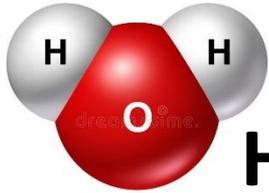
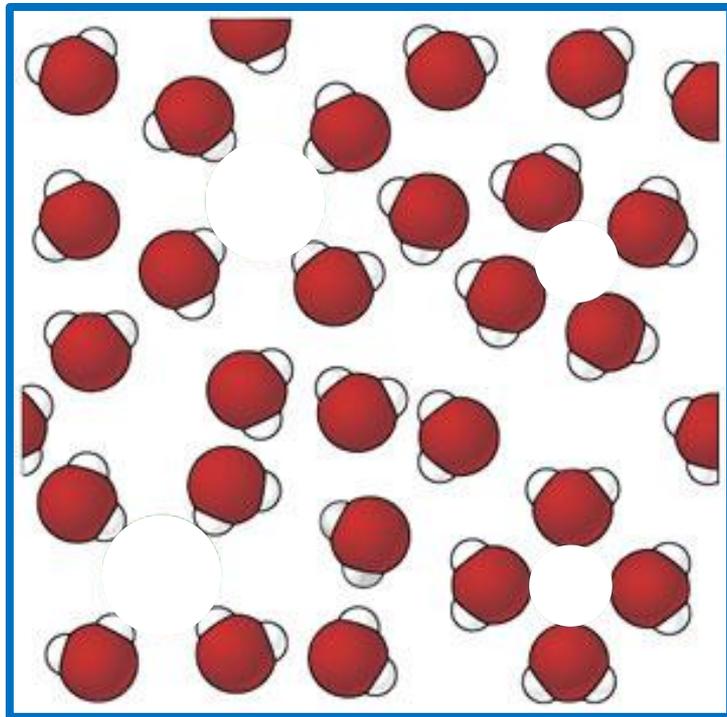


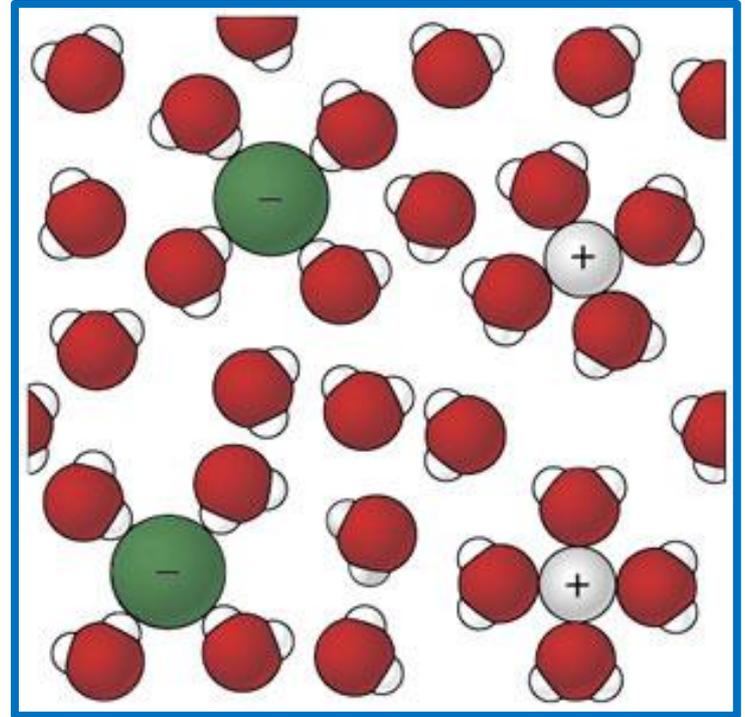
# What Kind of Water?



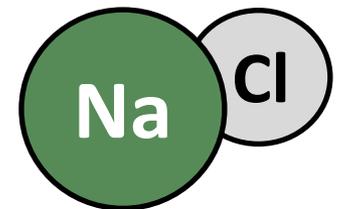
**H<sub>2</sub>O (water)**



**VS**



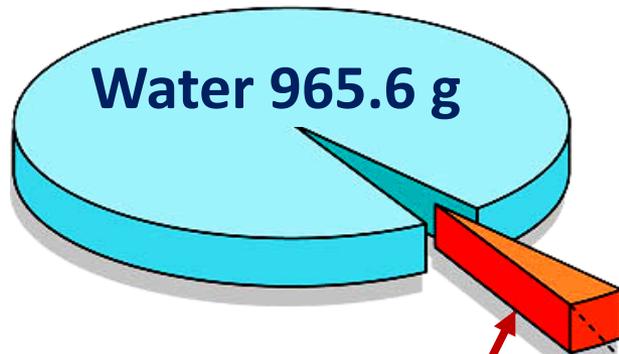
**NaCl**  
**(table salt)**



# How Salty is the World Ocean?

**Salinity** (measured in *percent, %*, or *parts per thousand, ppt or ‰*) is a measure of the **amount of salt dissolved in a liquid**.

1 kg seawater

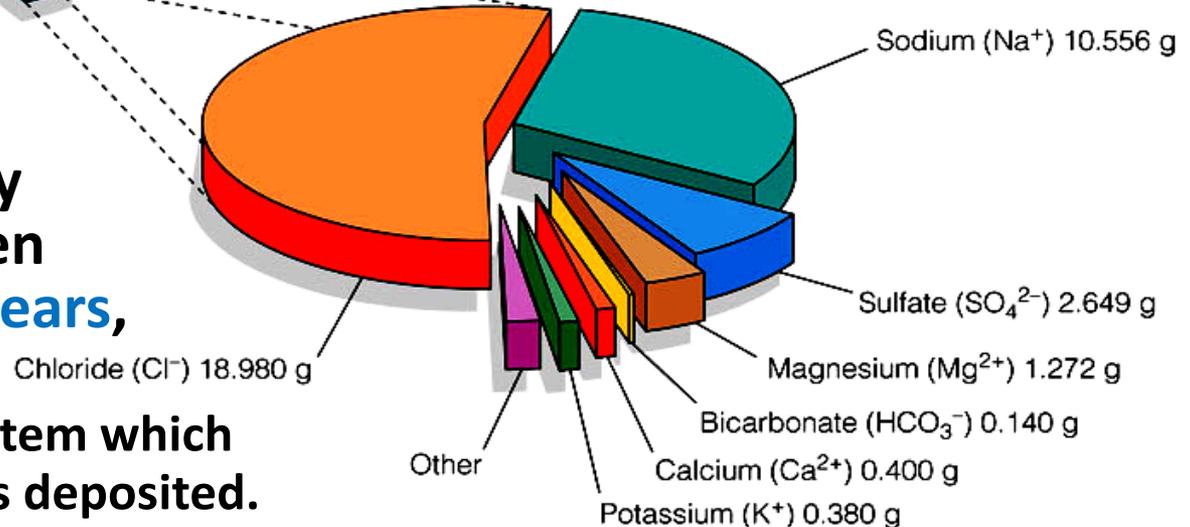


**Salts 34.4 g**

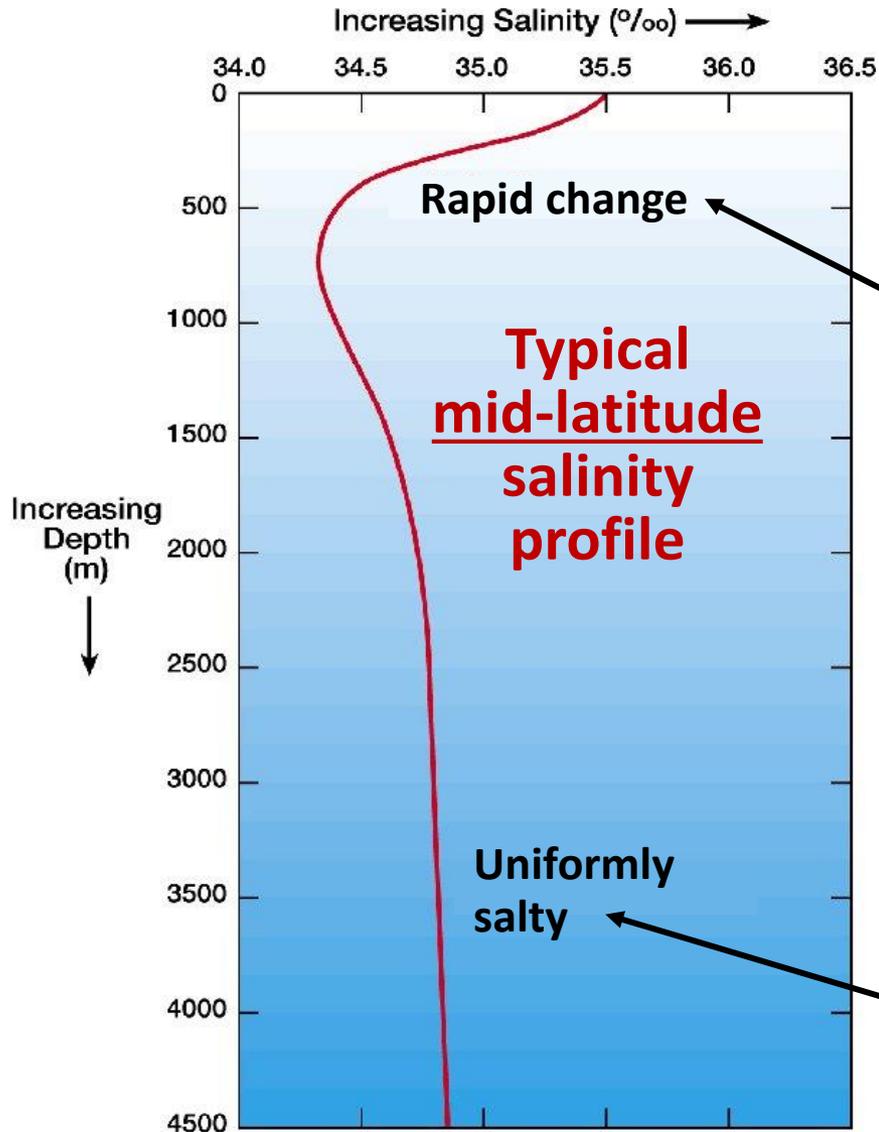
Salty seawater formed due to salts dissolved from the lithosphere:

- leached out of the ocean floor when the ocean formed
- brought by river flow over the ground and into the ocean

Average ocean salinity is **~3.44%** and has been **stable for billions of years**, most likely a result of a chemical/tectonic system which removes as much salt as is deposited.



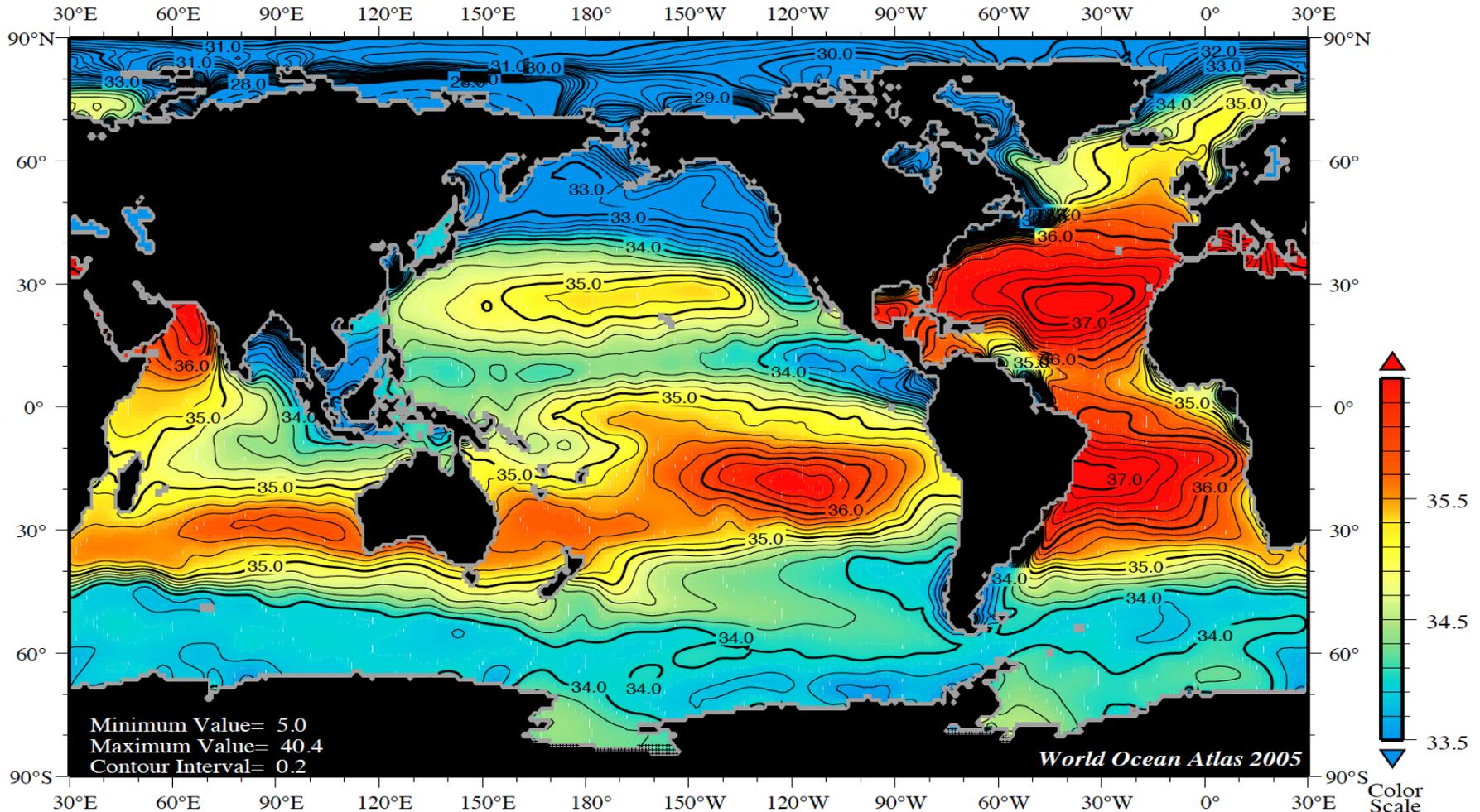
# Salinity Varies with Depth



Seawater is **not uniformly saline** throughout the world.

- Surface (mixed) layer salinity is influenced by:
  - evaporation of water (‰↑)
  - precipitation (‰↓)
  - ice formation (‰↑)
  - ice melting (‰↓)
- Saltier water is denser and consequently, it sinks down.
- Beyond ~1000 m, salt content changes very little.

# Ocean Surface Salinity Pattern



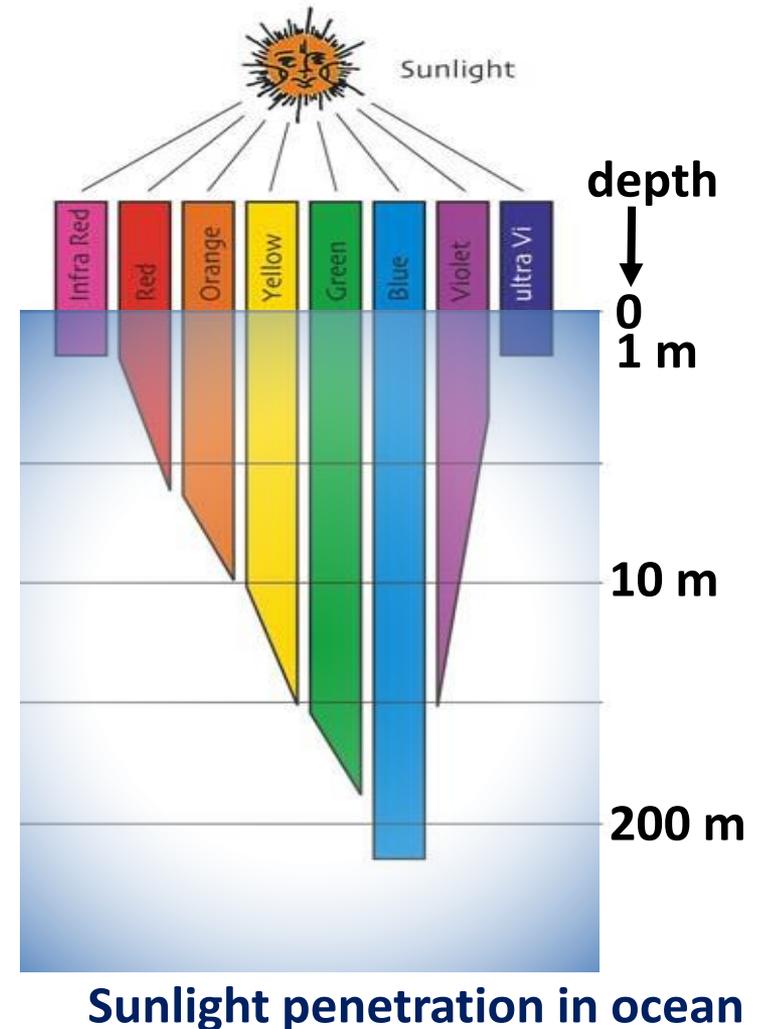
Salinity is an **ecological factor** of great importance, influencing:

- the types of organisms that live in a body of water,
- the kinds of plants that grow either in a water body, or on nearby land.

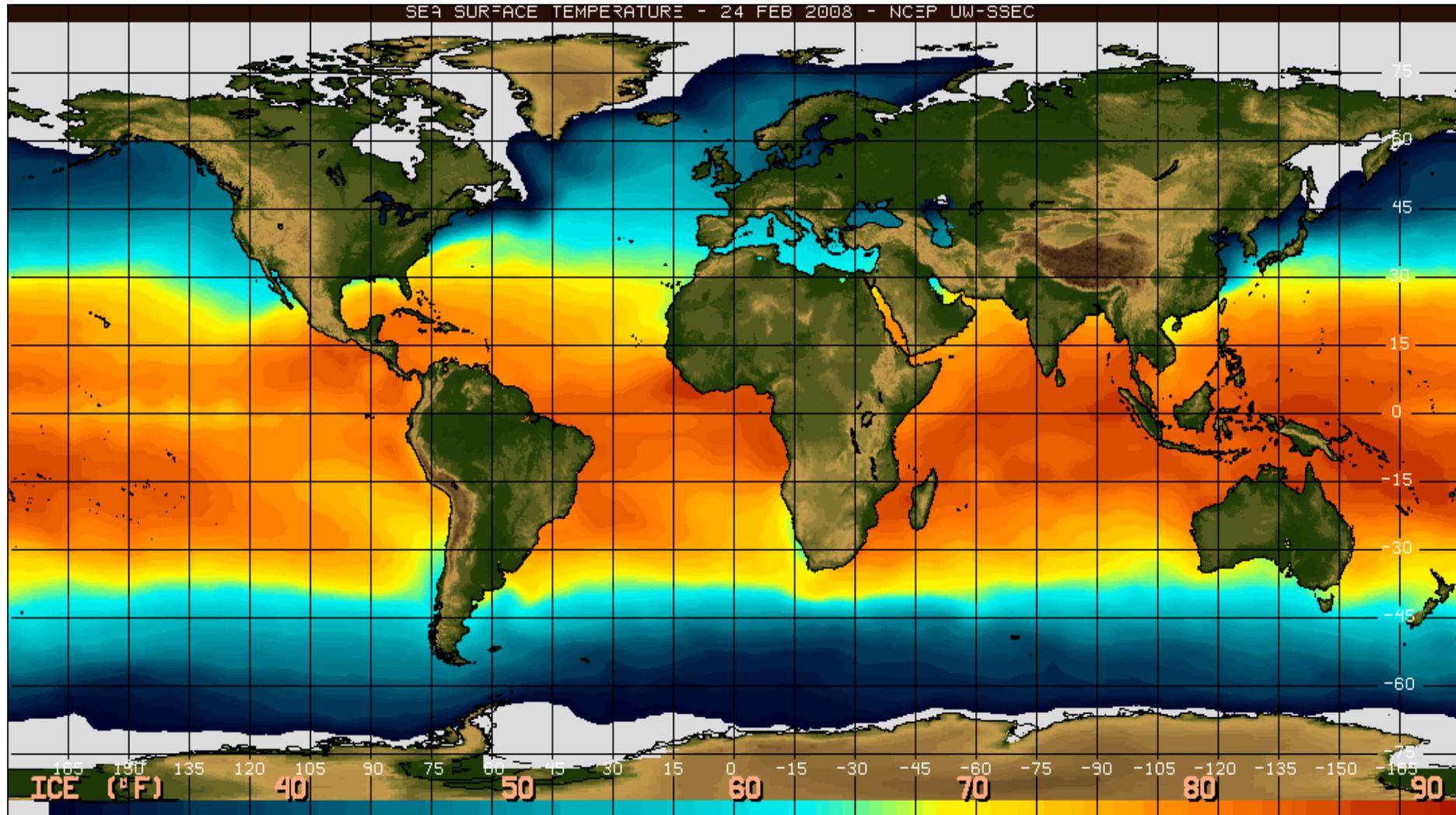
# Ocean Temperature

Ocean temperature varies with depth, latitude, and season.

- **Ocean** is **heated by the Sun** from the surface *downward*.
- Most of sunlight energy is absorbed within the top layer of <200 meters.
- Ocean surface temperature can vary a lot, but **deep waters are very cold**, 75% of the ocean is between 30 to 43°F (-1 to +6°C).
- Both *seasonal* and *latitude* variation of ocean surface temperature are mostly due to the relative position of the Earth and the Sun.

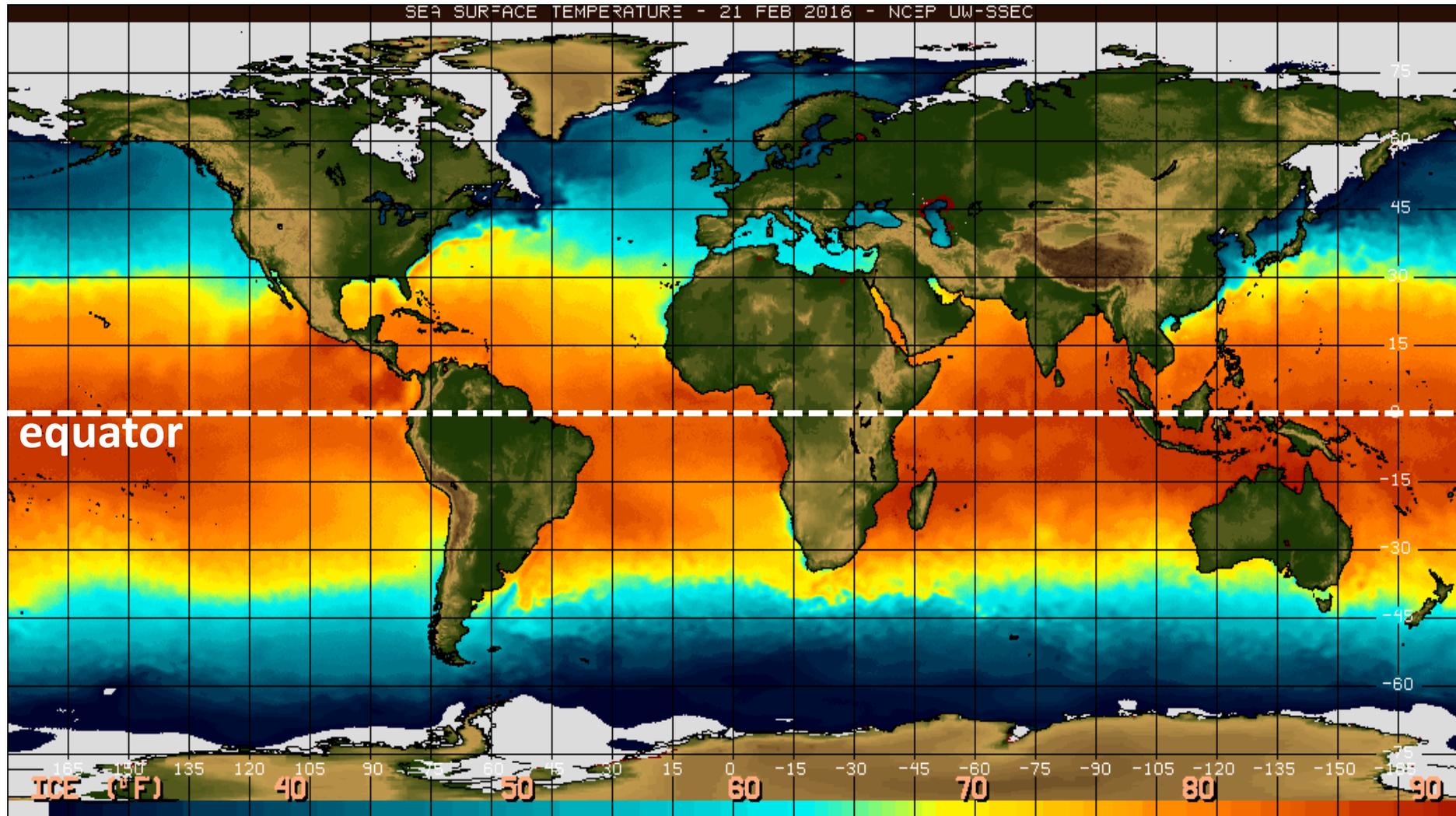


# Temperature: Latitude Variation



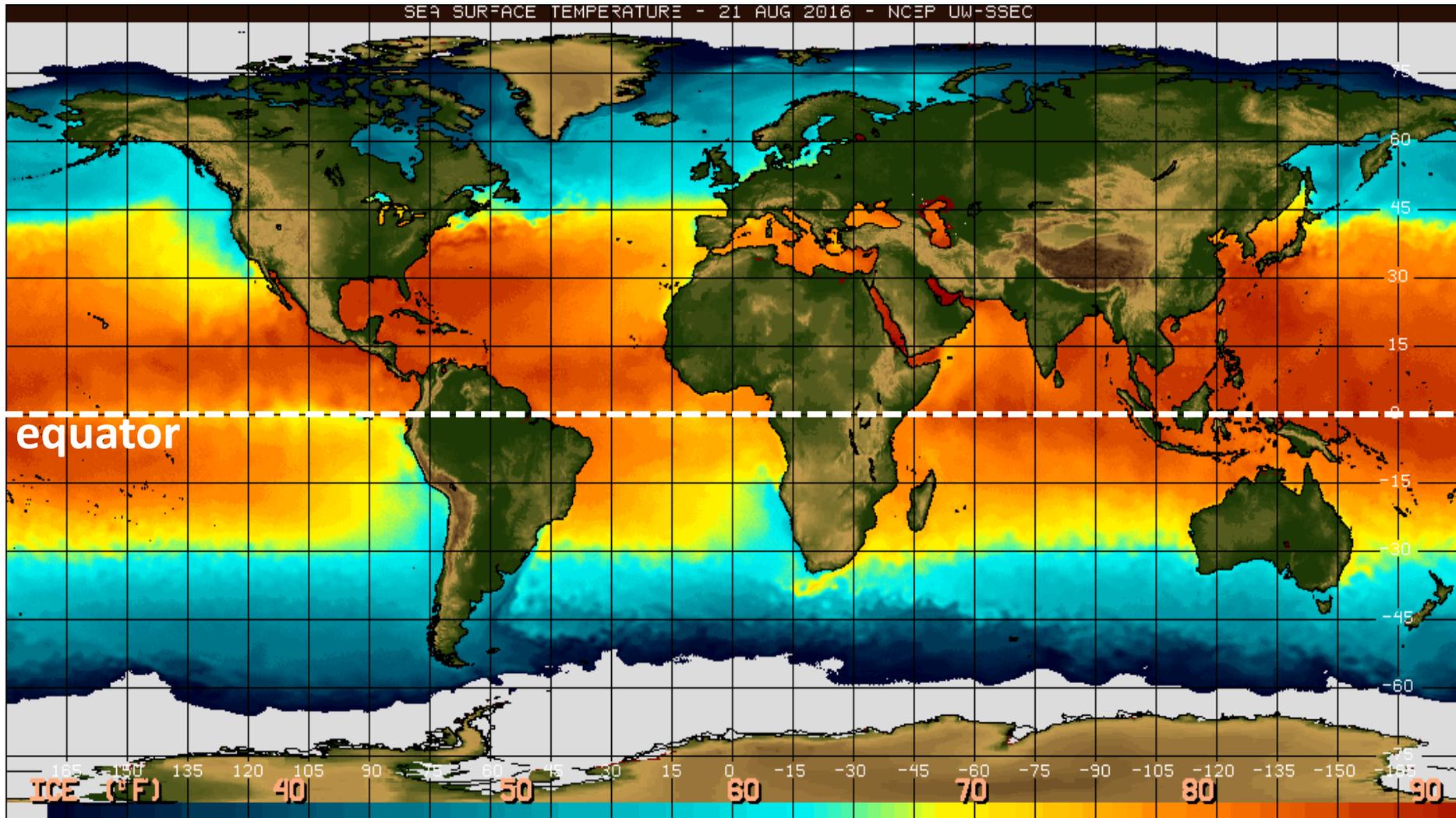
Ocean **surface temperature** varies greatly with **latitude**.

# Temperature: Seasonal Variation

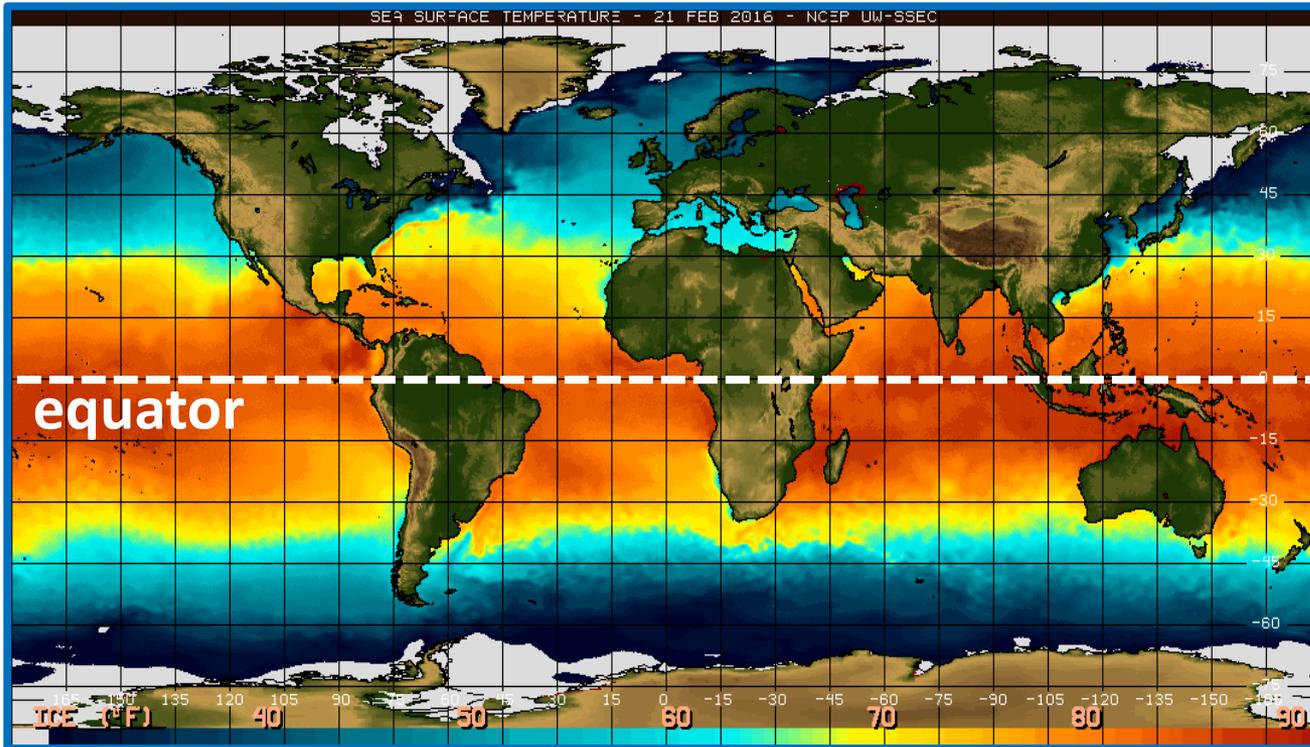


Ocean **surface temperature** on **February 21, 2016**.

# Temperature: Seasonal Variation

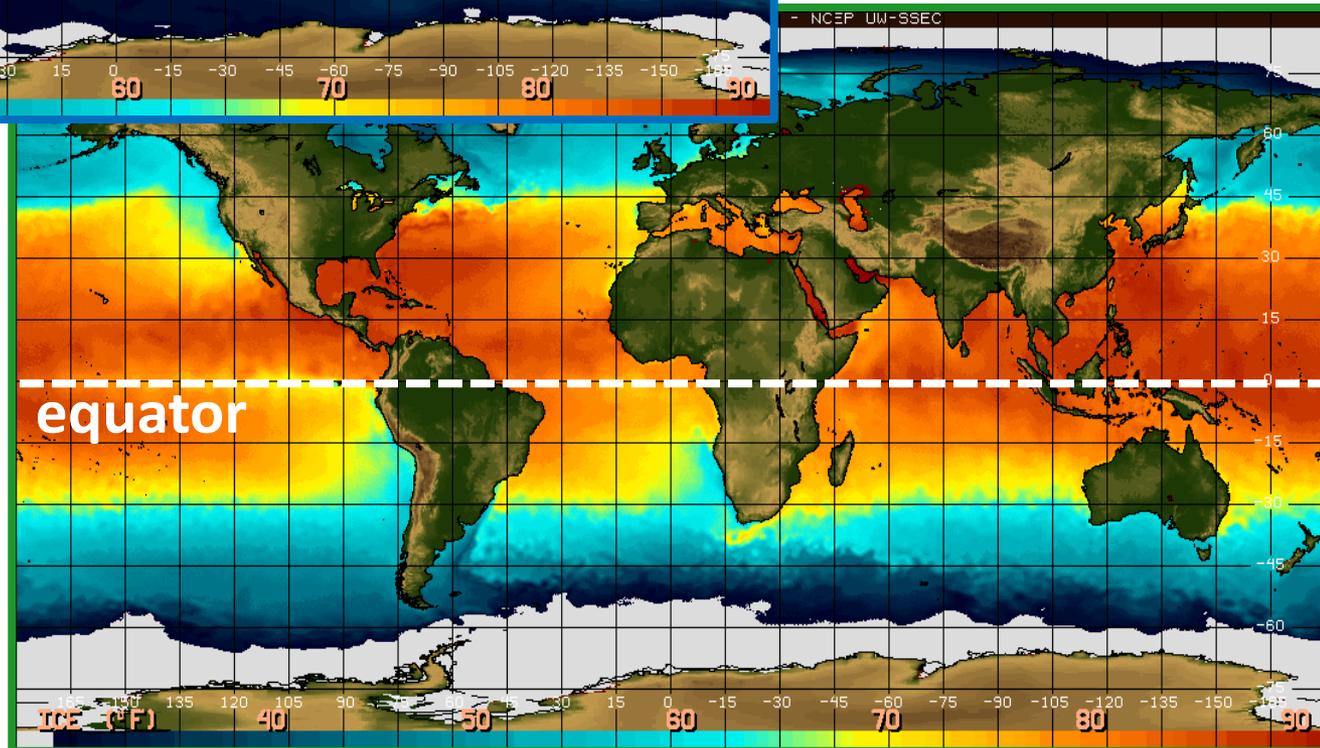


Ocean **surface temperature** on **August 21, 2016**.



↑  
February 21, 2016

August 21, 2016 →



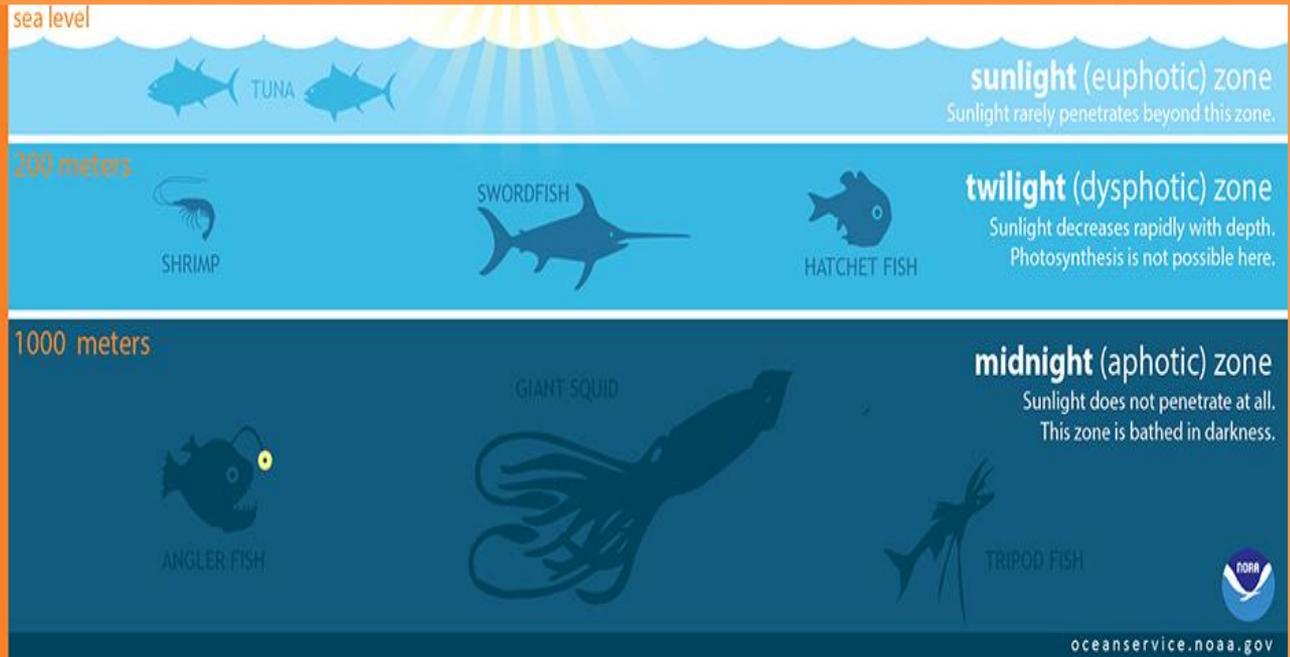
## Ocean Surface Temperature:

seasonal variation is slight since water loses or gains heat much more slowly than land.

# Ocean Layers

## Based on sunlight penetration:

- Sunlight (photosynthesis is possible)
- Twilight
- Midnight



## Based on water density:

- Mixed layer
- Pycnocline (rapid change of temperature/salinity)
- Deep ocean (cold and salty)

