Dynamic Planet

Lesson 8, 12/12

Last Week's Quiz

Congrats to everyone who took last week's quiz!! Take a look at your scores and **the key** and let me know if you have any questions! I'll also go over some frequently missed questions right now.

Today we'll start to learn about how water moves within the ocean! :))

01

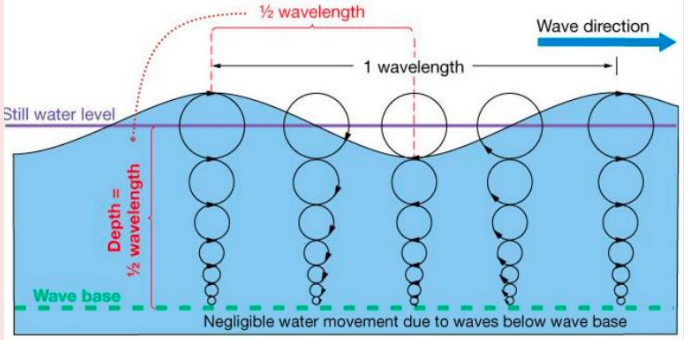
Waves

Wave Motion

Waves are just energy passing through water, causing it to move in a circular motion; in reality, the water in waves doesn't travel much at all.

As a wave passes through water, not only does the surface water follow an orbital motion, but so does a column of water below it (down to half the wave's wavelength).

As a wave approaches shore and water becomes shallower, the bottom portion of the wave will touch land. This will cause it to slow down and compress, forcing the wave's crest into the air. When wave steepness exceeds 1:7, the wave will break and this crest will come crashing down.



(b) Detail showing the decreasing size of orbital motion of water particles in waves with depth. Note that wave base (the depth at which orbital motion ceases) is at a depth of one-half the wavelength, measured from still water level.

Wave Characteristics

Wave Height

The vertical distance from the crest (highest point) of a wave to the trough (lowest point)

Wavelength

Distance from a point on a wave to the same point on the next wave (crest to crest/trough to trough)

Wave Speed

Distance a wave travels over time taken; wavelength ÷ period or frequency x wavelength

Wave Amplitude

Half the wave height; the maximum amount of displacement

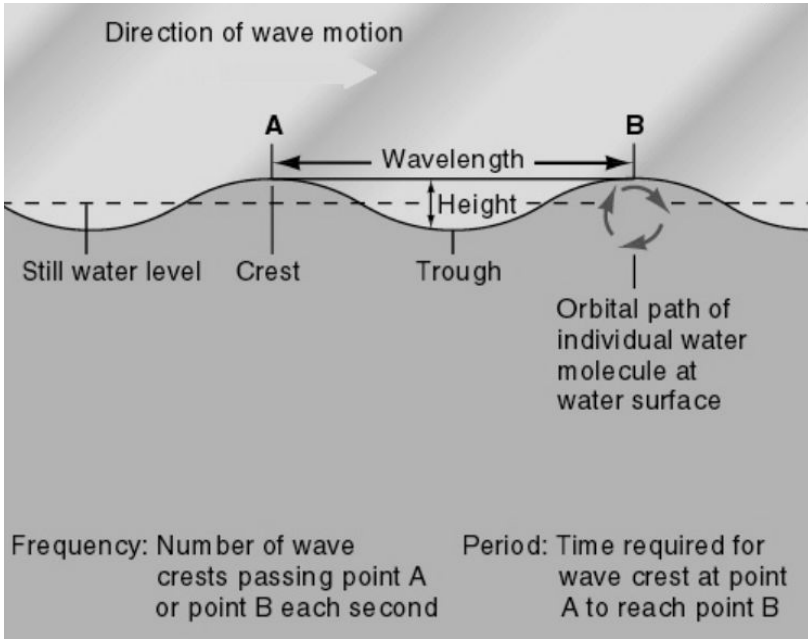
Wave Frequency

The number of waves passing a fixed point in a specified time period

Wave Period

The time it takes for one wavelength to pass a certain point

Wave Characteristics



Fetch, Swell, Surf

Fetch

Fetch is the area of an ocean/lake surface over which wind blows in a constant direction, generating waves. A synonym for fetch length, which is the horizontal distance over which wave-generating winds blow.

Swell

A swell is a collection of waves produced by storm winds raging out at sea, rather than the product of local winds along beaches. They become rounded and flatten as they move away from the storm area where they were formed.

Surf

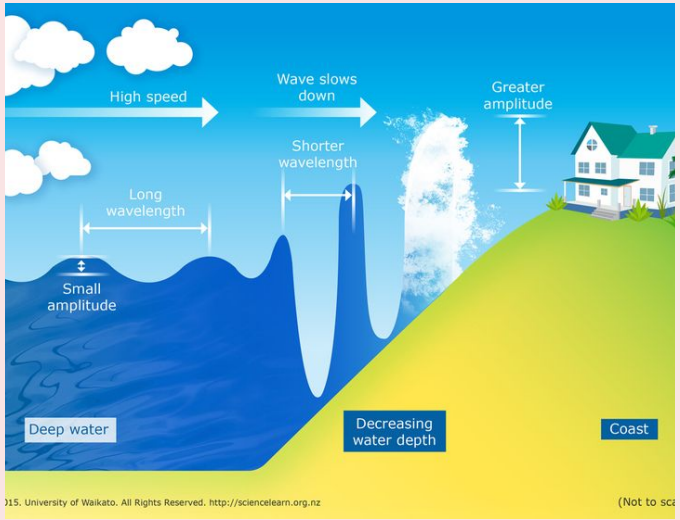
Surf is the foamy, bubbly substance that forms when waves break on shore. After breaking in the surf zone, waves run up the sloping front of the beach forming swash, then run back again as backwash.

Tsunamis

A series of waves caused by earthquakes or undersea volcanic eruptions; convergent boundaries most frequently yield tsunamis.

Long wavelengths mean they lose very little speed as they travel towards shore. As a tsunami approaches shore, the wave base will touch seabed and hinder circulation in the wave. The wavelength and speed will decrease, but the height will increase until the wave spills over and breaks.

The trough usually reaches shore first, producing an effect that sucks coastal water seaward. The crest usually makes landfall around 5 minutes later.



Tsunamis



02

Currents

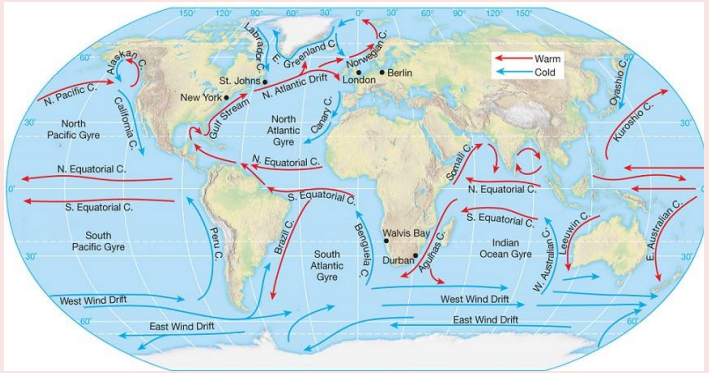
Surface Currents

Surface currents are driven by global wind systems fueled by energy from the sun.

Transfer heat from tropical to polar regions, influencing global climate; as these currents flow around the edges of continents, they affect the temperature of coastal regions.

Patterns of surface currents are affected by the Coriolis effect: the apparent deflection of moving objects produced by Earth's rotation — to the right in the northern hemisphere and to the left in the southern.

Gyre: any large system of rotating ocean currents, especially ones involved with large wind movements.



Coastal Currents

Longshore Current

When a wave hits shore, it releases a burst of energy that generates a current parallel to shore called a longshore current. Can cause longshore drift — the zigzag transport of sediments along a beach due to swash and backwash.

Rip Current

A powerful, narrow channel of water flowing away from shore, perpendicular to the coastline. Occur when water builds up by shore, due to either waves piling up water or a topographic obstacle, and rip currents are needed to return water to sea.

Upwelling

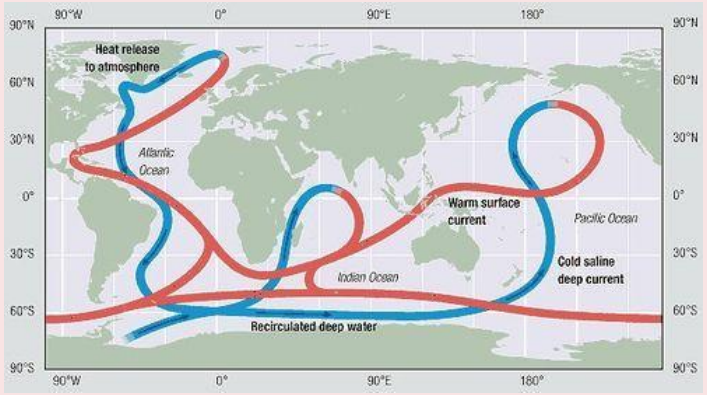
The process by which currents bring cold, deep, nutrient-rich water to the surface of the ocean. Occurs when wind pushes surface waters away, so deeper waters rise to fill that gap. Upwelling creates high biological productivity and good fishing grounds.

Deep Ocean Circulation

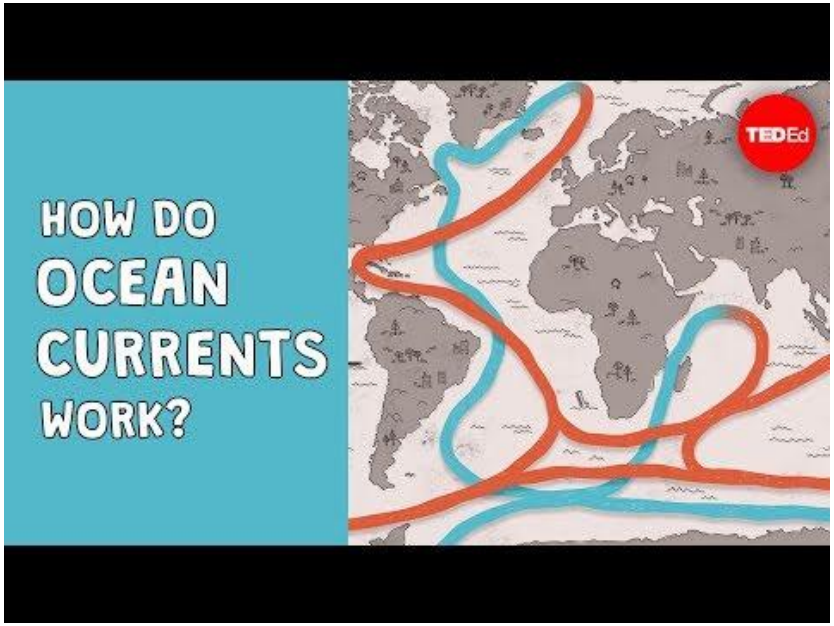
Deep ocean circulation is thermohaline — it is driven by differences in density, which is a function of temperature and salinity.

In polar regions, sea ice forms, leaving behind salt. This makes the surrounding seawater saltier and denser, causing it to sink. Surface water flows in to replace the sinking water, but eventually, it becomes cold and salty enough to sink too. This process starts the global conveyor belt.

The global conveyor belt is a connected system of surface and deep currents that circulates the globe every 1,000 years. Plays a critical role in climate and nutrient/carbon dioxide cycles.



Ocean Currents



Tides

03

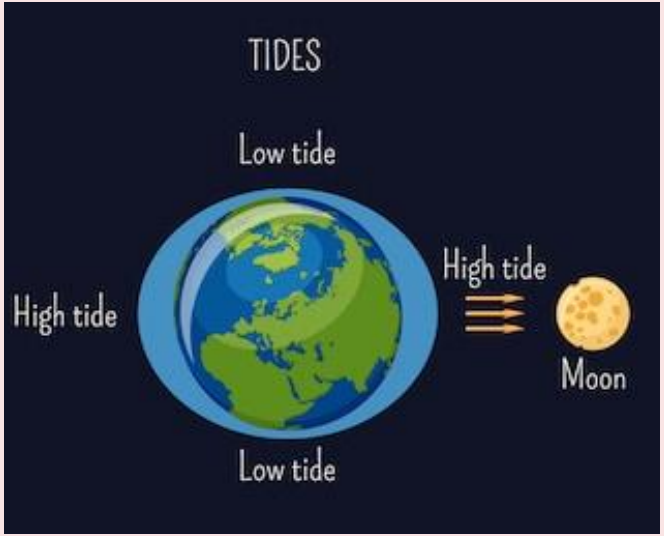
High and Low Tides

The moon's gravitational pull generates tidal force, which causes Earth's water to bulge on the sides closest and furthest from the moon.

As Earth rotates, each region passes through these bulges, creating a high tide, and outside of these bulges, creating a low tide.

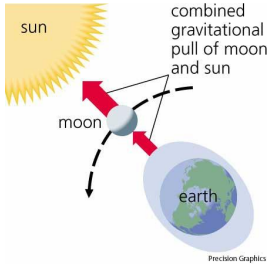
There are three types of tidal patterns: semidiurnal (2 high and low tides a day), mixed semidiurnal (also 2 high and low tides, but height may differ), and diurnal (1 high and low tide a day).

Tidal range can be affected by winds, pressure, latitude, bathymetry, and the shape of the coastline.



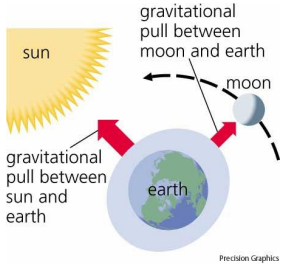
Spring Tide

Occur during full and new moons, when the Earth, moon, and sun are aligned. The pull of the sun is added to that of the moon, causing oceans to bulge more than usual. High tides are a little higher and low tides are a little lower.



Neap Tide

Occur seven days after spring tides, during the first and third quarter moons. The sun and moon are at right angles, so the sun's bulge partially cancels out the moon's bulge. Tides are more moderate — high tides are a little lower, low tides are a little higher.



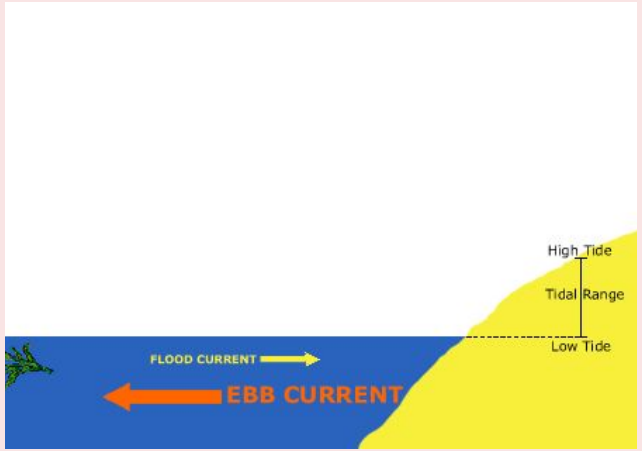
Tidal Currents

The vertical motion of tides near shore can create tidal currents.

These occur in conjunction with the rise and fall of tides. When a tidal current moves towards land, it “floods”, when it moves towards sea it “ebbs”.

Tidal currents are also affected by phases of the moon. During a new/full moon, tidal current velocities are strong and it is known as a “spring current”. During the first/third quarter moon, velocities are weak and it is called a “neap current”.

The strongest tidal currents occur at/around the peak of high and low tides.



For next week...

Pretty similar to how it always is :))

- After class today, I'll be sending everyone and their parents an email with their quiz score
- I'll of course be emailing everyone with class updates for this week, as well as a review worksheet for the content we learned today
- Remember my challenge for y'all!! Send me a picture at great.michelle.li@gmail.com of you taking action to prevent climate change or protect coral reefs and I'll send you a fun prize! This can be something as simple as tracking and conserving your water use, changing your lightbulbs to more long-lasting and energy-efficient bulbs, donating to an organization that works to prevent climate change and save the reefs, etc. Open until January 16!
- I'm looking into doing one final lab next week, so keep an eye out for details on that! I'll also be introducing the final project for this class next week ;))

Let's finish off 2020 strong (ノ◕ワ◕)ノ*✲゜*。⋆

Thanks

Any questions?

Get hyped for a new unit!
Let me know if you have any questions about the quiz/last unit's content.

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