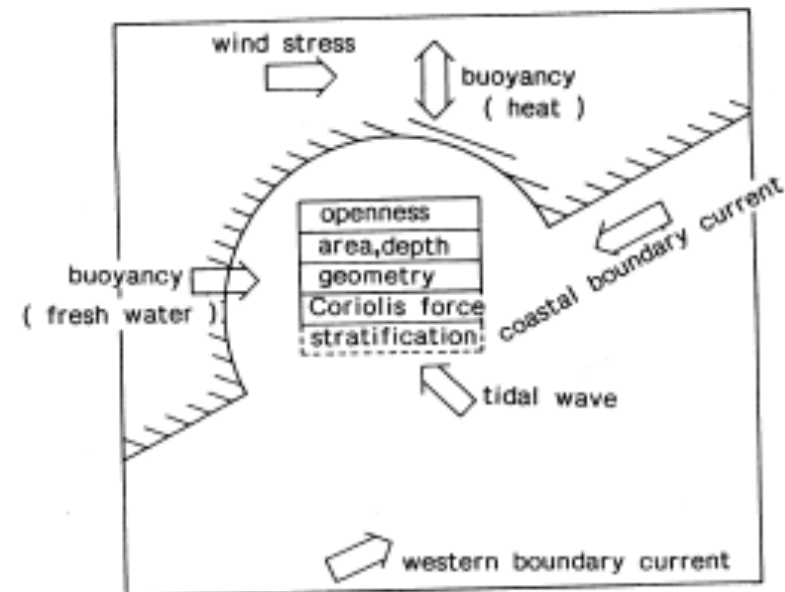




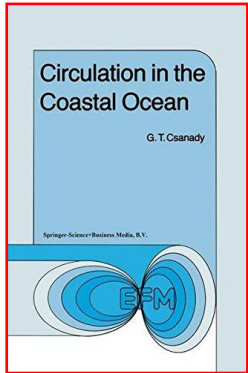
Alma Mater Studiorum Università di Bologna
Laurea Magistrale in Fisica del Sistema Terra
Corso: Oceanografia Costiera
Marco.Zavatarelli@unibo.it

General Introduction



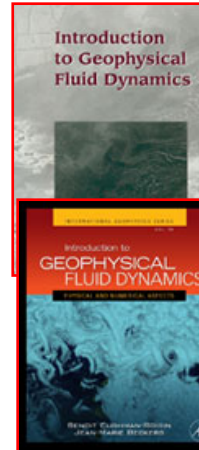


Reference books



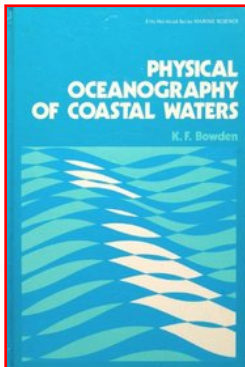
Main text

G.T Csanady: Circulation in the coastal ocean.
Springer or Dordrecht

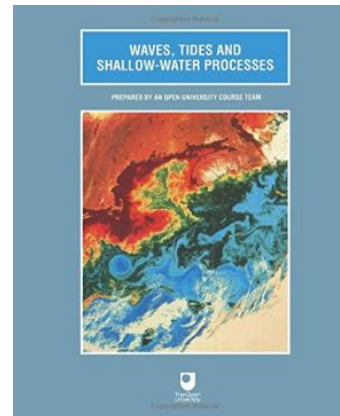


B. Cushman-Roisin
introduction to Geophysical fluid
Dynamics .Wiley.

B. Cushman-Roisin, J. M. Beckers
introduction to Geophysical fluid
Dynamics. Physical and numerical
Aspects Wiley.



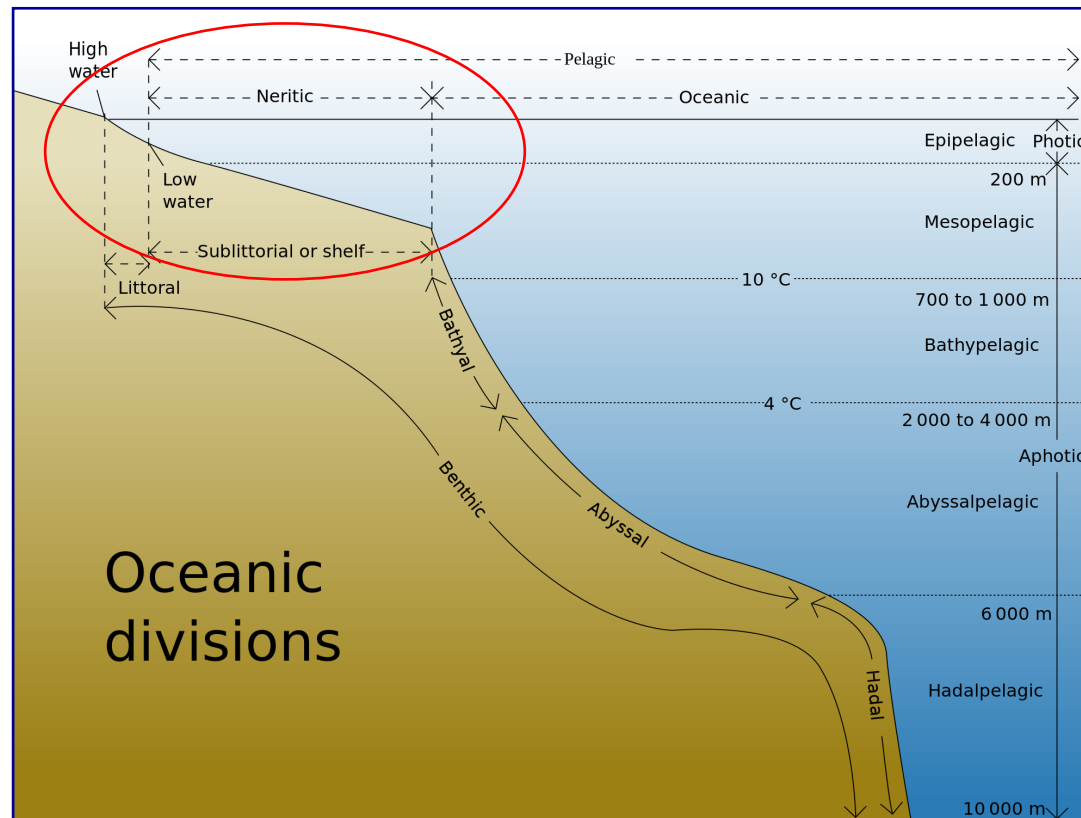
K.F. Bowden
Physical Oceanography
Of coastal waters
Wiley.



Open University
Waves, Tides and shallow water
processes

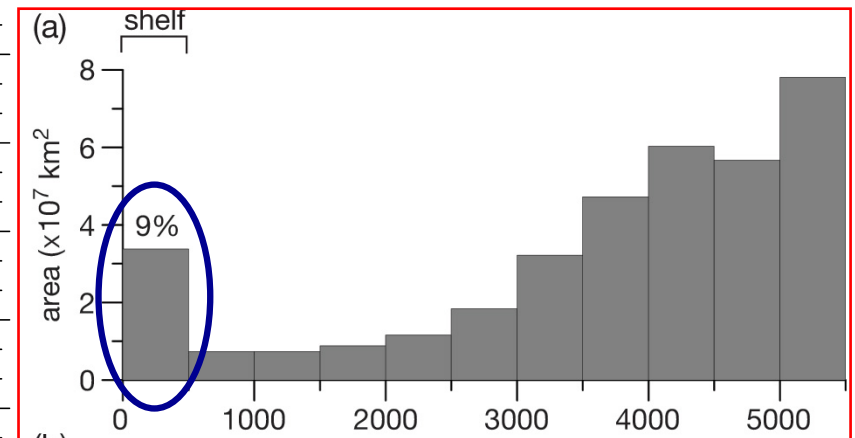
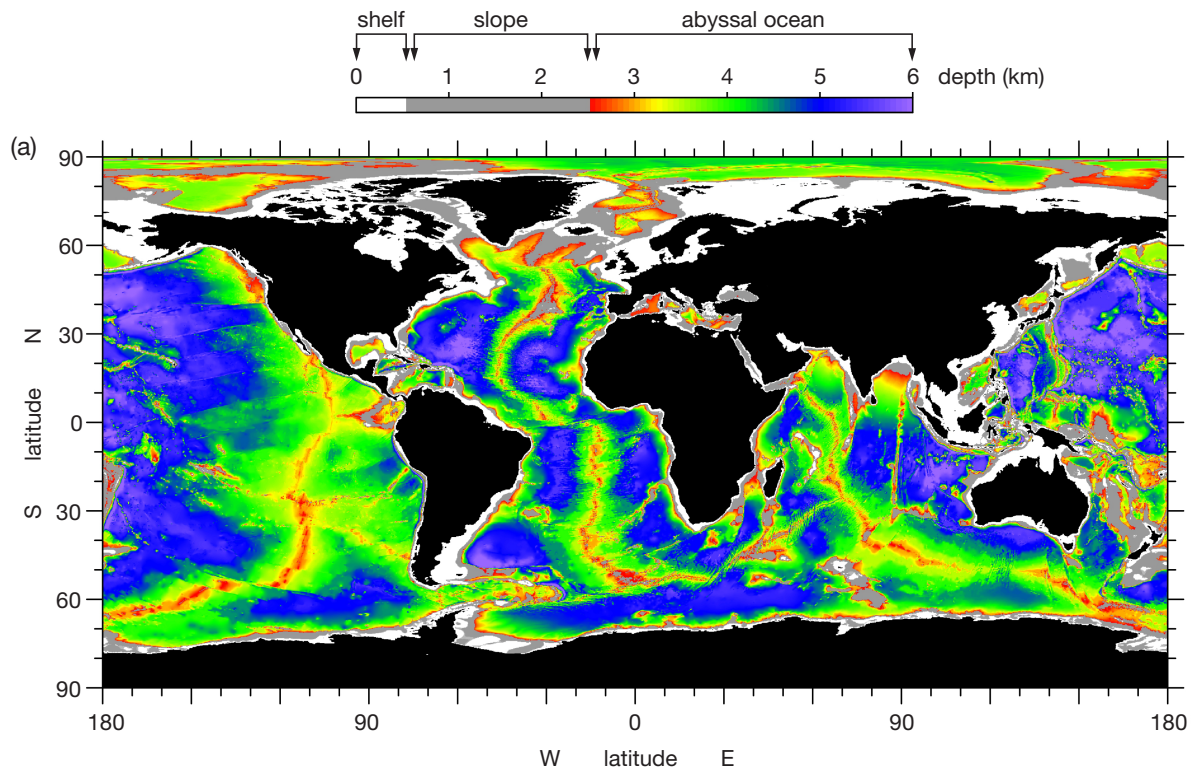
The Coastal Ocean

The Coastal Ocean: The portion of the ocean lying over the sea-bottom, extending from the shore to the depth corresponding to the shelf break (200-500 m)



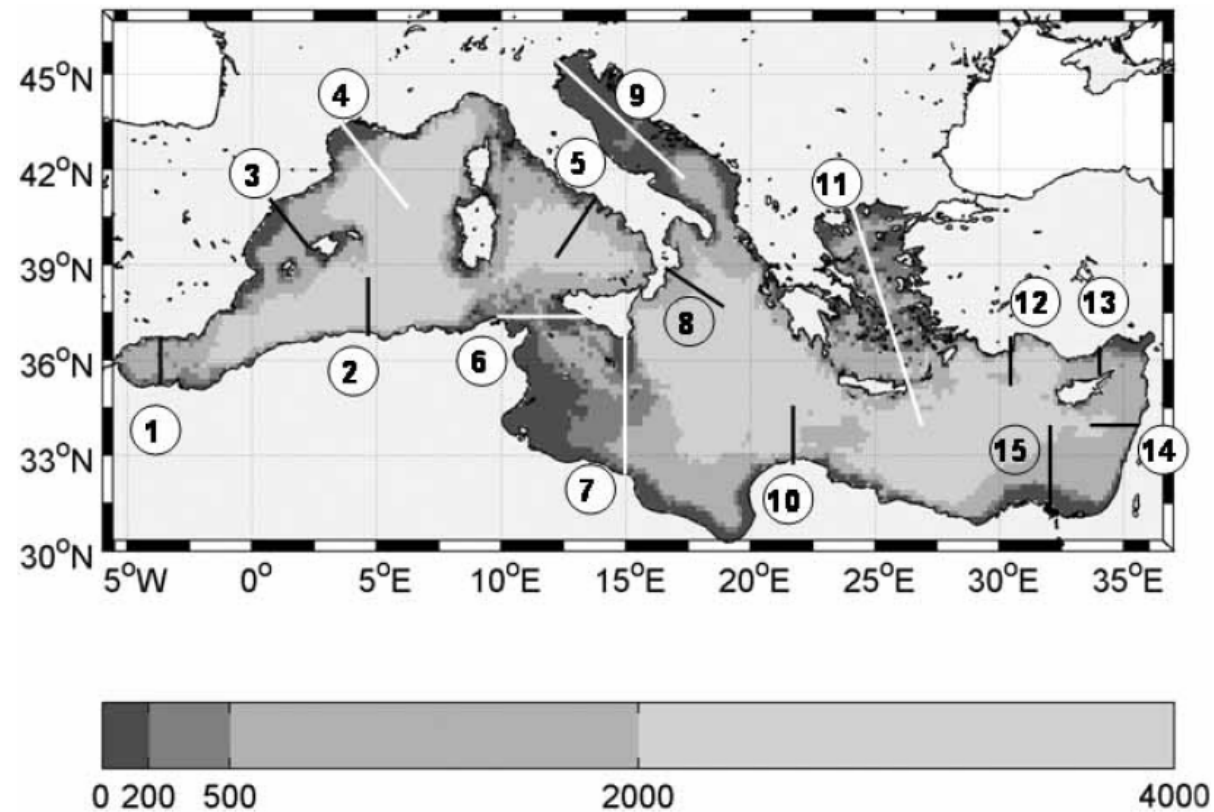
The Coastal Ocean

The Coastal Ocean: A relatively small portion of the global Ocean.....



The Coastal Ocean

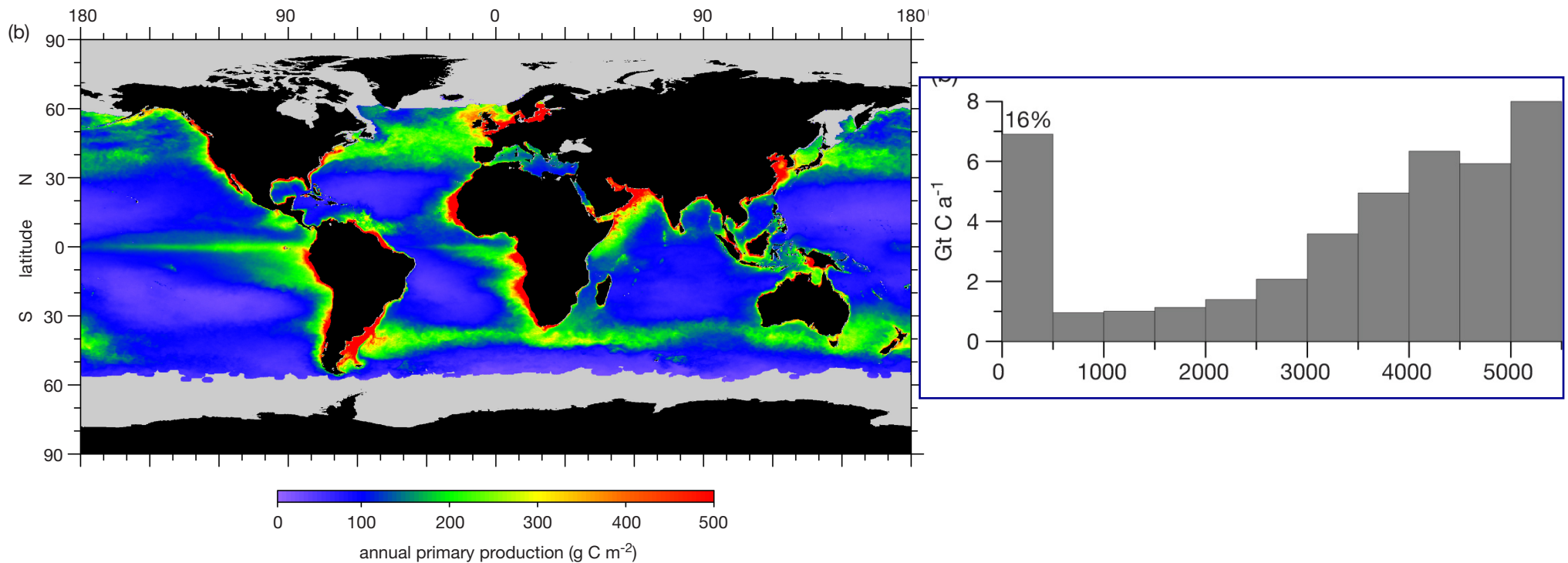
The Coastal Ocean: small portion of the Mediterranean.....





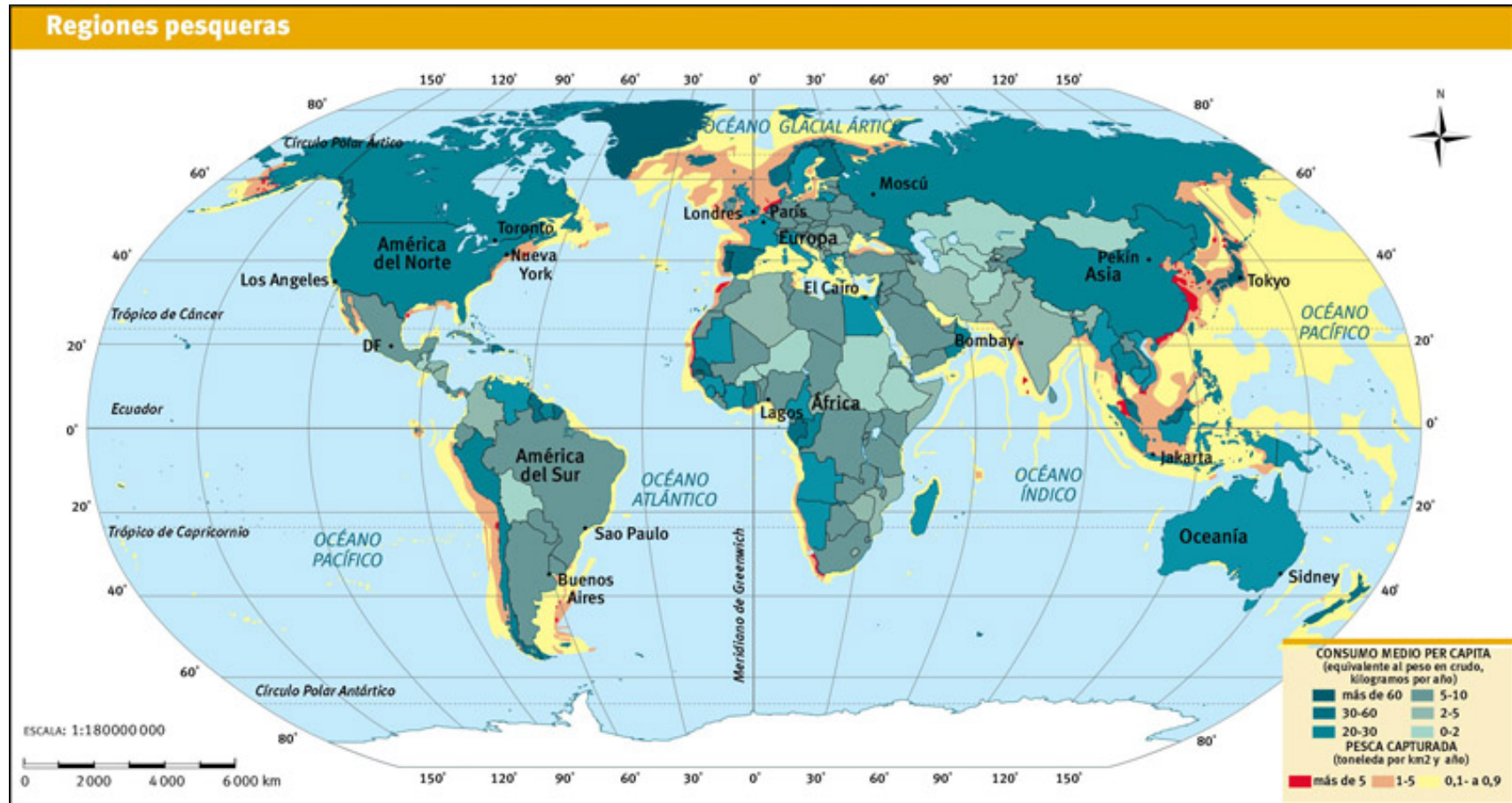
The Coastal Ocean

The Coastal Ocean: small but very important.....



Annual Oceanic Primary production

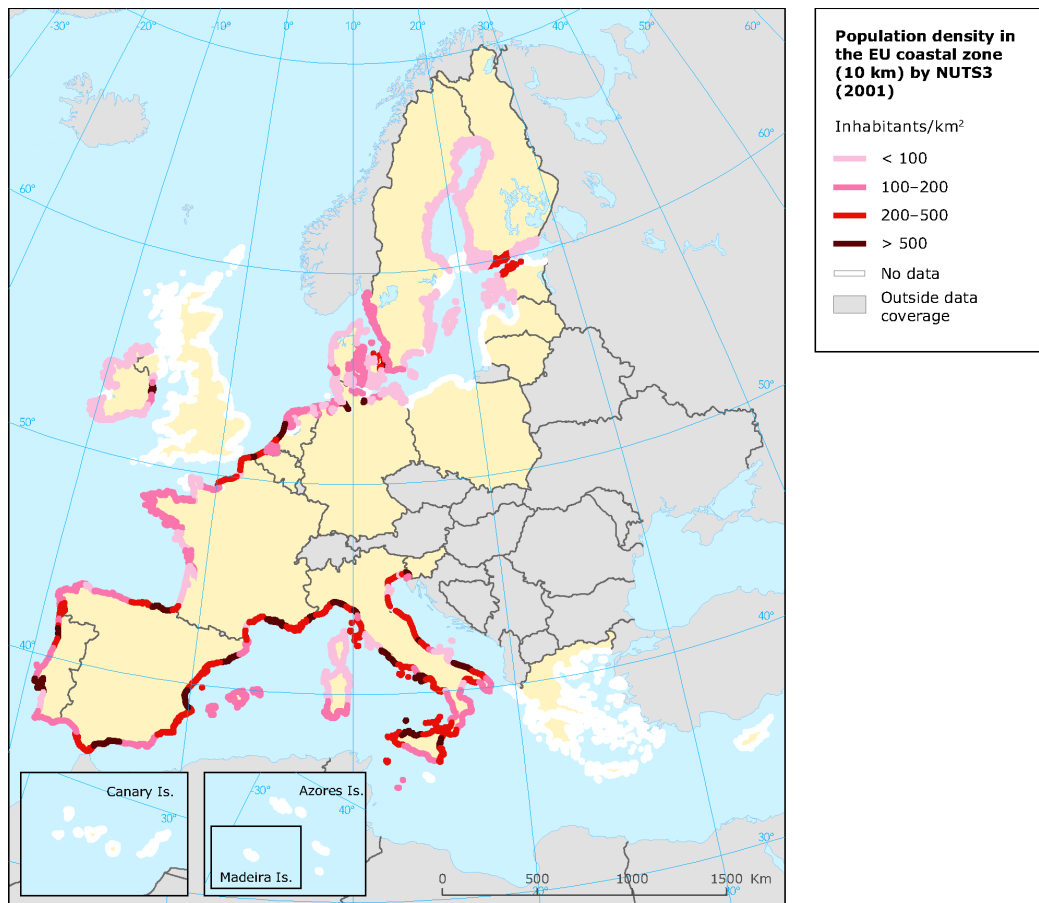
The Coastal Ocean



World fishery (tons/km²)....mostly coastal

The Coastal Ocean

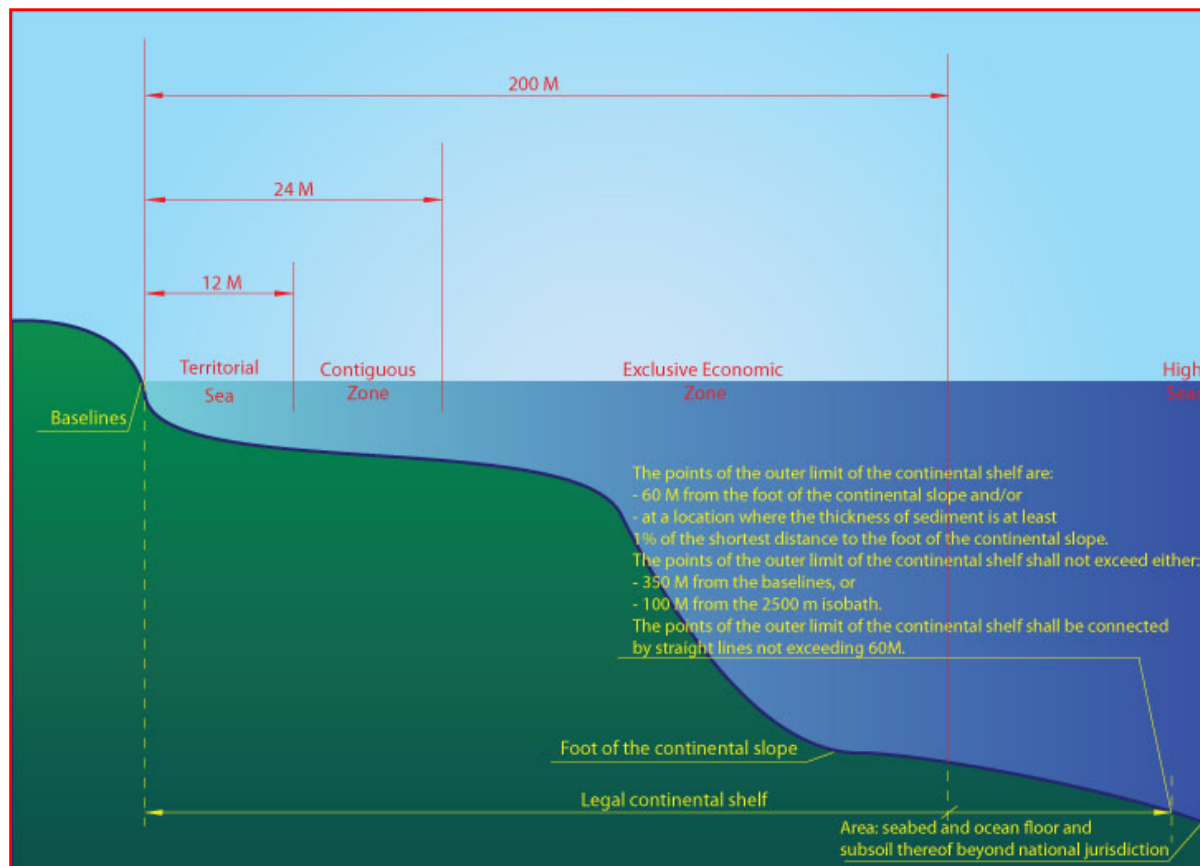
The Coastal Ocean:stressed.....



Population density in the EU coastal zone (10 km from the shore)

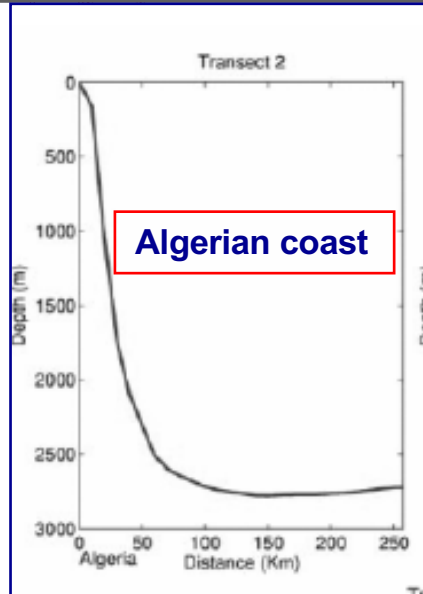
The Coastal Ocean

The Coastal Ocean:and strategic.

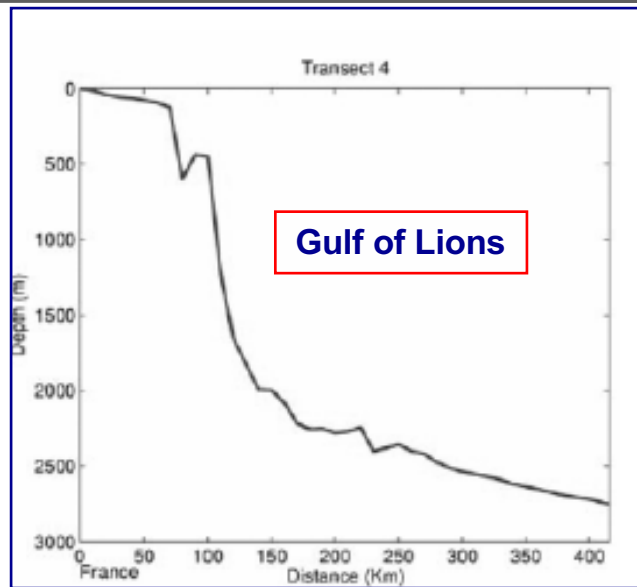


Coastal Ocean everywhere
Included in the
Exclusive economic zone
(EEZ)
(200 nm from the shore)

The Coastal Ocean

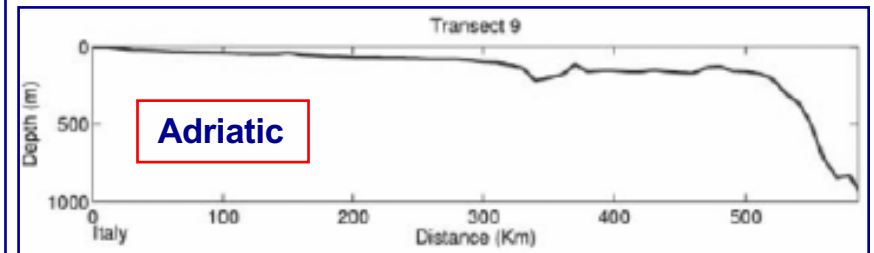


Shelf gradient (km/km)
 $5.2 \cdot 10^{-1}$



Shelf gradient (km/km)
 $7.4 \cdot 10^{-2}$

Shelf extension: very variable



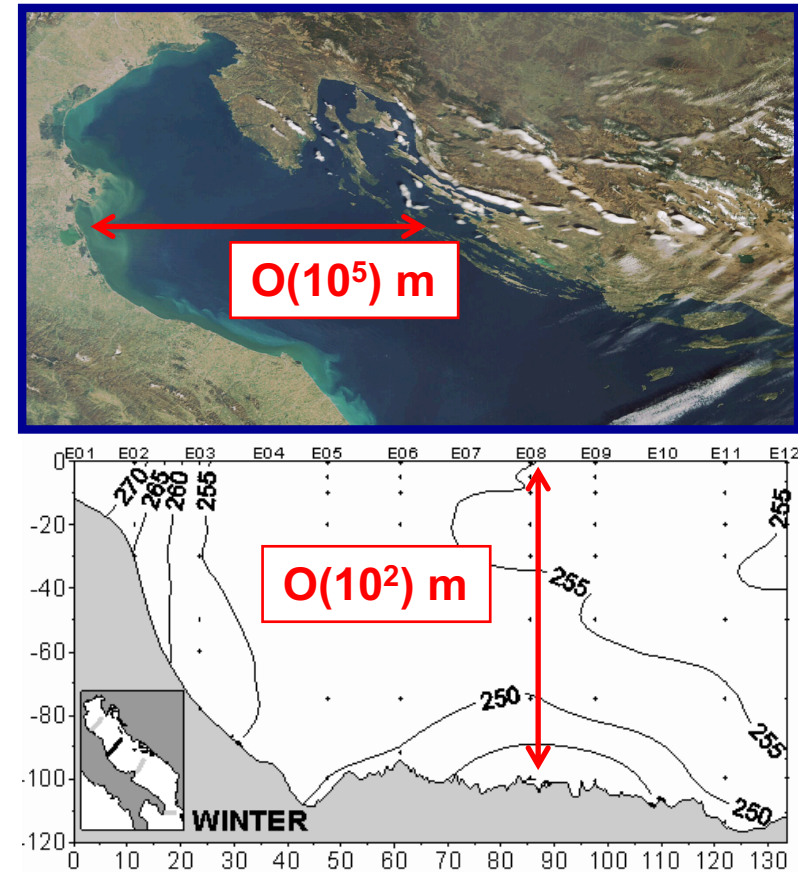
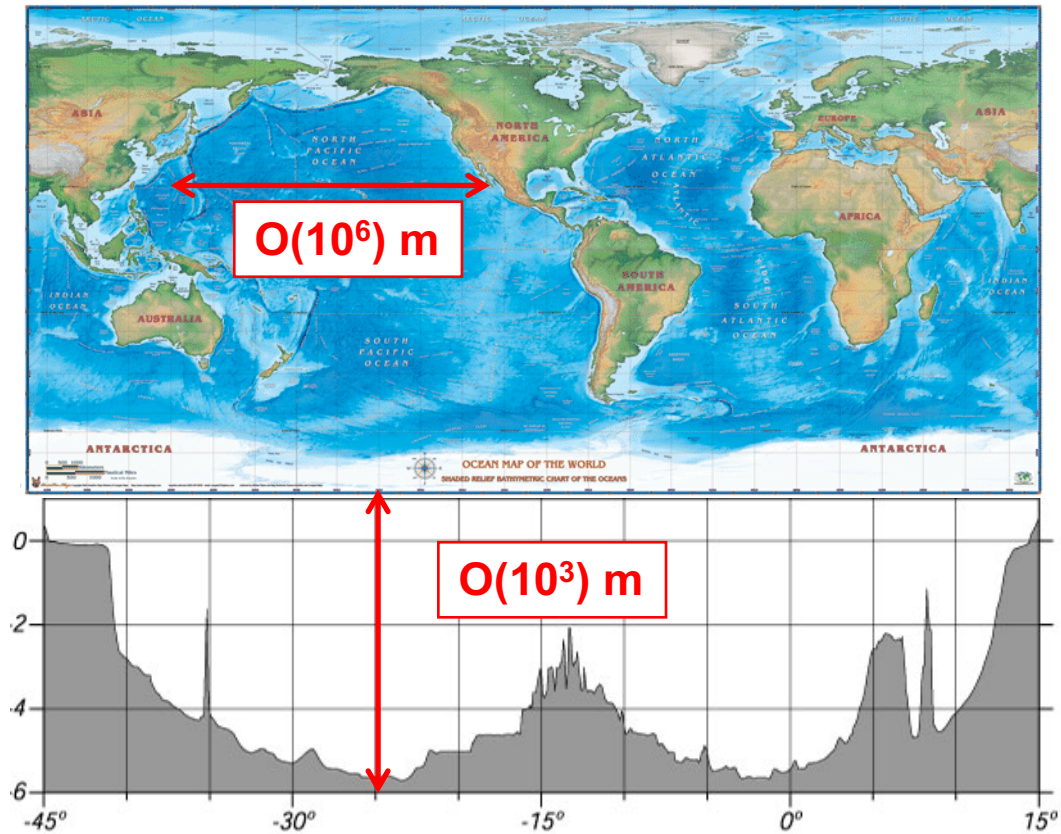
Shelf gradient (km/km)
 $7.0 \cdot 10^{-3}$

The Coastal Ocean is comprised between two boundaries:
Nearshore zone (landward boundary) and shelf edge zone (seaward boundary)

Shelf ocean dynamics can be coupled/uncoupled with/from nearshore and shelf edge processes
Depending on shelf extension and on the magnitude of the processes.

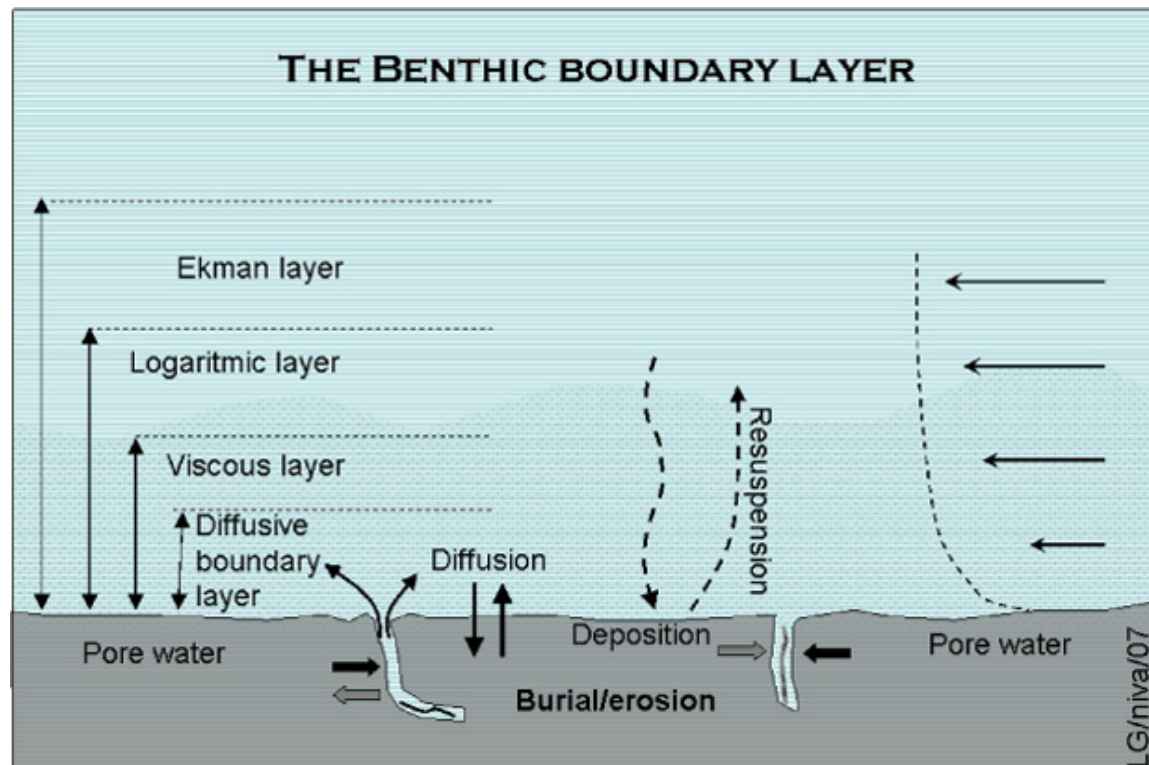
Dynamical processes in a shallow sea

Horizontal and vertical scales of motion are smaller than in the open ocean



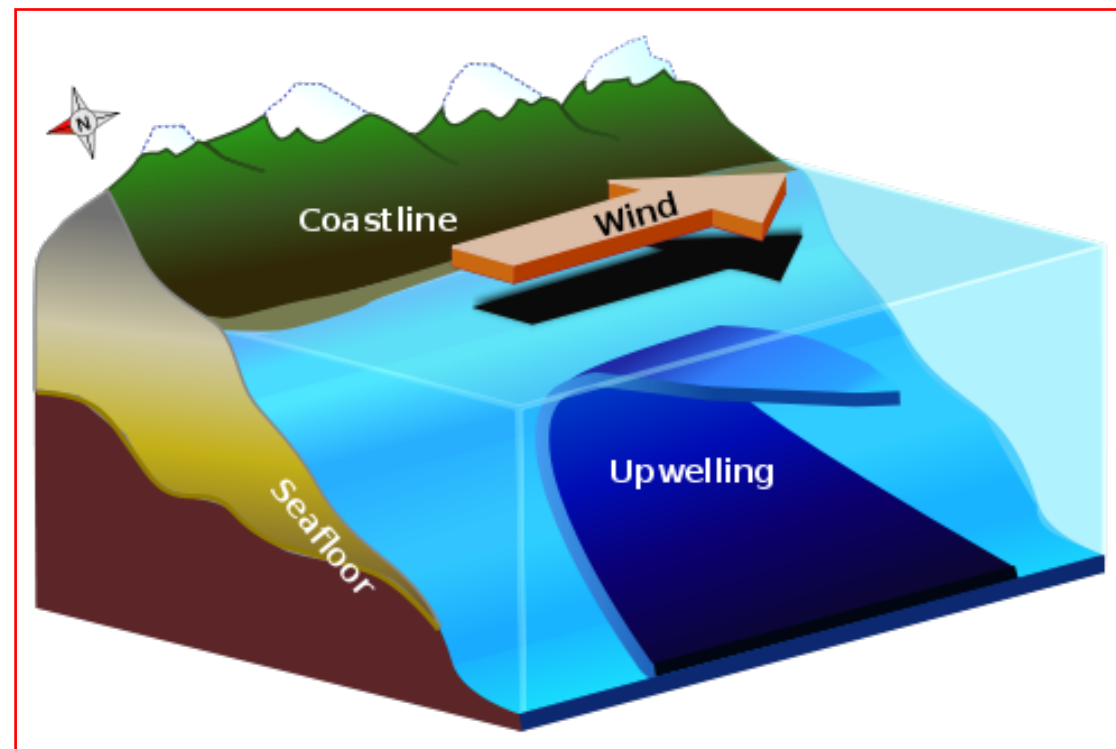
Dynamical processes in a shallow sea

The ocean bottom at shallow depth places a great constraint on water movement. Bottom currents are often large and bottom friction plays a significant role.



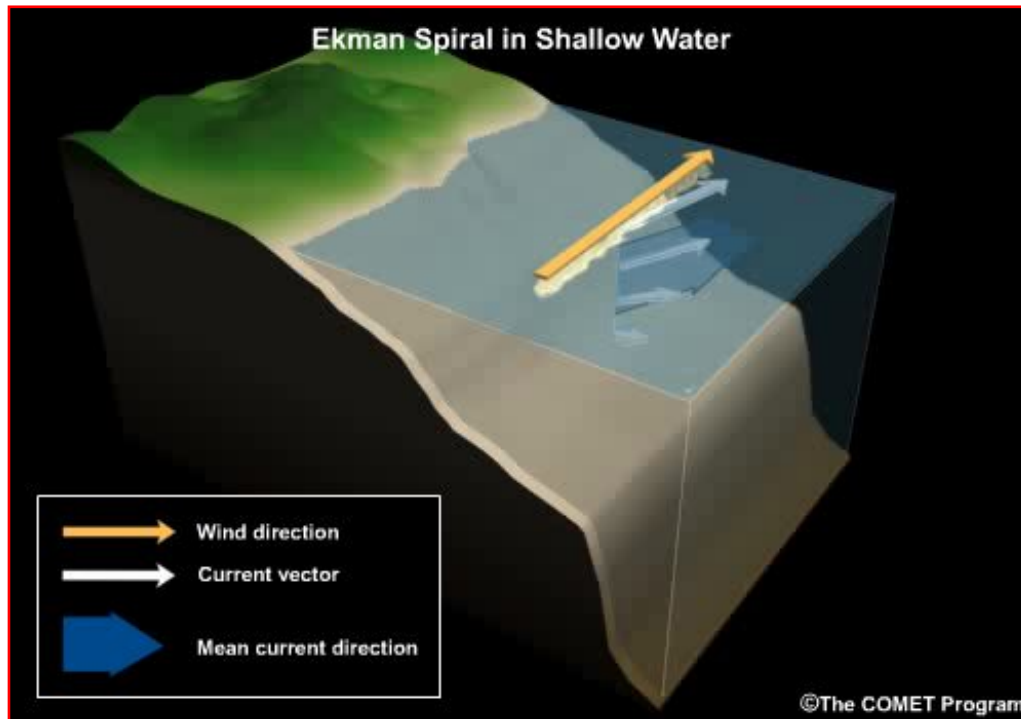
Dynamical processes in a shallow sea

The presence of a coastline is a strong constraint to water movement tending to divert it. By obstructing the flow toward it (**no flux through a solid boundary!**), the coastline causes development of surface slopes that modify water movement.



Dynamical processes in a shallow sea

Surface forcing extend to a larger fraction of the water column.



On the continental shelf and in shallower waters in bays and estuaries, the water is not deep enough for a full Ekman spiral. Thus, in shallow water, surface water moves at an angle to the wind that is substantially less than 45° . And overall, the mean water motion is typically much less than 90° to the wind direction.

The same applies for the heat surface forcing. Moreover.....



Dynamical processes in a shallow sea

.....Coastal Ocean is often a ROFI (Region Of Freshwater Influence) .

Strong buoyancy forcing determined by river runoff (plumes)

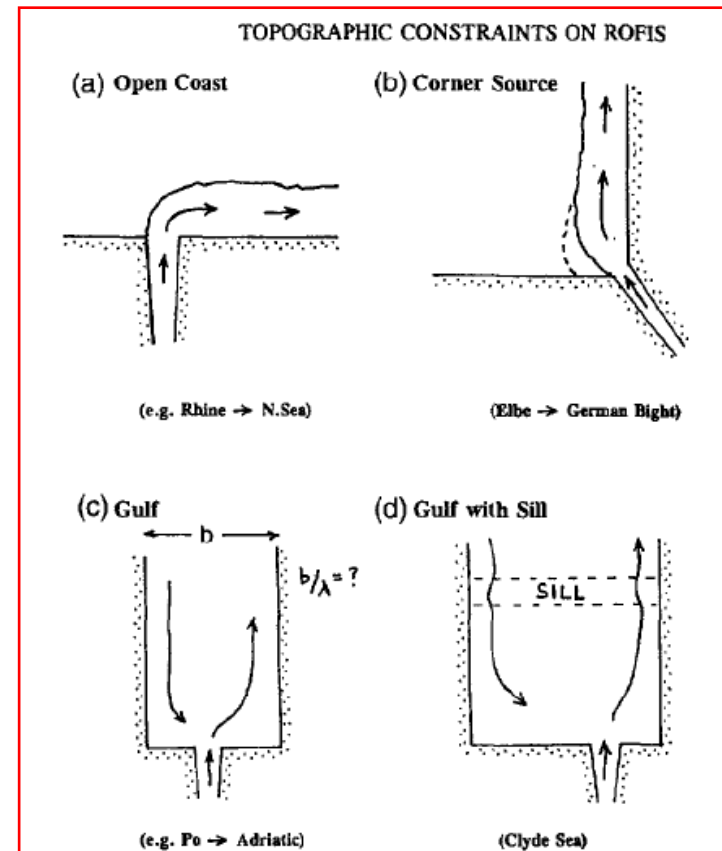
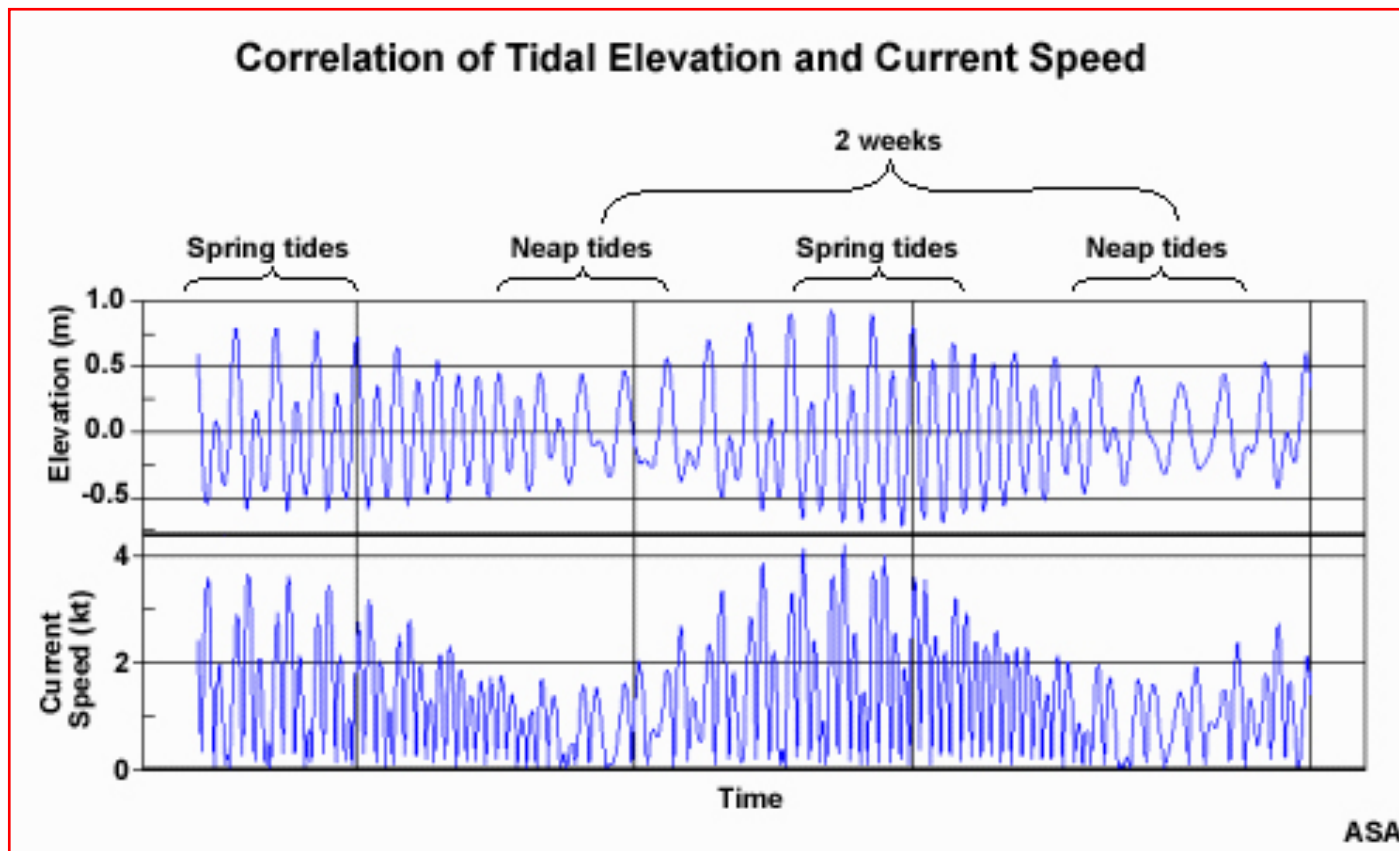


Fig. 2. Topographic setting of ROFIs (a) open coast, (b) corner source, (c) gulf and (d) gulf with sill restriction. A key parameter in (iii) and (iv) is the Kelvin number which is the width of the gulf b scaled by the internal Rossby radius λ .



Dynamical processes in a shallow sea

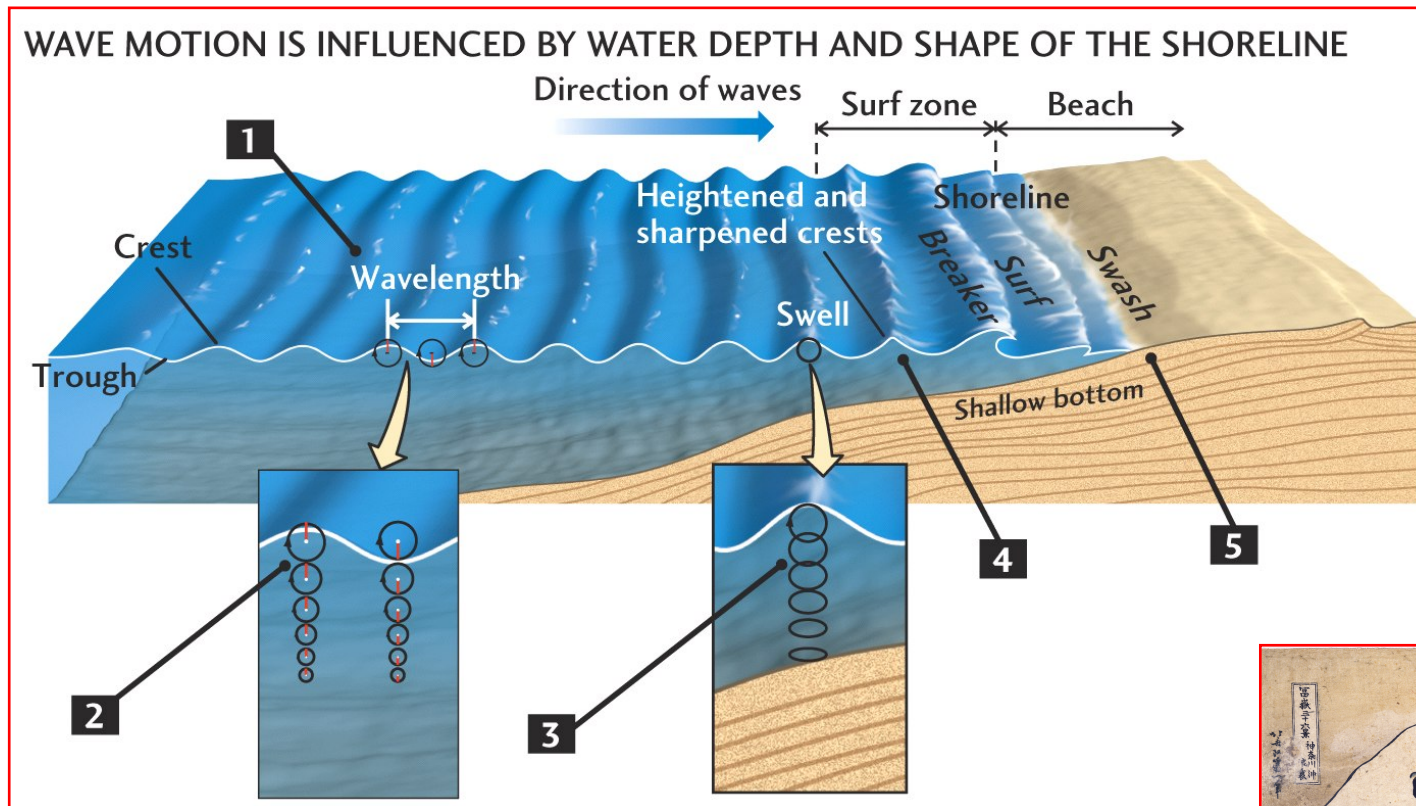
Tides are a significant coastal ocean forcing.....

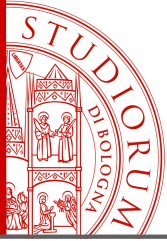




Dynamical processes in a shallow sea

.....As well as wave motion.





Corso di Laurea Magistrale in “Fisica del Sistema Terra”. “Oceanografia Costiera”

1. **Introduzione. Principali caratteristiche della circolazione costiera.**
2. **La Circolazione marina guidata dal vento in vicinanza di una costa. Upwelling costieri.**
3. **Lo strato limite bentico ed i suoi effetti sulla circolazione costiera.**
4. **Le maree (teoria).**
5. **Le maree come forzanti della circolazione costiera .**
6. **Gli effetti di buoyancy sulla circolazione costiera.**
7. **Moto ondoso**
8. **Accoppiamento biogeochimica marina e dinamica fisica.**