4 Notes: Currents, Conveyor, Albedo, El Nino

Ocean Currents

Ocean Surface Currents:

What is the causes ocean surface currents?

Mostly wind, but also tides, rotation of ⊕, land masses/ shapes

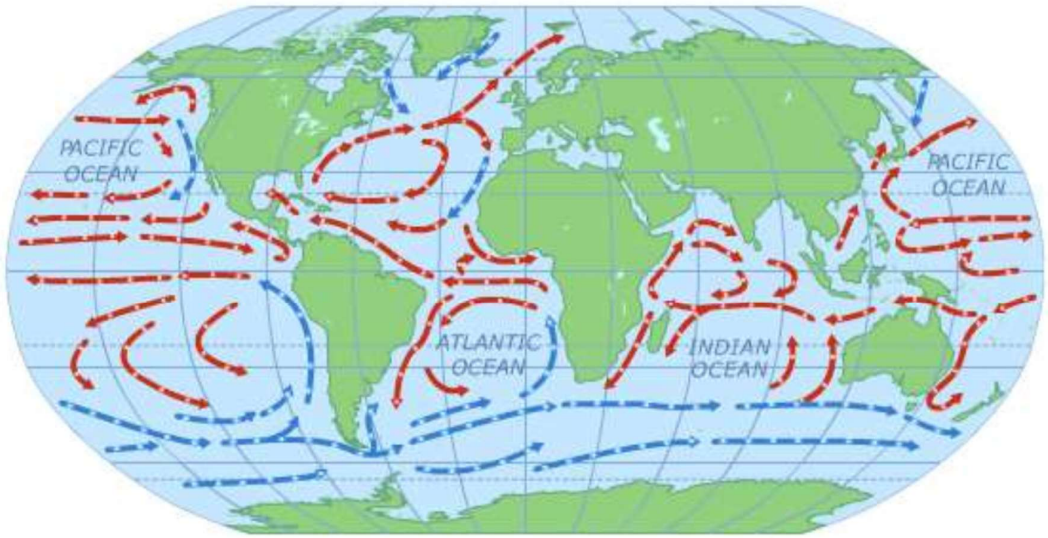
Most ocean surface currents in the world follow a circular motion movement called a gyre

Why do you think ocean currents move in a circular movement?

- coriolis effect – deflects to right in Northern Hem → cw gyres
  – " " left " Southern " → ccw gyres
  (similar to "highs" in atmosphere)

Do surface ocean currents affect coastal climates?

– yes, both temperatures and precipitation can be affected.



Deep-Ocean Circulation – the Ocean Conveyor:

Deep-Ocean circulation is caused by the vertical displacement of water in the ocean. What causes this vertical displacement?

- water densities (in response to temp. and salinity)

Describe the steps of Thermohaline circulation: (temp, saltiness)

In high latitudes, cold water on the surface of the ocean gets saltier as water evaporates due to wind. When sea ice forms, it pulls pure water out of the ocean, leaving salt behind making the ocean water even saltier. This saltier colder water is now denser so it sinks deep into the ocean and moves along the depths until it can rise to the surface.

Heat from the sun eventually warms the cold water at the surface, where evaporation makes the water saltier. This warm salty water is carries northwards by large powerful wind-driven ocean currents like the Gulf Stream, up the U.S. East coast, then into the North Atlantic region where it releases heat into the atmosphere and warms Western Europe. This water becomes very cold and dense again, sinks to the deep ocean, and the cycle continues.

What does the abbreviation "AMOC" stand for?

Atlantic Meridional Overturning Circulation

How does AMOC affect climate?

- brings moderate rains + temps to Europe
- carries huge amounts of heat to certain parts of the planet.

What climate change effect could disrupt the deep-ocean circulation cycle? How so?

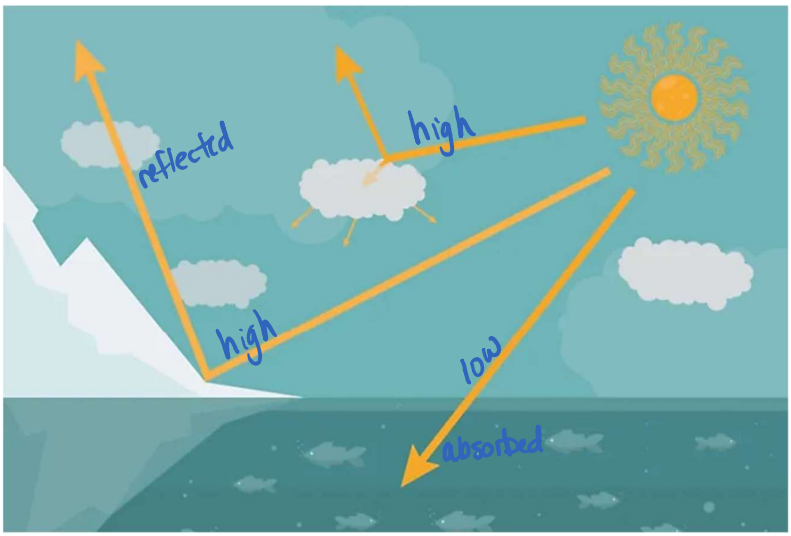
- melting ice (glaciers + sea ice)
  - ↳ dumps fresh water into the ocean, lower the density of seawater and slow down the sinking that drives the global ocean conveyor.

Oceans and Climate

Albedo Effect:

Albedo is the ability of a surface to reflect sunlight (heat from the Sun)

- Light (reflect)-coloured surfaces return a large part of the sunrays back to the atmosphere -> high albedo (1)
- Dark-coloured surfaces absorb the sunrays -> low albedo (0)



Most of the Sun's radiation is absorbed by the ocean.

The ocean doesn't just store solar radiation, it also helps to distribute heat around the globe.

Ocean water is constantly evaporating, increasing the temperature and humidity of the surrounding air to form rain and storms that are then carried by trade winds. Almost all rain that falls on land starts off in the ocean. The tropics are particularly rainy because heat absorption, and thus ocean evaporation, is highest in this area.

Outside of Earth's equatorial areas, weather patterns are driven largely by ocean currents. Ocean currents act much like a conveyor belt, transporting warm water and precipitation from the equator toward the poles and cold water from the poles back to the tropics. Thus, ocean currents regulate global climate, helping to counteract the uneven distribution of solar radiation reaching Earth's surface. Without currents in the ocean, regional temperatures would be more extreme — super hot at the equator and frigid toward the poles.

El NIÑO:

What is El NIÑO? (not a storm)

- a weather phenomenon in Pacific Ocean temps rise in equatorial pacific by 0.5°C – 3°C for 3 months and wind changes as do rainfall patterns.

What causes an El NIÑO event? Describe what happens.

- Normal E → W trade winds weaken, warm water that normally travels W now goes E
- warm ocean water warms atmosphere, moisture-rich air rises and becomes rainstorms
- ocean warm water pushes down colder water, blocking the usual up-welling.

How often to *El* NIÑO events take place?

- every 2-7 years

What kind of effects does *El* NIÑO cause?

- flooding/increased rainfall (western US + central/SAmerica)
- fish migrate to colder waters
- increased droughts, wildfires, colder ocean waters (Australia + SE Asia)

La Niña – opposite effect ... oceans cool below normal ...