

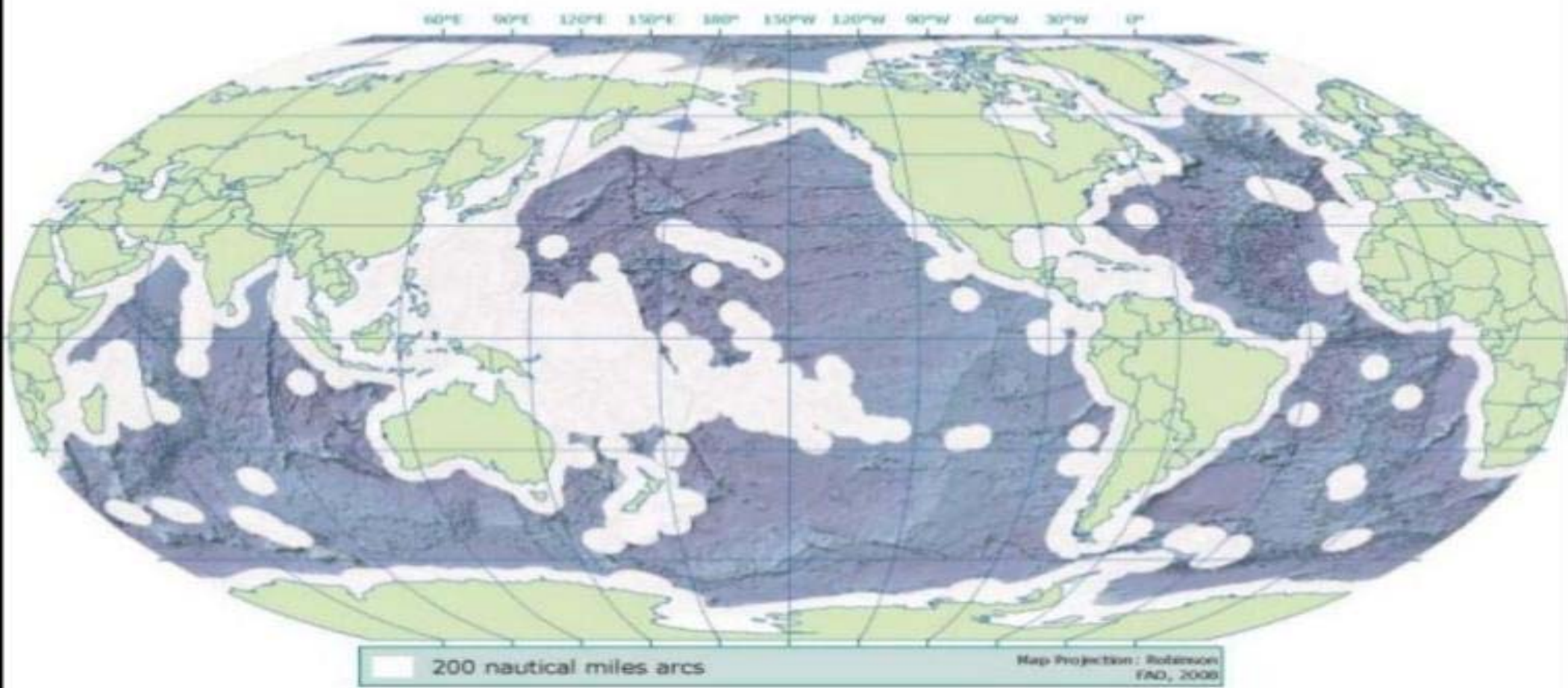
# Ocean pollution, mitigation and primary regulations

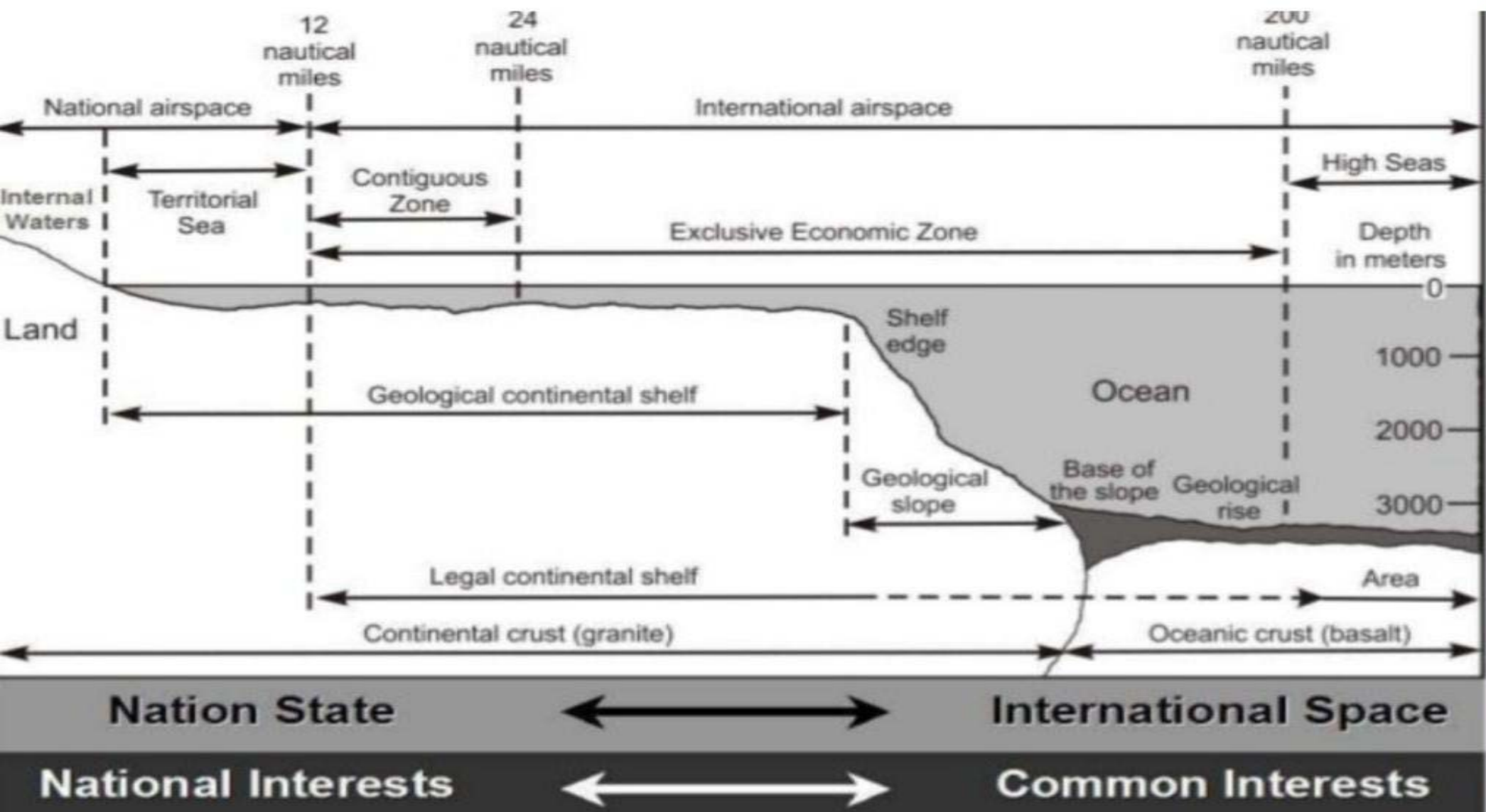
By

Dr P MISRA



# Open ocean





Territorial Sea  
(12 nautical miles  
from baseline)

Exclusive Economic Zone  
(up to 200 naut. miles from baseline)

High Sea

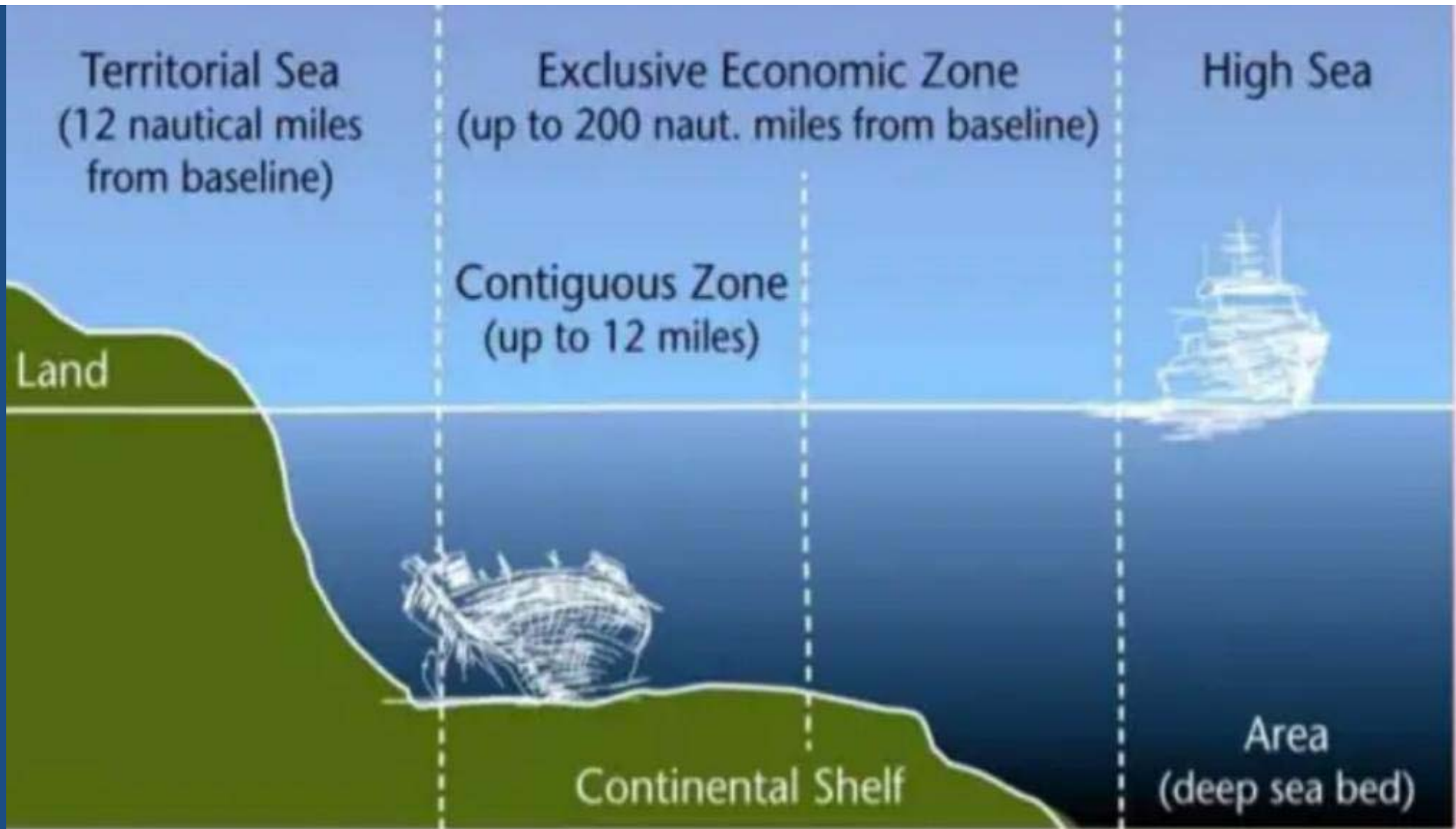
Contiguous Zone  
(up to 12 miles)

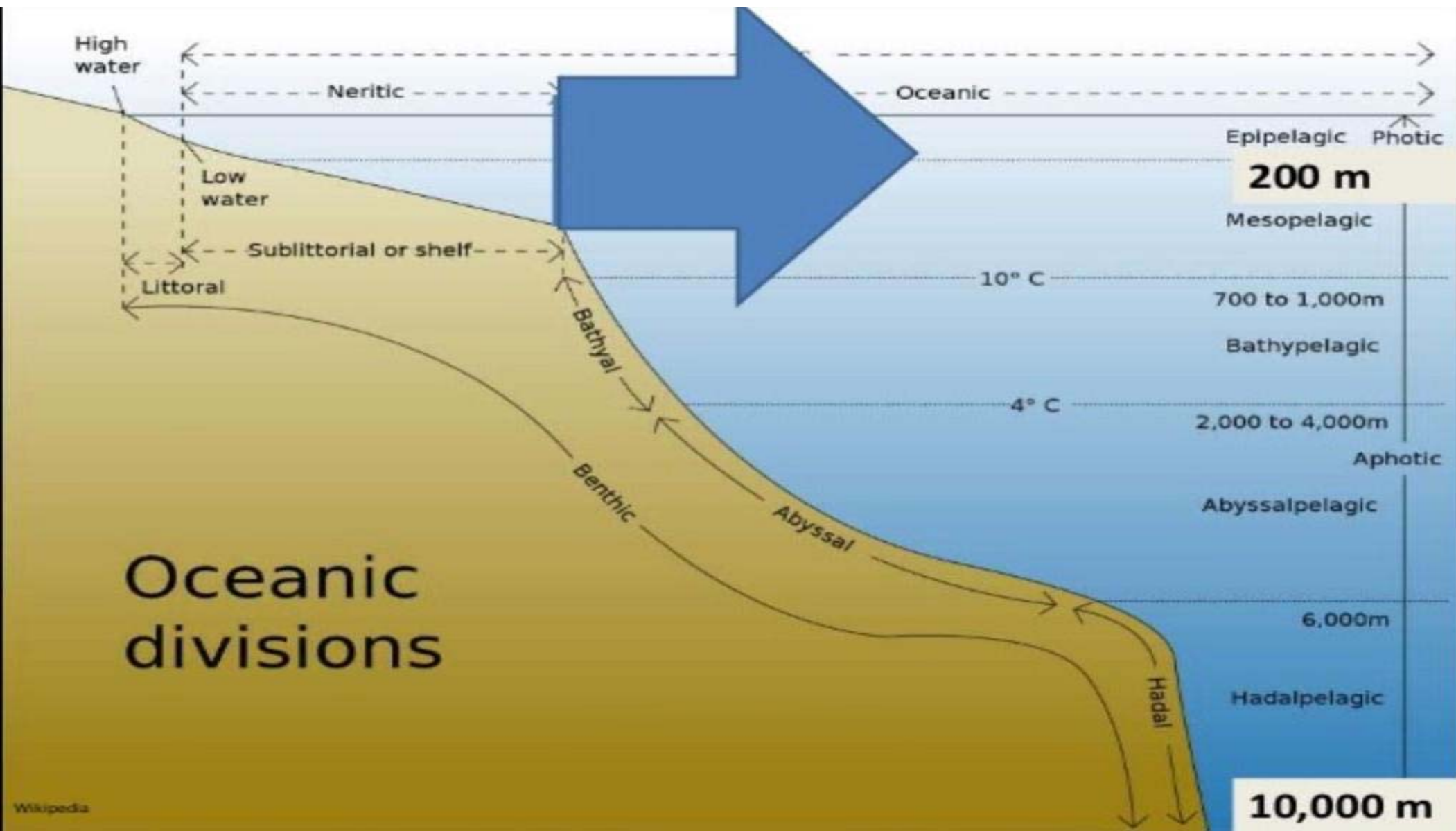


Continental Shelf

Area  
(deep sea bed)

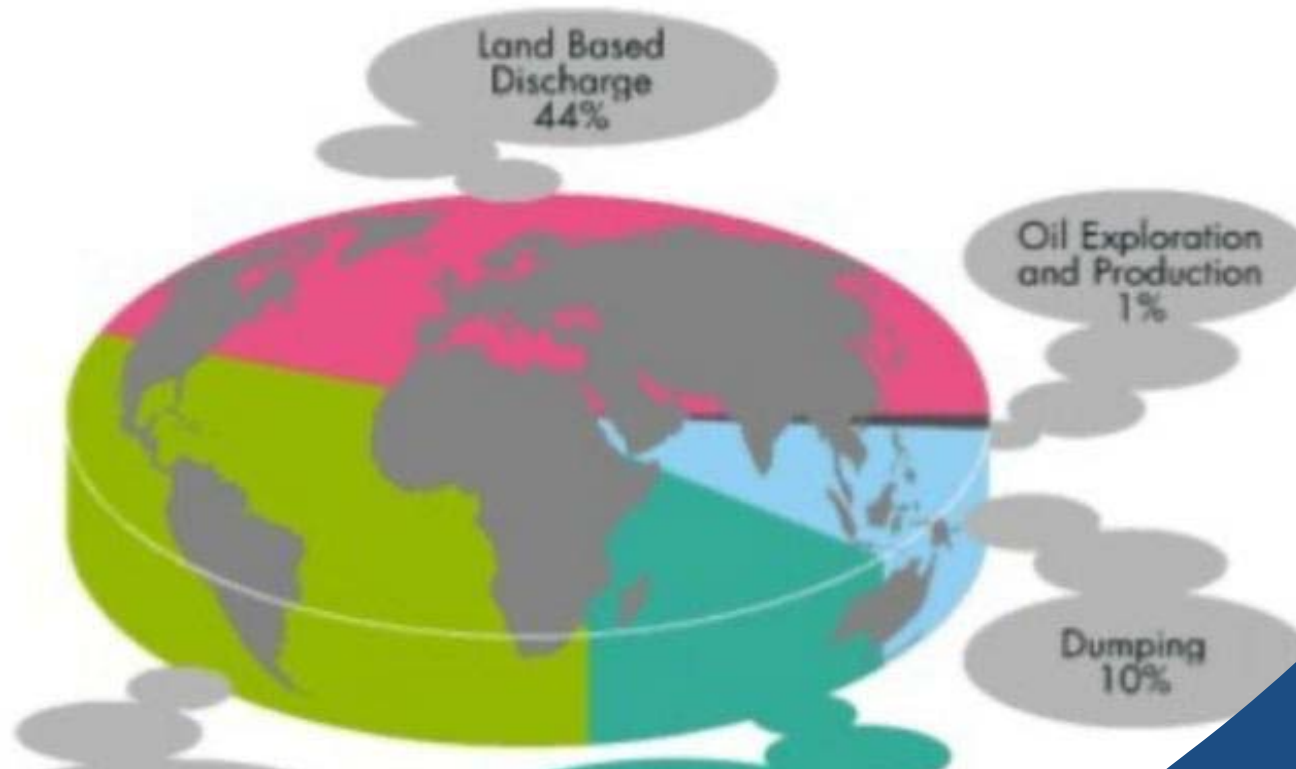
Land

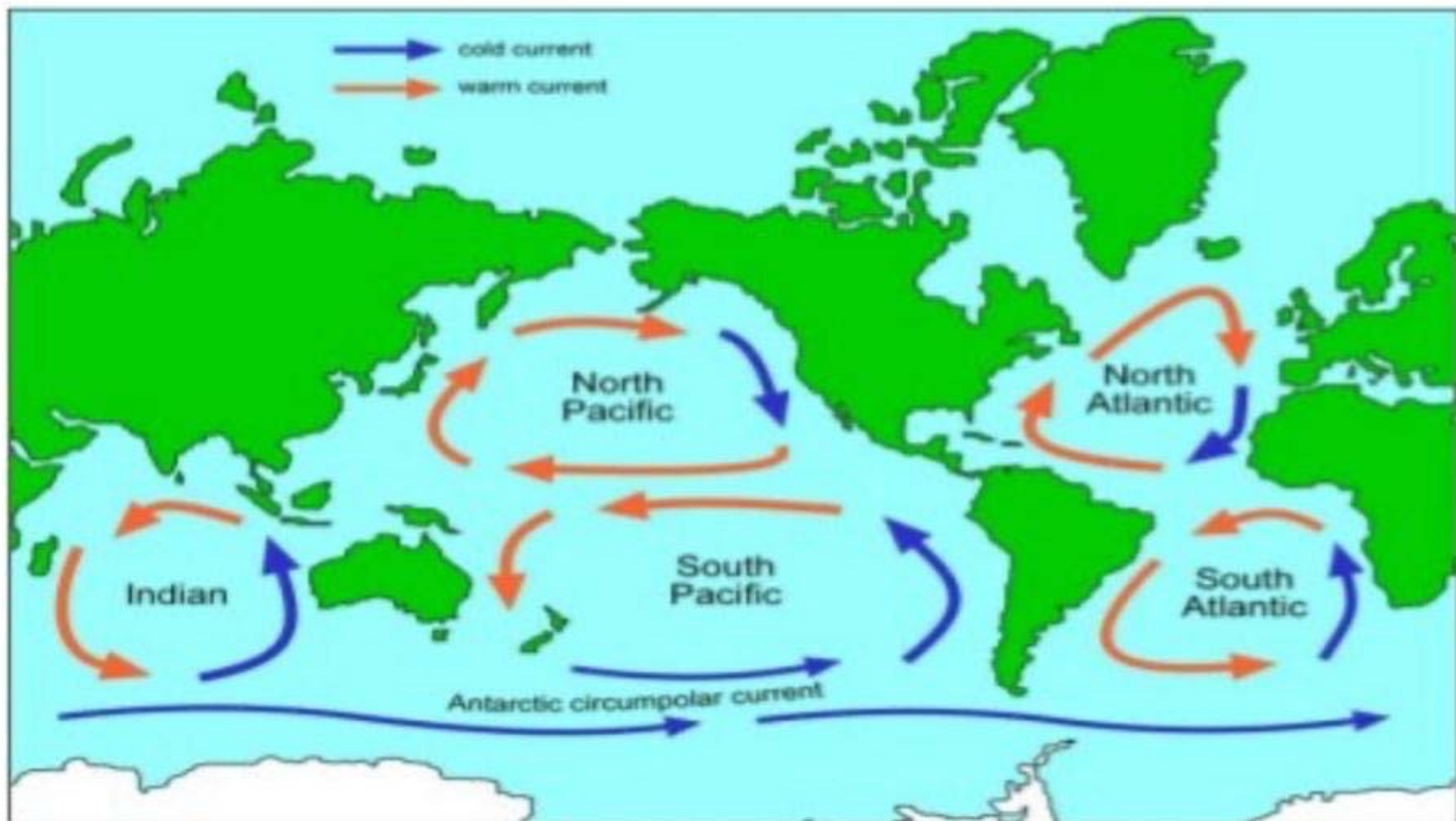




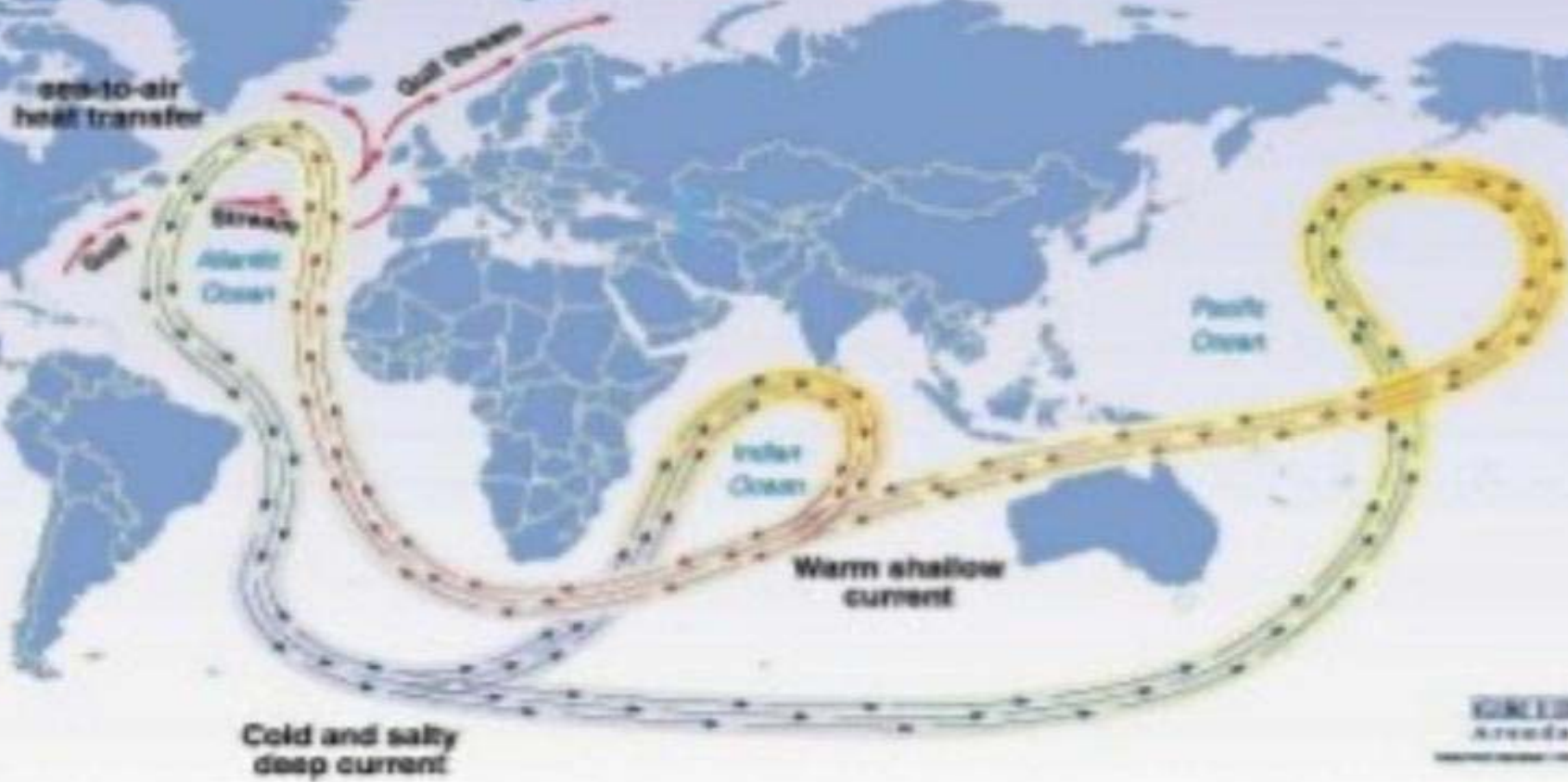
## Overview of Total Sea-Pollution

*Source: Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP)*

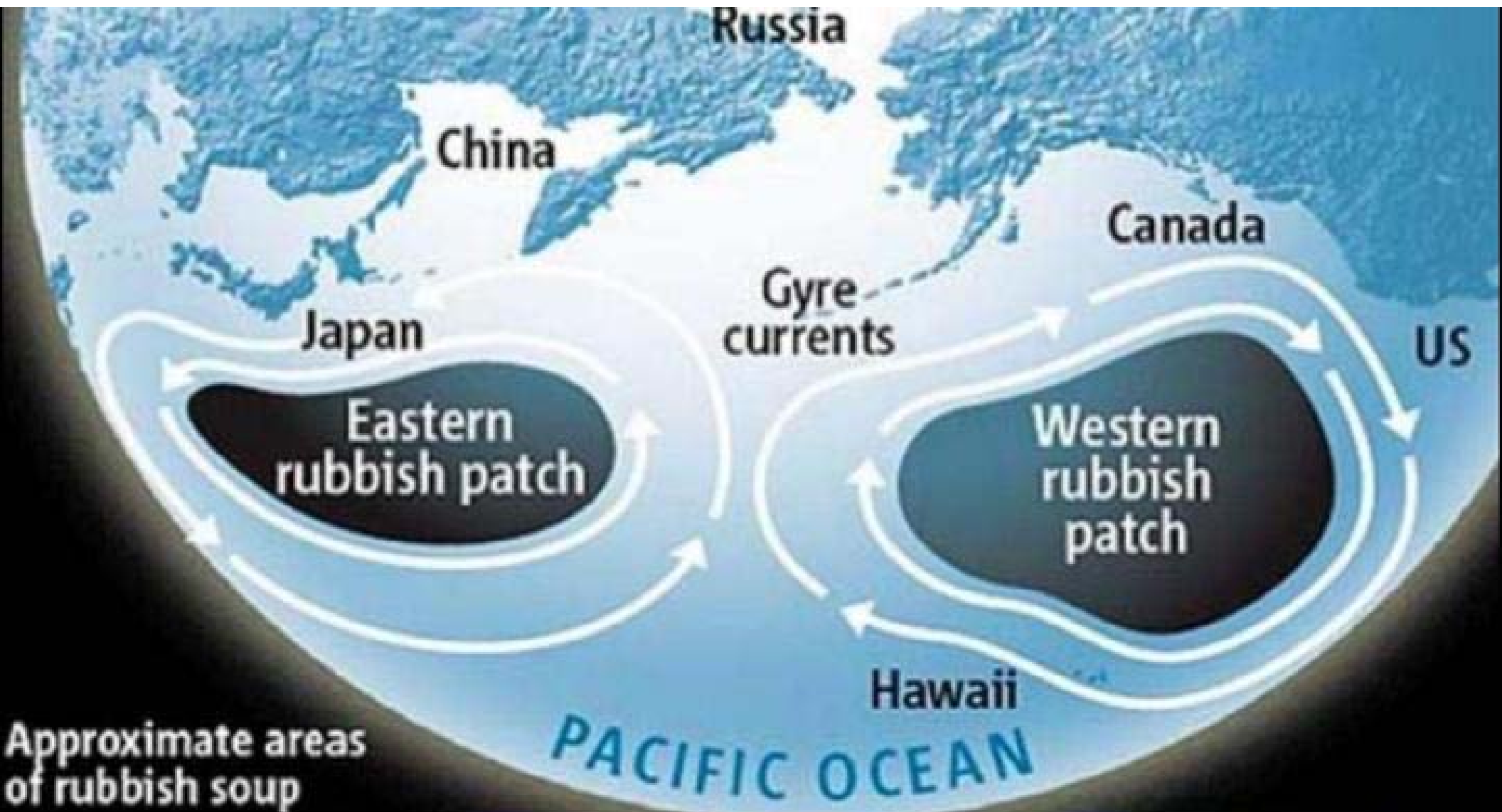




## Great ocean conveyor belt

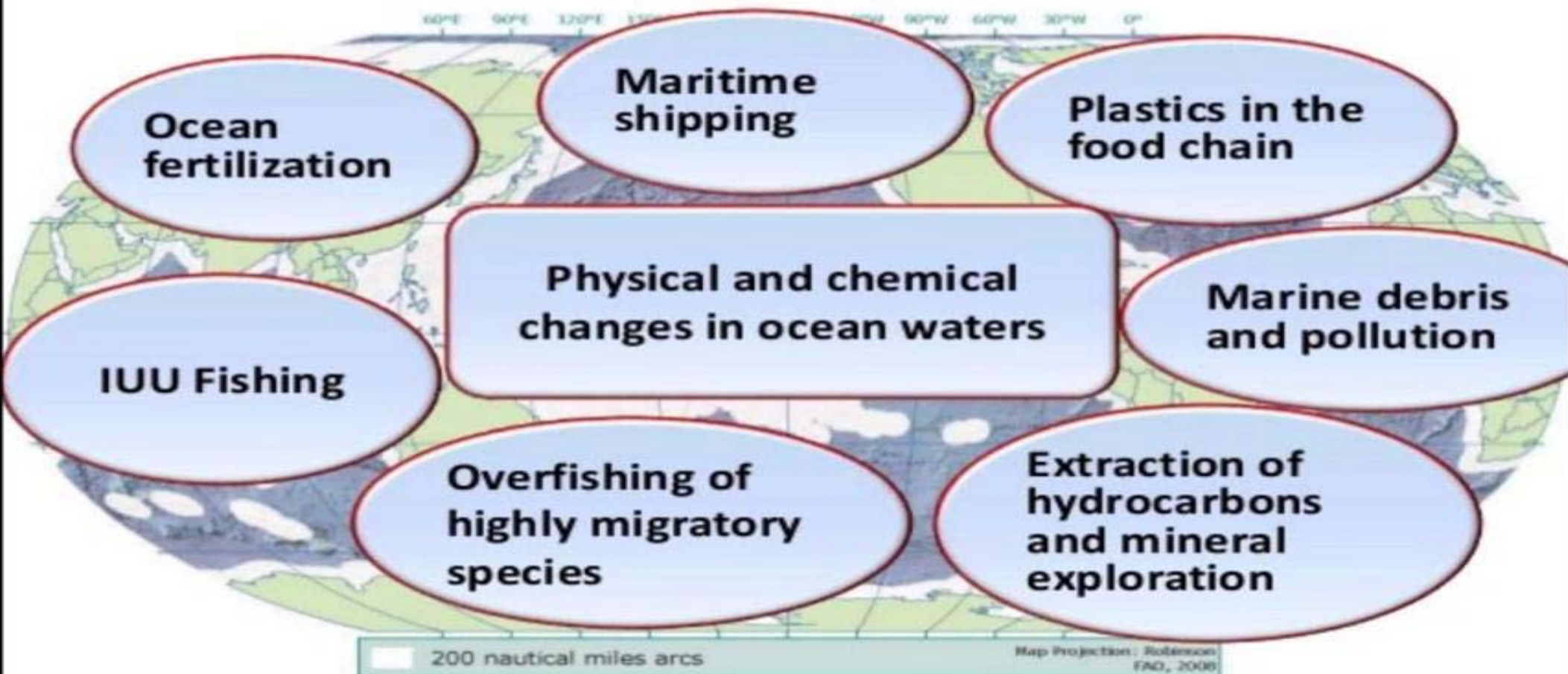






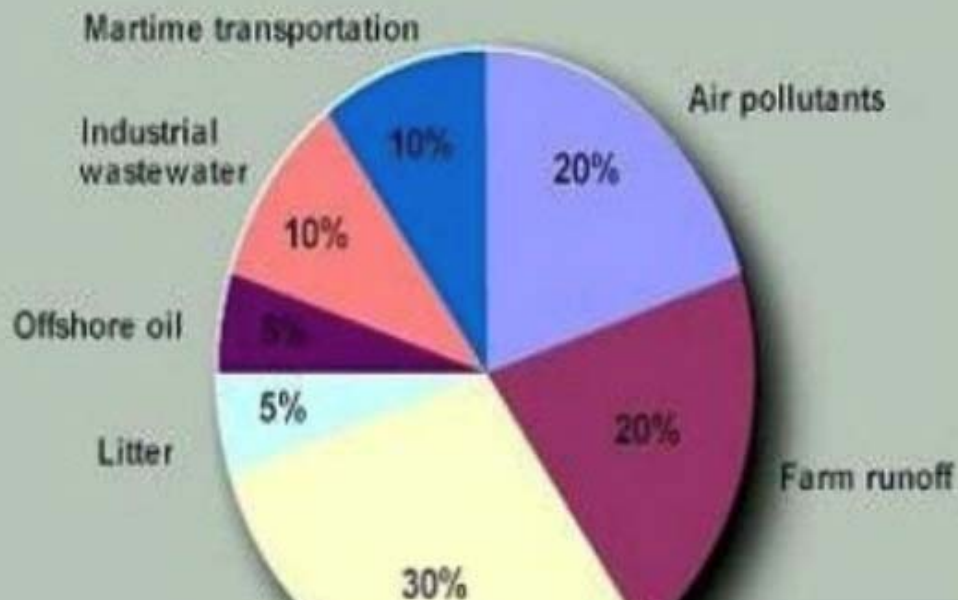
Approximate areas of rubbish soup

# Open ocean: a history of open access and multiple threats

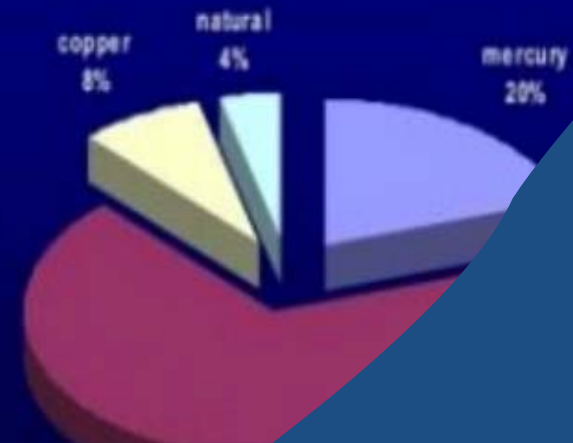


# MAJOR MARINE POLLUTANTS

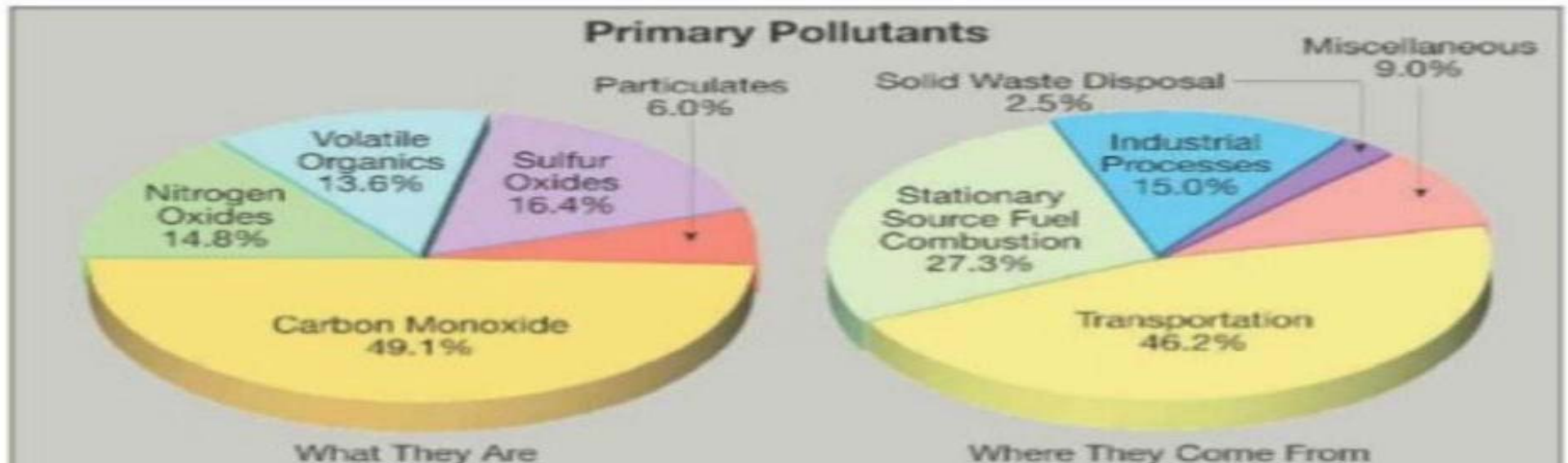
## Pollutants Entering the Oceans

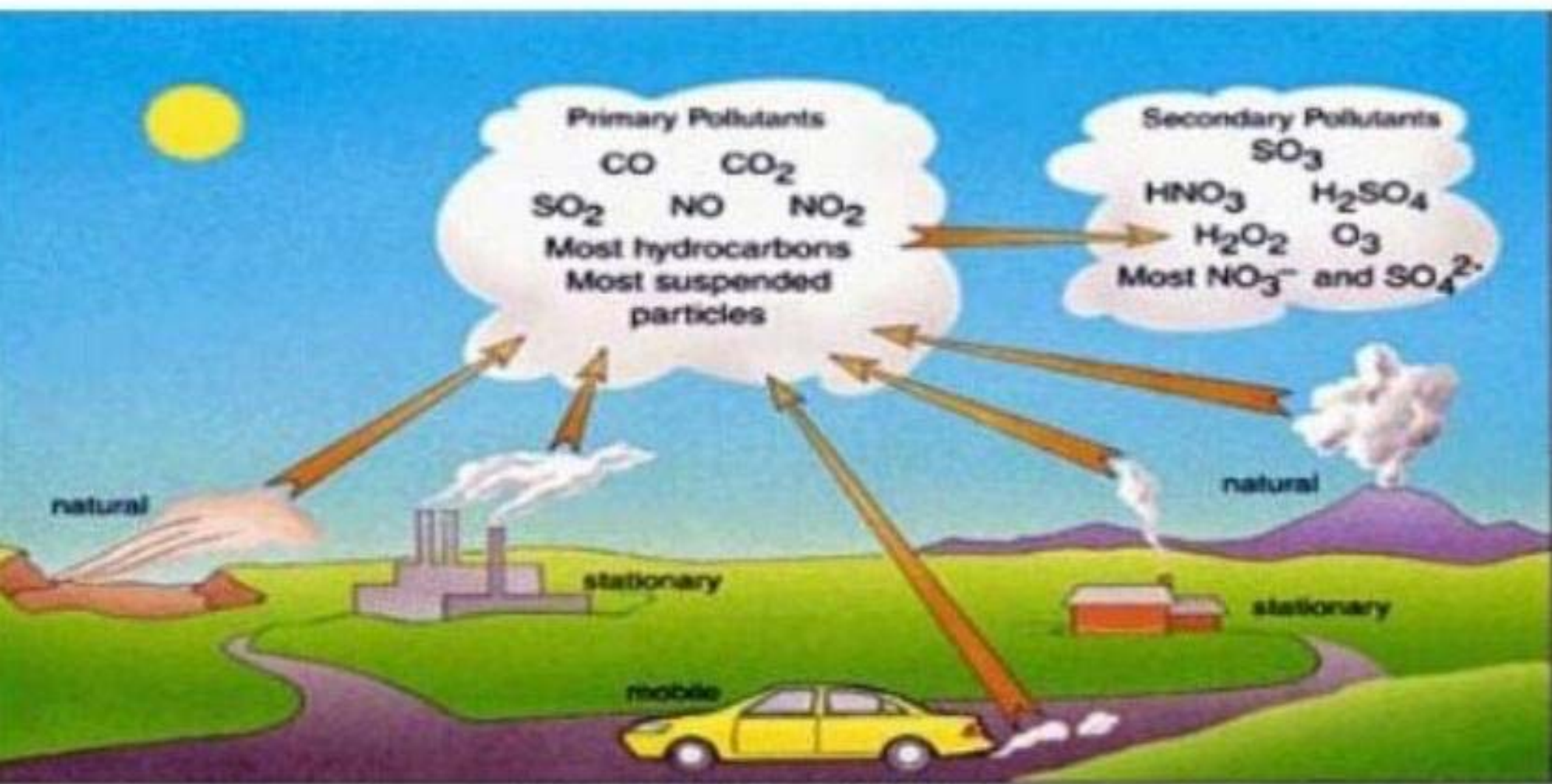


## Heavy Metals Entering Oceans



1. Particulate matter.
2. Nitrogen dioxide (NO<sub>2</sub>)
3. Carbon monoxide (CO)
4. Sulphur dioxide (SO<sub>2</sub>)
5. Chlorofluorocarbons (CFCs)
6. Lead.



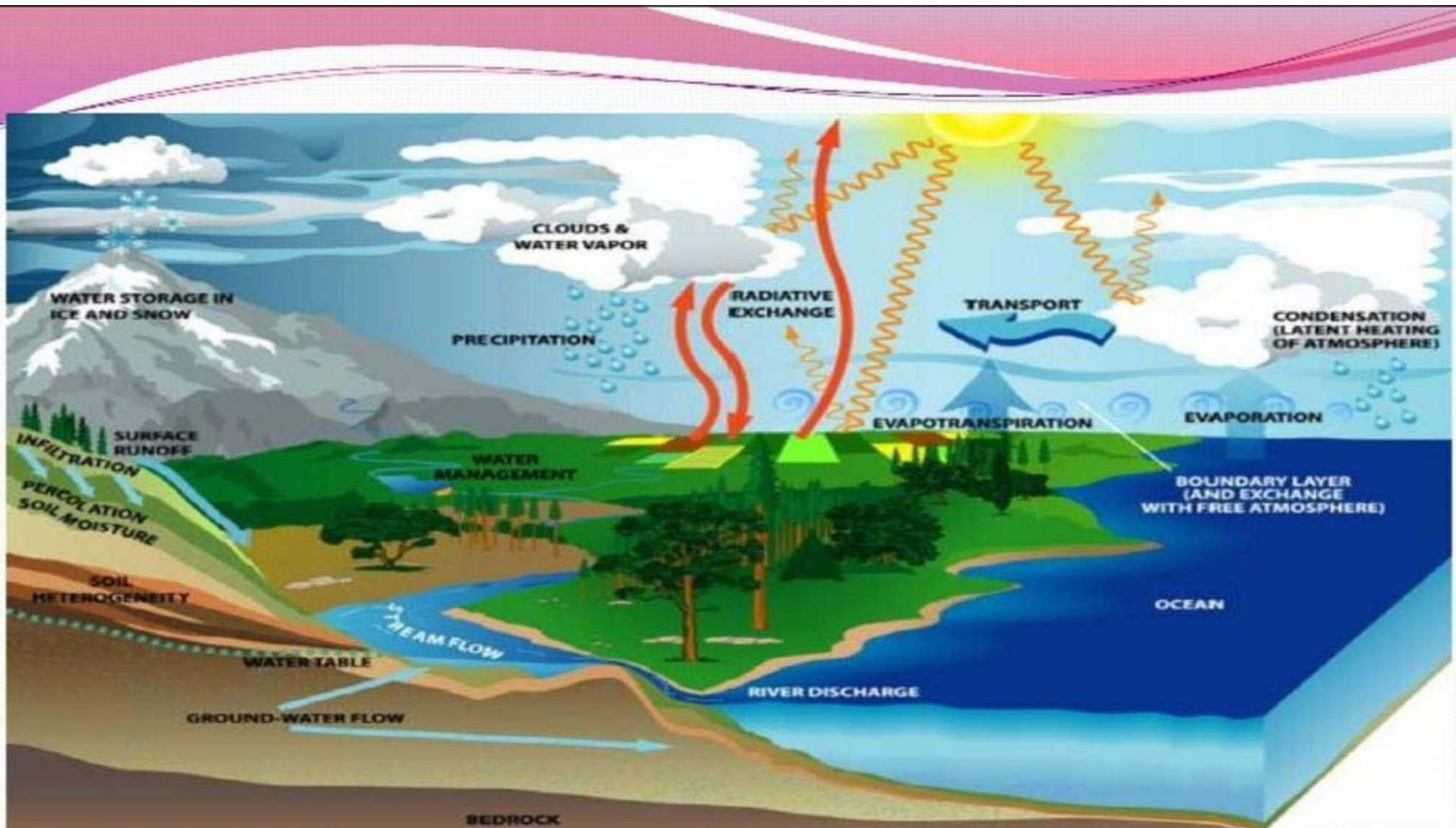


**Types and sources of air pollutants**

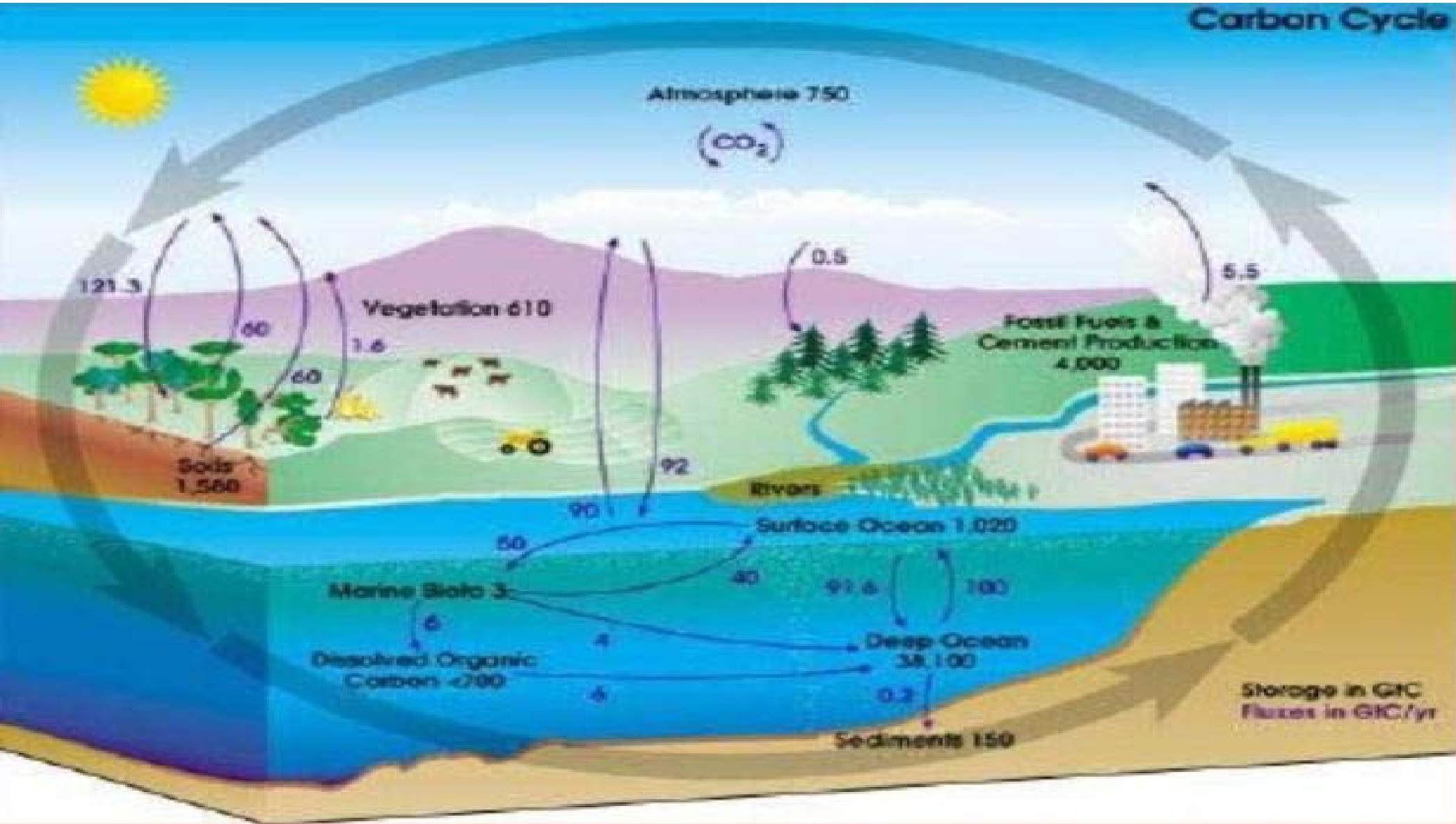
# AIR POLLUTION

- Water cycle
- Oxygen cycle
- Carbon cycle
- Nitrogen cycle
- Photosynthesis





# Carbon Cycle





# The Water Cycle



USGS

U.S. Department of the Interior  
U.S. Geological Survey  
<http://pubs.usgs.gov/of/watercycle/>

# Sound in the Ocean

## Water v Air

Water is ~800 times denser than air so sound travel 5 times faster.

## Marine communication

Chemical  
Visual  
Audio

Hunt

Mate

Uses of sound by marine species

Stake Territory

Navigation

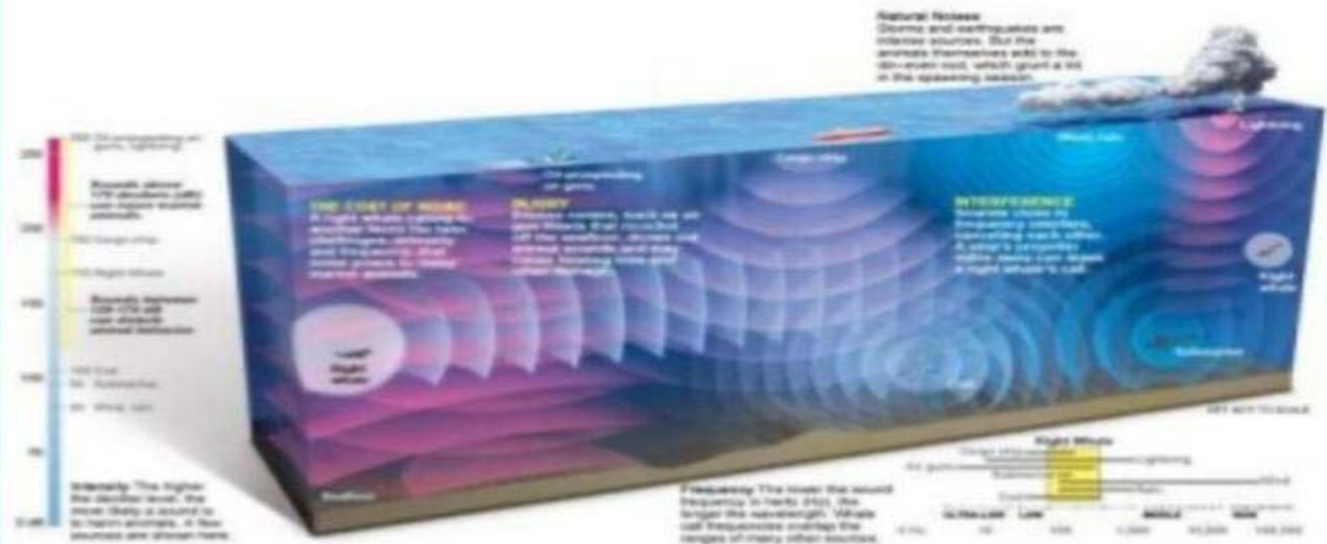
## THE OCEAN IS LOUD

### Anthropogenic Sources

- Oil exploration and Mining
- Cargo Ships
- Submarines
- Military Sonar
- Fishery noisemakers

### Natural Sources

- Storms and Earthquakes
- Other animals
- Vents



# Effects on animals

- Noise can cause serious damage to wild life. Ways in which animals are adversely affected by noise pollution includes.
- **Hearing loss**
- **Masking:** Masking is the inability to hear important environmental clues and animal signals
- **Physiological effects:** such as increase in heart rate, respiratory difficulties and stress.
- **Behavioral effects:-** Which could result in abandonment of territory and loss of ability to reproduce.
- **Ecological effects:** It leads to migration of birds which disturbs the ecosystem



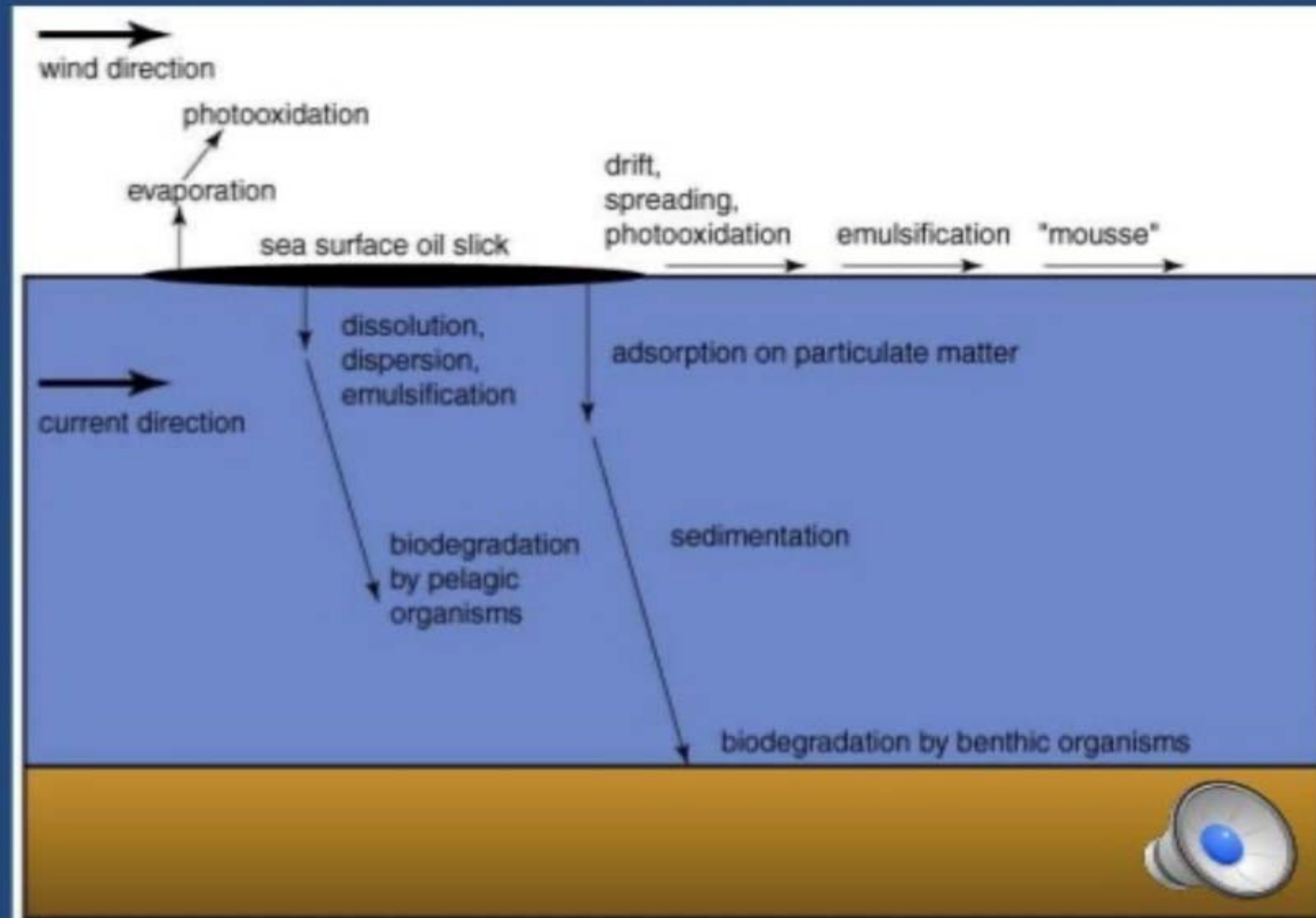
# What impacts does it have?

- entanglement
- starvation or ruptured organs
- block sunlight
- food web structure
- absorb harmful pollutants
- aesthetics



# Ocean Pollution: Petroleum

Various processes act to break up and degrade oil in the ocean environment



# Reducing risks



# Mitigation Measures



## More efficient use of energy



## Greater use of low-carbon and no-carbon energy

- Many of these technologies exist today



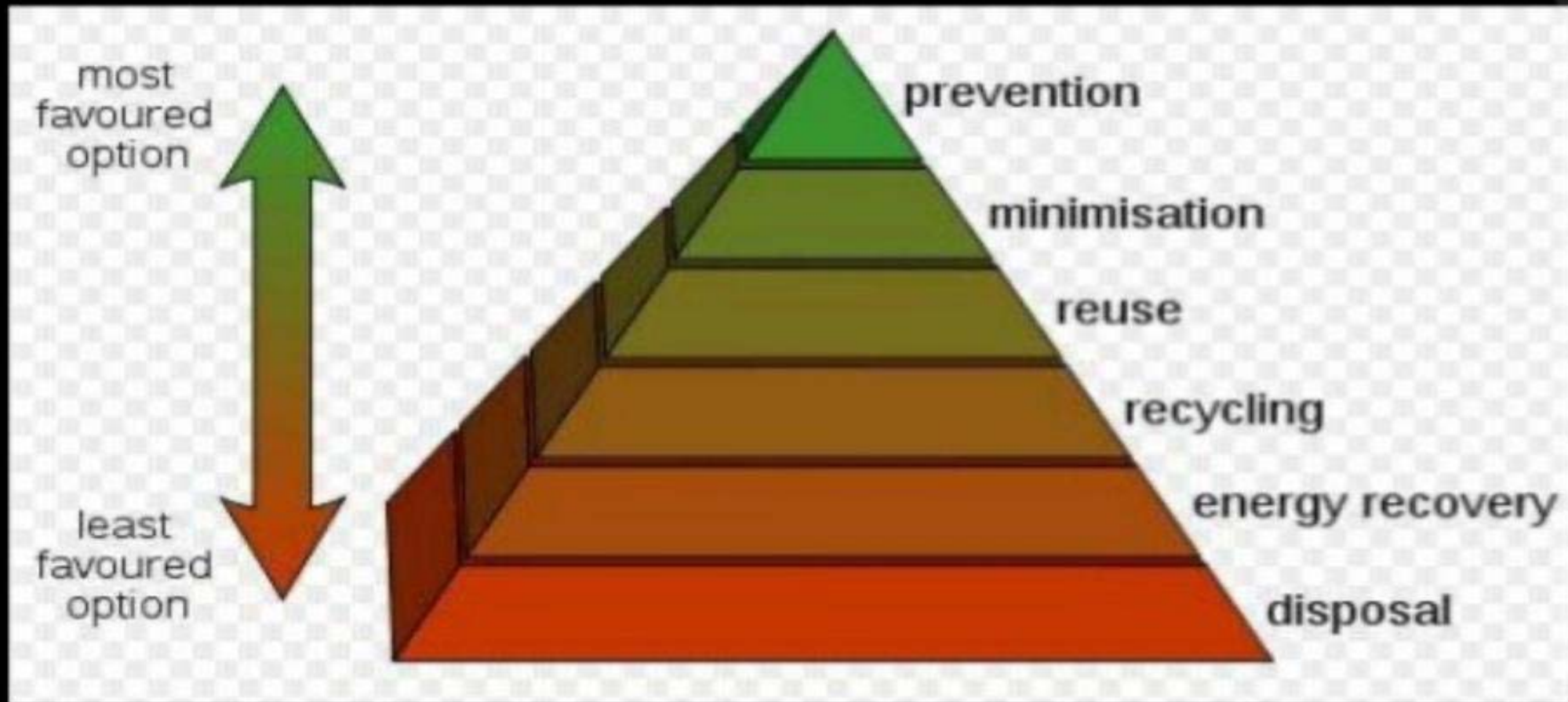
## Improved carbon sinks

- Reduced deforestation and improved forest management and planting of new forests
- Bio-energy with carbon capture and storage

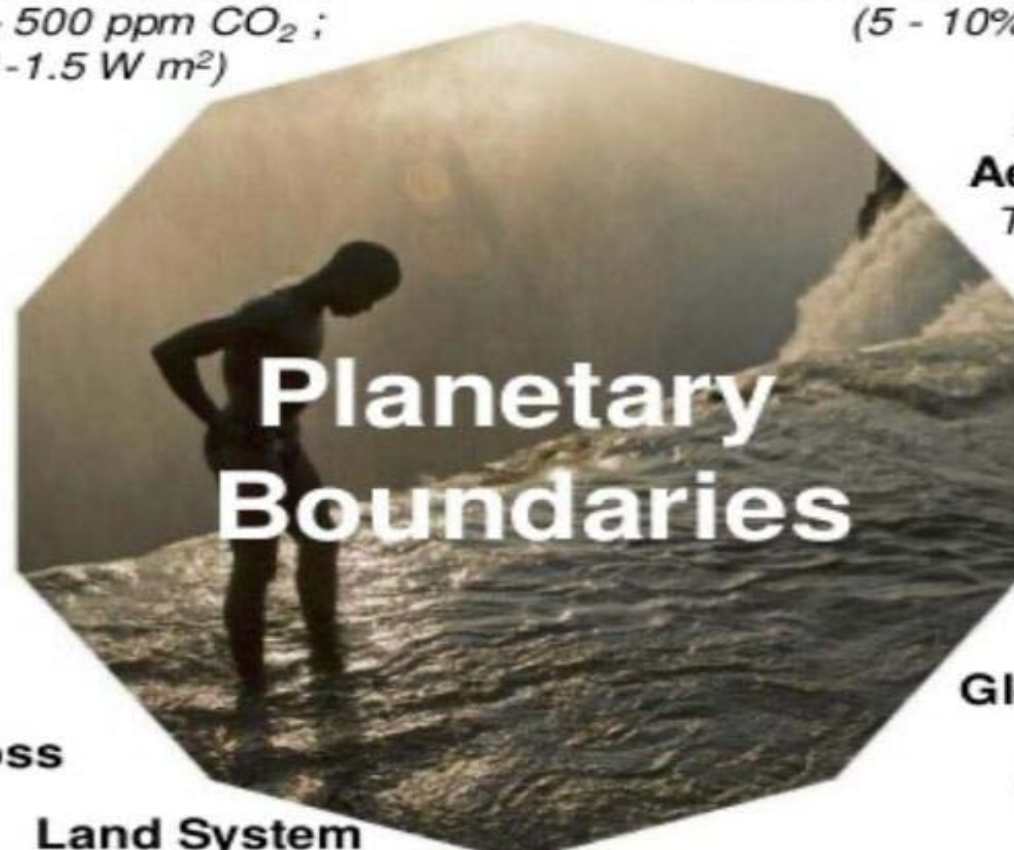


## Lifestyle and behavioural changes

# OPTIONS BEFORE US







# Planetary Boundaries

## Climate Change

$< 350 \text{ ppm CO}_2 < 1 \text{ W m}^2$   
( $350 - 500 \text{ ppm CO}_2$  ;  
 $1 - 1.5 \text{ W m}^2$ )

## Ozone depletion

$< 5 \%$  of Pre-Industrial 290 DU  
(5 - 10%)

## Biogeochemical loading: Global N & P Cycles

Limit industrial fixation of  $\text{N}_2$  to 35  $\text{Tg N yr}^{-1}$  (25 % of natural fixation) (25%-35%)  
 $P < 10 \times$  natural weathering inflow to Oceans (10x - 100x)

## Atmospheric Aerosol Loading

To be determined

## Ocean acidification

Aragonite saturation ratio  $> 80 \%$  above pre-industrial levels  
( $> 80\% - > 70 \%$ )

## Rate of Biodiversity Loss

$< 10 \text{ E/MSY}$   
( $< 10 - < 1000 \text{ E/MSY}$ )

## Land System Change

$\leq 15 \%$  of land under crops  
(15-20%)

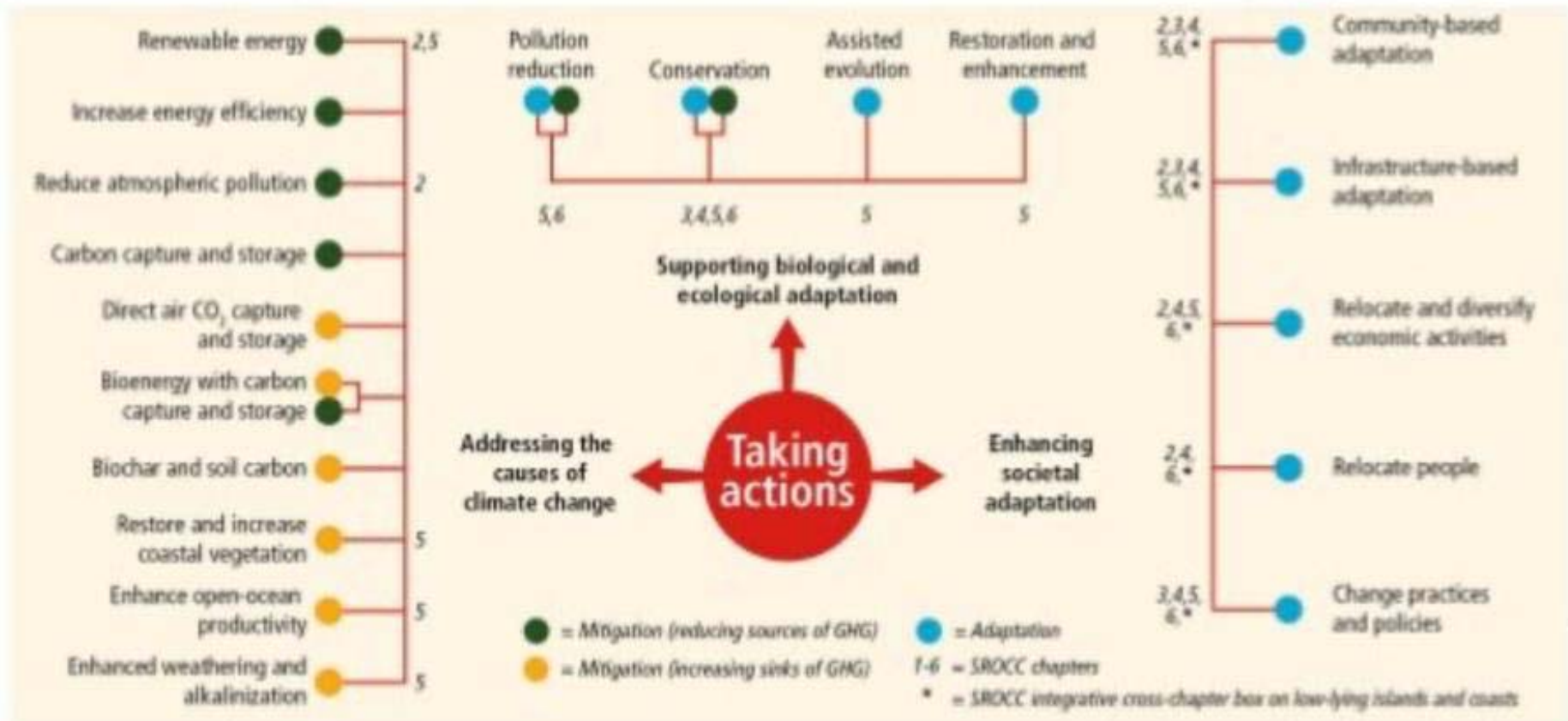
## Global Freshwater Use

$< 4000 \text{ km}^3/\text{yr}$   
( $4000 - 6000 \text{ km}^3/\text{yr}$ )

## Chemical Pollution

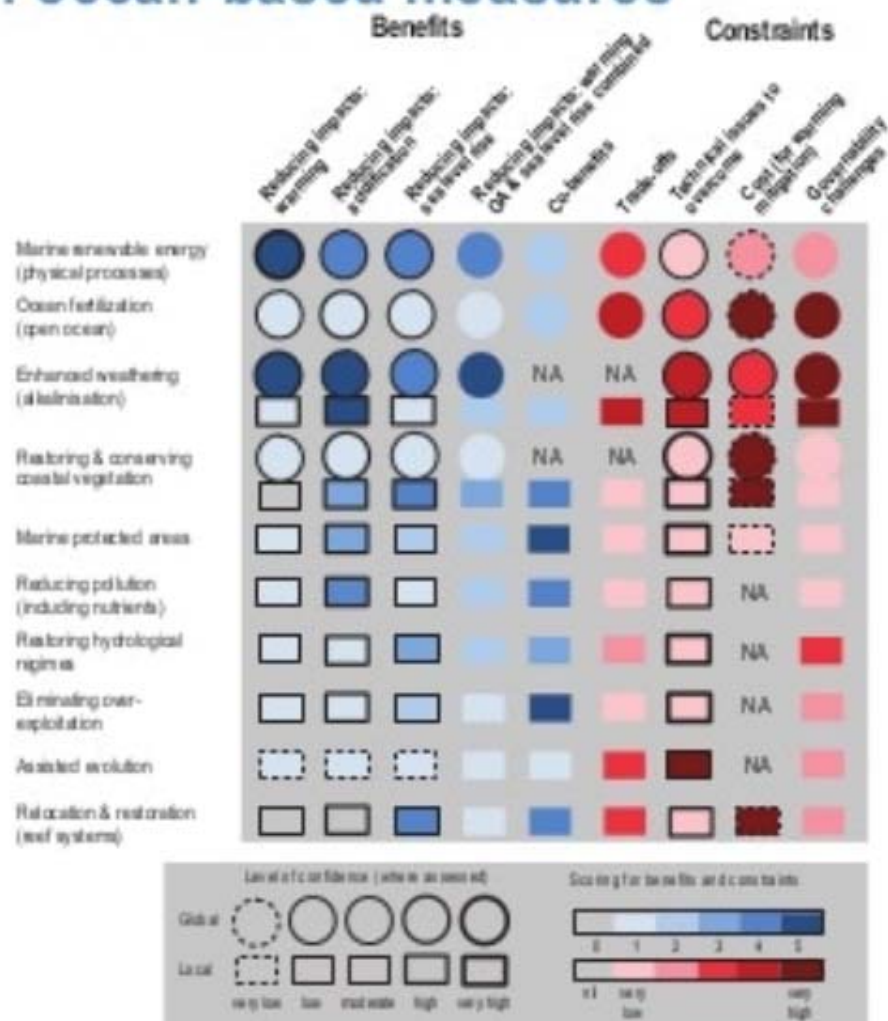
Plastics, Endocrine Disruptors, Nuclear Waste Emitted globally  
To be determined

# Potential ocean-based measures



Ocean-based solar radiation management will be covered in AR6

# Assessment of ocean-based measures



SROCC Chapter 5



IOC-UNESCO

GESAMP  
Seascape

ICP

LAMES

ISAF

REB / RFMOS

UNGA

CBD

FAO, UNEP, UNDP

UN-Regional Seas

UNCTAD

OMI

UN-Oceans

UN-Regional Seas

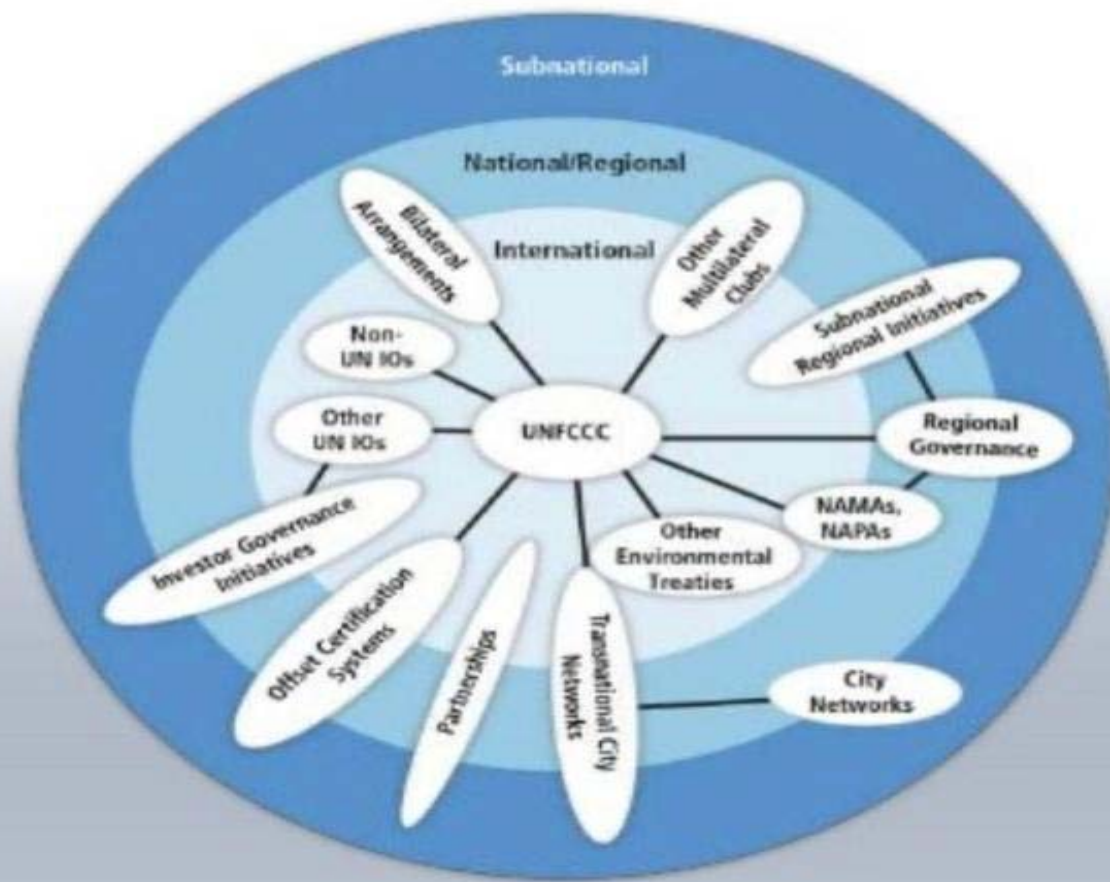
OALOS

WWF

PERSGA, STRA

MINDICN

# Climate change mitigation requires international cooperation across scales.

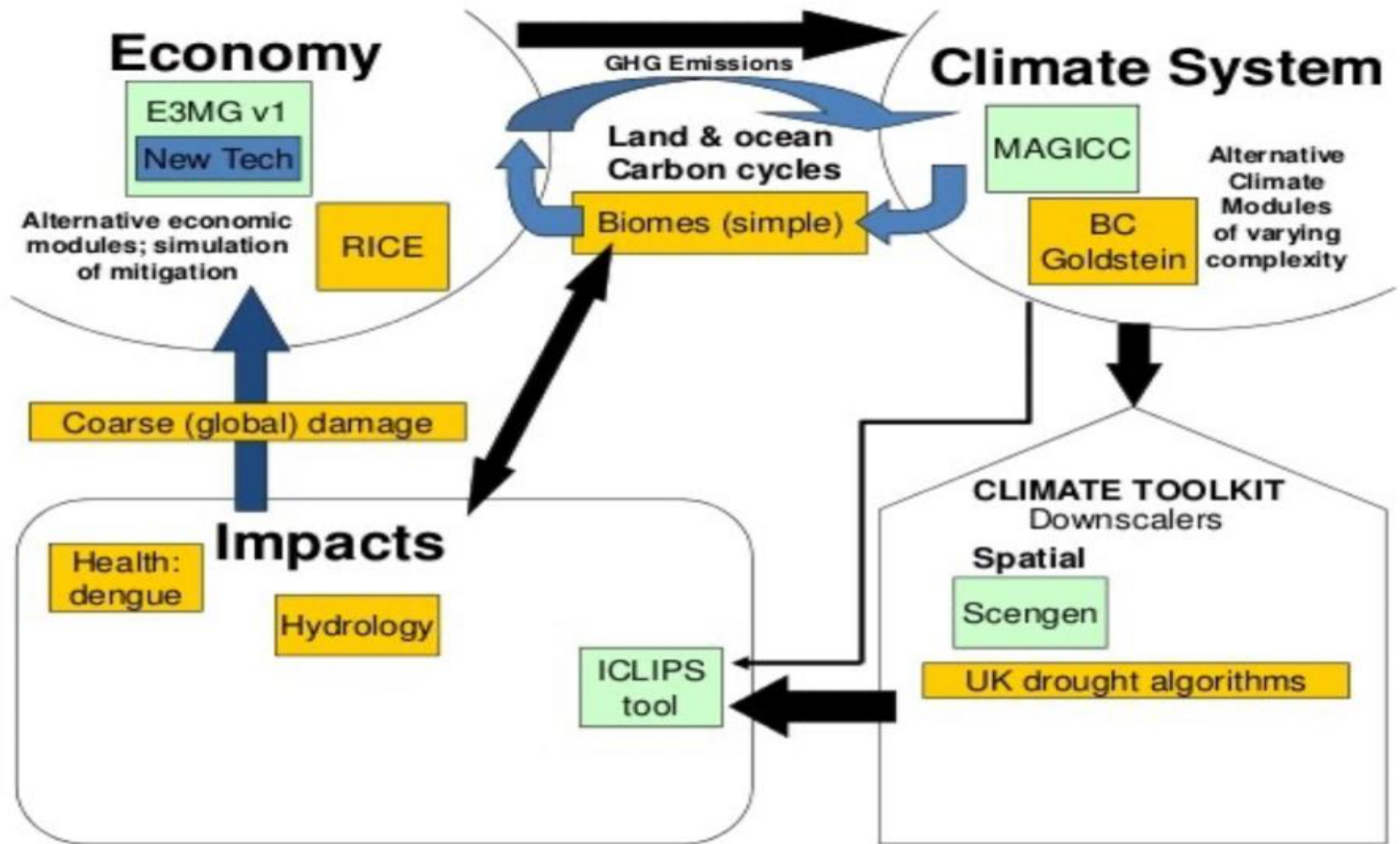


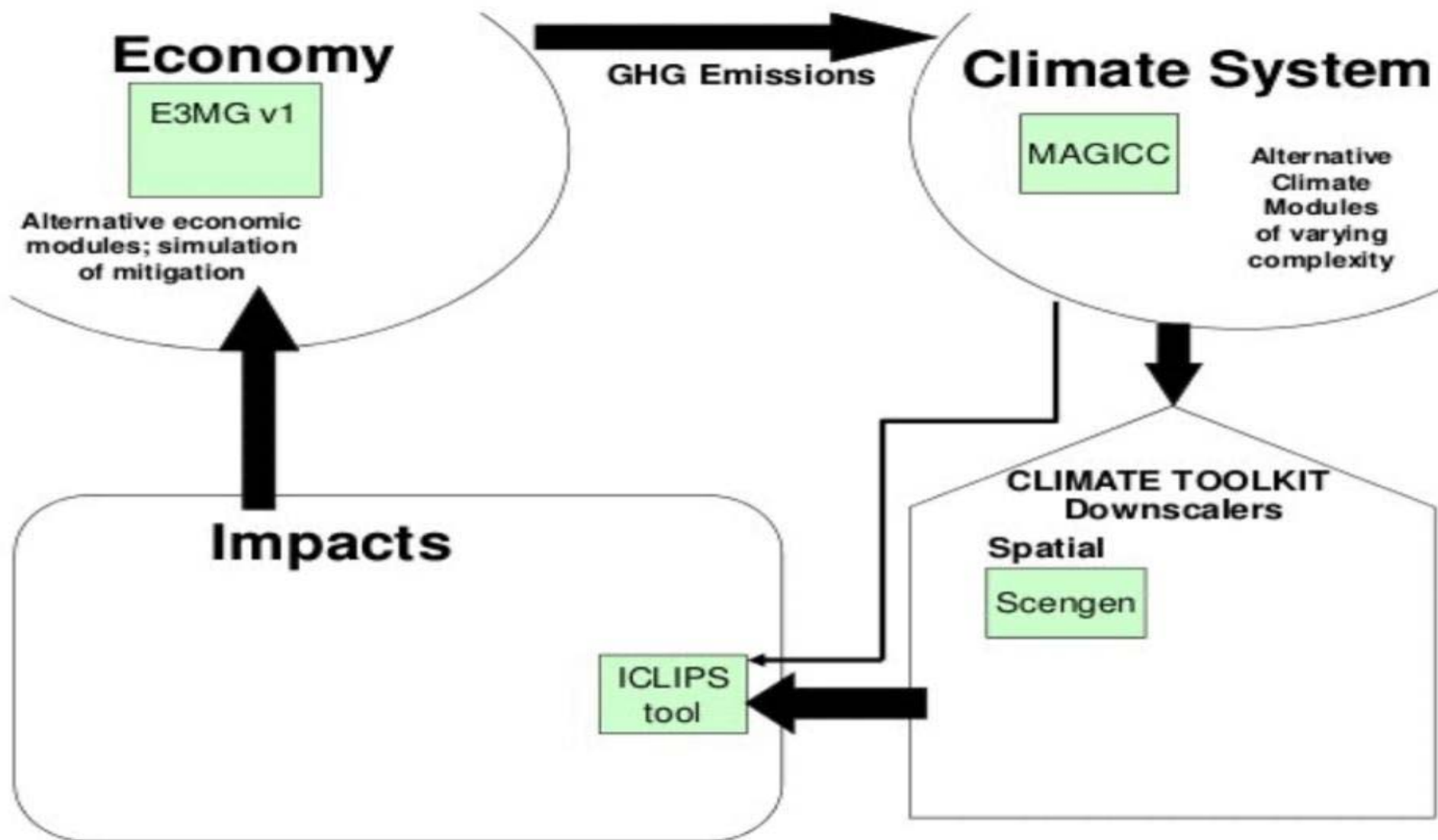
Based on Figure 13.1

## Basically, there are seven Pollution regulations.

1. The Water (Prevention & Control of Pollution) Act, 1974, and its amendments
2. The Water (Prevention & Control of Pollution) Cess Act, 1974 and its amendments
3. The Air (Prevention & Control of Pollution) Act, 1981 and its amendments
4. The Environment (Protection) Act, 1986 and its amendments
  - (a) National Environmental Tribunal Act of 1995 and
  - (b) National Environmental Appellate Authority Act of 1997
5. Hazardous Waste (Management and Handling) Rules, July 1989
6. The Public Liability Insurance Act, 1991.

The Public Liability Insurance Act 1991 has been included as the sixth environmental regulation because it is the first regulation which gives some teeth to the other five pollution regulations listed above.

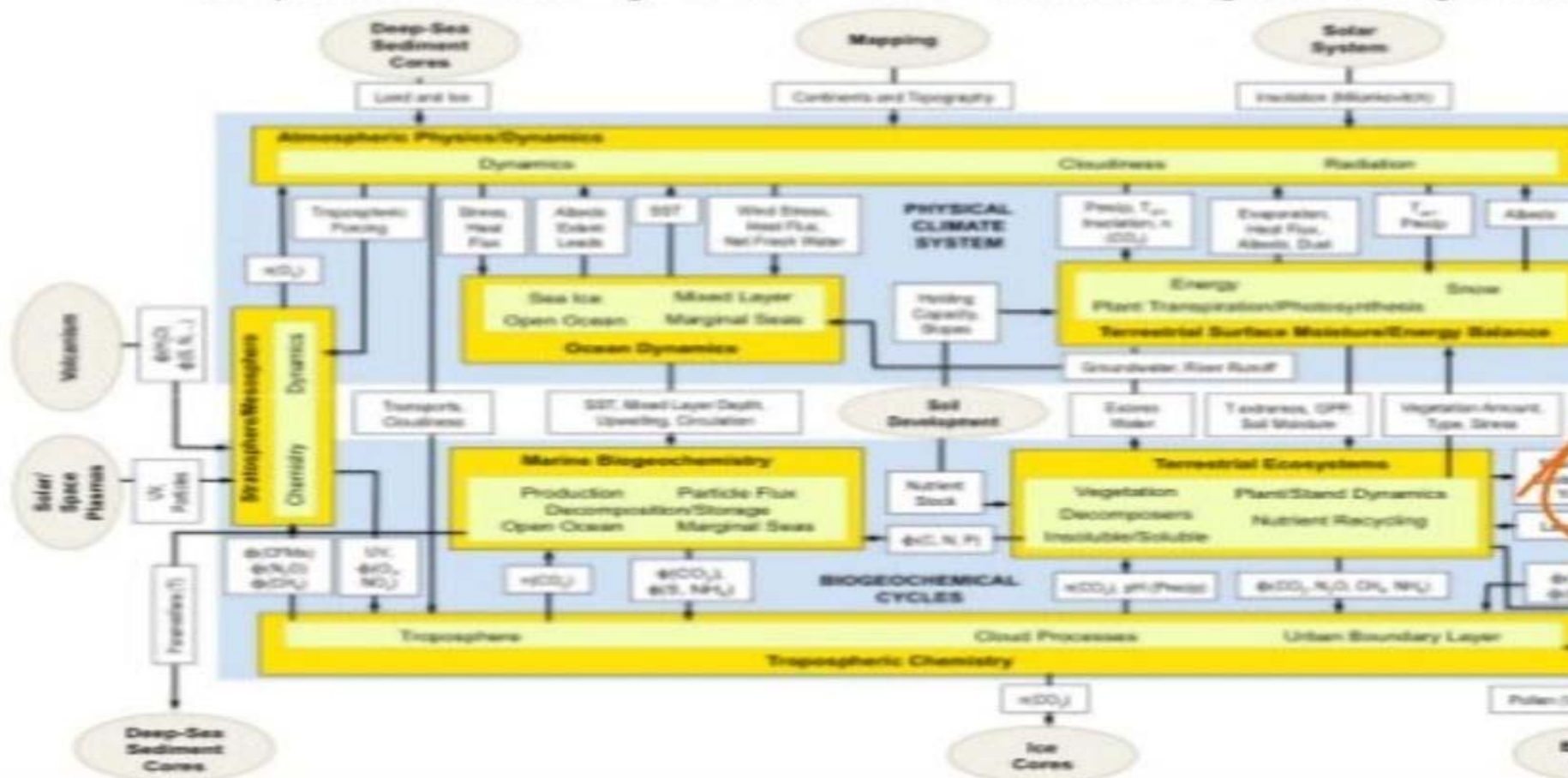






# How do we know? We simplify. We observe\*

The 'Bretherton Diagram' (NASA 1988) set out the observational, conceptual, and computational modelling framework for 1-2 decades of global change research.





THANK YOU