

**GEOG 101 Part II
People and their
Physical Environment**

11

**The Hydrosphere:
Oceans**

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PART II: People and their Physical Environment

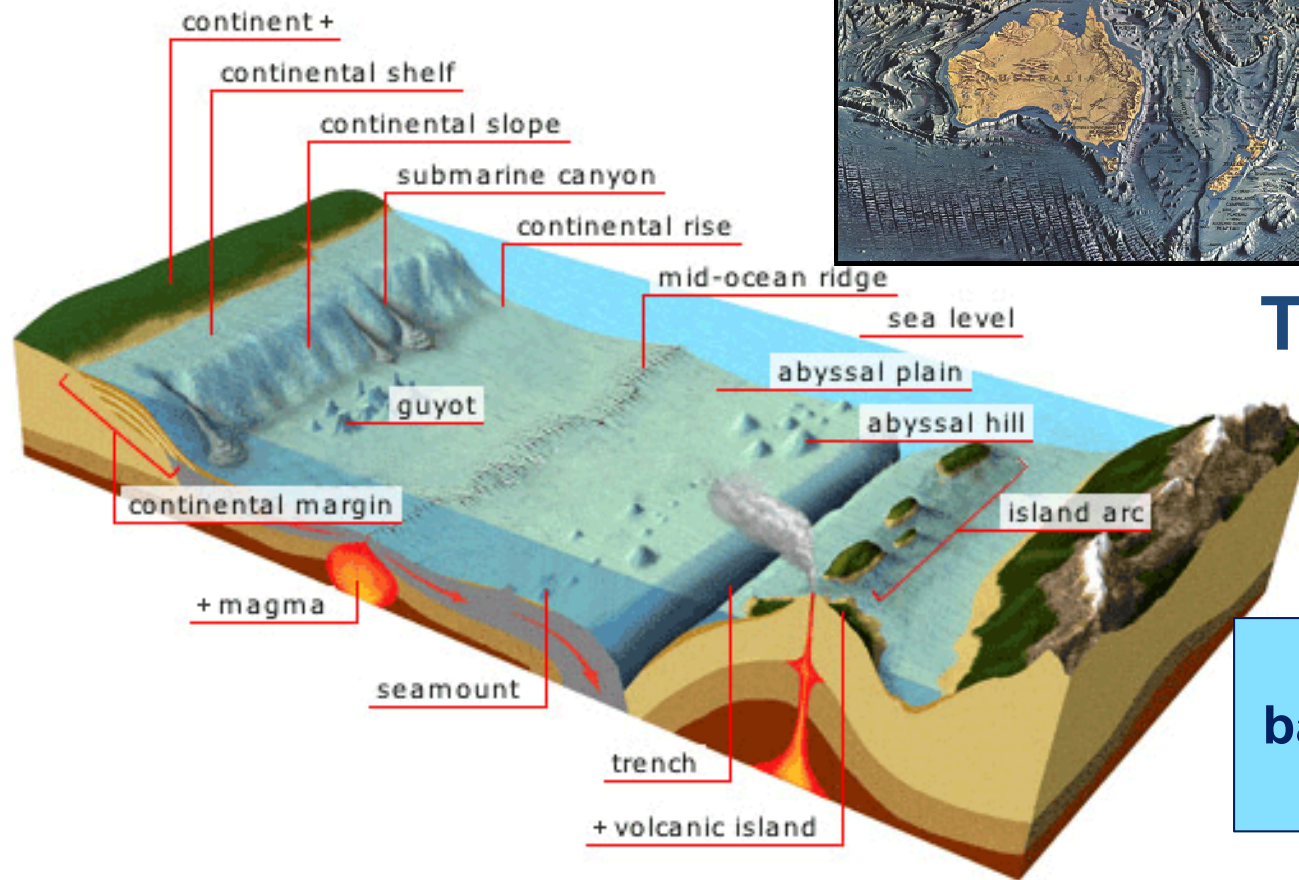
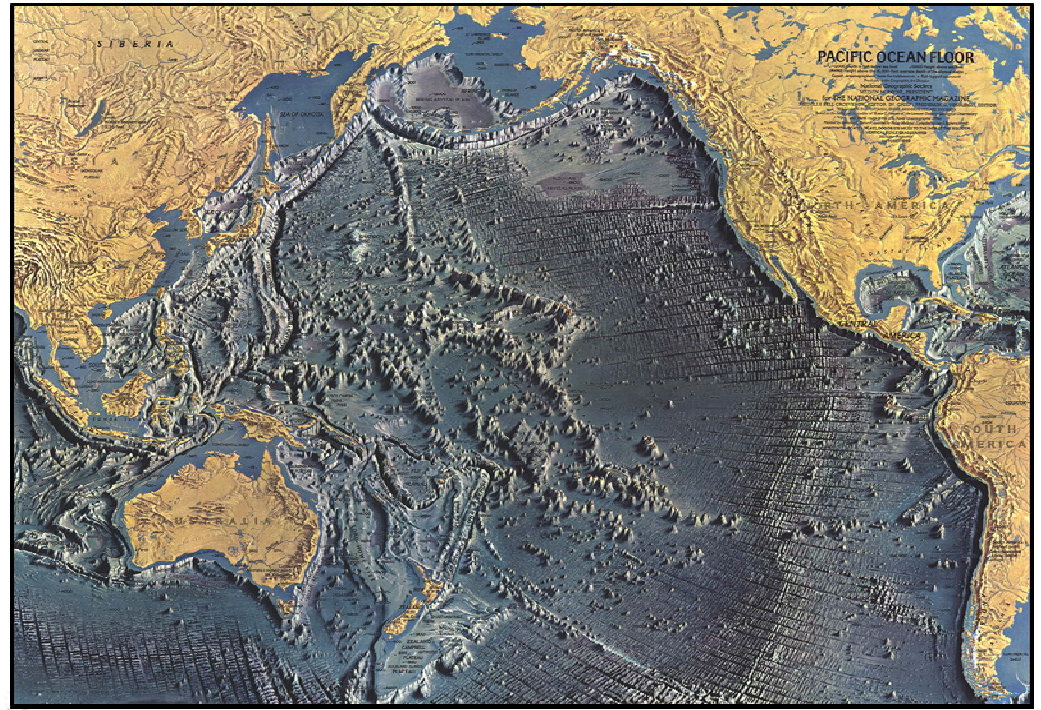
- ✓ **I. Introduction to the Physical Environment**
- ✓ **II. Earth-Sun Relationship**
- **III. Earth Systems**
 - A. The Hydrosphere: Oceans**
 - B. The Atmosphere: Weather and Climate
 - C. The Lithosphere: Geologic Influences
- IV. Earth Habitat**
 - A. Biosphere
 - B. Natural Controls and Cycles
 - C. Human Impact
 - D. Natural Hazards
 - E. Earth Resources

HYDROSPHERE: Overview

- **Earth is the Water Planet:** 71% of surface is water and 97% of all water is in the oceans.
- **Ocean Movements:** The oceans are a dynamic system with much activity and interactions.
- **Water Temperature and Climate:**
Surface ocean temperatures affect air temperature and therefore climate.
- **Oceans and People:** Oceans play an important role in earth environment, influencing many things people do.

<https://www.youtube.com/watch?v=vP4QTyVQTUo>
2 min oceans video

OCEAN BASIN TOPOGRAPHY



The ocean floor is not flat!

More on the ocean basin when we do the geology section.

THE DYNAMIC OCEAN

The movements found in the ocean are a result of numerous aspects of fluid dynamics working together, transferring energy and creating motion.

❖ **Ocean current:** a ribbon of moving water with unique characteristics.

❖ **Gyre:** giant circulation system; it is found both on the surface of the oceans and in the atmosphere; caused by the earth's rotation and the Coriolis Effect.

❖ **Ocean gyre:** a system of circular ocean currents.

❖ **Wave:** a friction-generated phenomena created as wind passes over and touches the surface of water, dragging it forward.

❖ **Tsunami:** seismic sea wave created by a shock (falsely called a tidal wave).

❖ **Tide:** moving water bulge created the moon's gravitational pull and by earth's rotation.

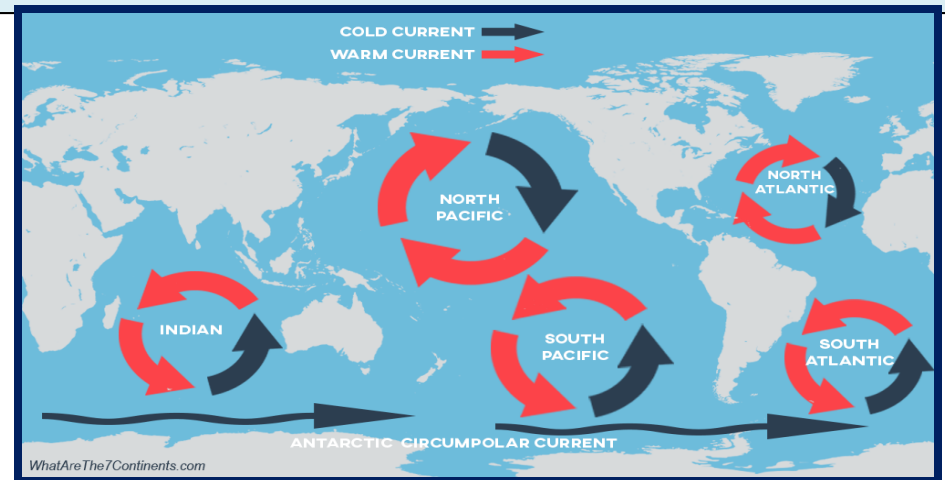
MOVEMENTS in the OCEAN

❖ **Ocean current:** A ribbon of moving water with unique characteristics generated by earth's **rotation** and by **differences in water salinity** and **water temperature**.

- ✓ Ocean current movements are both horizontal (surface) and vertical (deep sea).

- ❖ **Gyre:** giant circulation system linked to rotation and Coriolis.
- **Ocean gyre** is a large system of **circular ocean currents** formed by global wind patterns, Earth's rotation and the Coriolis effect.
 - ✓ Movement of the world's **five ocean gyres** helps drive the oceanic conveyor belt which circulates ocean water around the planet.

https://www.youtube.com/watch?v=5xQP_B18vMw
3 min video on ocean water salinity



MOVEMENTS in the OCEAN

❖ Waves are generated mainly by wind-friction.

- ✓ Waves help to mix water of different temperature and salinity.
- ✓ Waves alter the coastline by erosion and deposition.

❖ Tsunamis are **seismic sea waves** (falsely called tidal waves).

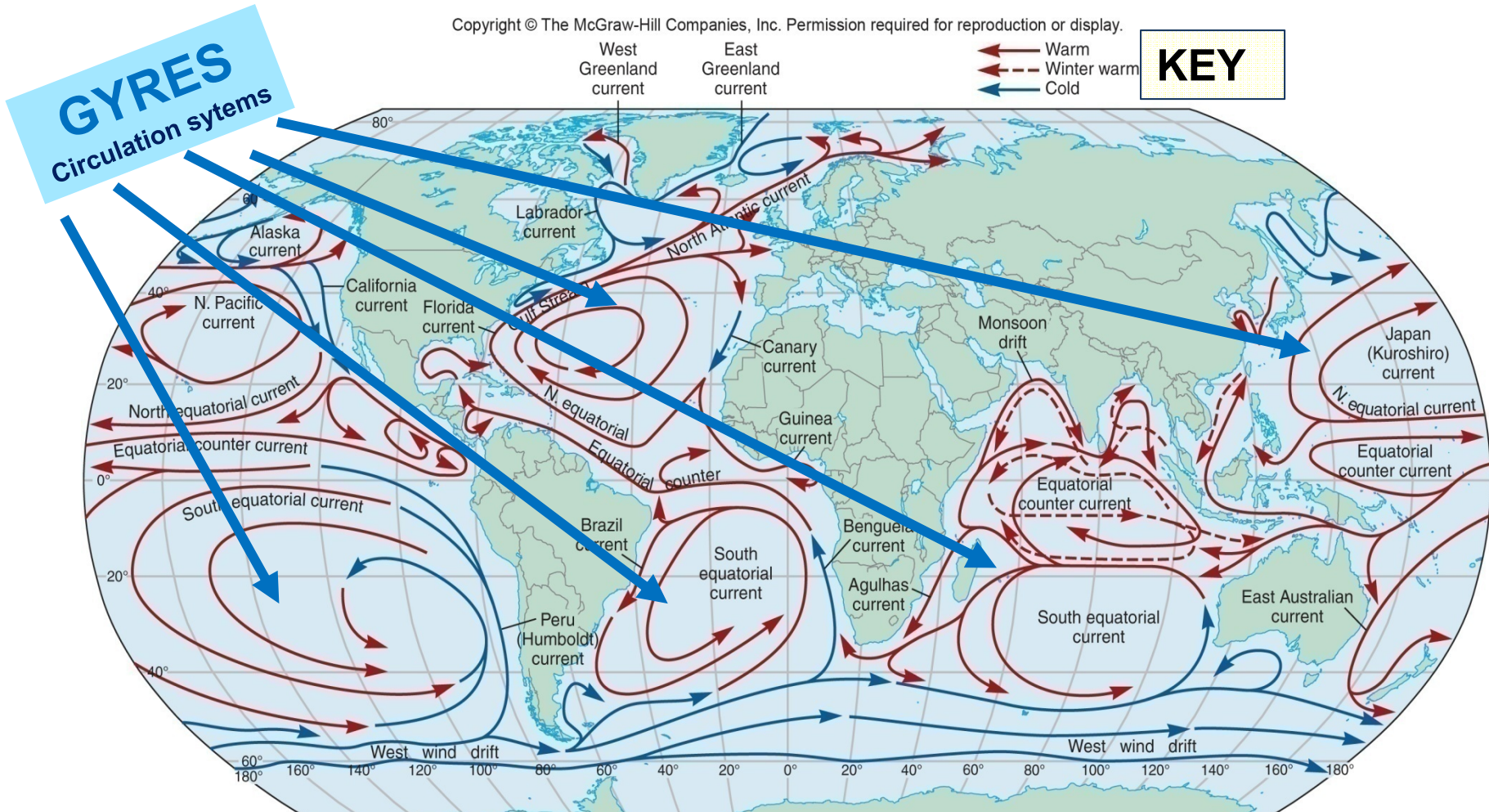
- ✓ They are generated by earthquakes, underwater landslides and any other **shock** inducer.

❖ Tides (moving water bulges) are caused by the gravitational pull of the moon and the earth's rotation.

- Tidal bore (a true tidal wave) is the leading edge of the incoming tide.
- Tidal range is the difference between high and low tide.

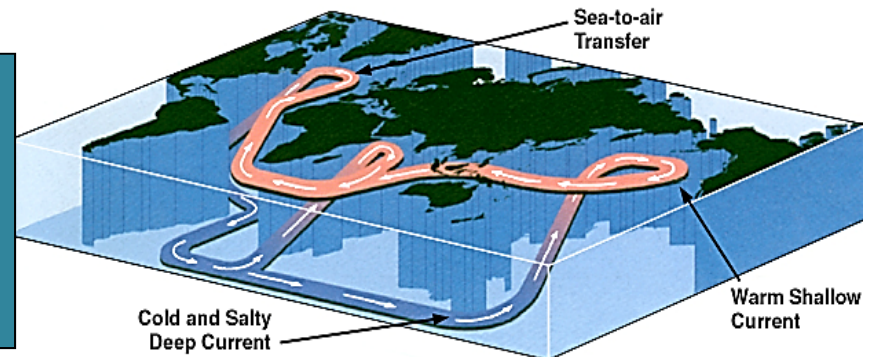
SURFACE OCEAN CIRCULATION

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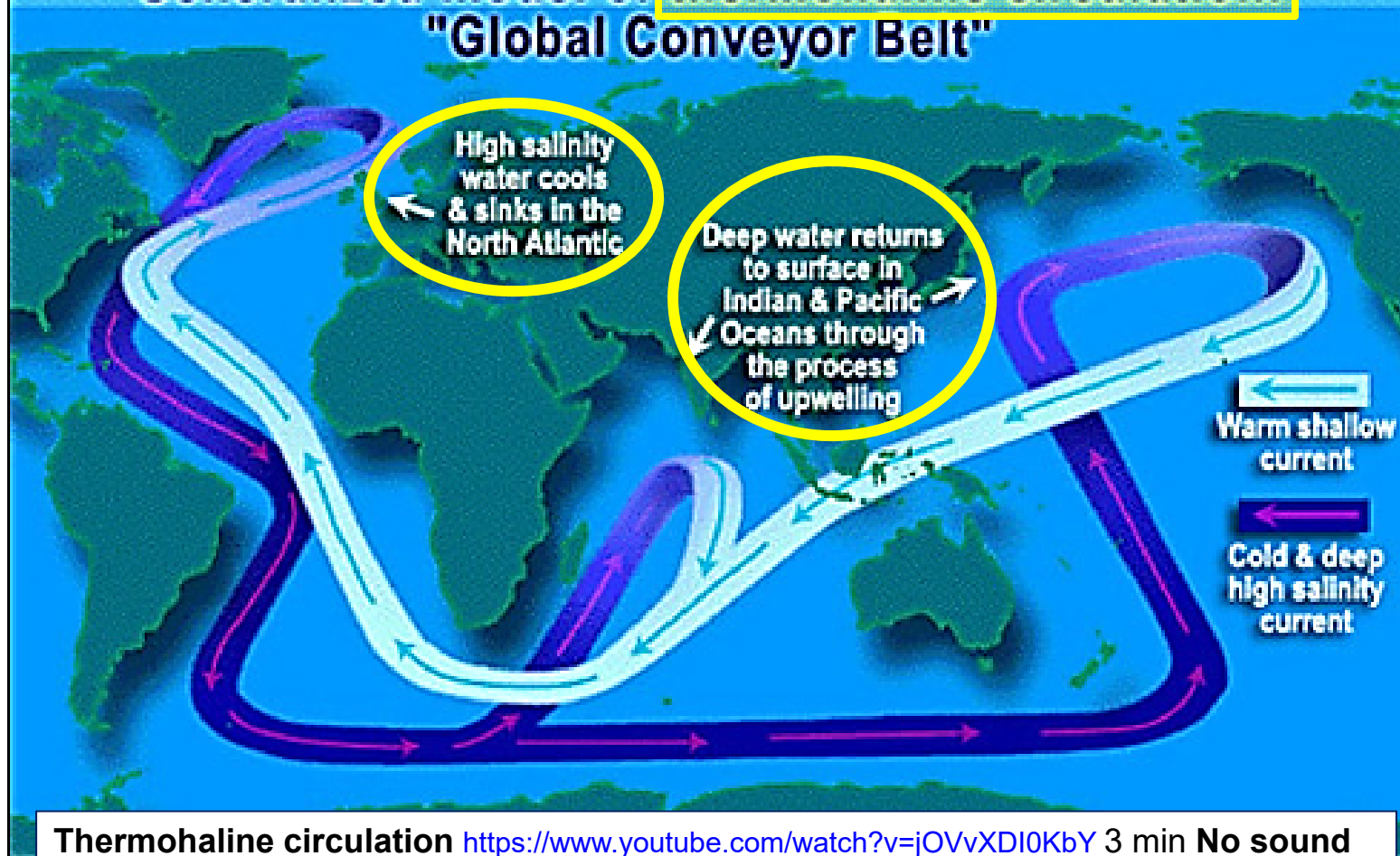


Currents are designated **warm** and **cold** by their source region, not their temperature. **Surface currents influence climate on land through the transfer of temperature and moisture characteristics.**

DEEP-SEA OCEAN CURRENTS



Generalized model of thermohaline circulation: "Global Conveyor Belt"

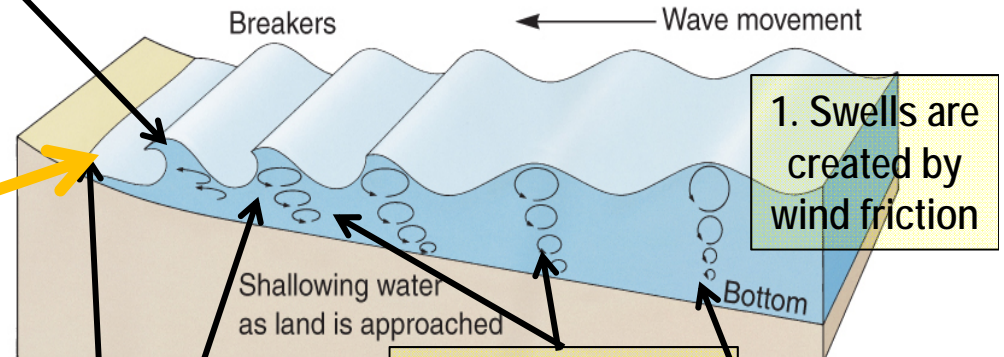
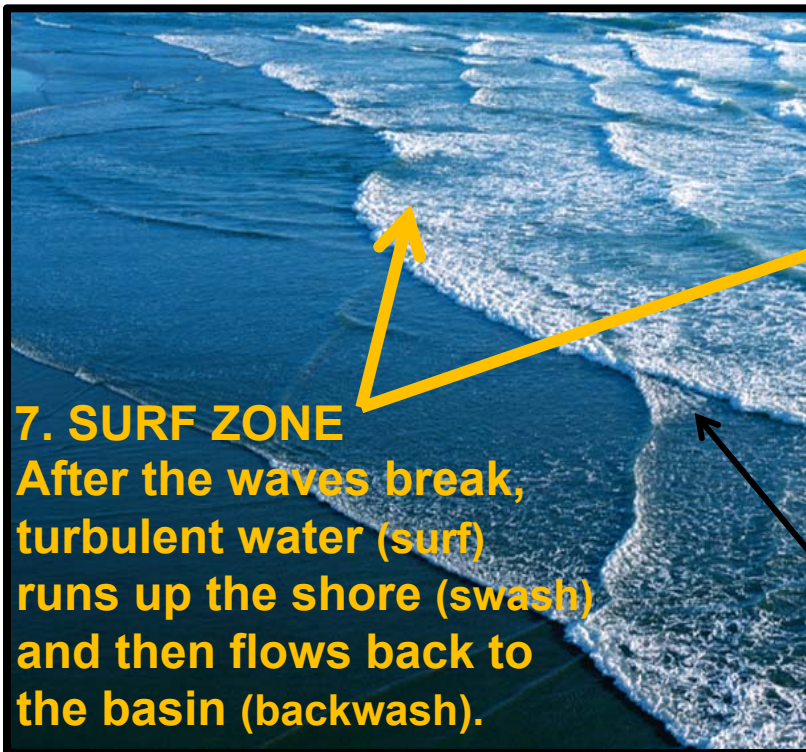


Thermohaline circulation <https://www.youtube.com/watch?v=jOVvXDI0KbY> 3 min No sound

WAVE FORMATION

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5. The "wave swells" grow in height until they reach a point beyond which they cannot support themselves (orbit collapses) and the "swells break apart and crash" creating breakers.



6. "Broken" wave swells (breakers) create the surf zone.

4. Maximum steepness of orbit occurs before the wave breaks.

3. Wave energy is affected by proximity to the sea floor and in shallow water wave orbits slant shoreward; orbits become oval-shaped.

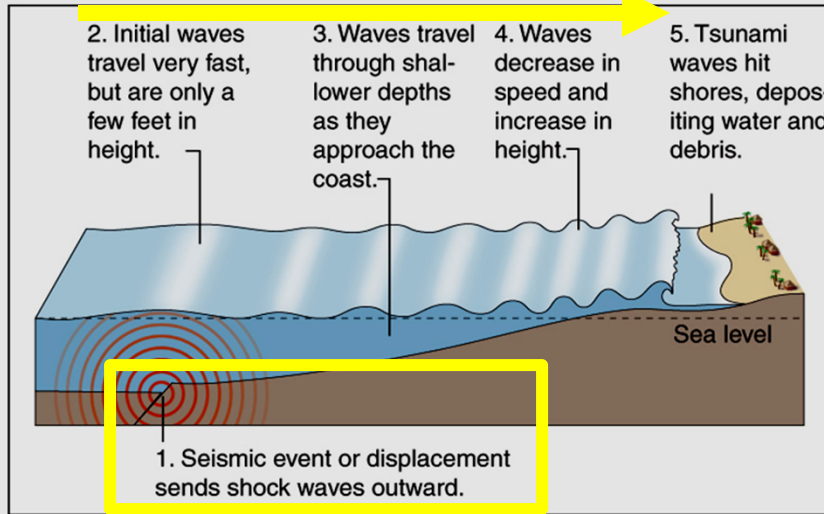
2. Wave energy from swells in deep sea water is contained within a circular orbital motion.

Most waves are wind generated. Friction from the bottom of an air mass moving against the top of the water causes the water to move in orbits and pile on top of itself creating swells.

✓ Breaking waves in the surf zone constantly shape the shoreline.

TSUNAMI: A shock-generated ocean wave

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CAUSES:

- Earthquake
- Landslide
- Meteor strike

Sendai, Japan (2011) before and after being hit by the tsunami.



<https://www.youtube.com/watch?v=SlwZzbGh7Cw>

earthquake tsunami 3D demo 1 min
no sound

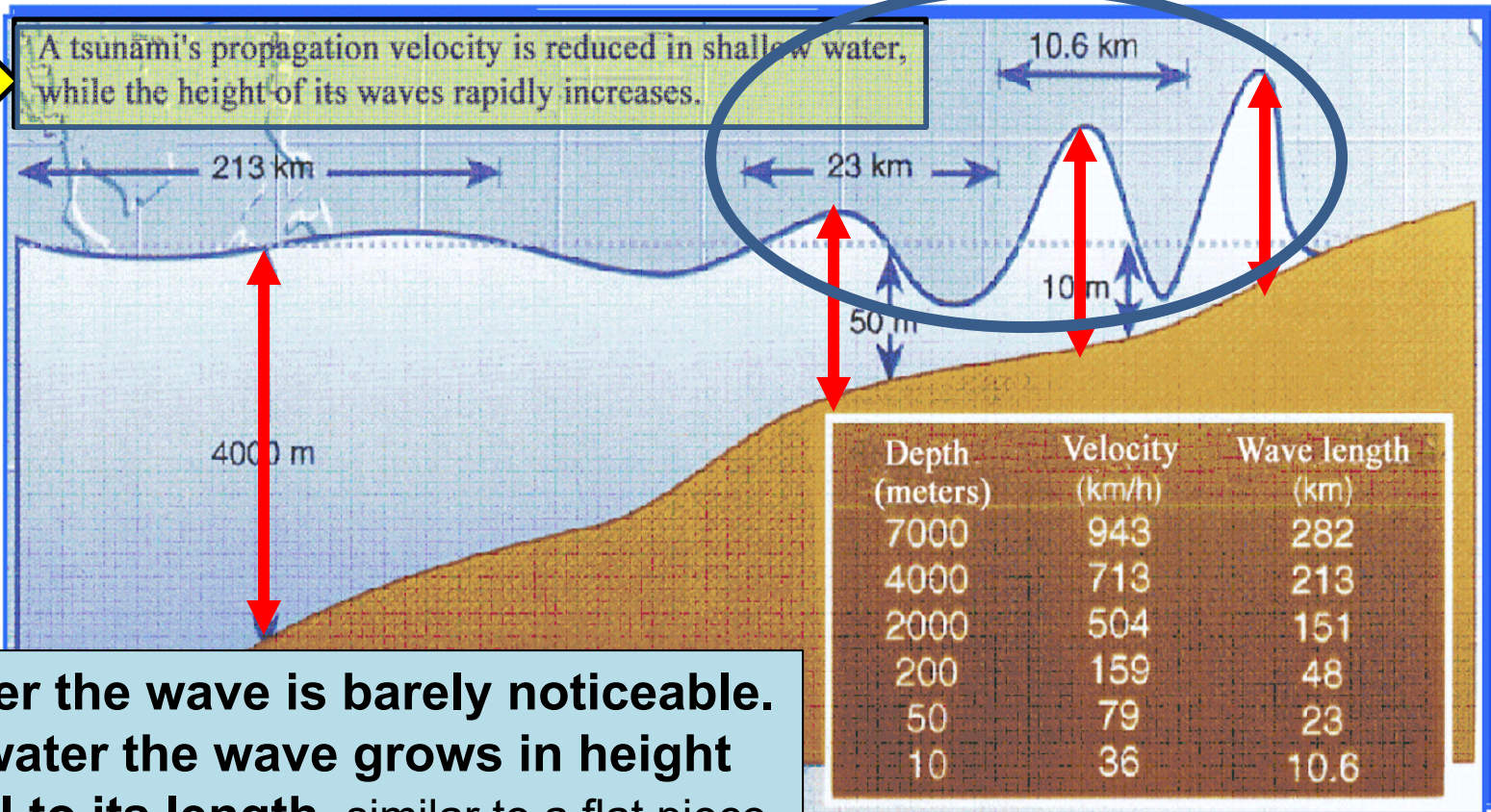
<https://www.youtube.com/watch?v=KstQogN8DUA> NOAA Hawaii landslide tsunami scenario, animation, 2 min

<https://www.youtube.com/watch?v=mDf6zELkDHk> Small tsunami, Indonesia, Jan. 2018, 2 min

Tsunamis and the Ocean Floor

The physics behind a tsunami wave

A tsunami's propagation velocity is reduced in shallow water, while the height of its waves rapidly increases.

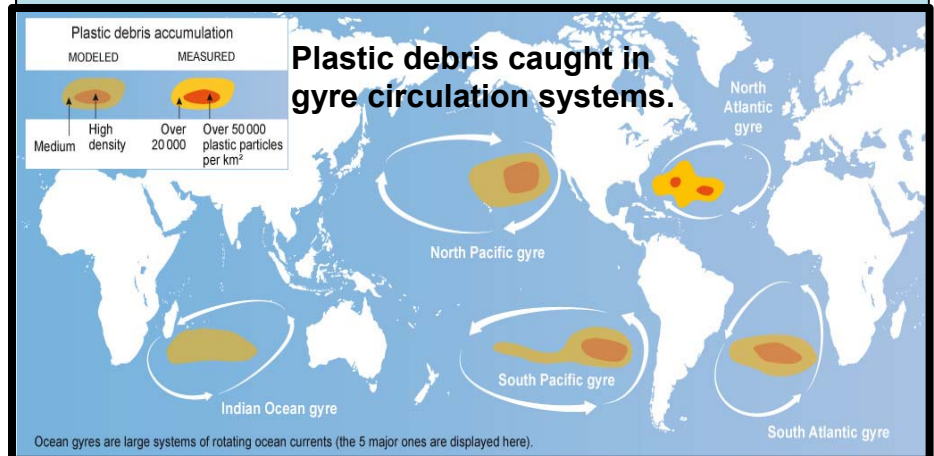


In deep water the wave is barely noticeable. In shallow water the wave grows in height proportional to its length, similar to a flat piece of paper being pressed against a hard object. Also, note that the wave crests are closer to each other in shallow water producing numerous “wave hits” against the shoreline within a short period of time.

OCEANS and PEOPLE

- ✓ Oceans help to **equalize the Earth's temperature.**
- ✓ They are the **chief source of atmospheric moisture.**
- ✓ They are an important **link in the carbon/oxygen cycle.**
- ✓ They are a **source of food.**
<https://www.nytimes.com/2019/02/28/climate/fish-climate-change.html?login=email&auth=login-email>
- ✓ They are a **source of minerals.**
- ✓ Their rise and fall effects **coastline habitation.**

- ✓ They are used for:
 - **transportation**
 - **drinking water** through desalinization process
 - **recreation**
 - **waste disposal**



- ✓ They are a major **barrier to interaction.**
- ✓ Historically ocean coasts have been the **gateway to cultural interaction.**

NEXT

THE ATMOSPHERE:

Aspects of Weather and Climate