



EN-GB

Adults



CLIMATE FRESK

All the cards are in your hands!

How to play?

You need one deck of cards per team (6 to 8 pp), a paper roll or tablecloth of 1*2 meters, pencils, rubbers, colour felt pens and some tape.

The aim is for each team to place the cards in order on the table, find all the cause and effect relationships and draw arrows between the cards to illustrate what climate change is about.

Deal the cards set by set and wait until all cards are down on the table before dealing the next set.

Time indications: ~1hour to place the cards, ~1hour to decorate the Fresk and ~1hour to sit down together for a heart-to-heart discussion.



Reasoning



Creativity



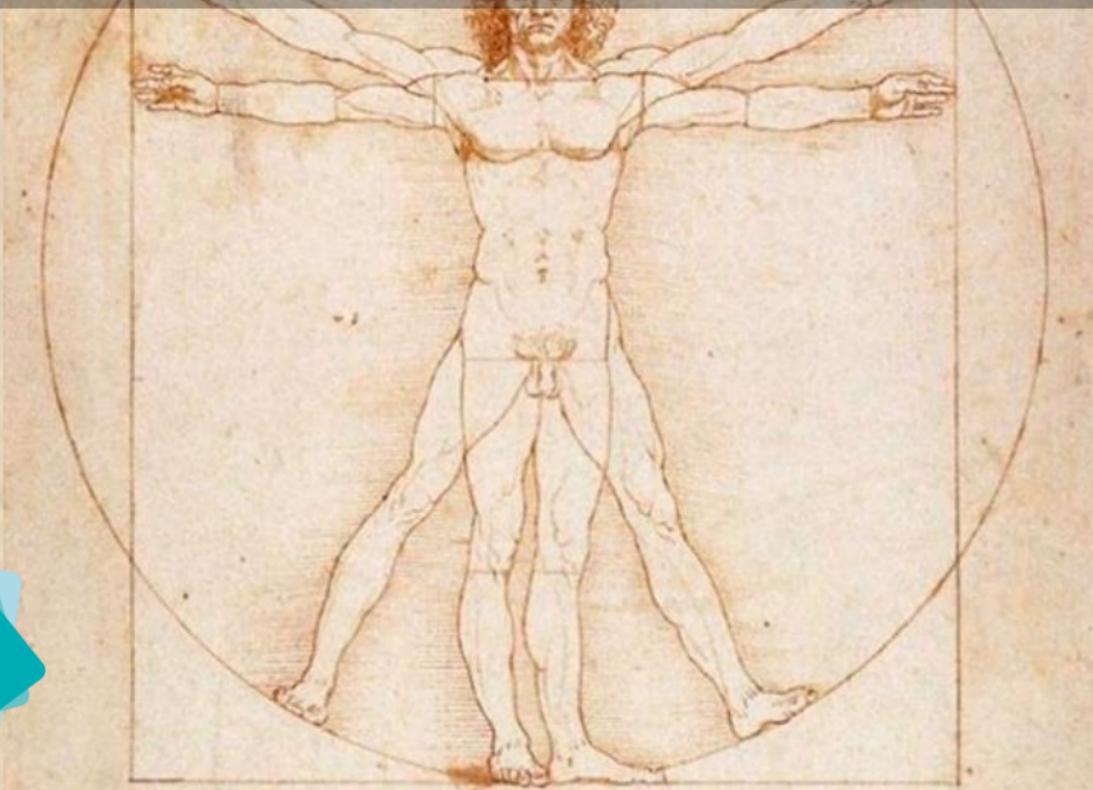
Review



Debrief

For a simpler (or quicker) version of the game, take off cards #10, #14, #15 and/or #41, #42.

Human activities

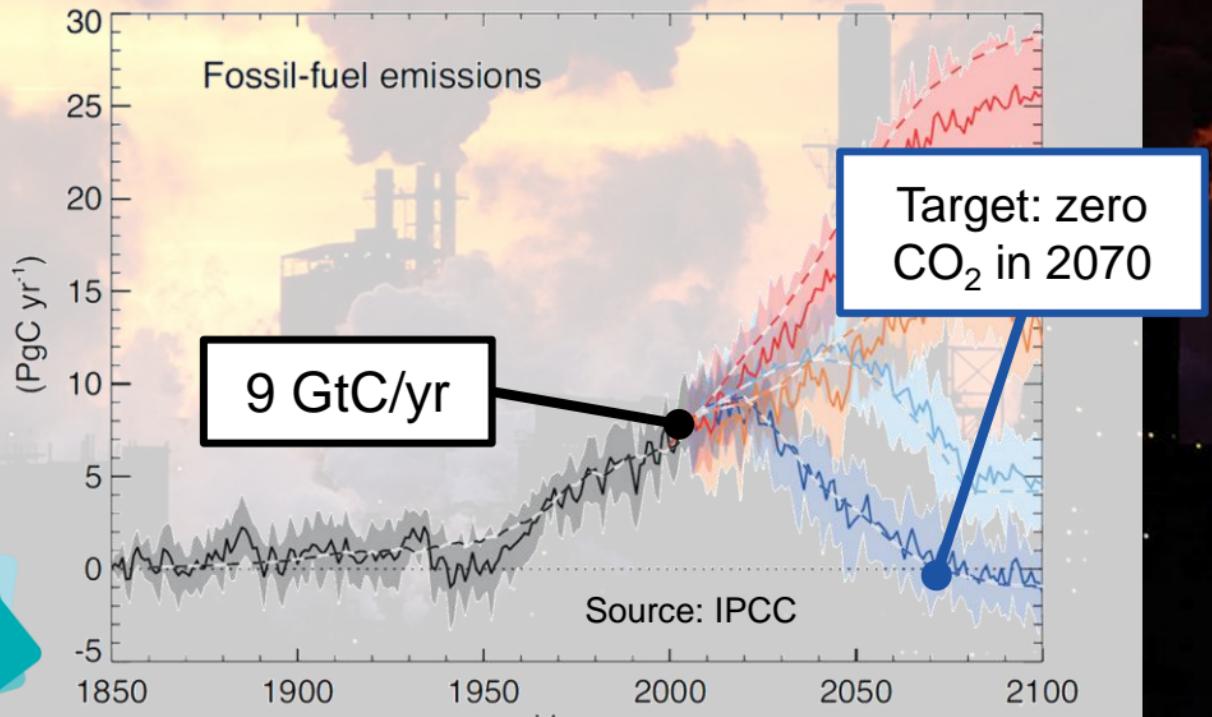


1



That is where it all begins...

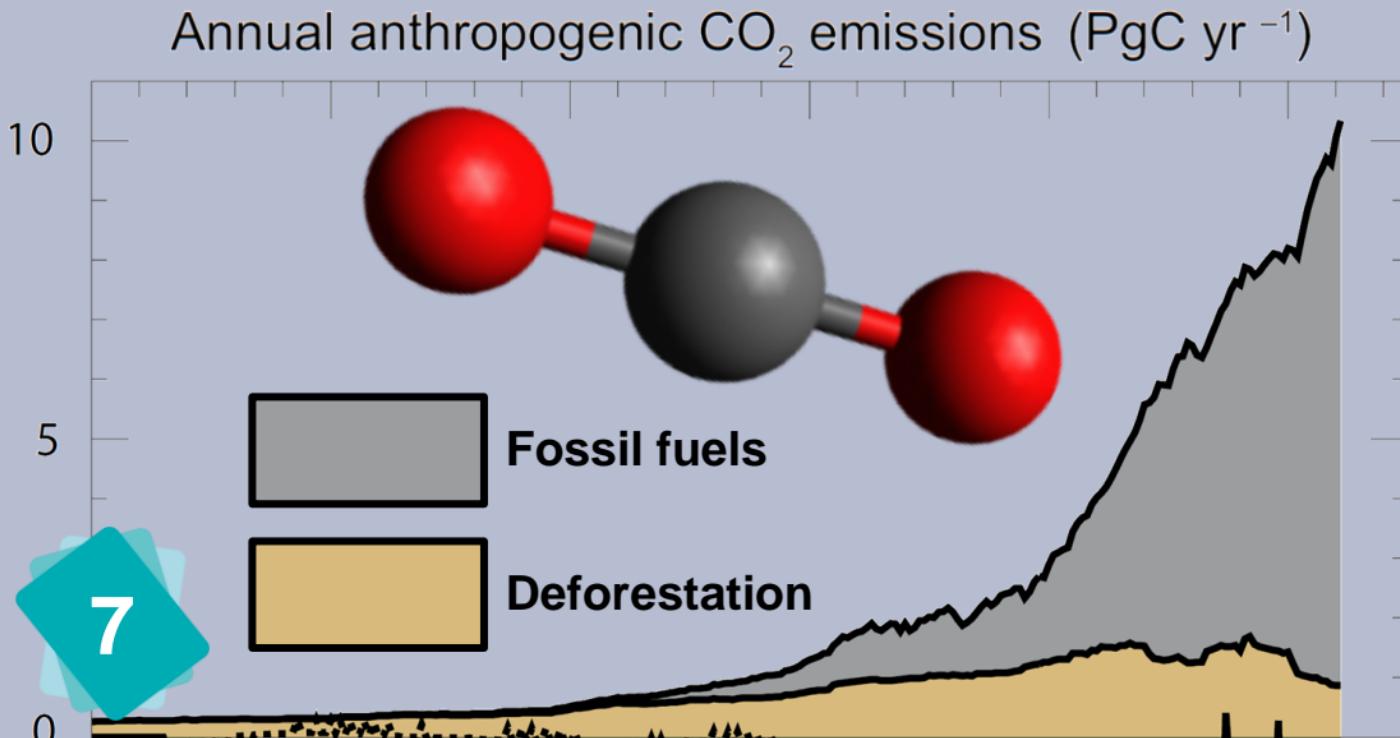
Fossil Fuels



5

Fossil fuels are coal, oil, and natural gas. They are used mainly in buildings, transportation, and industry. They emit CO₂ when burned.

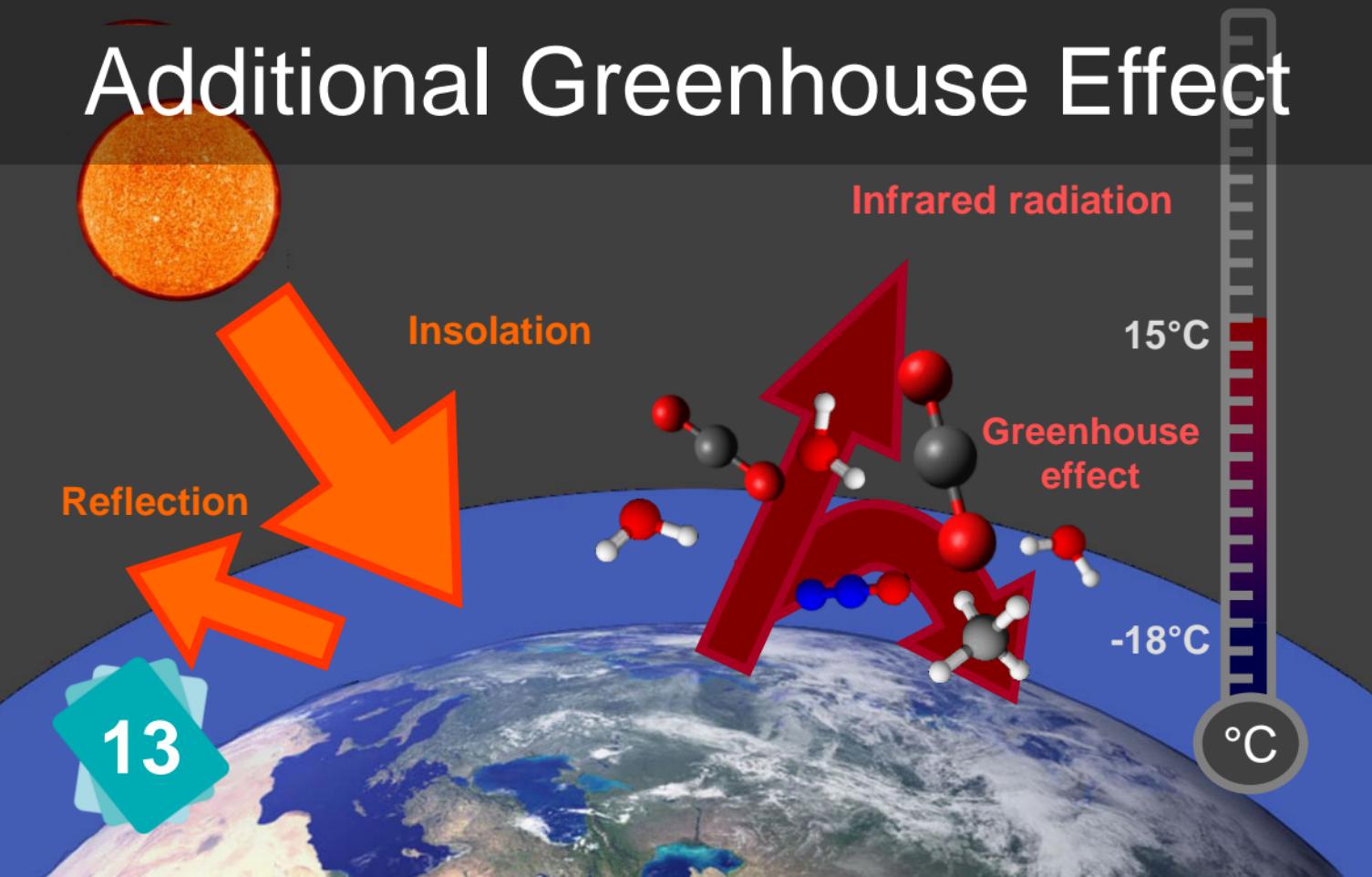
CO_2 Emissions



7

CO_2 (or carbon dioxide) is the first anthropogenic (ie linked to human activity) greenhouse gas in terms of emissions. These emissions come from our use of fossil fuels and deforestation.

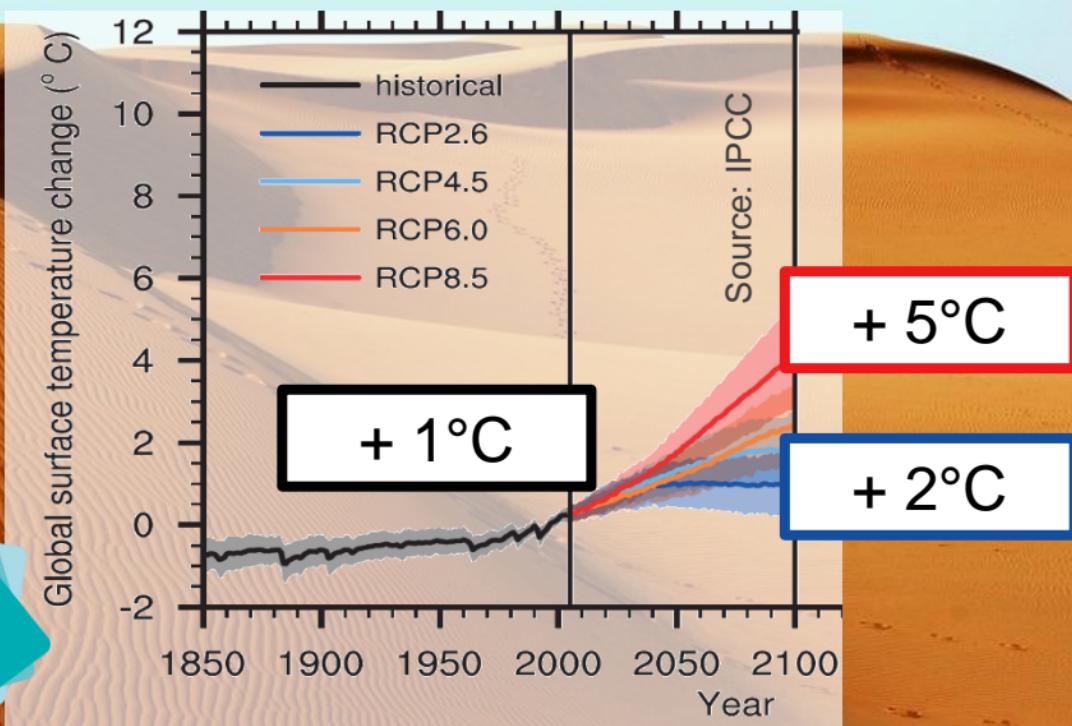
Additional Greenhouse Effect



13

The greenhouse effect is a natural phenomenon (by the way, the first GHG is water vapor). Without greenhouse effect, the planet would be 33°C colder and life as we know it would not be possible...But CO₂ and other GHGs related to human activity increase the natural greenhouse effect and unbalance the climate.

Temperature Rise



21

Here we are referring to the average temperature of air above the ground on Earth. It has increased by 1°C since 1900. Depending on the scenarios, the rise in temperature could reach 2°C to 5°C by 2100. At the end of the last ice age years, the average temperature was only 5°C lower than today's... And deglaciation lasted 10,000 years!

Melting of Sea Ice



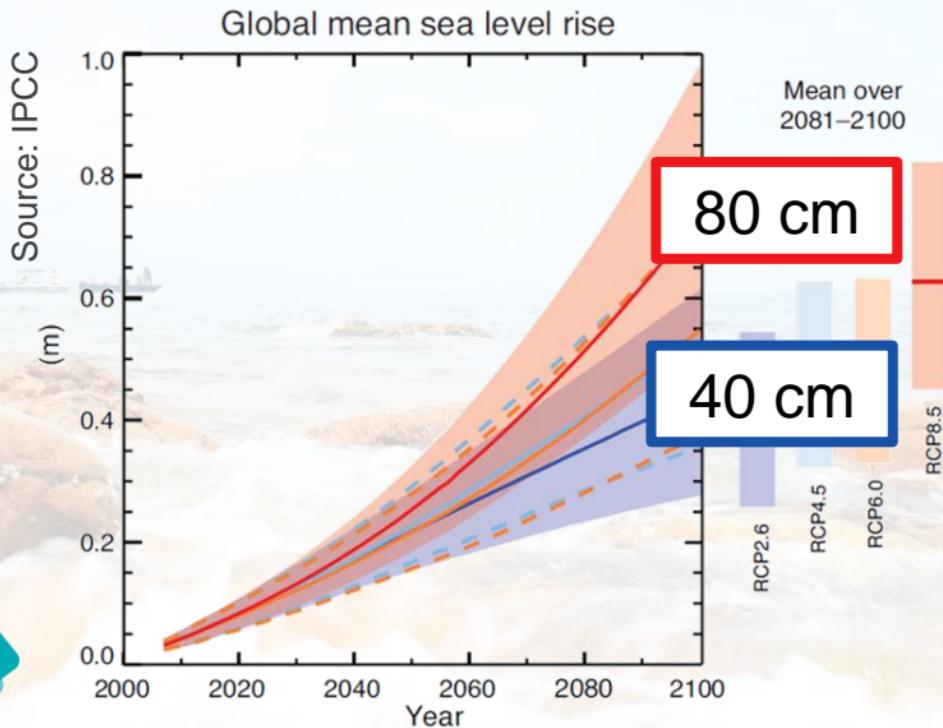
18

Photo : NASA

18

The melting of sea ice is not responsible for sea level rise (an ice cube that melts in a glass of water doesn't make the water overflow the glass). However, as sea ice melts, it leaves space for a much darker element (the sea), which therefore absorbs more sun rays than white ice.

Sea Level Rise



22

Since 1900, sea level has risen by 20 cm. Sea level rise is caused by the thermal expansion of ocean waters, and the melting of glaciers and continental glaciers.

Industry



2

Industry uses fossil fuels and electricity. It accounts for 40% of greenhouse gas (GHG) emissions.

Set 2

Building Usage



3

The building sector (housing and commercial use) uses fossil fuels and electricity. It accounts for 20% of greenhouse gas (GHG) emissions.



4

4

The transportation sector is highly dependent on oil. It accounts for 15% of greenhouse gas emissions.

Set 2

Deforestation

6



6

Deforestation consists in cutting or burning trees beyond the ability to restore the forest. 80% of the deforestation is related to agriculture.

Set 2

Agriculture

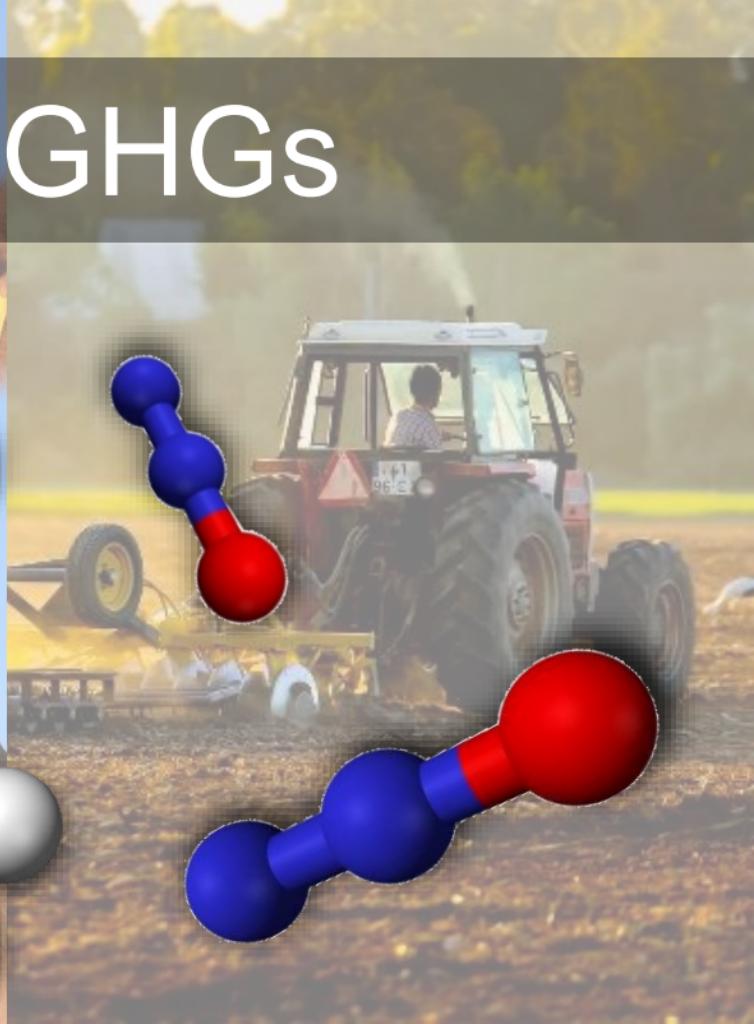
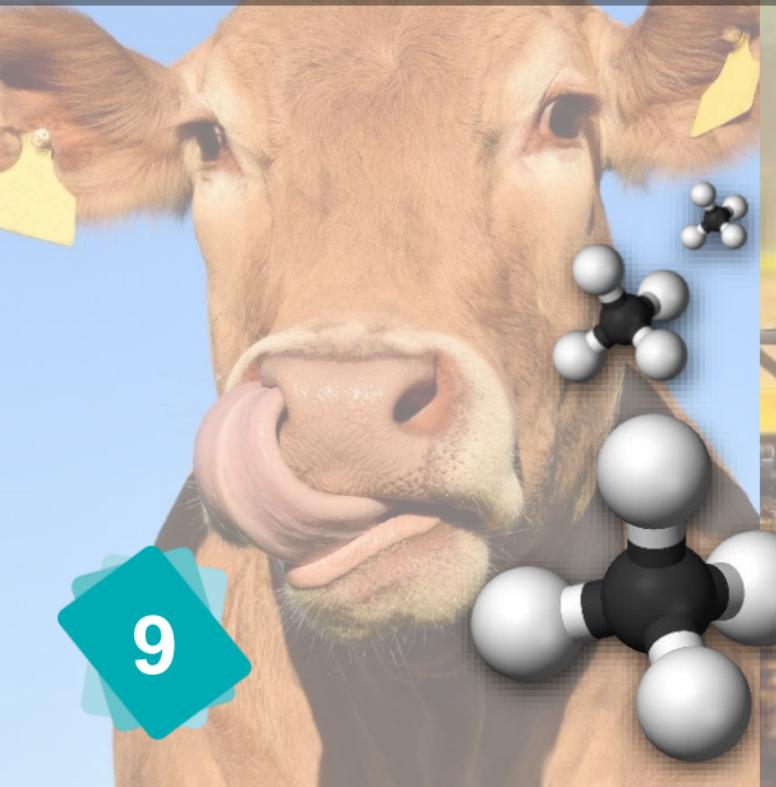


8

8

Agriculture does not emit a lot of CO₂, but is responsible for the emission of methane (cows and paddy fields) and nitrous oxide (fertilizers) in high quantity. In all, it is 25% of GHGs if we include induced deforestation.

Other GHGs



9

CO₂ is not the only greenhouse gas (GHG). Among others are methane (CH₄), and nitrous oxide (N₂O), two gases mainly emitted by agricultural activities.

Set 2

Concentration of CO₂ (ppm)

Source: IPCC

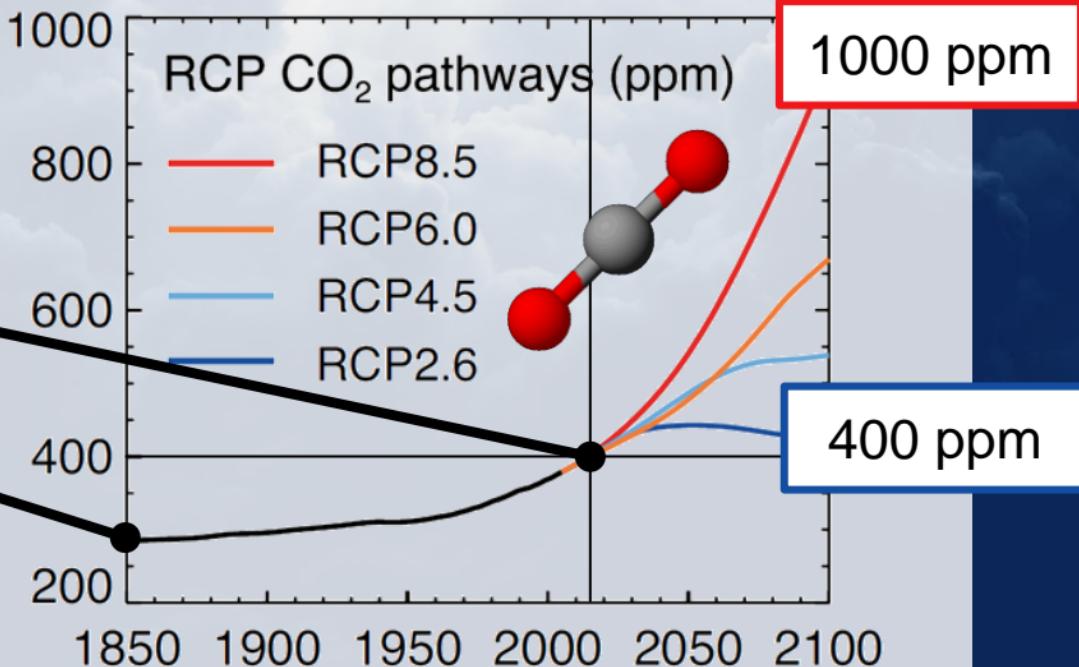
410 ppm

280 ppm

1000 ppm

400 ppm

11

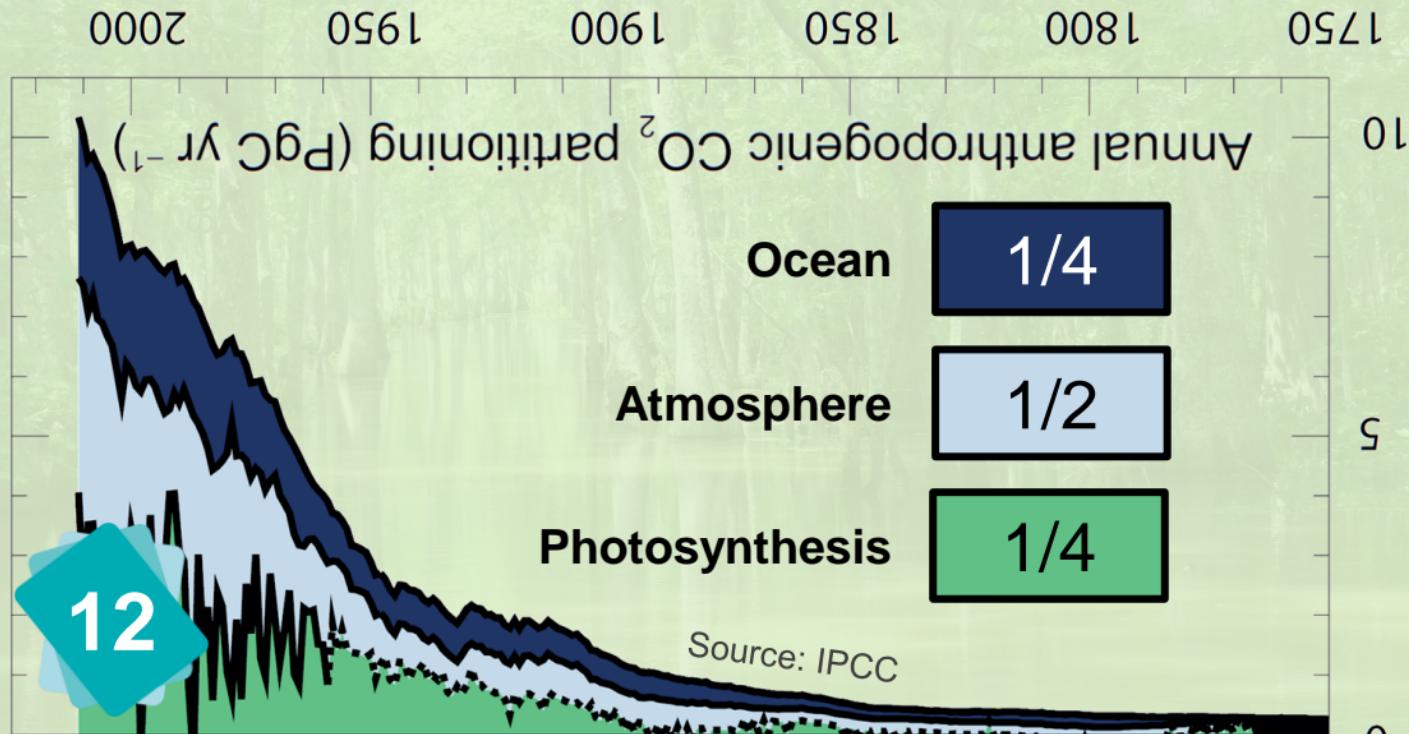


11

About half of our CO₂ emissions are captured by natural carbon sinks. The other half remains in the atmosphere; the concentration of CO₂ in the air has increased from 280 to 410 ppm (parts per million) in 150 years.

Set 2

Carbon Sinks



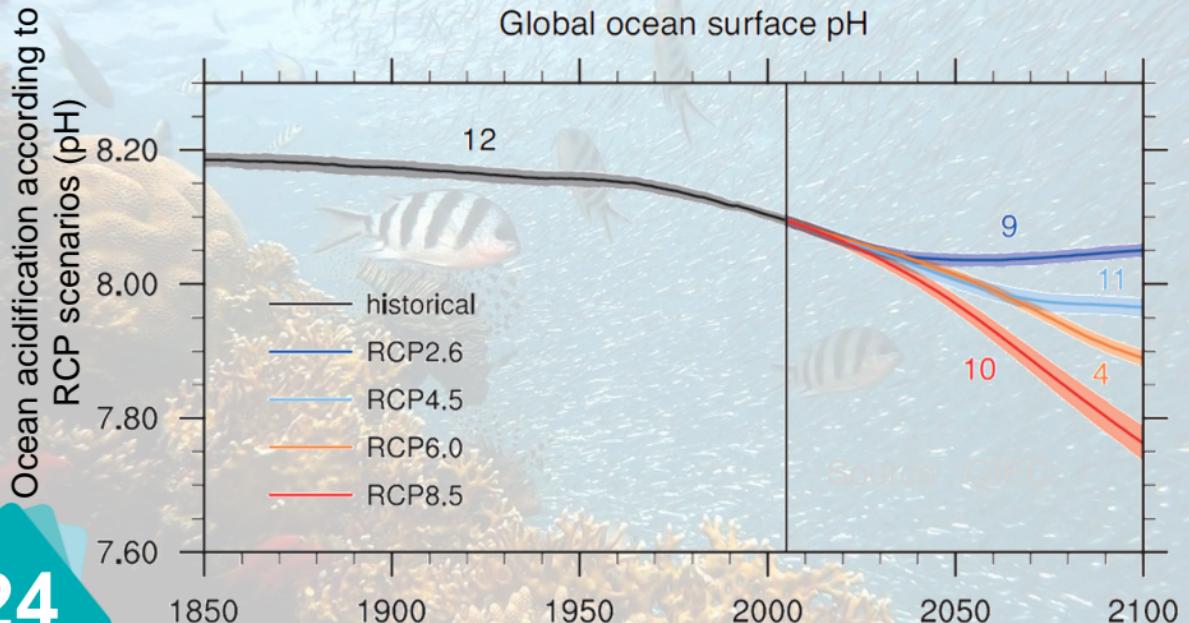
12

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

- 1/4 by the vegetation (through photosynthesis)
- 1/4 by the ocean

The remaining half (1/2) stays in the atmosphere.

Ocean Acidification



24

When CO_2 dissolves into the ocean, it turns into acid ions (H_2CO_3 and HCO_3^-). The effect of this transformation is the acidification of ocean (the pH decreases).

Aerosols

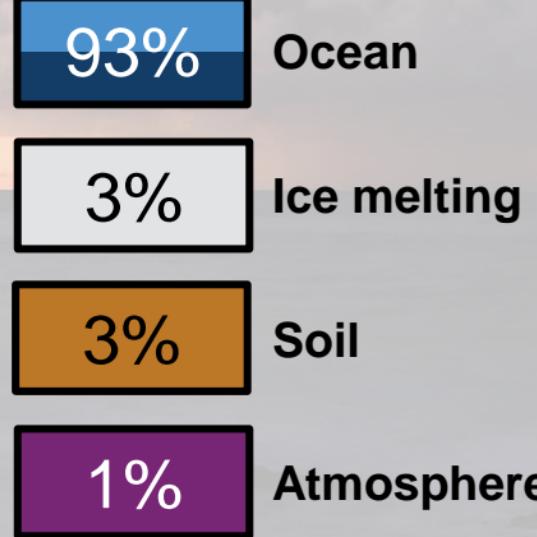
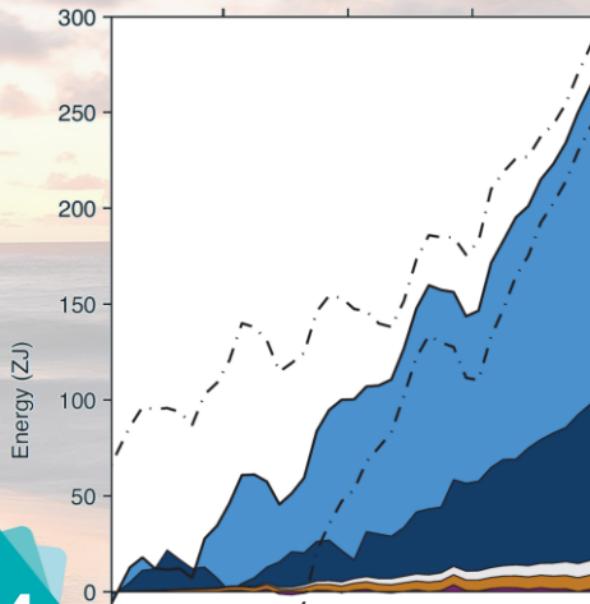


10

10

Nothing to do with aerosol spray cans.
Aerosols are a type of local pollution that comes from the incomplete combustion of fossil fuels. They are bad for human health and they contribute negatively to radiative forcing (they cool the climate).

Energy Budget



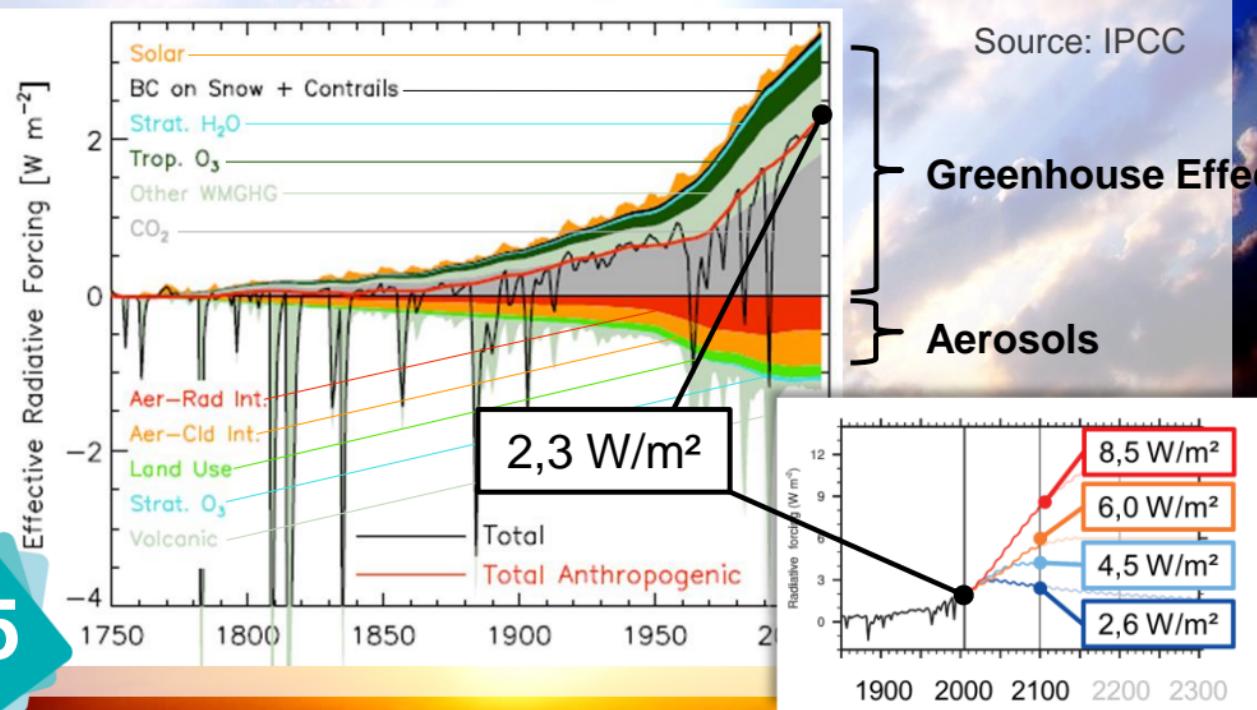
Source: IPCC

14

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 3

Radiative Forcing



15

Radiative forcing represents the difference (caused by human being) between the energy that arrives on earth each second and the energy that is released. In the 5th assessment report of IPCC, it is rated at 2.3 W/m^2 (Watt per square meter).

Melting of Glaciers



16

16

Almost all of the glaciers have lost mass. Hundreds of them have even disappeared. These glaciers play a regulating role as a source of fresh water.

Increase in Water Temperature

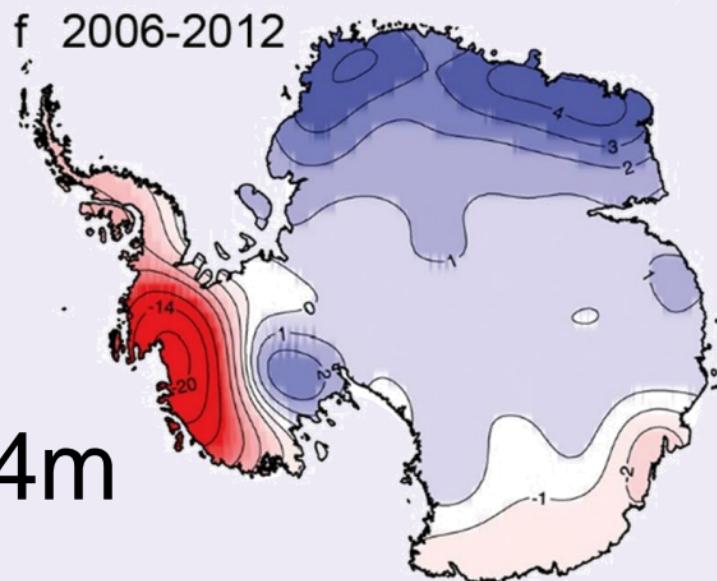
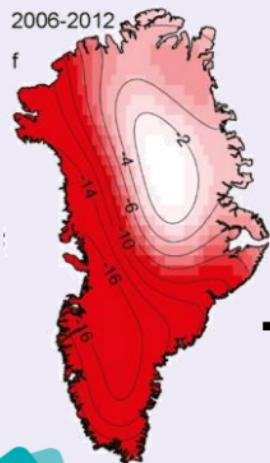


17

The Ocean absorbs 93% of the energy accumulated on Earth. Its temperature has therefore increased, especially in the upper layers. While heating, water expands.

Set 3

Melting of Ice Sheets



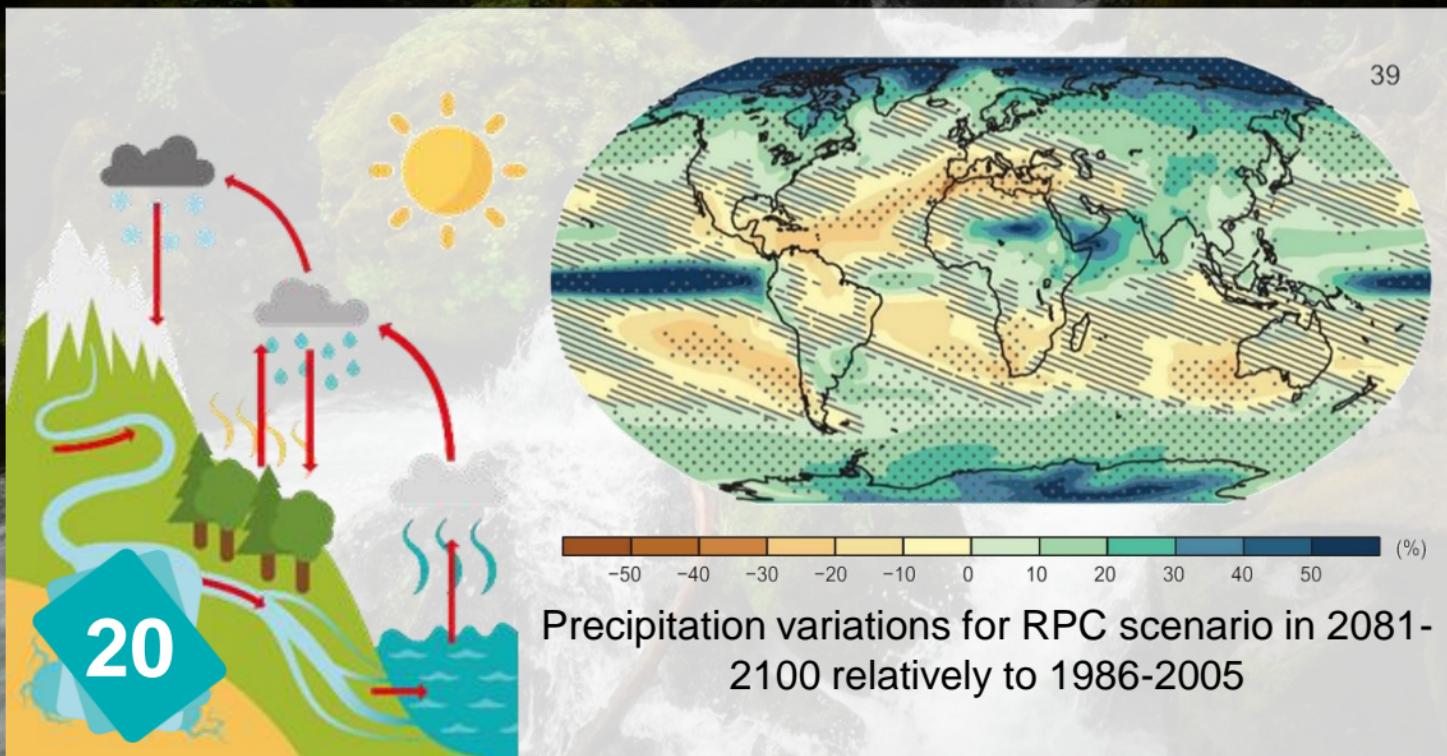
19

Source: IPCC

19

Continental glaciers (or ice sheets) are in Greenland and Antarctica. If they melt completely, they will cause a rise in ocean levels of 7 meters for Greenland and 54 meters for Antarctica. During the last ice age, ice caps were so huge that the sea level was 120 m lower than today.

Disruption of the Water Cycle



20

The evaporation that happens at the ocean surface increases if the temperatures of the ocean and of the atmosphere increase.

That means more rain clouds. The same evaporation phenomenon exists between soil and air, then the soil dries out.

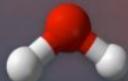
Hindered calcification process

How will changes in ocean chemistry affect marine life?

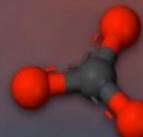
CO₂ absorbed from the atmosphere



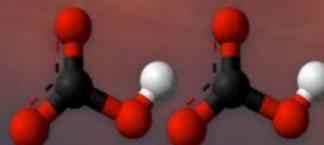
carbon
dioxide



water



carbonate
ion



2 bicarbonate
ions

23

consumption of carbonate ions impedes calcification

23

When the pH drops, the formation of calcium carbonate (and more specifically, of calcified shells) becomes more difficult.

Terrestrial Biodiversity

25



25

Animals and plants are affected by the changes in temperature and the perturbation of the water cycle: they migrate, die, or, more infrequently, proliferate.

Set 4

River Flooding



26

The disruption of the water cycle can cause more water or less water. More water can lead to river flooding. If the soil is dried by drought it's worse because the water runs off.

Marine Biodiversity



27

Pteropods and coccolithophores are at the basis of the food chain in the ocean. Therefore, if they disappear, all marine biodiversity is threatened. The warming of ocean waters also threatens marine biodiversity.

Set 4

Cyclones

34

Cyclones use energy from warm waters at the ocean's surface. Because of global warming, they are becoming stronger.

Pteropods and Coccolithophores



29

Pteropods are a kind of zooplankton
and Coccolithophores a kind of
phytoplankton. These organisms
have a calcified shell.

Set 4

Droughts



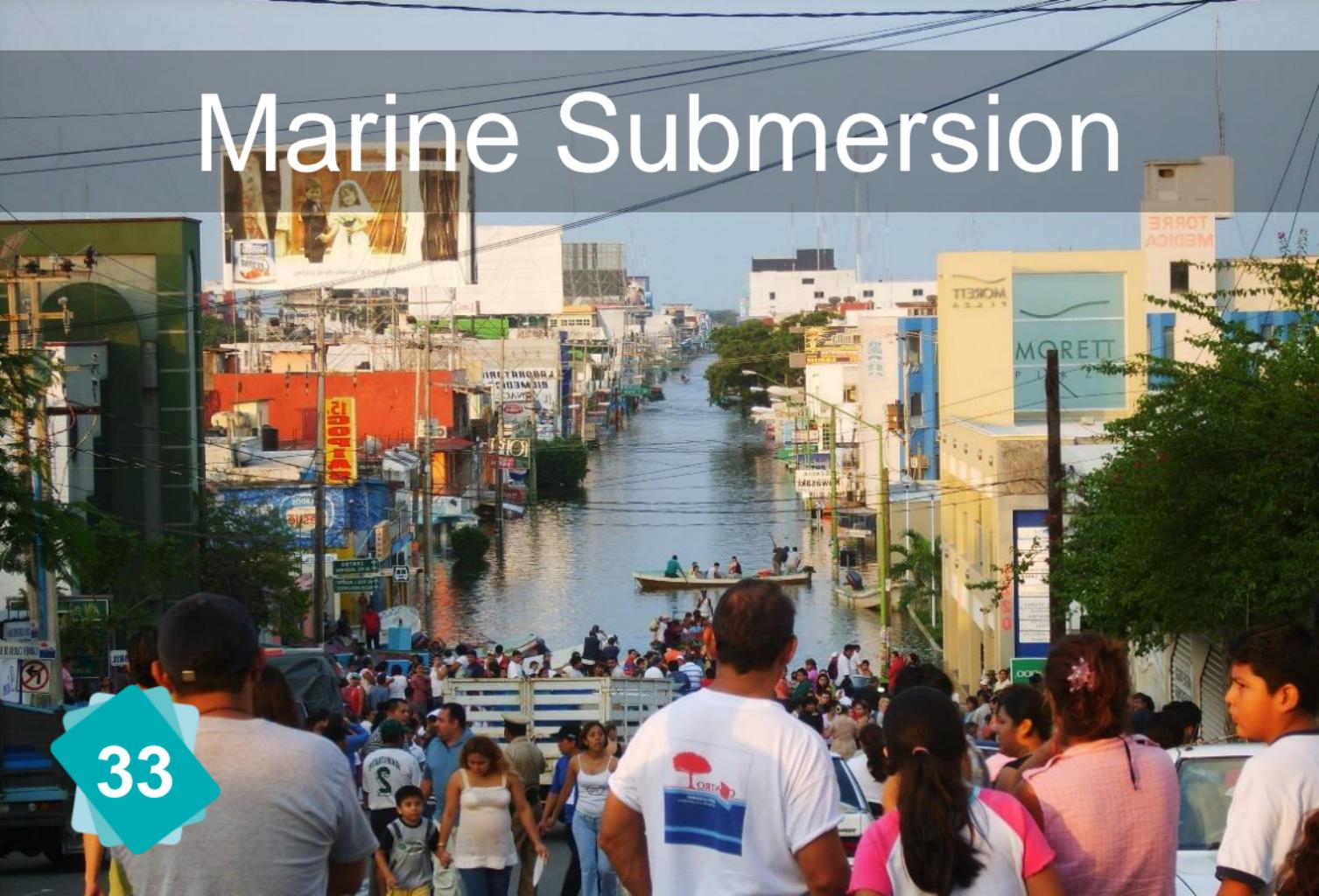
30

30

The disruption of the water cycle means more or less water in different places. When these perturbations lead to less water, it's a drought. Droughts are likely to be more frequent in the future.

Set 4

Marine Submersion



33

33

Cyclones and weather disturbances bring wind (therefore waves) and low pressure. Now, 1 hectopascal less means a 1 cm sea level rise. Therefore cyclones can cause marine submersions (or coastal flooding), amplified by the sea level rise already caused by global warming.

Set 4

Vectors of Disease



28

With global warming, animals migrate. Some of them carry diseases and will reach areas where the population is not immunized against those diseases.

Freshwater Resources



31

Freshwater resources are affected by changes in rainfall and by the disappearance of glaciers that play a regulatory role in streams flow.

Decline in Agricultural Yields



32

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

Forest Fires



35



Forest fires start more easily during
droughts and heat waves.

Heat Waves



36

36

A manifestation of temperature increase is the multiplication of heat waves.

Set 5

Starvation



37

Starvation can be caused by lower agricultural yields and by the reduction of marine biodiversity.

Human Health



38

Starvation, displacement of disease vectors, heat waves and armed conflicts can affect human health.

Climate Refugees



39

Imagine that you live in a place that has been miraculously spared by climate change. Several billions of human beings might want to share this space with you.

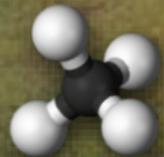
Armed Conflicts



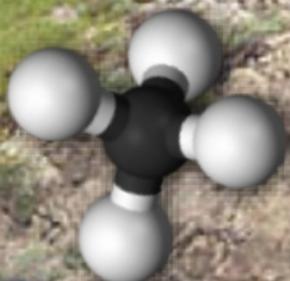
40

That's how we shouldn't let it
end...

Set 5



Permafrost

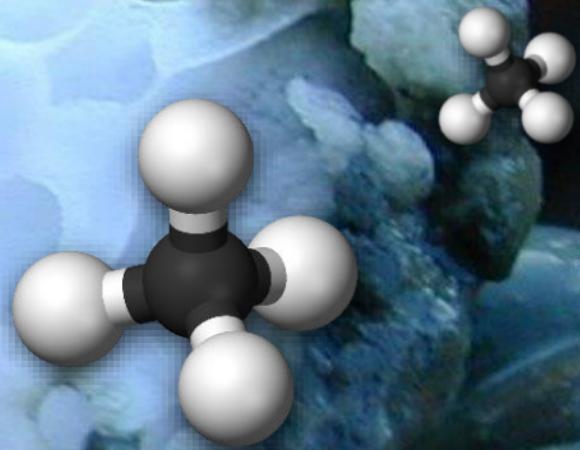


41

41

Permafrost refers to permanently frozen ground. Permafrost thawing leads to the decomposition of organic matter previously frozen underground, a phenomenon that releases methane and CO₂ into the atmosphere. Beyond +2°C of warming, it is almost certain this phenomenon will accelerate and lead to a climate uproar.

Methane Hydrates

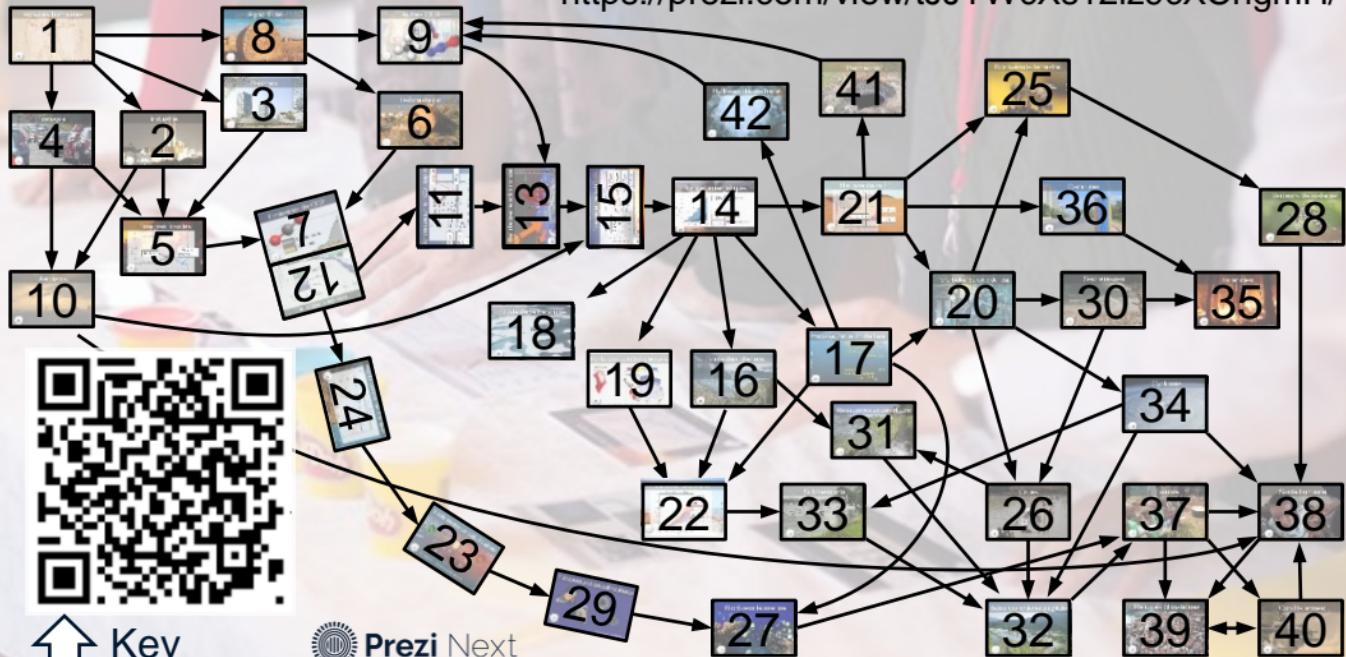


42

Methane hydrates (or methane clathrates) are a form of ice on the ocean floor, along continental slopes, that traps methane molecules. They can become unstable above +2°C.

Key

<https://prezi.com/view/tJJYWcXs12lz9cXCngmH/>



**The Climate Fresk was developed by Cédric Ringenbach.
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English



Scan to join us !



All the cards are in your hands!