Dynamic Planet

Lesson 9, 12/19

Recap of last week

Get hyped for the new unit!! 🎉

- Last week we started our unit on how water moves within the ocean and learned about waves, currents, and tides
- If anyone missed the last meeting, I highly encourage you go back and watch the **presentation** & **recording**, because this content will make up the bulk of our new unit and is important for you to know!
- I sent out an email last night with the **lesson 8 review worksheet**; any questions about this? I know I didn't give you all much time to complete this, so feel free to do it during break as well
- Those of you who didn't receive an email with your quiz score & **the quiz key** before last week's lesson should've received one directly after; any questions about this?

Thanks for finishing 2020 with a bang! (ﾉ◕ヮ◕)ﾉ*✲゚*｡⋆

Simulation of the Coriolis effect :))

How to do the simulation

You'll probably need two people for this simulation; feel free to ask a parent or sibling!

- First, fully inflate your balloon so it's round like the Earth!
- Then, draw a line around the circumference of the ballon and **label it "the Equator"**. Label the very top of the balloon the "North Pole" and the bottom of the balloon, near the knot, the "South Pole"
- Ask your partner to **rotate the balloon from west to east**, or left to right. Another way to imagine this is that if you were viewing your balloon from the North Pole, it would be rotating counterclockwise
- Then, take some type of permanent marker and, while your partner is still rotating, try to **draw a straight line** from the North Pole to the Equator; repeat the same thing for the South Pole
- Observe your lines; are they really straight, or do the **bend in a certain direction**?

Video of simulation



The Coriolis effect is the apparent deflection of moving objects, produced because Earth rotates faster at the Equator than it does at the Poles. It deflects objects to the right in the Northern hemisphere and to the left in the Southern hemisphere.

What is the Coriolis effect?

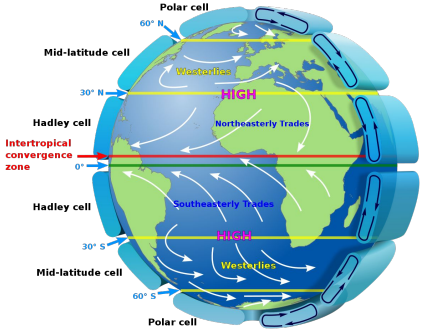


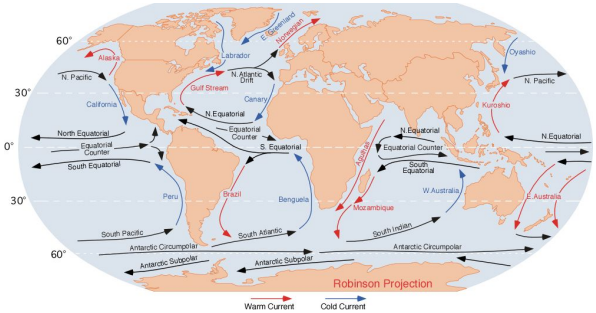
How does this affect oceans?

The Coriolis effect affects the movement of water in the ocean!

- Without the Coriolis effect, winds would just flow from **the Poles to the Equator**, because gases tend to move from area of high pressure to low pressure. However, with the Coriolis effect, we can get different **wind cells** (Hadley Cells, Ferrel Cells, and Polar Cells) and different **wind flows** (trade winds, westerlies, polar easterlies)
- Surface currents are **wind-generated**, so they are affected by these different wind flows; so are **gyres**, which are large systems of circulating ocean currents that rotate right or clockwise in the Northern hemisphere and left or counterclockwise in the Southern hemisphere

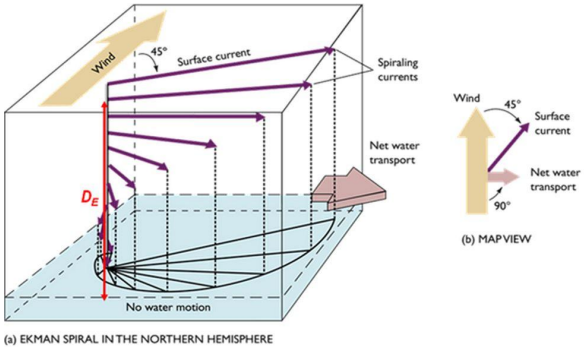






New content: Ekman & geostrophic balances!

The Ekman spiral

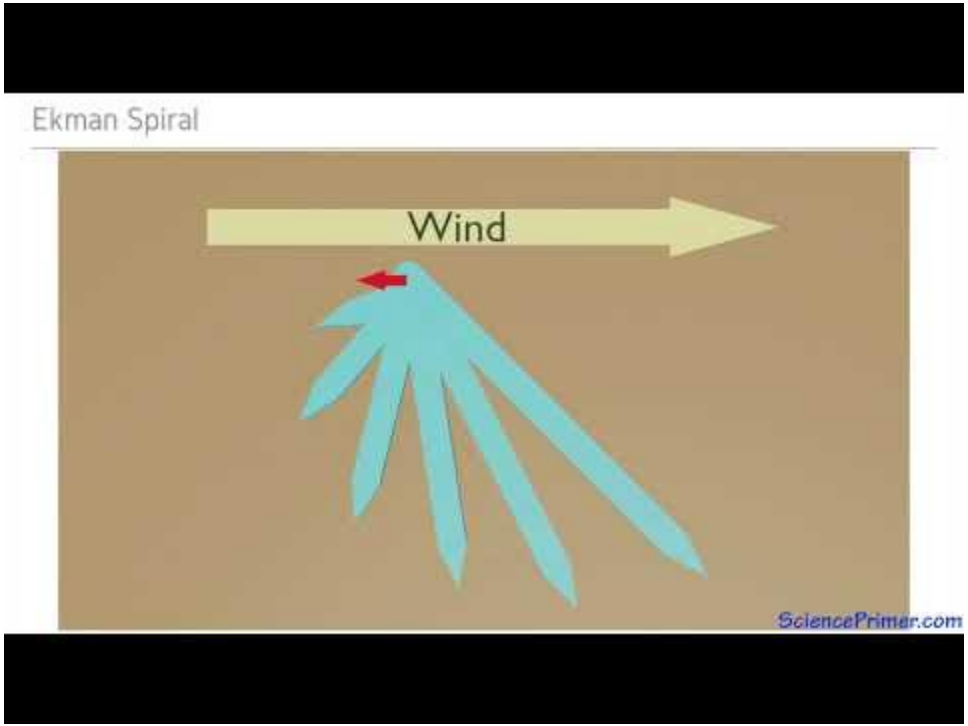


When surface water moves due to wind, it drags deeper layers of molecules below it. Each layer is moved by friction from shallower layers and each layer moves slower than the one above it, due to loss of momentum. This movement stops at around 100 meters.

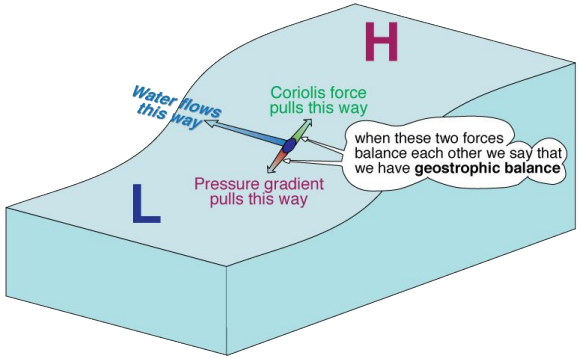
This creates in a spiral effect. The net movement of the upper 100 meters of water column is 90° relative to original wind direction — this is known as Ekman transport. Due to the Coriolis effect, Ekman transport is 90° right in the Northern hemisphere and 90° left in the Southern hemisphere.

Ekman transport has significant impacts on the biogeochemical properties of the world's oceans.

Ekman spiral video



Geostrophic balances



An oceanic current in which pressure gradient force is balanced by the Coriolis effect. Flow must be perpendicular to the pressure gradient force, because Coriolis effect deflects things 90°.

Instead of flowing from high to low pressure, water moves along isobars — lines of equal pressure.

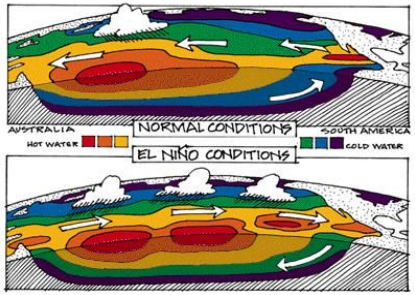
Geostrophic currents flow with the high pressure to the right of the flow in the northern hemisphere, and to the left of the flow in the southern.

New content: fisheries & ocean circulation!

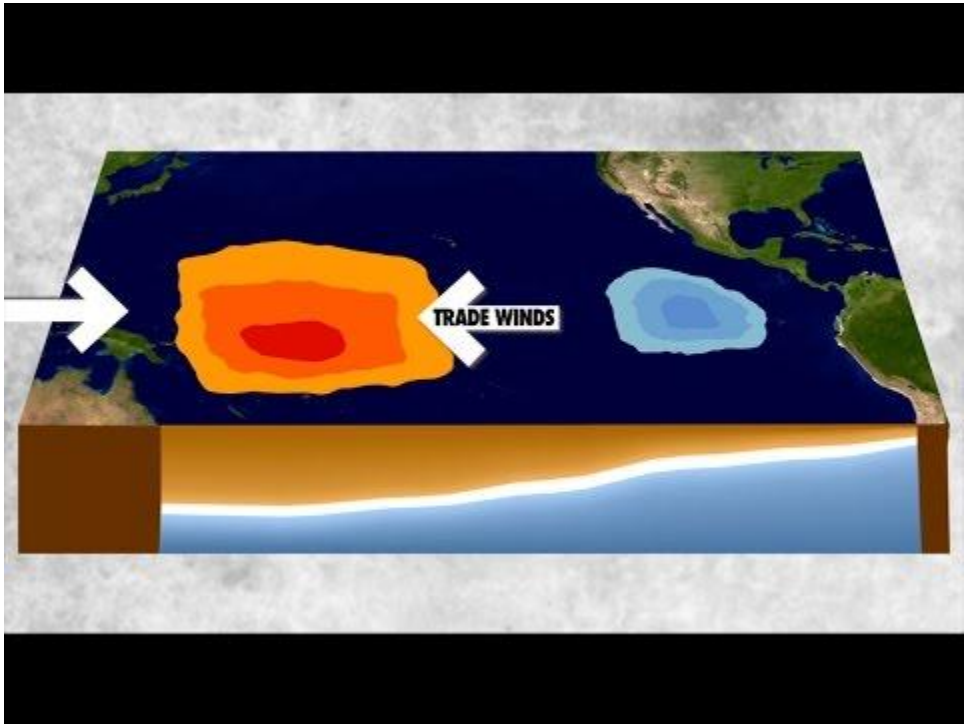
El Niño and La Niña

Let's learn about oceanic circulation with fancy Spanish names!

- The warm (El Niño) and cold (La Niña) phases of El Niño Southern Oscillation (ENSO), which consists of **sustained sea temperature anomalies** across the east-central Equatorial Pacific
- Caused by **strengthening or weakening of trade winds** that usually push warm surface waters towards Asia
- Can affect global weather, temperature, and fisheries; generally, El Niño increases water temperatures and **decreases upwelling** off the coast of western South America, which has a negative effect on fisheries, and La Niña **increases upwelling**, creating a positive effect on fisheries
- Remember that upwelling is the rising of cold, nutrient-rich water to the surface of the ocean
- In Ohio, it tends to be drier during El Niño and wetter during La Niña



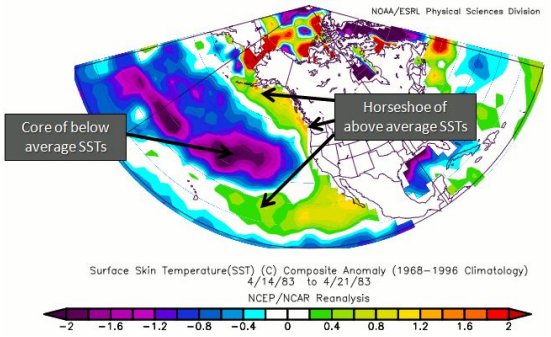
ENSO explained video



Pacific Decadal Oscillation

It's basically ENSO but longer!!

- Pacific Decadal Oscillation (PDO) is a "long-lived El Niño-like **pattern of Pacific climate variability**"
- Like ENSO, it also consists of warm and cold phases, but it can remain in the same phase for 20-30 years
- During warm PDO, **above-average water temperatures** off the coast of North America wrap in a horseshoe shape around a core of cooler-than-average water in the central Pacific. During cold PDO, the opposite occurs
- PDO generally has the **same effects on fisheries as ENSO**, just on a longer time scale; also, fish spawning generally decreases during PDO's warm phase



Introducing your final project & general plans for the next weeks :))

Your final project

You'll be making your own lesson on any Dynamic Planet related topic!

- Your final project will be to make a **5 minute long presentation** that looks more in-depth at any of the topics we've learned about so far (general ocean information, features & processes, movement of water)
- I'm giving you guys a lot of freedom with this project, so I won't set specific guidelines, but it should be a high-quality completed product that is **engaging and educational** for the audience
- You can **work in groups**, but each group member must contribute as much as one individual would
- This project will be presented in front of all parents and classmates during our final lesson of this session on **January 16, 2021**; you should begin thinking about this project during break
- During our next class after break, January 9, 2021, we will take our final exam for the class, then any additional time will be dedicated to working on your projects and receiving feedback from me

If time permits...let's brainstorm topics!

For next week

It’s finally the holiday season!!

- As always, I will be sending out an updates email with a review worksheet for this lesson and a **study guide** for the final exam; I highly encourage everyone to do these and get them checked with me!
- We will **not be having class for the next two weeks** in honor of Christmas/Hanukkah/Kwanzaa/New Years/whatever else y’all celebrate! This means our next class will be **Saturday, January 9, 2021**
- Winter break is a great time to begin working on your final project! If anyone needs the contact information of their partner/groupmate, **please let me know** and I can give you their email; additionally, if you ever have questions about the project or even want to me briefly with me to check in, **just email me**!
- Thank you all for spending an awesome and fun half-of-2020 with me :))

Wishing everyone and your families a safe, restful, and fun holiday season! 🎄

Thanks!

Any questions?

HAPPY HAPPY HOLIDAYS!! Thanks for a great year :,))

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