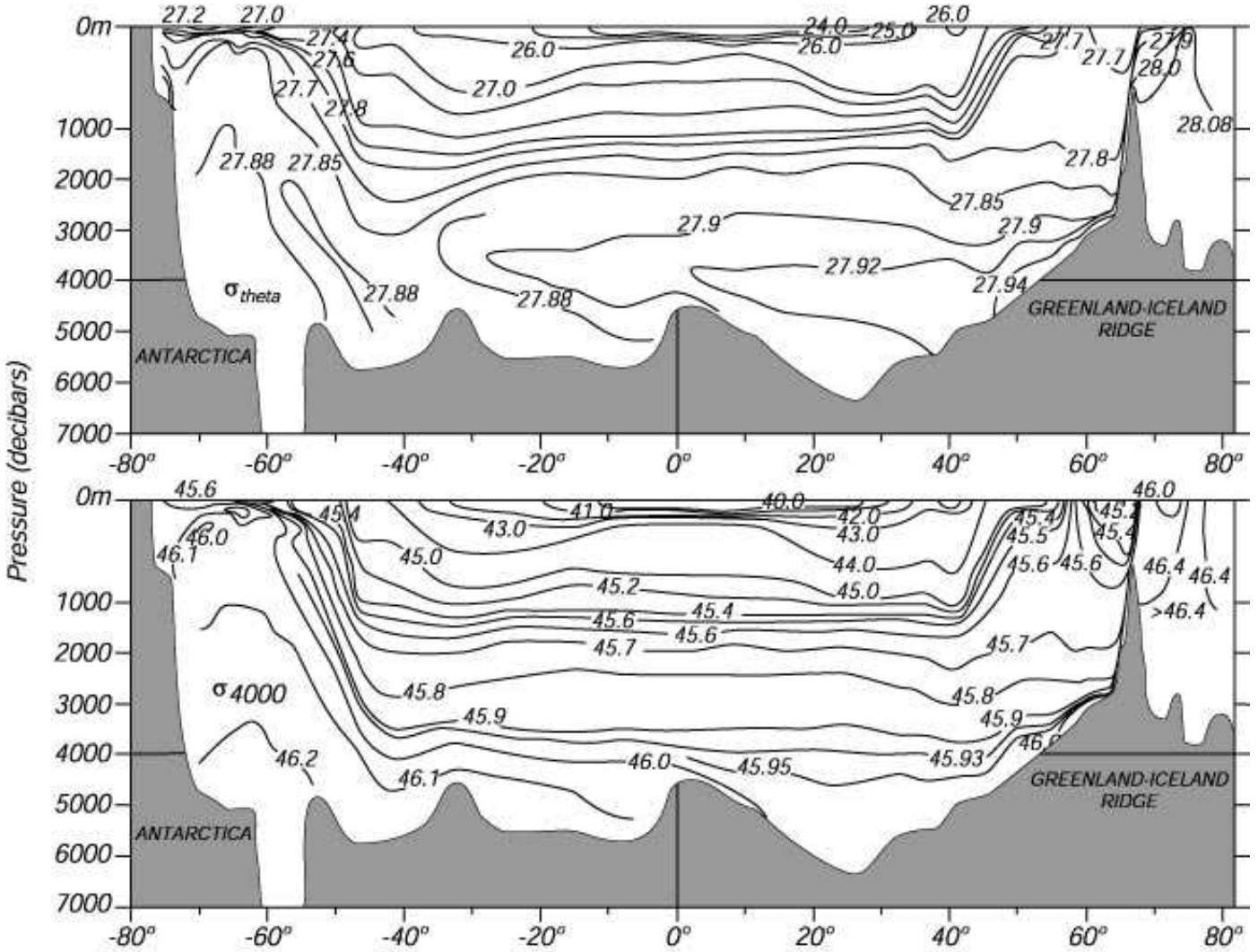
$$K_w = 19\ 652.21 + 148.4206\ t - 2.327\ 105\ t^2 + 1.360\ 477 \times 10^{-2}\ t^3 - 5.155\ 288 \times 10^{-5}\ t^4$$

$$A_w = 3.239\ 908 + 1.437\ 13 \times 10^{-3}\ t + 1.160\ 92 \times 10^{-4}\ t^2 - 5.779\ 05 \times 10^{-7}\ t^3$$

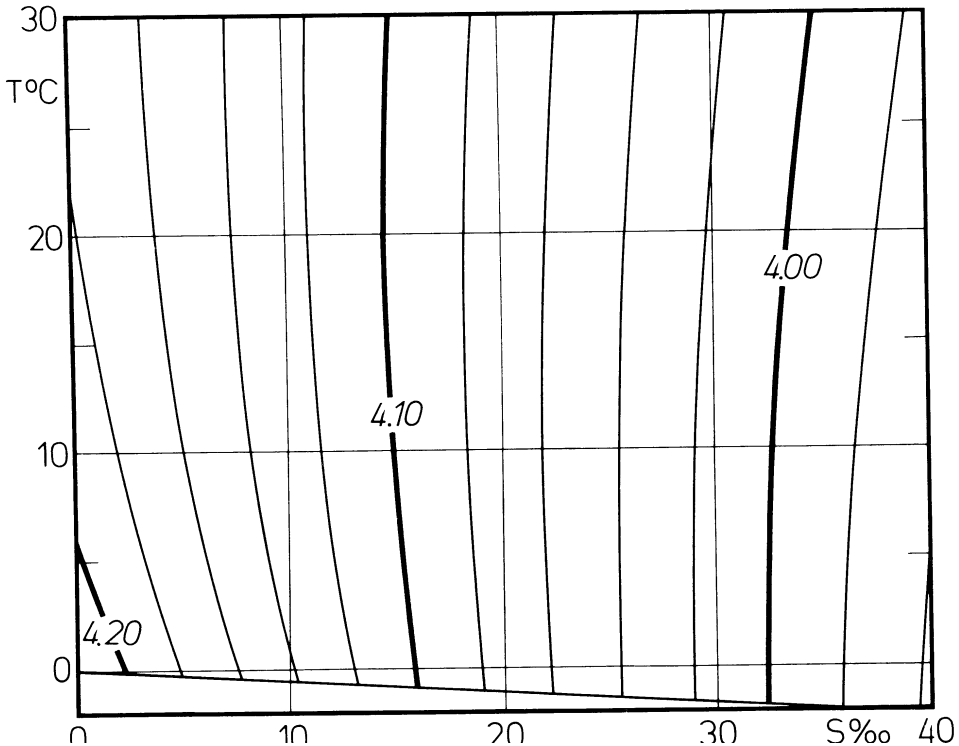
$$B_w = 8.509\ 35 \times 10^{-5} - 6.122\ 93 \times 10^{-6}\ t + 5.2787 \times 10^{-8}\ t^2$$

The high pressure International Equation of State of Seawater, 1980 is valid for practical salinity from 0 to 42, temperature from −2 to 40°C and applied pressure from 0 to 1000 bars.

Thermobaricity ; σ_θ vs σ_{4000}



Cappacité de Chaleur Massique



Sea Ice

Sea Ice

Sea Ice