

Climate Change

Greenhouse effect

Greenhouse gases do not interact with the incoming shortwave sun light. Therefore, most of the light just passes through to the ground, heating it up. The ground in turn emits longwave heat radiation, which can interact with greenhouse gases. This way part of the heat radiation is sent back to the ground and effectively "trapped".

Man made

The fast and large rise in global temperature can be well explained by the fast and large rise in man made greenhouse gas concentrations (mainly carbon dioxide and methane). So far, all observations agree with this hypothesis. All other attempts to explain it (Sun, volcanoes, internal variability,...) have, even in sum, too little effect.

Climate vs weather

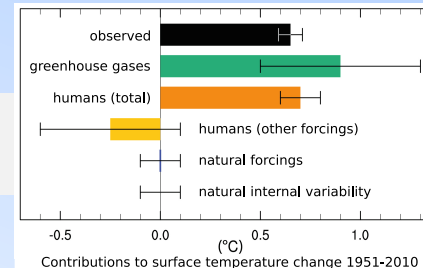
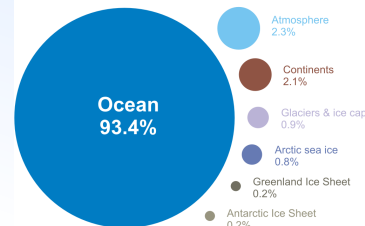
While weather is local, climate happens on larger scales in time and space.
In other words: The weather report might tell you to bring an umbrella tomorrow. The climate report tells you not to buy coastal property in the coming decades.

greenhouse gases in the atmosphere

Energy budget

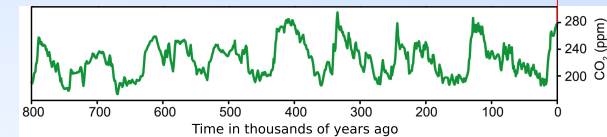
Only around 0.2 % (0.6 W/m²) of the incoming solar radiation is trapped by the greenhouse gases and heats up the Earth. This may sound small, but corresponds, distributed across the whole surface of the Earth, to a total energy output equivalent to about 4 Hiroshima atomic bombs per second.

Where is global warming going?



Carbon dioxide

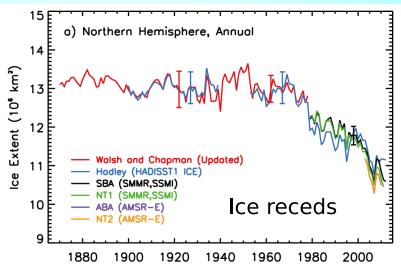
Carbon dioxide (CO₂) levels are high and are rising very fast. Over the last 800,000 years, CO₂ levels varied between around 200 ppm (during the ice ages) and 280 ppm (during the warm ages). These variations of around 80 ppm occurred over time spans of 10,000 to 100,000 years each time. Today, CO₂ levels exceed 400 ppm and we got there in less than 200 years. Through, among others, radiochronology and oxygen measurements scientists are very certain that this excess CO₂ comes from humans burning fossil fuels.



shortwave sun light

longwave heat radiation

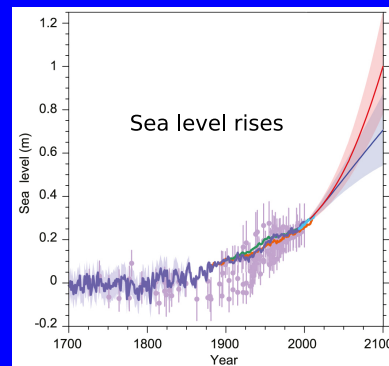
"trapped" radiation



Oceans and Ice

Surplus heat is mostly going into the oceans, which causes the water to expand thermally. This, in combination with melting glaciers, causes the average sea level to rise. Over the past 200 years sea levels rose by about 25 cm. However, this rise is not equally distributed, making it enough to increase the frequency of floodings and the rate of erosion in coastal areas all over the world.

Until 2100 we expect the sea level to rise by another 70 cm. This will cause hundreds of millions of people to lose their homes and land, triggering mass migrations. In the long run, estimates for the final sea level rise due to man made Climate Change range from around 6 m, if we take action now, to more than 50 m, if we keep burning fossil fuels at the current pace.



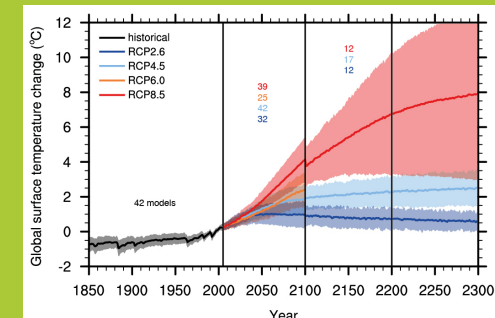
Sea level rises

Rising temperatures and the consequences

Currently, the average temperature on Earth is around 1 °C higher than in 1880. This is already enough to make heat waves and droughts more likely and more severe, which is detrimental to health and crops. Extreme precipitation and storms also got more abundant.

The habitat of many animals is destroyed by Climate Change. Over the last 100 years around 2 species of vertebrates have gone extinct each year. For the last 2 million years before that, this rate was around 2 species every 100 years.

Spix's Macaw, one of the 3 bird species to go extinct in 2018



If we keep burning fossil fuels, the global temperature will rise by about another 4 °C until 2100. To put this in perspective, this is about equal to the difference between an ice age and a warm age.