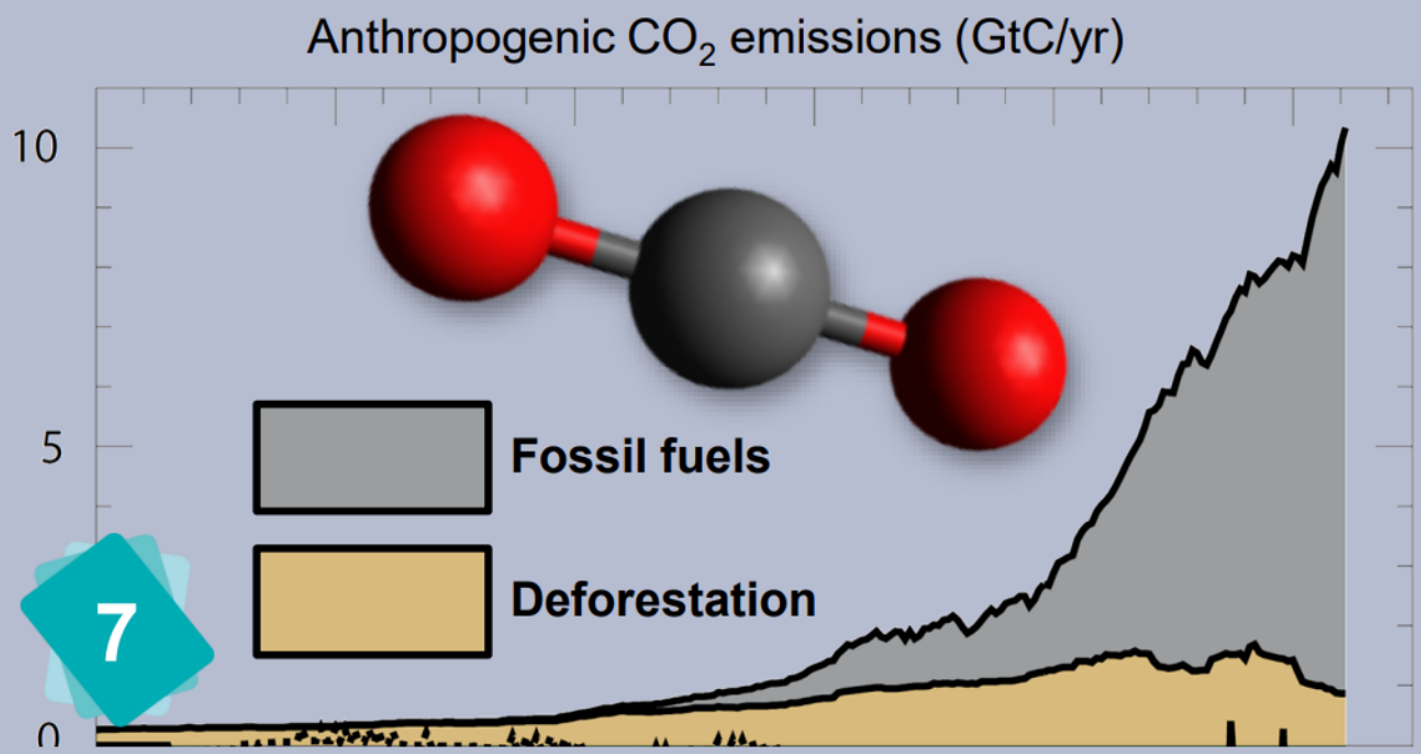
CO_2 Emissions



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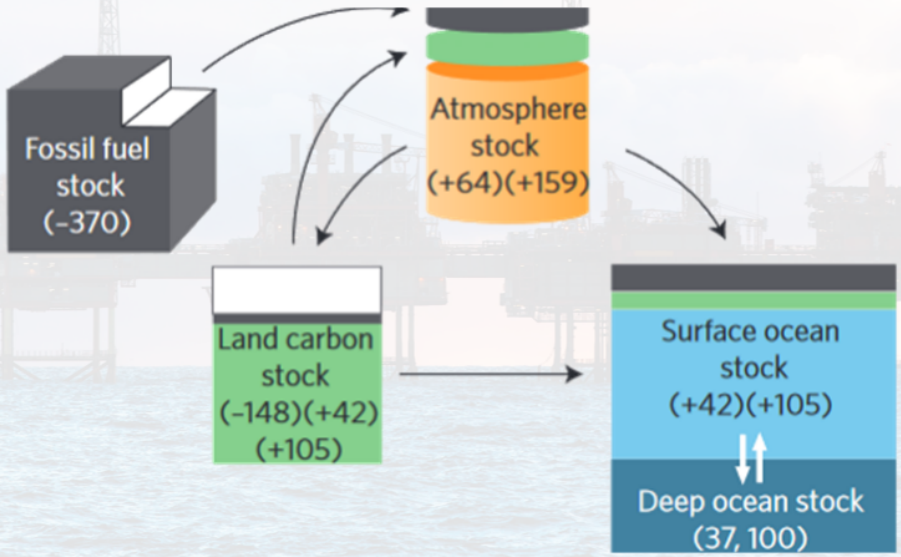
CO_2 , or carbon dioxide, is the main anthropogenic (produced by human activities) greenhouse gas in terms of emissions. These emissions come from our use of fossil fuels and from deforestation.

Disrupted Carbon cycle



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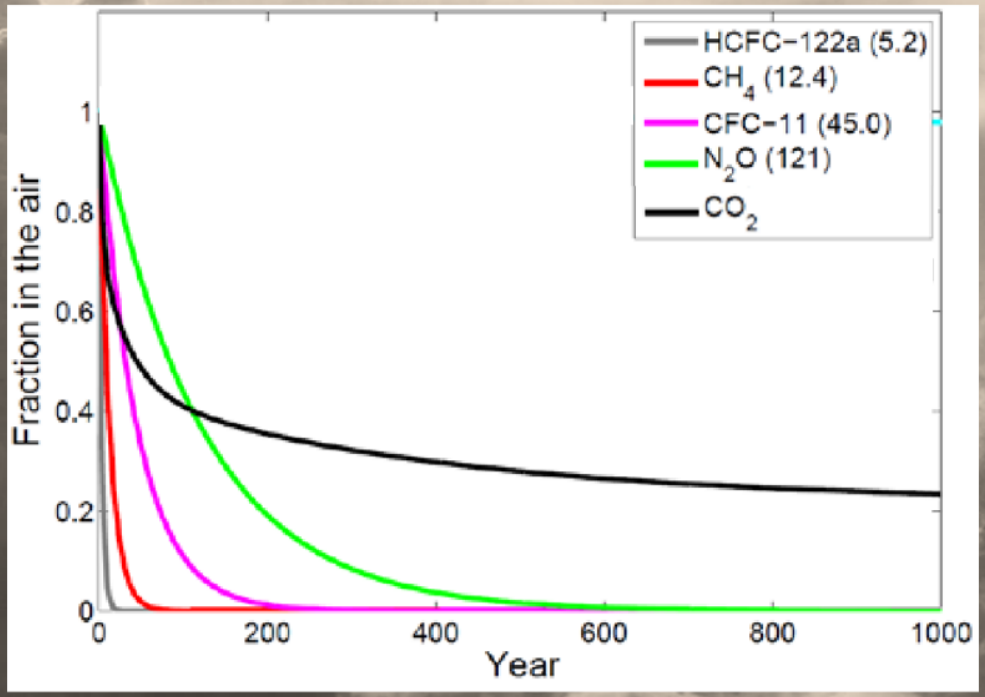
Since the 19th century, human started burning fossil fuel. The "equilibrium" established between the ocean, the land and the atmosphere carbon stocks is disrupted by this flow of carbon from fossil fuels which will remain forever in the cycle

GHGs persistence



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All these GHGs remain into the atmosphere. Each gas has its own lifetime in the atmosphere and the longest is CO_2's. But they each have in common their lifetime's order of magnitude which is about hundred years.

Human activities

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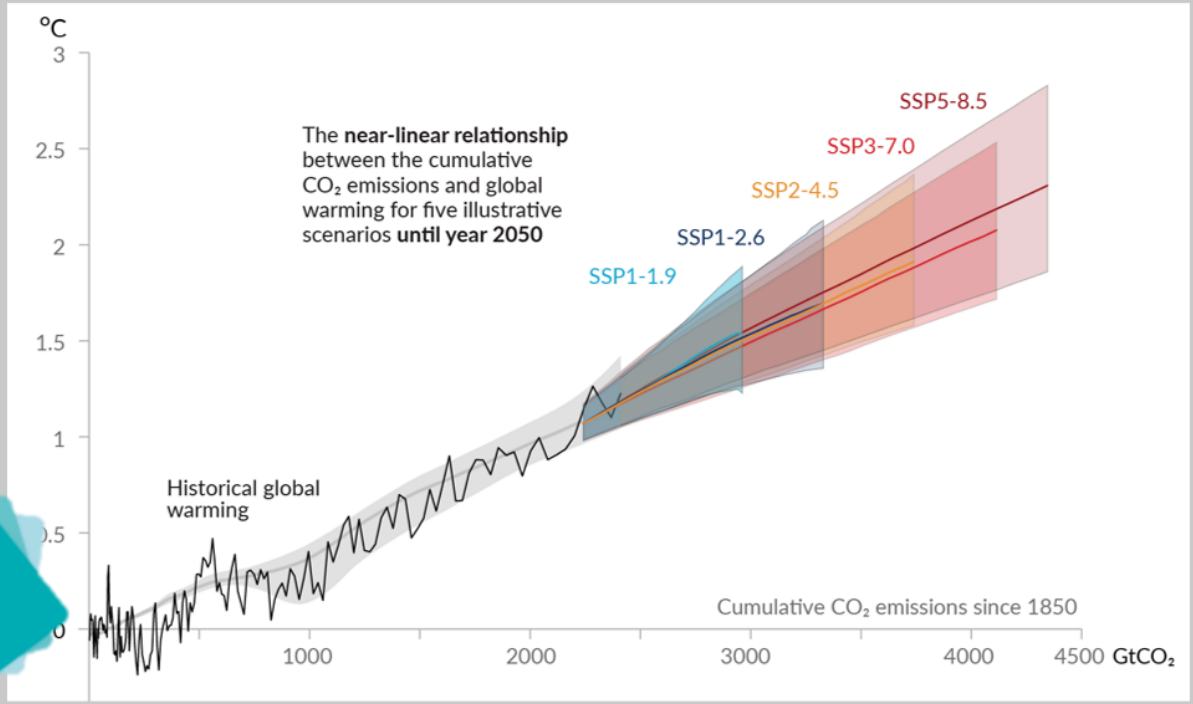
Human activities such as industry, building sector, transportation and agriculture are using fossil fuels and emitting a lot of GHGs.

Greenhouse gas emissions per sector

Linearity temperature CO_2

Global surface temperature increase since 1850-1900 (°C) as a function of cumulative CO_2 emissions ($GtCO_2$)



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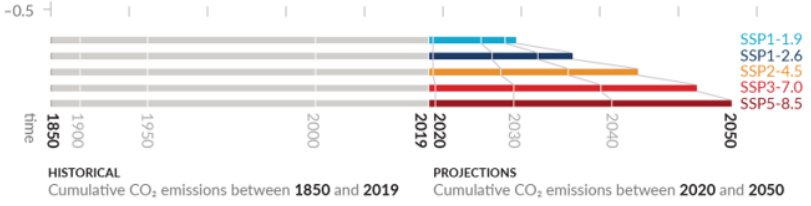
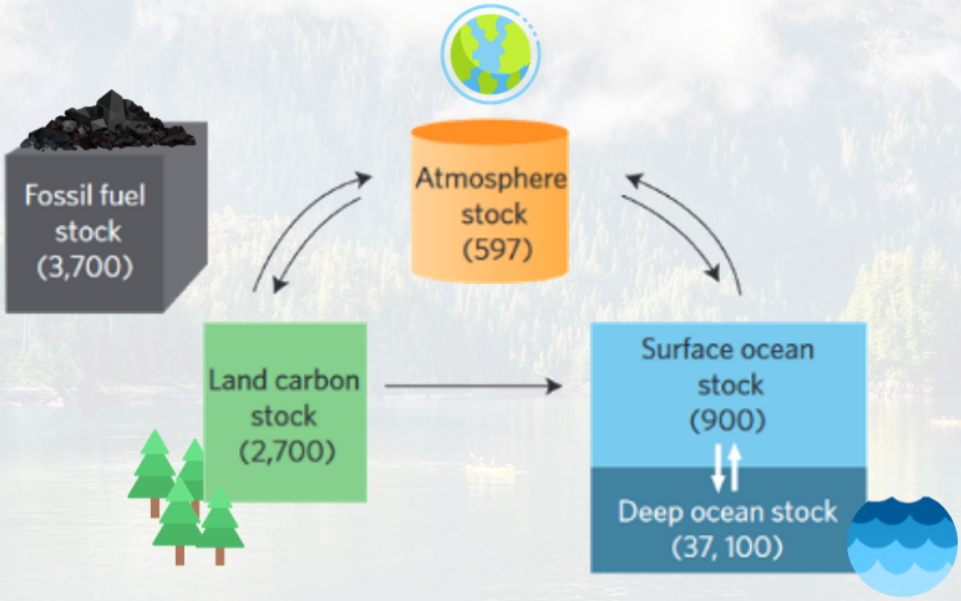
Studies have shown a linearity between the carbon dioxide cumulative emissions and the temperature increase. This linearity shows that it is not the rate of emissions that matters, but the cumulative emissions. The more we emit now, the less we can emit before we reach a given temperature increase.



Future cumulative CO_2 emissions differ across scenarios and determine how much warming we will experience.

Natural Carbon cycle



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The 4 main carbon stocks are the ocean, the atmosphere, the land and fossil fuel. Atmospheric CO2 is absorbed by the ocean as dissolved inorganic carbon and by the land as biomass or soil organic carbon. These processes take place on very different time scales.

Natural emissions

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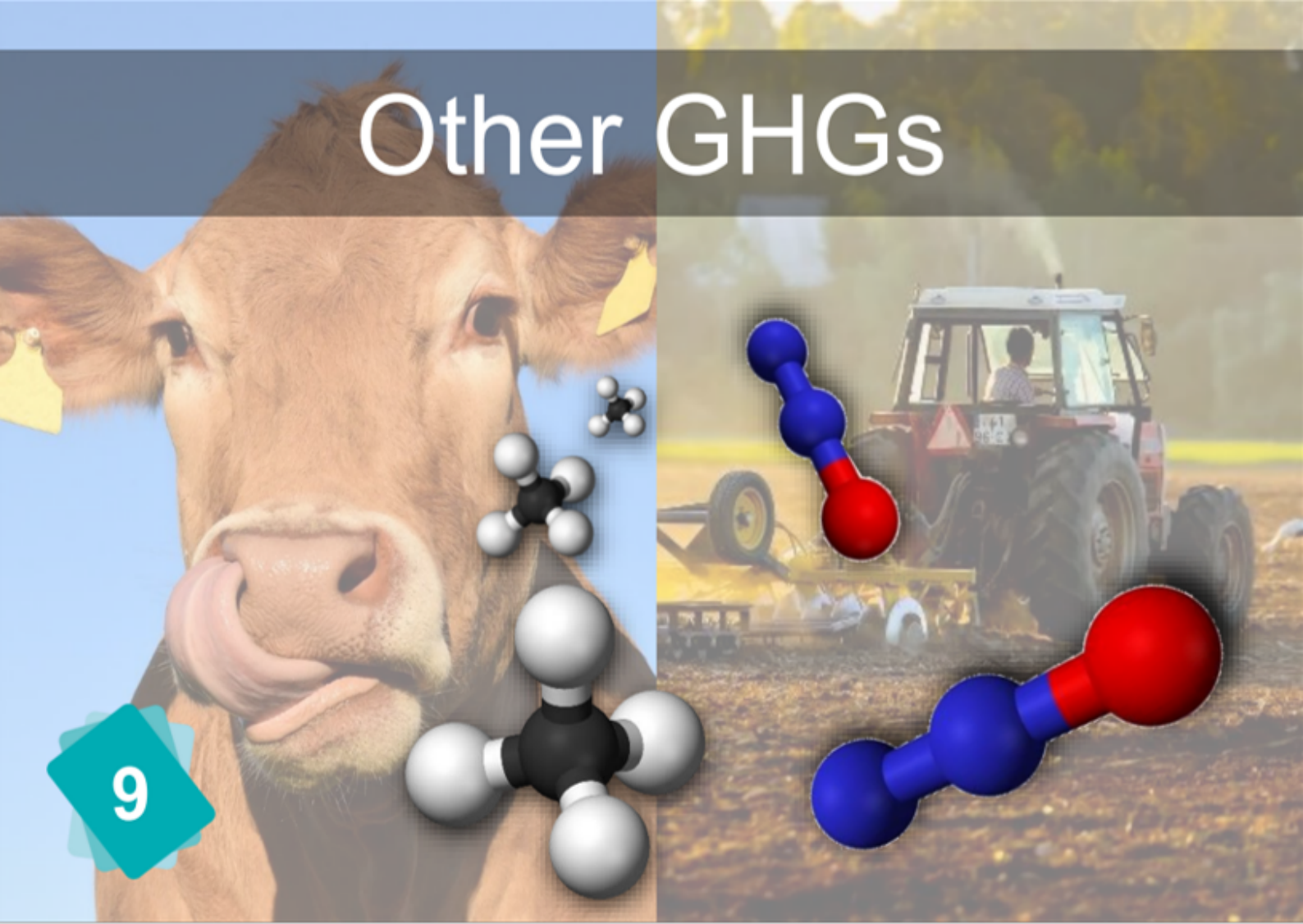
Carbon dioxide emissions can be of natural origin: they come from underground, from ocean discharge, from forest fires, from volcanic eruptions, or from animal and plant respiration.

Other GHGs



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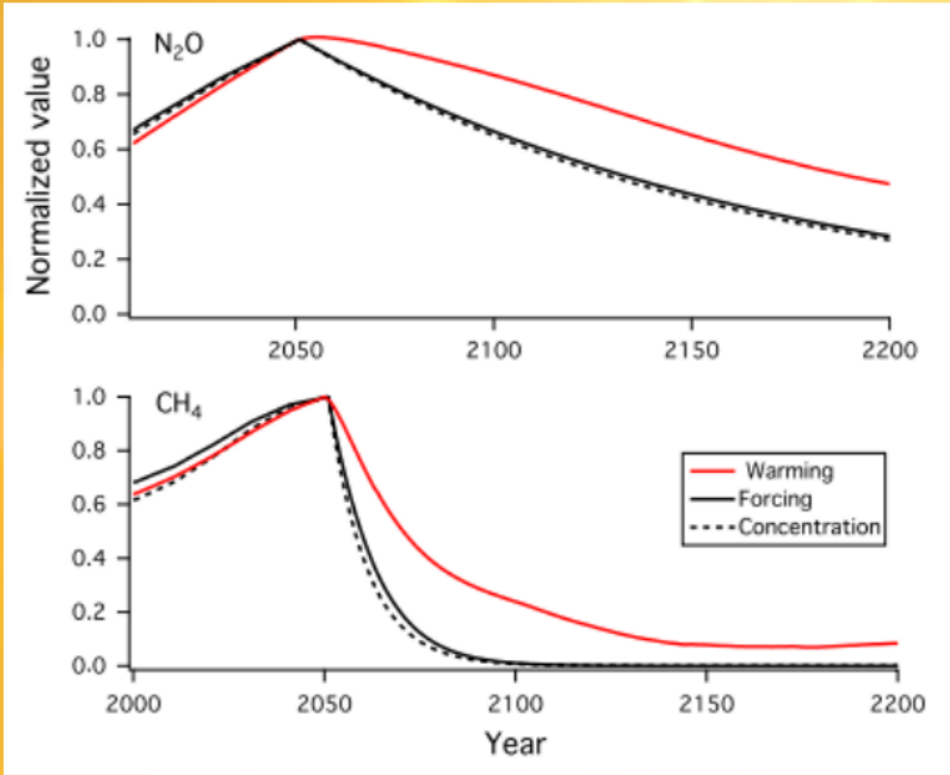
CO_2 is not the only greenhouse gas (GHG). Among others are methane (CH_4) and nitrous oxide (N_2O), both of which mainly come from agricultural activities.

Other GHGs influence on temperature



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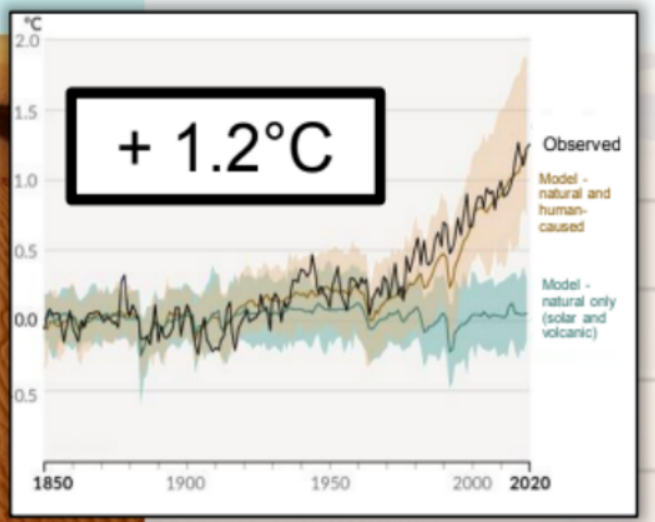
While the response in temperature to CO2 emissions is linear, the response for other GHGs varies from one gas to an other. But keep in mind that a fast decrease is not necessarily better. The methane for example, has the fastest response but in fact it has more impact on radiative forcing than CO2.

Global Warming



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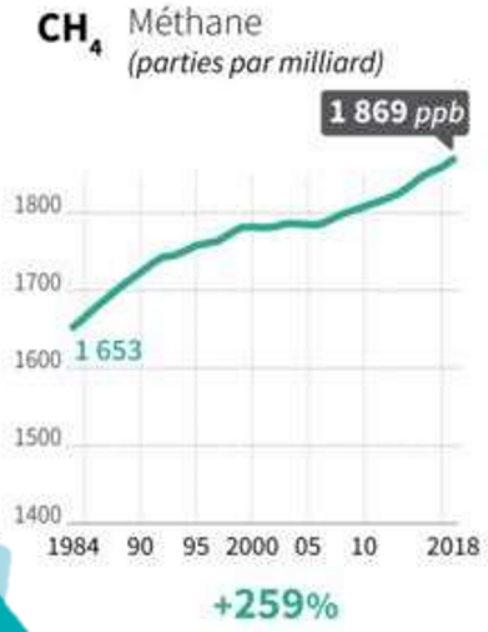
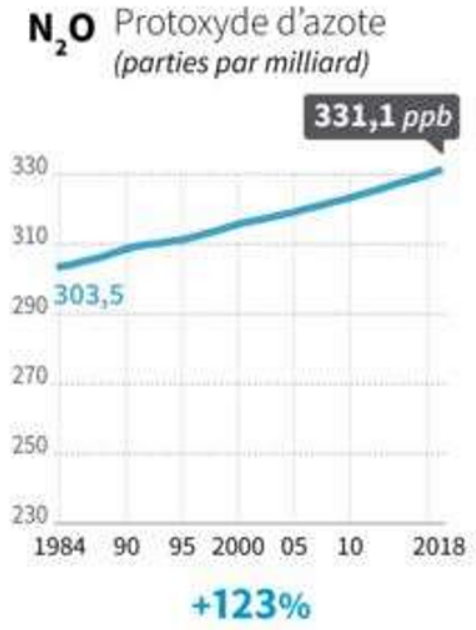
The average air temperature at the surface of the Earth has increased by 1.2°C since 1900. Future emission scenarios predict that this increase will reach between 2 and 5°C by 2100.
During the last ice age 20,000 years ago, the average air temperature was only 5°C lower than today and warming up took 10,000 years.

Surplus of other GHGs





compared to the pre-industrial era of 1750

10

With all these emissions, there is too much GHGs in the atmosphere and it is continually rising up. Their numbers have exploded since the pre-industrial era.

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