

What is that Greenhouse effect?

Simple question demands a simple answer:

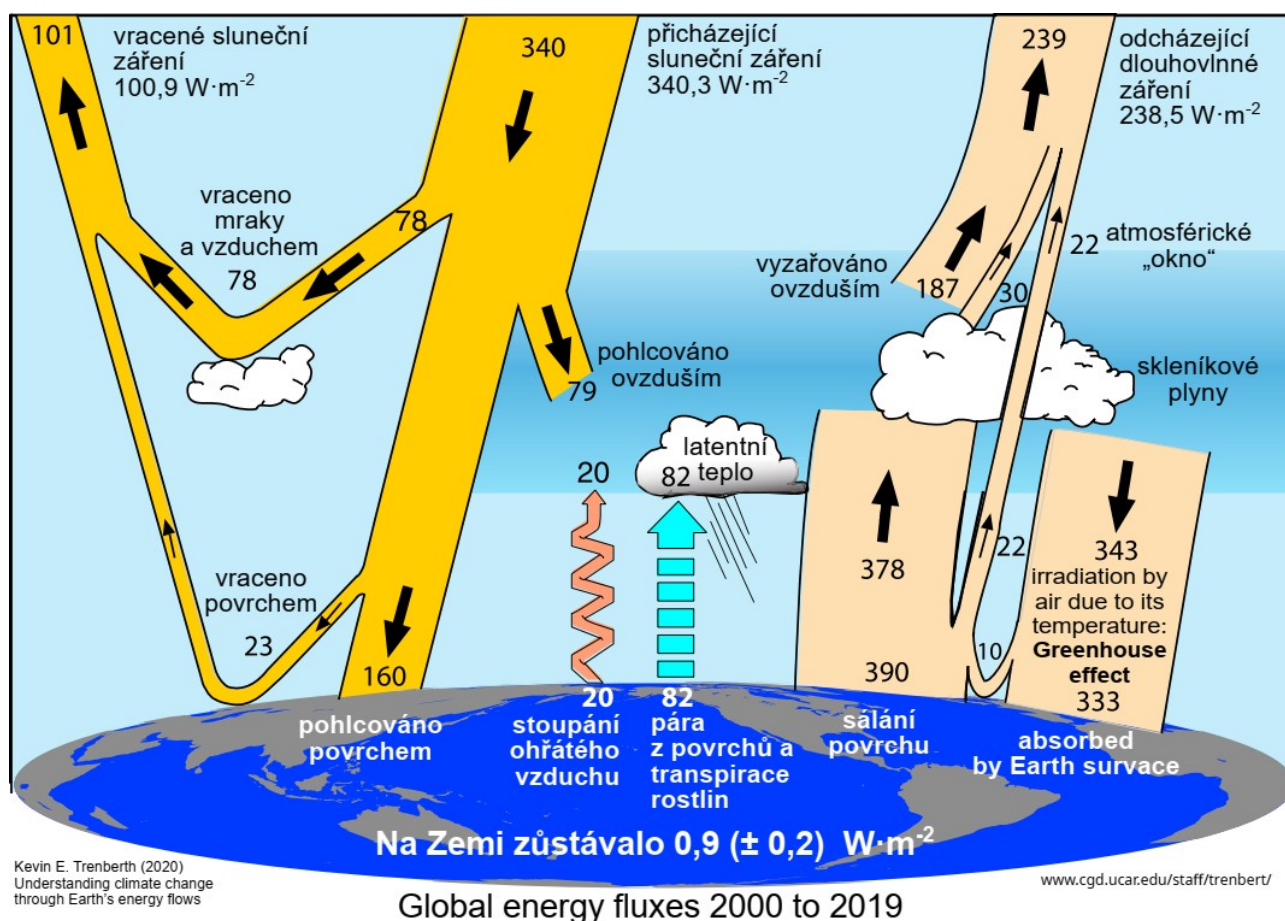
“It is the radiation of the atmosphere – due to its temperature – to the surface of the planet.”

A natural further question might be:

“Can we measure it? Isn't it negligible?”

“In case of Earth, it amounts, per square meter, to 1/3 kW globally. That is a lot, twice more than solar radiation absorbed by its surface.”

That ratio is visible in a complex scheme of heat fluxes Sun-Earth-Univers by [Kevin Trenberth from 2020](#), in its Czech version partly made English again, with added text and title “Greenhouse effect” into the broad downward arrow on the right side, and further text below the very scheme, with a hyperlink to the [Mauritsen et al. 2025](#) paper Earth's Energy Imbalance More Than Doubled in Recent Decades (links are live in its svg and pdf versions, svg is shown in the html version of this draft, here is but a png:



Global energy fluxes 2000 to 2019

From that temperature-caused irradiation, *the greenhouse effect* (343 $\text{W}\cdot\text{m}^{-2}$) got the surface *twice more heat* (333 $\text{W}\cdot\text{m}^{-2}$) *than from the Sun* (160 $\text{W}\cdot\text{m}^{-2}$).

The imbalance „gained heat - lost heat“, **EEl**, **rises**, from that old average of 0.9 $\text{W}\cdot\text{m}^{-2}$ it climbed by 2025 to 1.3 $\text{W}\cdot\text{m}^{-2}$.

Further question could be on the mechanism:

“OK, hot stoves or the Sun heats us by their radiation very perceptibly, but how can the air send heat to the ground, if the clear sky is so very transparent?”

“It is almost transparent to solar (shortwave) radiation, especially light, but almost opaque to longwave infrared radiation, emitted by terrestrial environments with temperatures far lower than the Sun. The *ability to absorb that radiation is equal to the ability to emit*. Clouds are almost black in that respect, they absorb and emit (according to their temperature) at all long wavelengths. But even column of clear air, when long enough, say hundred meters or several kilometers, behaves similarly; molecules with at least 3 atoms are doing that: water vapor, carbon dioxide, methane and nitrous oxide – the so-called *greenhouse gases*. Unlike clouds, however, they do not emit and absorb all long infrared wavelengths, just most of them – so some longwave radiation from the surface gets straight to the space. Those gases together with clouds (and aerosols) act as a very good thermal insulation of the Earth surface against very cool Universe, which has but 4 K absolute temperature.”

Maybe the last question:

“How much is the greenhouse effect dependent on carbon dioxide?”

“Almost totally. When CO₂ concentration is rising, so is the greenhouse effect and temperature of the surface and troposphere. Warmer air can hold more water vapor, and its concentration rises. This increases the greenhouse effect further – it is a *positive feedback*. Without carbon dioxide, the temperature would be below freezing point everywhere, and the vapor content of the atmosphere would be very low. The Earth would change to a snowball, reflecting most of solar radiation. Its temperature would finally drop by almost 100 K.”

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a draft document by Jeník Hollan, September 2026