GAME PLAN

What do we already know?

- **Introduction to oceans and climate**
  - Analyze different datasets to build a model of the interactions between ocean and climate

- **Climate effects in South – East Asia**
  - Understand what major climate effects like the East Asian monsoon and El Niño are – why they occur? How can we identify them?

Climate in Vietnam

- **Climate proxy data**
  - Convert coral core data into ocean conditions

- **Past climate in Vietnam**
  - Understand how climate effects have changed over time
  - Is there a signal of anthropogenic warming?

WE ARE MEETING NATHALIE!

https://earthobservatory.sg/project/knowledge-capsules-unlocking-climate-secrets

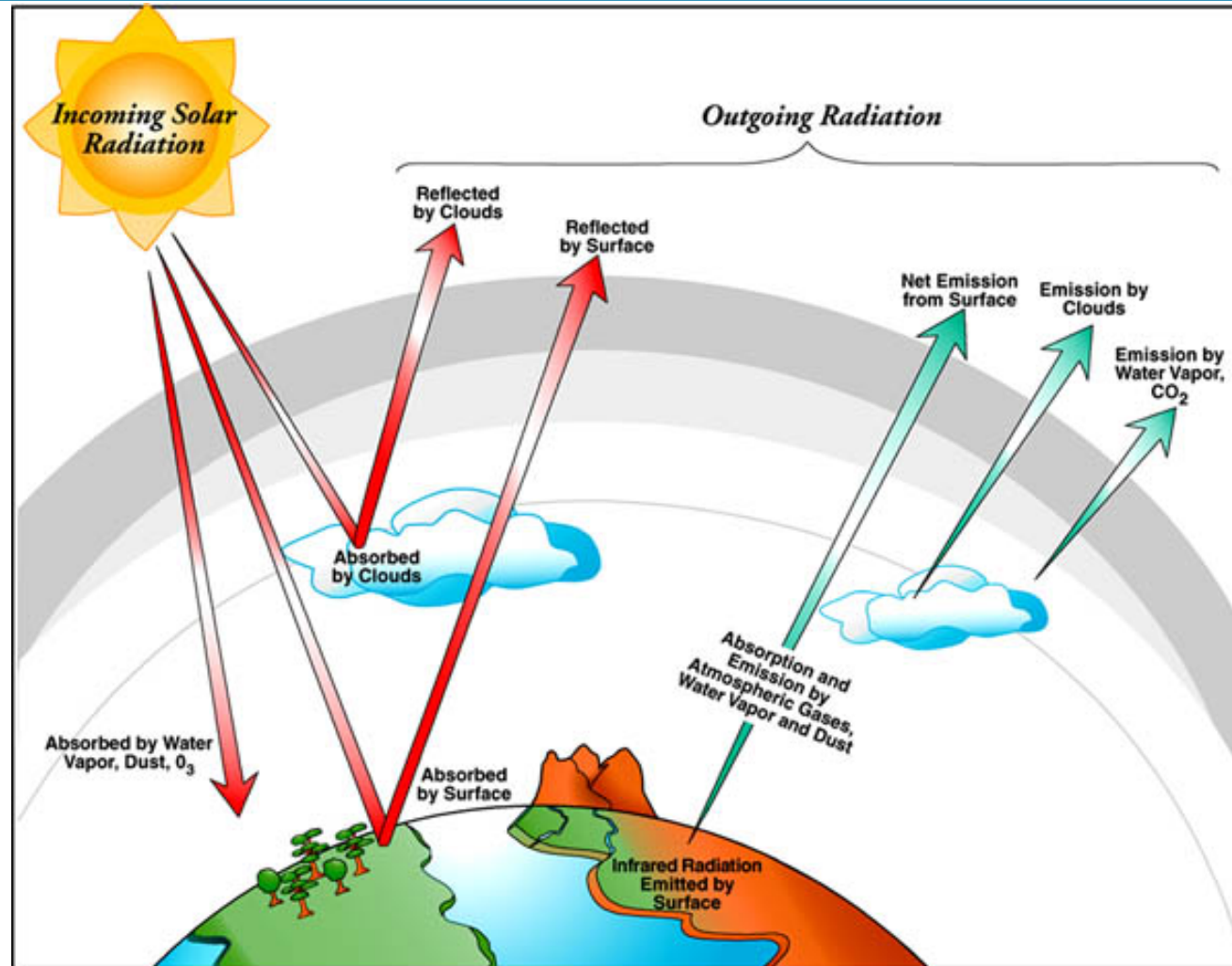Slack me two questions you would like to ask Nathalie!
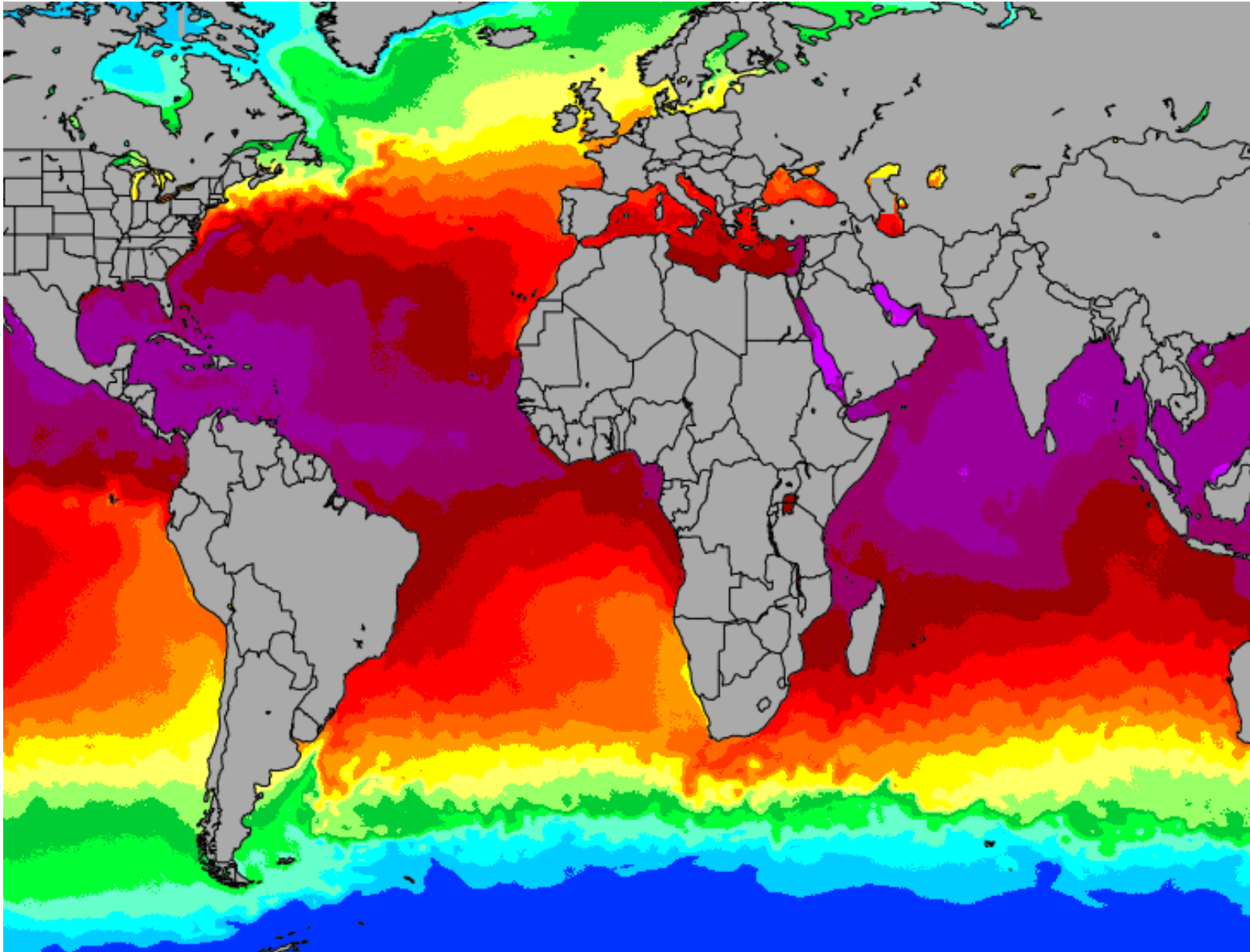
SEA SURFACE TEMPERATURE

UNIT 1: INTRODUCTION TO OCEANS AND CLIMATE

OCTOBER 17TH, 2019
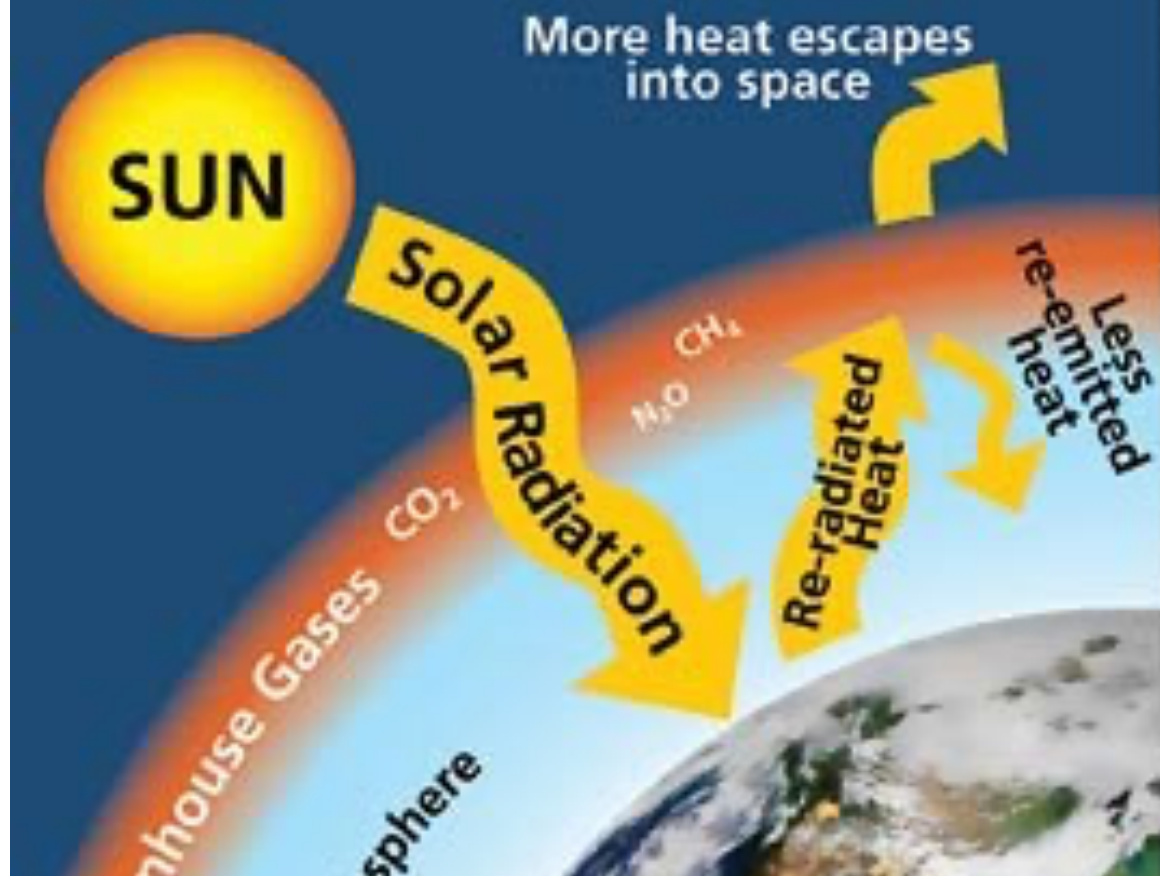
WHAT HAPPENS TO THE EARTH'S SOLAR RADIATION?

What's missing?

Natural Greenhouse Effect

SUN

More heat escapes into space

Solar Radiation

Re-radiated Heat

Less re-emitted heat

Greenhouse Gases CO₂ N₂O CH₄

Atmosphere

Human Enhanced Greenhouse Effect

Less heat escapes into space

SUN

More re-emitted heat

Re-radiated Heat

CO₂

Solar Radiation

CH₄ N₂O More Greenhouse
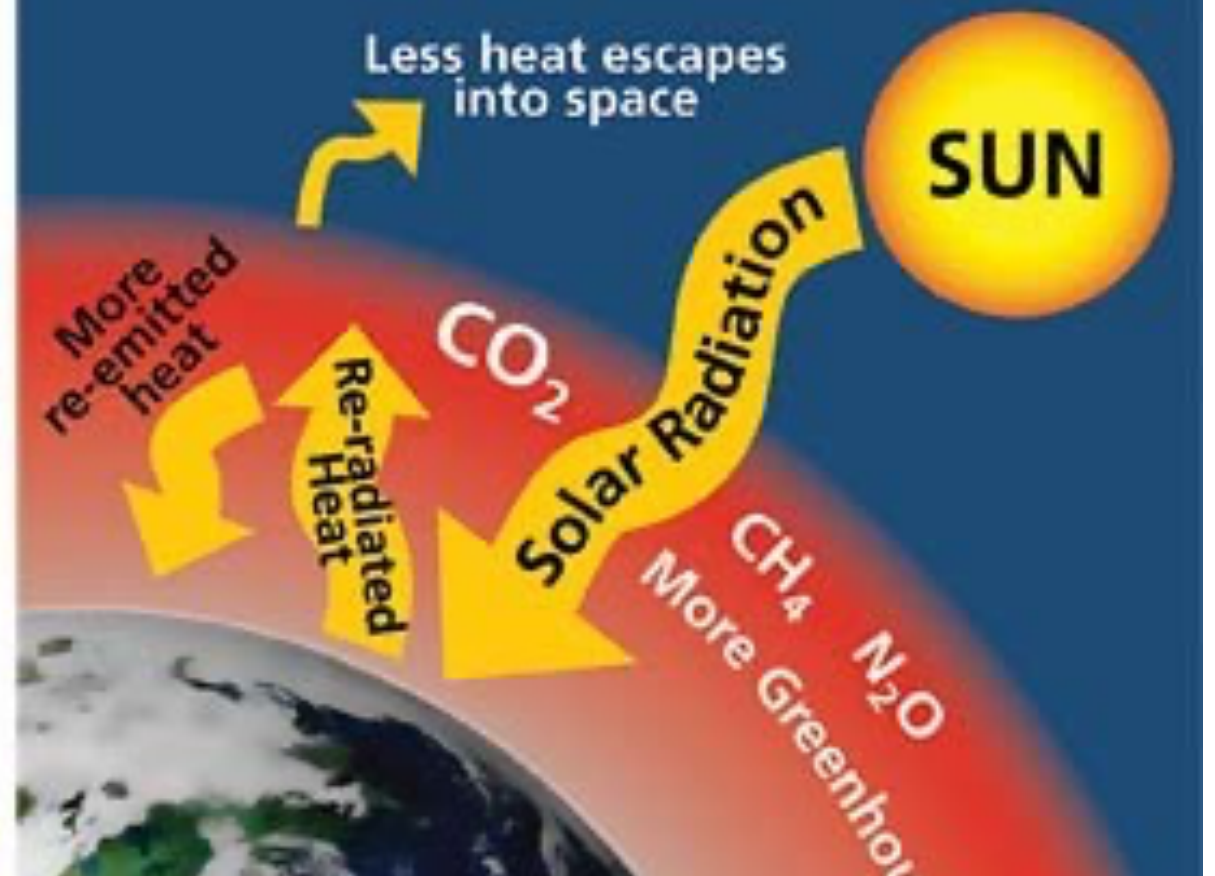
HEAT CAPACITY

- Material's ability to absorb heat
  - *Scientific definition:* Amount of energy needed to raise the temperature of a substance by 1 degree.

Water balloon experiment (https://youtu.be/QuWBtMy8L5A)

- Which one is water?

TRIVIA ROUND

How much of the excess heat created by global warming is absorbed by the ocean?

A. None

B. 10%

C. 50%

D. 90%

LET'S MODEL THE EARTH'S OCEANS

Based on what you learned, write/ color/ draw on your map:

- What you expect the surface temperature of the ocean to be from the equator to the poles? (remember to take into account the tilt of the Earth)

- How might this change seasonally?

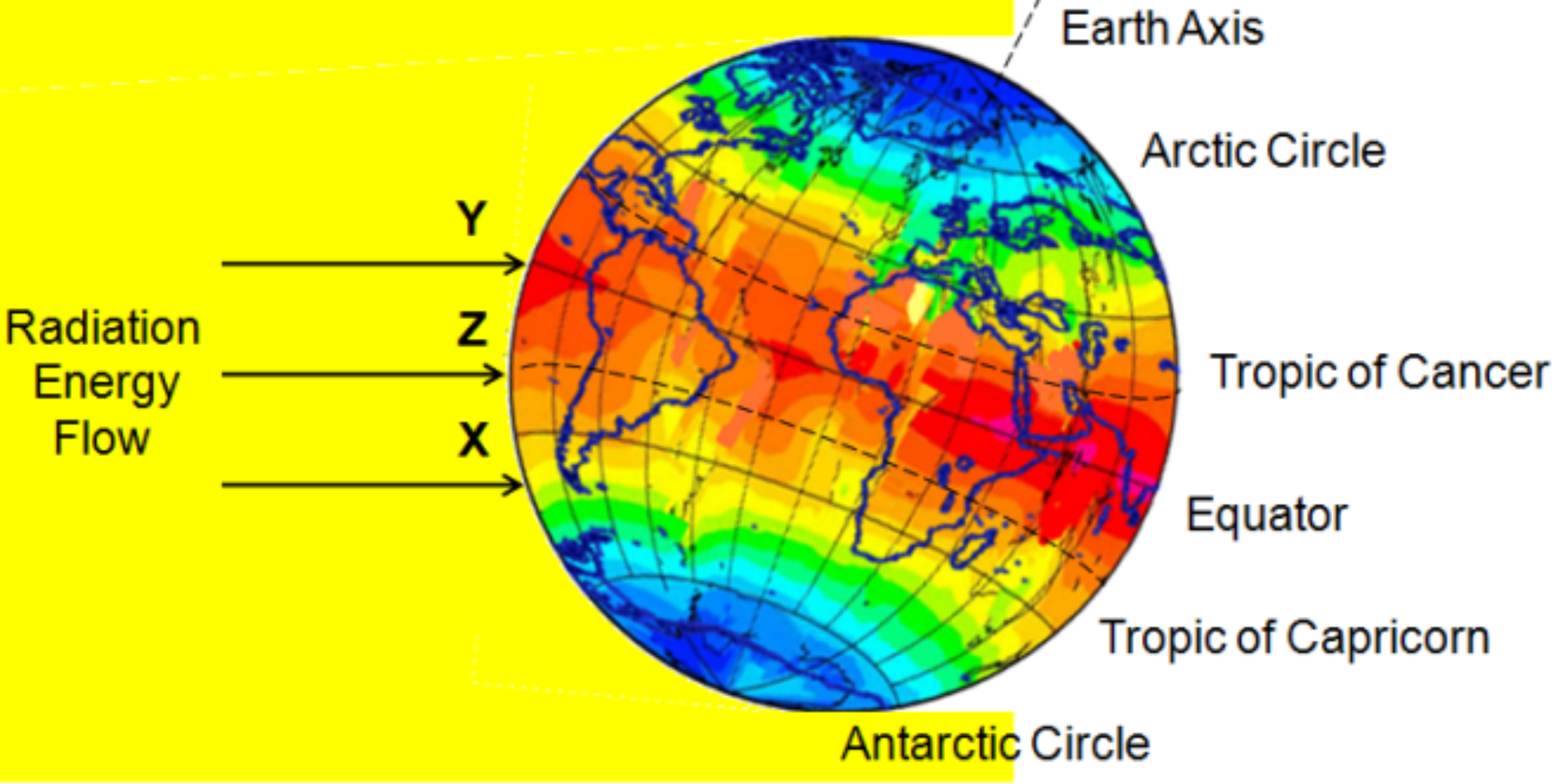- What other factors could influence sea surface temperature?
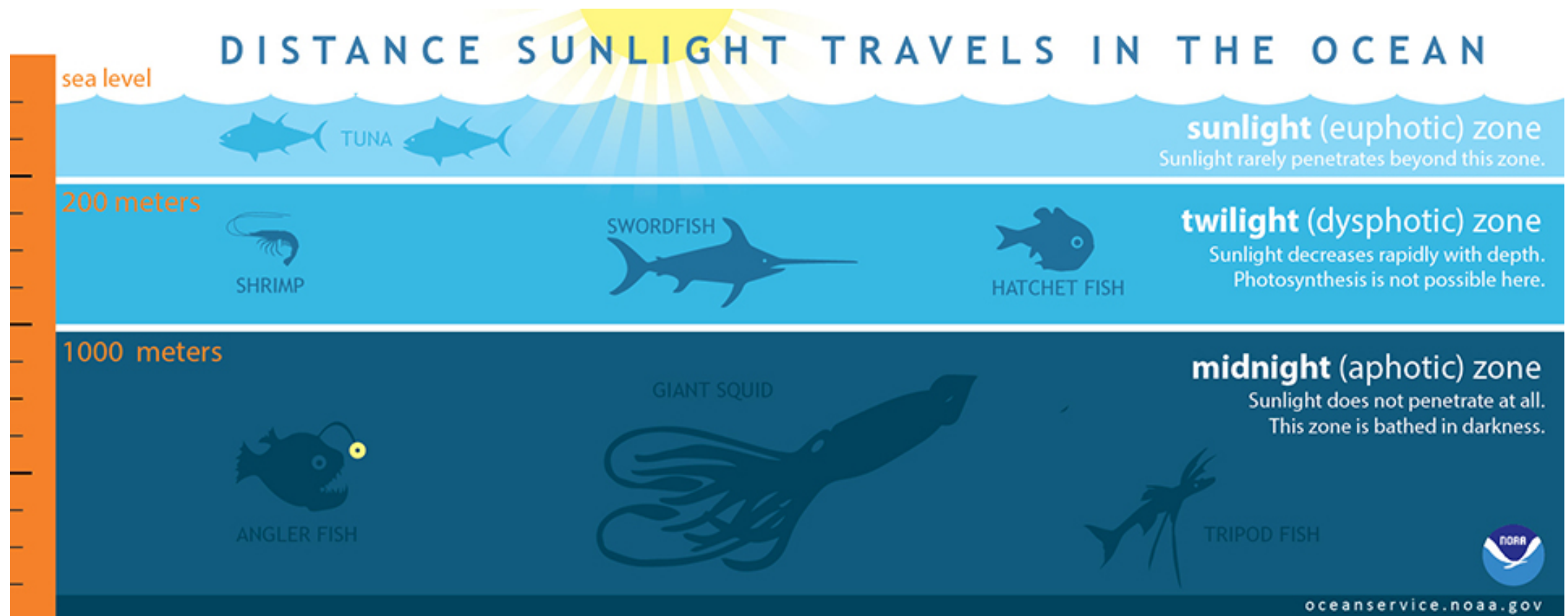
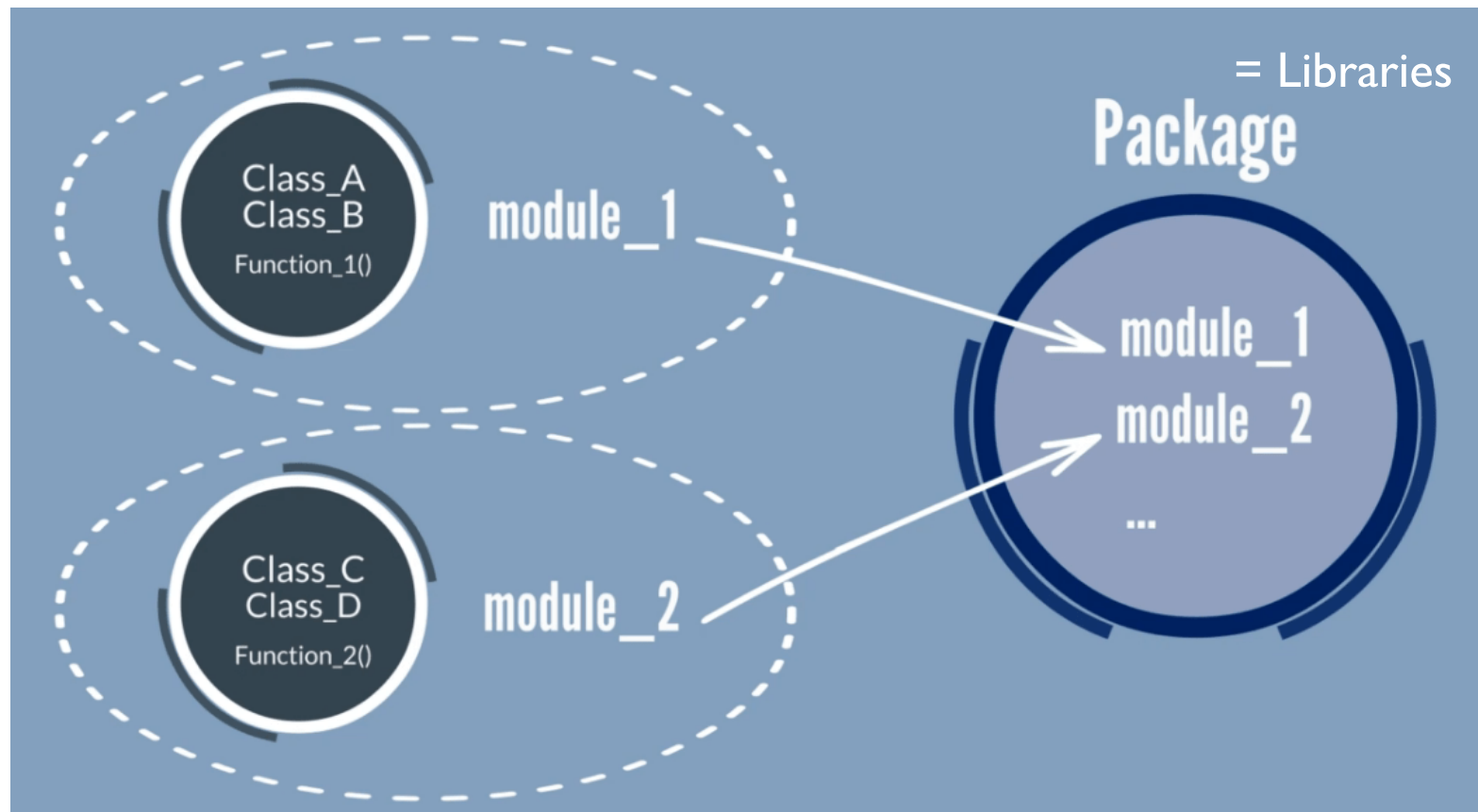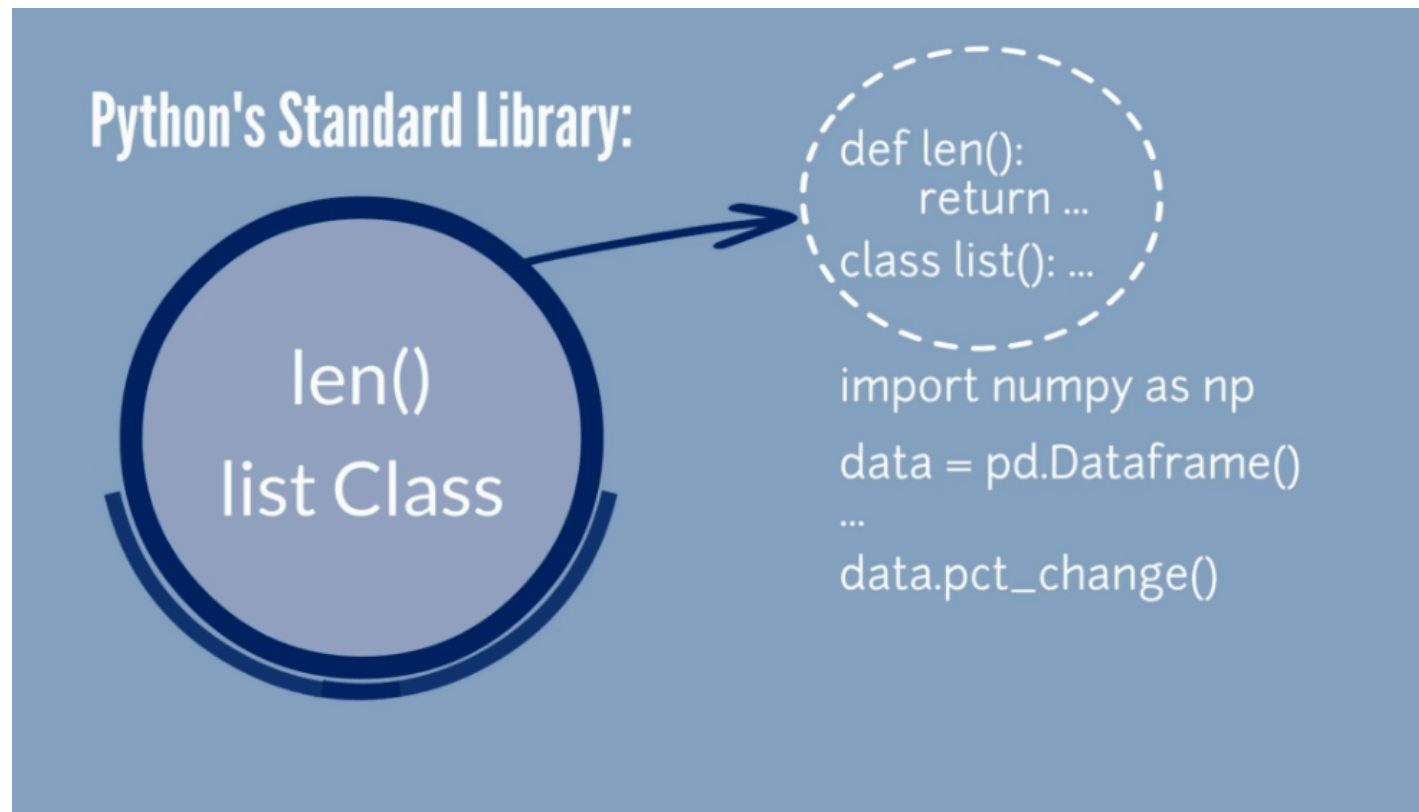We'll compare our model to NASA's satellite observations

WORLD
Oceans & Seas

N

ARCTIC OCEAN

Chukchi Sea
Beaufort Sea
Greenland Sea
Baffin Bay
Barents Sea
Kara Sea
Laptev Sea
East Siberian Sea
Bering Sea
Gulf of Alaska
Hudson Bay
Labrador Sea
Norwegian Sea
Gulf of Bothnia
White Sea
Sea of Okhotsk
Bering Sea

NORTH AMERICA
NORTH PACIFIC OCEAN
Baltic Sea
North Sea
EUROPE
Aral Sea
ASIA
Sea of Japan

Gulf of St. Lawrence
Bay of Biscay
Adriatic Sea
Black Sea
Caspian Sea
NORTH ATLANTIC OCEAN
Yellow Sea
East China Sea

Sargasso Sea
Strait of Gibraltar
Mediterranean Sea
Dead Sea
Persian Gulf
Gulf of Oman
PACIFIC OCEAN

Gulf of Mexico
Red Sea
Arabian Sea
Bay of Bengal
South China Sea
Philippine Sea

Caribbean Sea
AFRICA
Gulf of Aden
Andaman Sea
Celebes Sea

Gulf of Guinea
Flores Sea
Arafura Sea

SOUTH AMERICA
Java Sea
Timor Sea
Coral Sea

INDIAN OCEAN
AUSTRALIA & OCEANIA

SOUTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
Tasman Sea

Scotia

Earth Axis

Arctic Circle

Y

Radiation
Energy
Flow

Z

Tropic of Cancer

X

Equator

Tropic of Capricorn

Antarctic Circle

AS WE GO DEEPER...

DISTANCE SUNLIGHT TRAVELS IN THE OCEAN

sea level

sunlight (euphotic) zone
Sunlight rarely penetrates beyond this zone.

TUNA

200 meters

SHRIMP

SWORDFISH

HATCHET FISH

twilight (dysphotic) zone
Sunlight decreases rapidly with depth.
Photosynthesis is not possible here.

1000 meters

GIANT SQUID

midnight (aphotic) zone
Sunlight does not penetrate at all.
This zone is bathed in darkness.

ANGLER FISH

TRIPOD FISH

oceanservice.noaa.gov

PYTHON REFRESHER: LIBRARIES, PACKAGES, MODULES

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PYTHON REFRESHER: FUNCTIONS