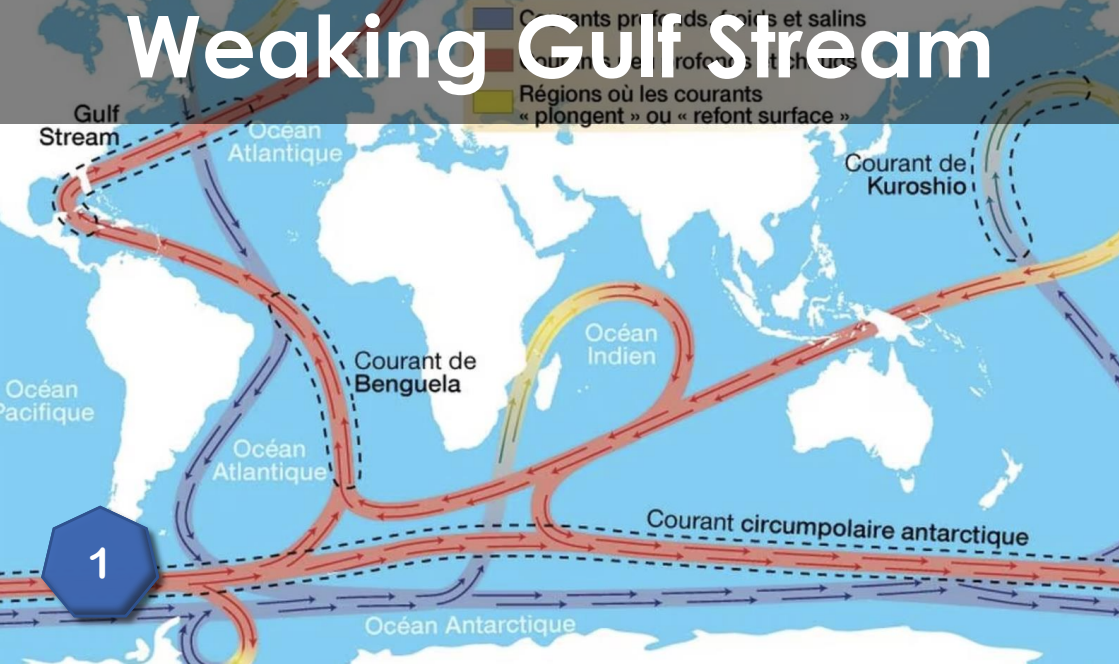


Weaking Gulf Stream





This is where it all begins...

Set 1

Seawater Temperature

A world map where the oceans are color-coded to represent seawater temperature. The colors range from dark blue (coldest) to red (warmest). The warmest waters (red) are found in the tropical regions, particularly in the Indian Ocean and the western Pacific. The coldest waters (dark blue) are found in the polar regions, particularly in the Southern Ocean and the Arctic. The equatorial regions show a mix of yellow and orange, indicating moderate temperatures. The continents are shown in a realistic color palette.

2

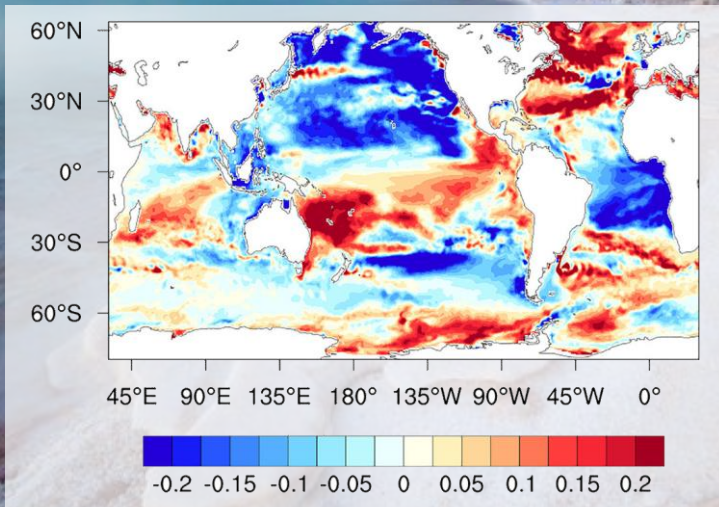


2

Ocean currents carry heat from the equator to the poles and bring cold from the poles back to the equator, ensuring that the world's oceans are constantly mixing.

Set 1

Ocean Salinity



As water moves towards the North Pole, it gets colder. It also has a higher concentration of salt, because the ice crystals that form trap water while leaving salt behind.

Seawater Evaporation

13

Seawater evaporation is the process by which water from the ocean or other bodies of saltwater is converted to water vapor through heat and atmospheric pressure changes. Evaporation is a key component of the global water cycle, as it is the primary way that water is transferred from the ocean to the atmosphere.

Water Cycle

The diagram illustrates the water cycle with the following components and processes:

- Evaporation:** Three arrows point upwards from the ocean and a lake towards the sky.
- Condensation:** A dark grey horizontal bar at the top contains the word "Condensation".
- Precipitation (Snow):** On the left, snowflakes are shown falling from a cloud. A box labeled "Snow" is positioned below the snowflakes.
- Precipitation (Rain):** In the center, rain is falling from a cloud. A box labeled "Rain" is positioned below the rain.
- Run off:** A blue river flows from a brown mountain on the left towards the ocean. A box labeled "Run off" is positioned above the river.
- Evaporation from Land:** A curved arrow points from a green forested area on the right back up to the "Evaporation" box.

The water cycle, also known as the hydrologic cycle, is the continuous process by which water is circulated between the Earth's surface and the atmosphere.

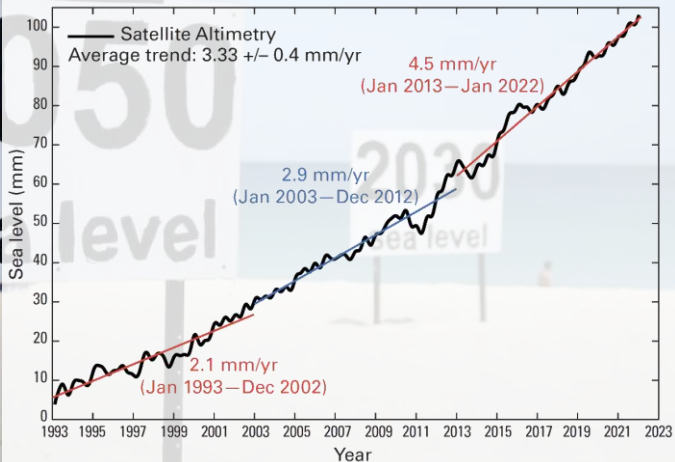
Air Humidity

19

Air humidity refers to the amount of moisture or water vapor present in the air.

The amount of water vapor that the air can hold depends on the temperature and pressure of the air.

Rising Sea Level



**Sea level has been rising year by year.
This is caused by the thermal
expansion of ocean waters and the
melting of glaciers and ice sheets.**

A world map illustrating air temperature distribution. The map uses a color scale where blue and purple represent cold temperatures, and red, orange, and yellow represent warm temperatures. The coldest temperatures (blue/purple) are found at the poles, while the warmest temperatures (red/orange) are found at the equator. The temperature decreases as one moves away from the equator towards the poles. The text "Air Temperature" is overlaid in white on a dark blue horizontal band across the middle of the map.

Air Temperature

A dark blue hexagonal icon containing the white number 3.

3



3

Ocean currents transport heat from low latitudes to high latitudes, and transport cold from high latitudes to low latitudes, maintaining the global heat balance. Warm currents transport heat to the air, and cold currents transport cold to the air.

A weakening of the Gulf Stream will reduce this heat exchange.

Set 2

Climate Change



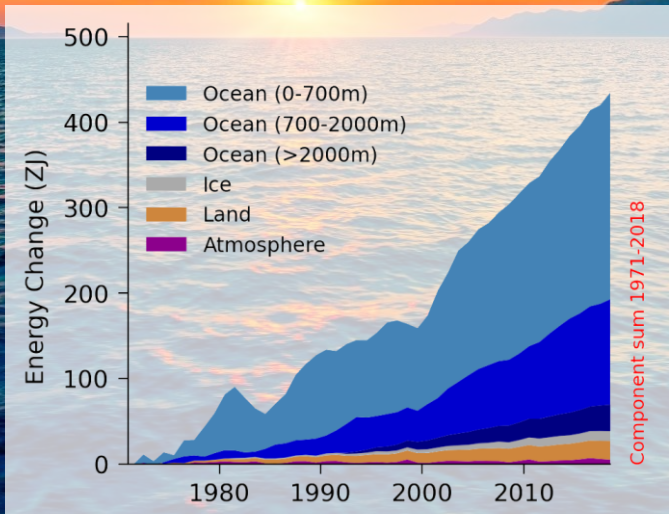


4

Climate change refers to long-term changes in the Earth's climate system, including changes in Earth's surface temperature, precipitation patterns, sea levels, and polar ice caps.

Set 2

Energy Budget





5

This graph explains where the energy accumulated on Earth due to radiative forcing goes. It warms up the ocean, melts ice, dissipates into the ground and warms up the atmosphere.



Set 2

Radiative Forcing

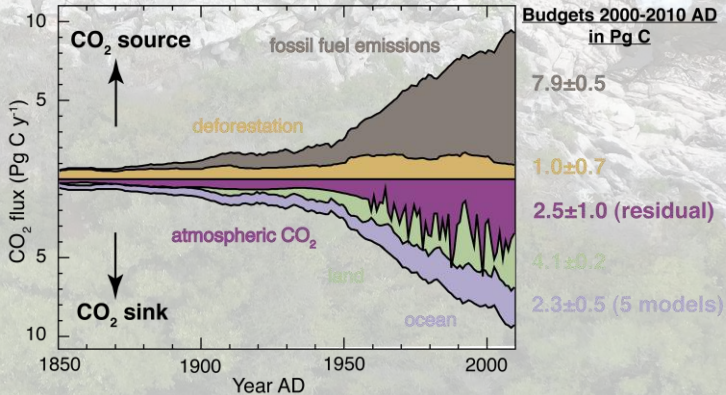


6

Atmospheric greenhouse gases such as carbon dioxide, methane and nitrous oxide trap radiation emanating from the Earth's surface, resulting in less energy being radiated back into space.

Set 2

Carbon Cycle





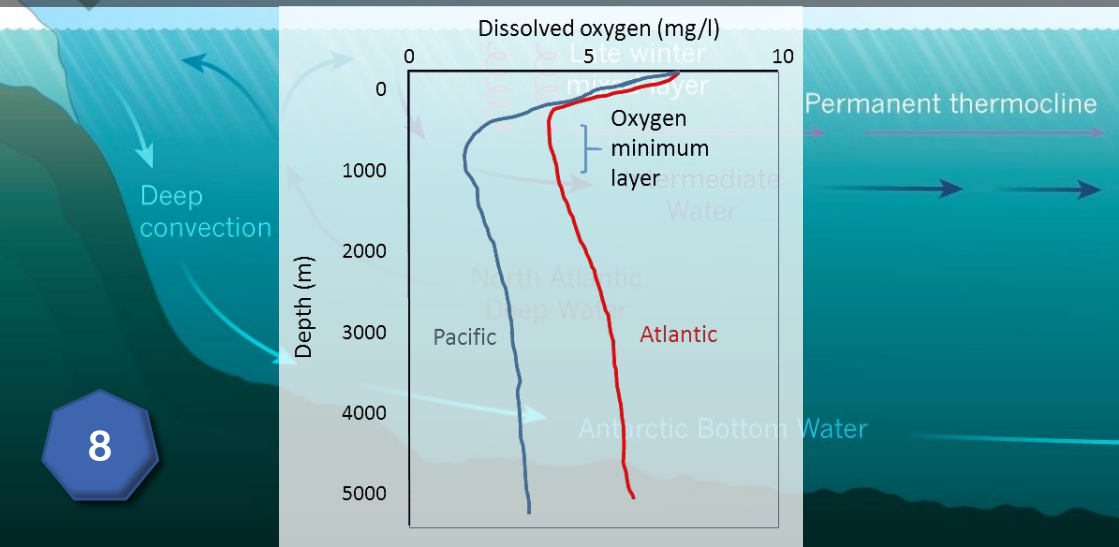
Half of the CO₂ we emit every year is absorbed by carbon sinks:

- **1/4 by vegetation via photosynthesis**
 - **1/4 by the oceans**

The remaining half stays in the atmosphere.

Ocean Dissolved Oxygen

Antarctica



8

Ocean dissolved oxygen refers to the amount of oxygen that is dissolved in seawater. Like most living organisms, marine life needs oxygen to survive.

The level of dissolved oxygen in the ocean is influenced by a variety of factors, including temperature, salinity, and the amount of photosynthesis that occurs in the water.

Set 2

Atmospheric CO₂

Concentration of CO₂

Dissolved
CO₂

Water movements
enhancing gas
exchanges

100m

Sequestration of carbon
in the deep cold waters

9



ocean-climate.org

**Seawater can absorb carbon dioxide (CO₂)
from the atmosphere.**

**This occurs primarily at the surface of the
ocean, where CO₂ in the air above the water
dissolves into the uppermost layer of
seawater.**

Atmospheric carbon dioxide



Ocean Acidity

Dissolved carbon dioxide

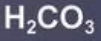


+

Water



Carbonic acid



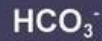
Hydrogen ions



Carbonate ions



Biocarbonate ions



Deformed shells

10



9

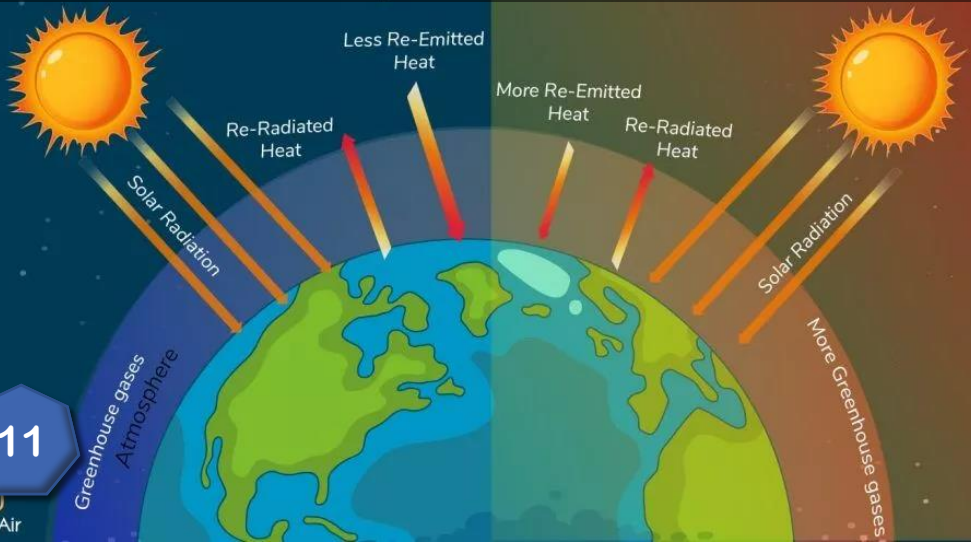
The amount of CO_2 absorbed by the ocean affects the pH value of seawater.

Set 2

Natural
Greenhouse Effect

Human Enhanced
Greenhouse Effect

Greenhouse Effect



11

The greenhouse effect is a natural phenomenon. Without the greenhouse effect, the Earth would be 33°C cooler and life as we know it would not be possible.

But carbon dioxide and other greenhouse gases in atmospheric increases can exacerbate the greenhouse effect and throw the climate off balance.

Cyclone

An aerial satellite-style photograph of a cyclone over the ocean. The cyclone is a large, circular storm system with a distinct eye in the center. The clouds are white and spiral inward from the outer edges. The surrounding ocean is dark blue, and the landmasses are green and brown.

14

Cyclones draw their energy from warm water at the surface of the ocean. They are getting stronger because of global warming.

Melting Sea Ice



Sea ice melting does not make the sea level rise (just as a melting ice cube does not make a glass overflow).

When it melts, the white ice gives way to much darker sea, which absorbs more sun rays.

Melting Glaciers

A large glacier is melting, creating a turquoise lake. The glacier is a mix of white and blue ice, with a large rock formation protruding from its edge. The lake is filled with meltwater and small icebergs. The foreground is a rocky, gravelly shore. In the background, there are dark, rocky mountains with patches of snow under a blue sky with some clouds.

16

Melting glaciers refer to the process by which glaciers, large masses of ice and snow, are reduced in size and volume due to rising temperatures and changing climate patterns.

Rainfall



Rainfall refers to the amount of precipitation in the form of rain that falls to the ground from the atmosphere. Rainfall is a crucial component of the water cycle, which describes the continuous movement of water between the atmosphere, oceans, land, and living organisms.

Freshwater Resources

21

Freshwater resources are affected by changes in rainfall and by the melting of glaciers that regulate the flow of rivers.

Terrestrial Ecosystem



Terrestrial ecosystem refers to a community of living organisms and their physical environment that exists on land.

Marine Ecosystem



24

Marine ecosystem refers to a community of living organisms and their physical environment that exists in the ocean or other saltwater environments, such as estuaries and coral reefs.

Agriculture

A photograph of a vast agricultural field with rows of young green plants, likely corn, growing in dark brown soil. The plants are in the foreground and middle ground, with a blurred background of more fields and trees under a bright sky. The overall scene is a close-up, low-angle view of the crops.

25

Food production can be affected by temperature, droughts, extreme weather events, floods and marine submersion (e.g. the Nile Delta).

Heatwaves



One consequence of higher temperatures is more frequent heatwaves.

Extremely Cold Weather

The background of the entire page is a movie poster for 'The Day After Tomorrow'. It depicts the Eiffel Tower in Paris, France, completely encased in a thick layer of snow and ice. The sky is a dark, stormy grey, and the city below is also covered in snow, with some buildings and streets visible through the white. The overall atmosphere is one of extreme cold and desolation.

THE DAY AFTER TOMORROW
WHERE WILL YOU BE?

IN THEATERS WORLDWIDE 28 MAY 2004

27

One of consequences of lower temperatures is more extreme cold.

Drought

A large, leafy tree stands at the border between a parched, cracked earth on the left and a lush green field on the right. The cracked earth is a deep brown color, while the field is a vibrant green. The background shows a hazy landscape with mountains under a bright sky. A dark grey horizontal bar is overlaid on the top of the image, containing the word 'Drought' in white text.

28

The disruption of the water cycle can both increase and decrease rainfall.

A lack of rain can cause drought.

Droughts are likely to become more frequent in the future.

River Flood



The disruption of the water cycle can both increase and decrease rainfall. More rain can lead to river flooding. If the soil is very dry, it makes matters worse because the water runs off it.

Marine Submersion

An aerial photograph showing a residential area completely inundated with water. Several large, multi-story houses are partially submerged, with only their roofs and upper floors visible. Numerous boats are scattered throughout the flooded area. The background shows a dark, overcast sky and a body of water extending to the horizon.

30

Marine submersion, also known as coastal or tidal flooding, refers to the temporary inundation of coastal areas by seawater.

This can occur as a result of a combination of factors, including high tides, storm surges, and sea level rise.

A photograph of a fishing boat deck. A large, dark blue net is being hauled in, and the deck is covered with a massive catch of small, silvery fish. A person in a blue jacket is visible on the deck, and another person in a red jacket is partially visible. The boat's hull is white with a blue stripe, and the number '20' is visible on the side. The background shows a calm sea and a distant shoreline with trees.

Fishery

Fishery refers to the activity of catching, harvesting, processing, and selling fish and other aquatic organisms for food or other purposes.

Economy Decrease



32

Economic decreases can occur for a variety of reasons, including economic recessions, financial crises, natural disasters, or other external shocks to the economy.

Vectors of Disease



Some animals carry diseases. Global warming causes them to migrate, possibly reaching human populations that have no immunity against these diseases.

Infrastructure

A photograph of a high-speed train, possibly a Shinkansen, covered in a thick layer of snow. The train is white with a red stripe and is stopped on a track. The ground is covered in snow, and there are overhead power lines and a signal light visible in the background.

33

Cold weather may cause damage or paralysis of pipelines, roads, bridges, utility poles and other infrastructure, resulting in traffic paralysis, interruption of water and electricity supply, etc.

Forest Fires



34

Forest fires start and spread more easily during droughts and heatwaves.

Climate Refugees



Climate change can lead to a range of environmental and social impacts, including sea level rise, drought, flooding, and extreme weather events, which can in turn lead to displacement of populations.

Human Health

A young child with dark skin is lying in a hospital bed, wearing a white hospital gown. The child is holding a doll with dark skin and curly hair. The doll is wearing a blue shirt and has a medical device attached to its hand, which is wrapped in white bandages. The child's eyes are closed, and their hand is resting on the doll's head. The background is slightly blurred, showing a hospital setting.

36

Hunger, new vectors of disease, heatwaves and armed conflicts can have a negative effect on human health.

A top-down view of many hands of various skin tones reaching towards the center, where a large pile of golden-brown grain (likely rice or wheat) is held. The hands are arranged in a circular pattern, creating a sense of unity and shared purpose. The background is dark, making the hands and the grain stand out.

Food Crisis

Food crises can be caused by natural disasters, conflict and violence, economic shocks, and environmental degradation.

Famine



Famines are mainly caused by natural and human factors, such as climatic causes, natural disasters, wars and conflicts, poverty and economic problems, etc.

Conflict

A photograph of a heavily damaged urban area, likely a conflict zone. The buildings are made of mud-brick and are in various states of ruin, with many windows missing and walls crumbling. Debris is scattered throughout the streets. In the foreground, several children are playing in a dusty area. A woman is standing near a building on the right. The overall atmosphere is one of devastation and hardship.

39

39

We shouldn't let it come to this...

Set 5