Danish Methanol Association

Understanding Global Warming

Earth Atmosphere

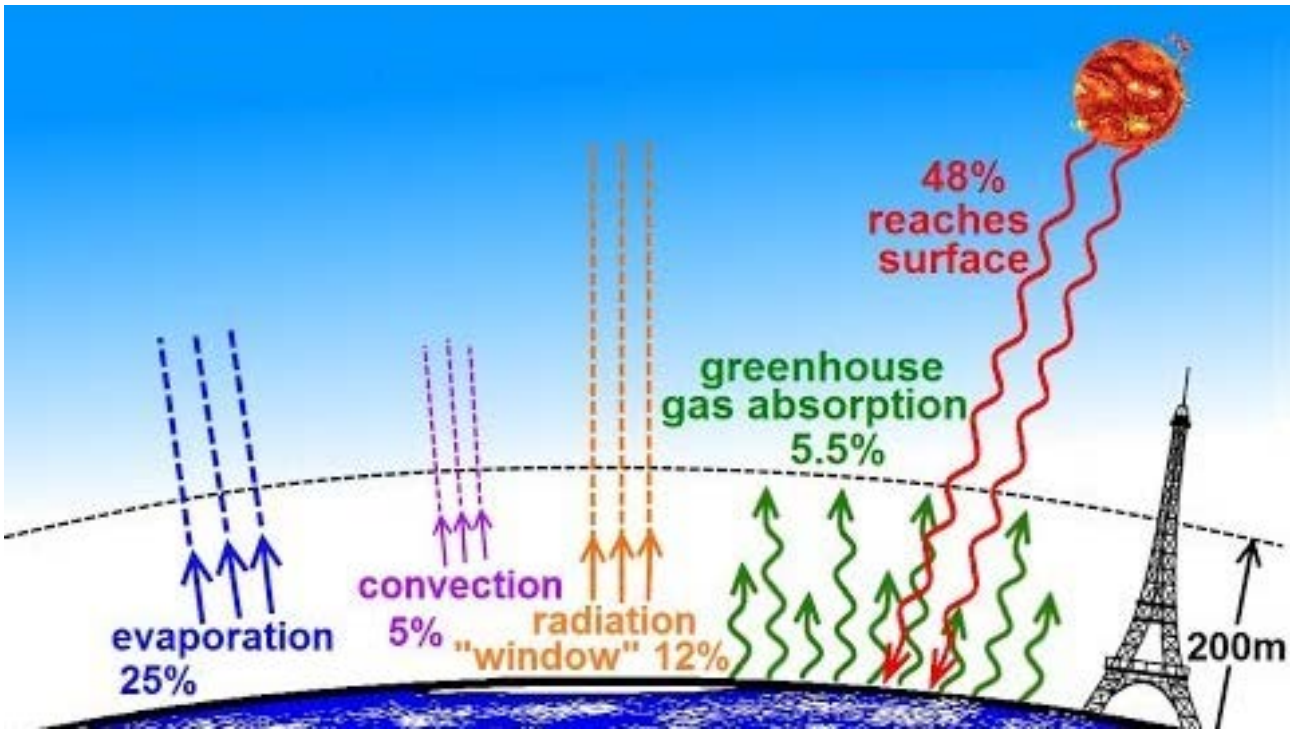
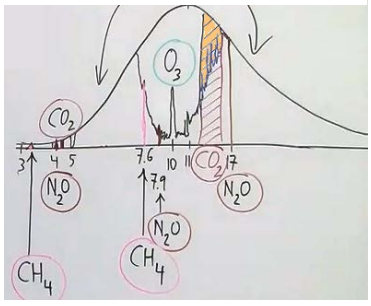


Figure 1. Astronomy - Ch. 9.1: Earth's Atmosphere (29 of 61) by Michel van Biezen – Video No. 29.

Greenhouse gasses (GHG) are keeping us nice and warm with an average temperature of app. 15 °C. Without GHG the temperature on Earth would be 33 °C colder. The solar energy received at the upper atmosphere is 1361 W/m^2 of which 48% reaches the surface of the Earth and then radiated back. However 5-6% of the incoming energy and reflected from the Earth is temporarily absorbed by GHG and thereby delaying the radiation back to space – the more delay the warmer it gets – Video No. 4.

Figure 2.Black body radiation curve for the Earth with absorptions bands for the various greenhouse gasses. The yellow colored area is not overlapped by water vapor absorption and represents the major contribution by carbon dioxide. Video No. 21.



Water vapor and CO_2 are together responsible for 98-99% of the greenhouse effect, of which CO_2 7½ % ~ 2½ °C. The Water the most because as a true dipole it has many absorptions modes covering a large part of the radiation spectrum. But there is a water vapor window where water vapor absorption is not completely overlapping the carbon dioxide absorption at 14-16 µm.

The effect of GHG depends also on the gas concentration. Half the effect of CO_2 is achieved already at 20 ppm. Doubling the present level of 400 ppm will not raise the effect much. If, however, an even small effect of CO_2 will raise the temperature this may cause more water to evaporate and cause a feedback mechanism thereby gearing the CO_2 effect. Measurement of TPW (Total Precipitable Water) in the troposphere during satellite time does not

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confirm this is happening to any significant extent. Overestimation this feedback may be a major reason the climate models predict higher temperatures than actual being measured. Antero Ollila, Aalto University explain this in greater detail in "Challenging the Greenhouse Effect Specification and the Climate Sensitivity of the IPCC" – PCIJ 2019 and "Absorption in the Atmosphere" – video No. 5.

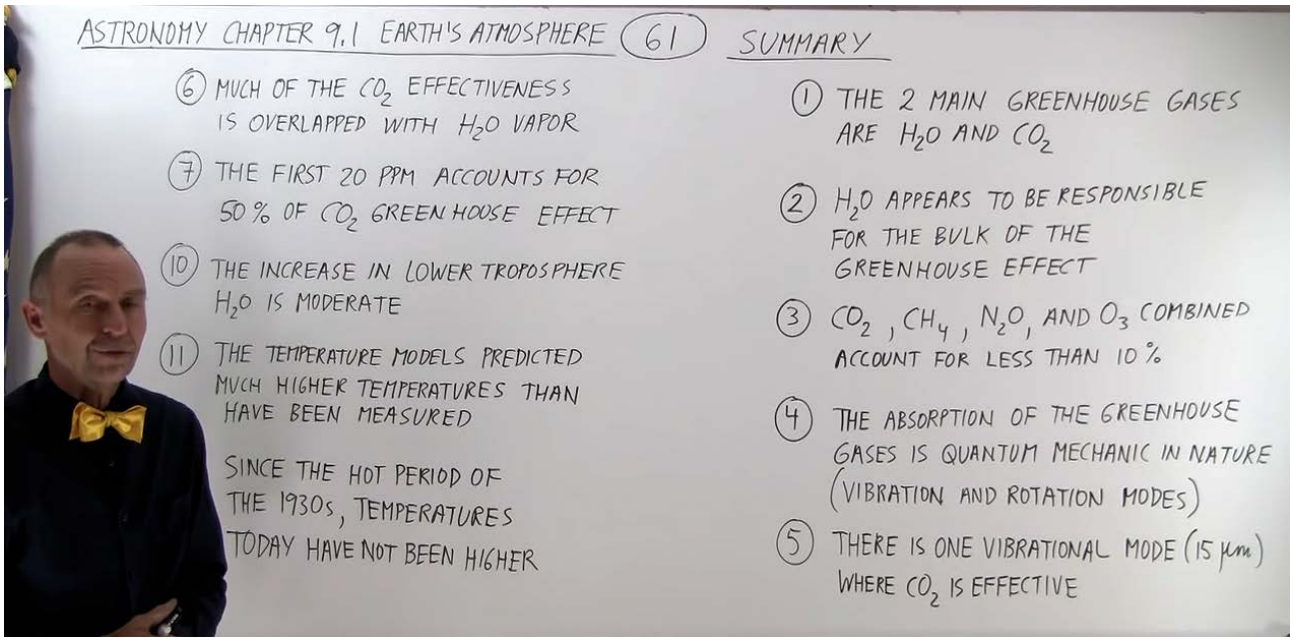


Figure 3. Astronomy - Ch. 9.1: Earth's Atmosphere (61 of 61) The Greenhouse Effect: What can we Conclude? By Michel van Biezen. Video No. 61.

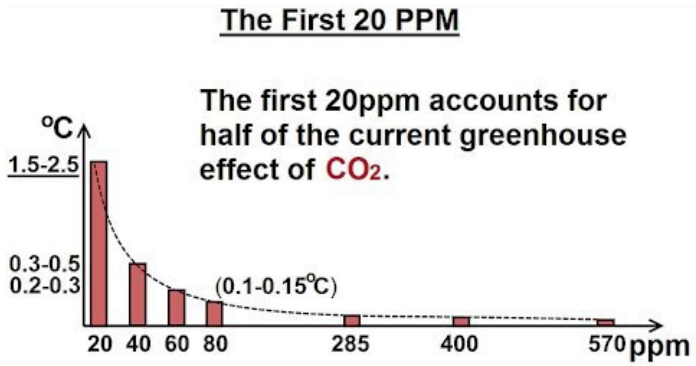


Figure 4. Michel van Biezen – Video No.: 56.

From IPCC AR5 we know that the atmosphere contains app 830 Gt carbon as carbon dioxide. IPCC also estimates the fossil carbon pool at 1.000-2.000 Gt carbon. Burning fossil fuels, half the carbon dioxide released will add to the atmospheric content and the other half is absorbed by the hydrosphere and the biosphere. This is contributing to the observed increase of carbon dioxide in the air. This extra carbon dioxide will not stay in the air forever but will eventually be absorbed by the oceans and plants. Pieter Tans has calculated how the atmospheric content of carbon dioxide will change if we burn 1.000 Gt and 1.500 Gt carbon respectively from the fossil pool – it is burning most of the known proved reserves. This will, however, never increase the concentration to more than at the most 600 ppm of carbon dioxide in the air – Carbon Pools.

So even burning all our known proven fossil reserves of carbon the atmosphere will peak at 600 ppm CO_2 around year 2060 acc. to the assumptions made by Peter Tans. As explained by Michel van Biezen this will not contribute much to the temperature increase. That leaves us with the sun as the crucial climate driver.

CO_2 emission and its distribution.

From Global Carbon Atlas[1] is downloaded annual emissions from gas, oil, coal, gas flaring and cement calculated as Gt C and from NOAA[2] CO_2 at Mauna Loa as CO_2 ppm and transformed to Gt C. The difference between emission and the part in the air is absorbed by the ocean and land – the annual Flux is in Gt C.

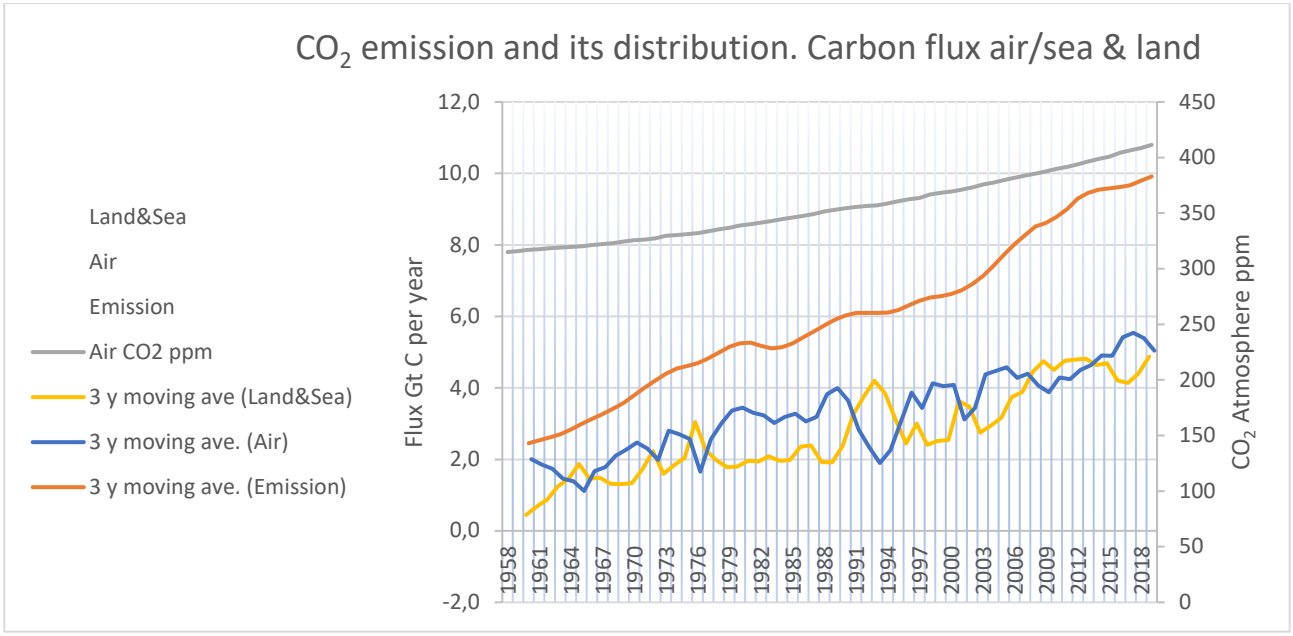
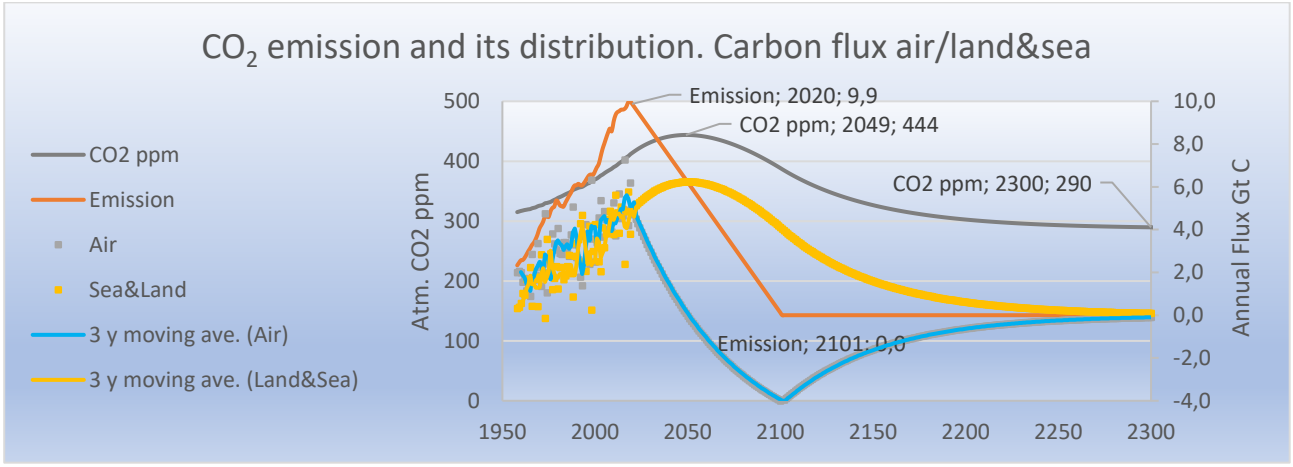
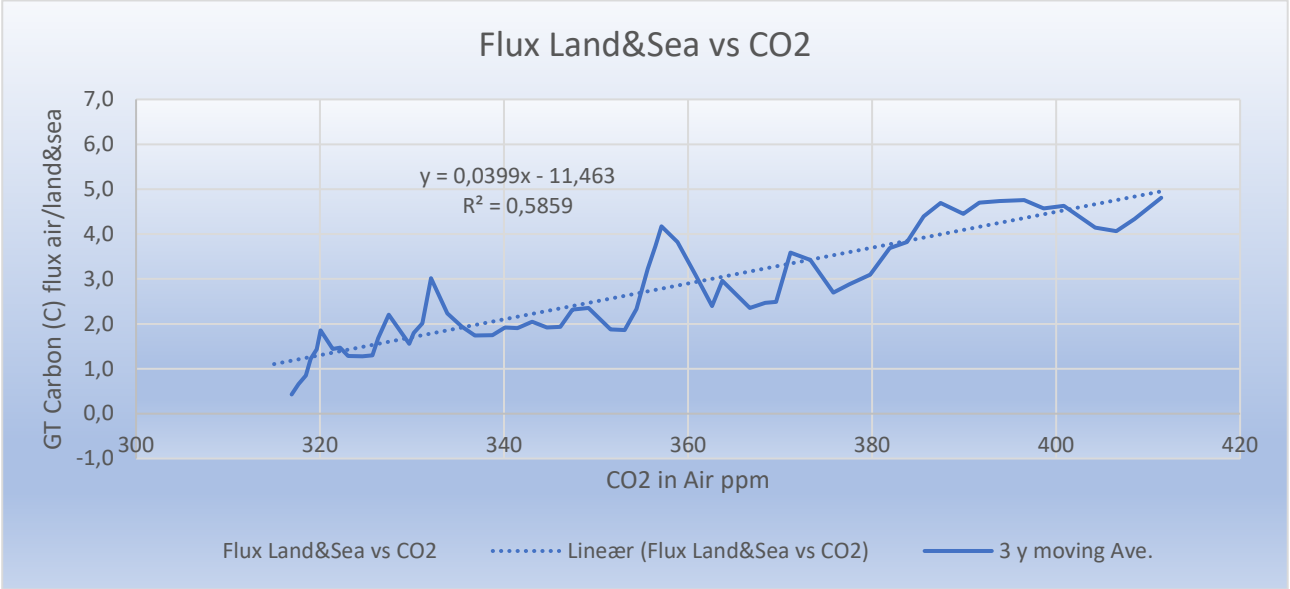


Figure 5. Data are shown as rolling averages over three years. The beginning of the century shows an increase in the flux over sea and land.

When carbon dioxide CO_2 is released into the atmosphere from the burning of fossil fuels, approximately 50% remains in the atmosphere, while 25% is absorbed by land plants and trees, and the other 25% is absorbed into the ocean. That is how it has been since measurements at Mauna Loa began. However, will this continue if the emission is reduced or will the flux air/sea&land follow the concentration and partial pressure of CO_2 in the air? The latter is pictured below.



[1] Global Carbon Atlas. http://www.globalcarbonatlas.org/en/CO2-emissions
[2] NOAA. https://www.esrl.noaa.gov/gmd/ccgg/trends/data.html



lt May 27, 2020