

Supplementary Material to the paper “A narrative review of Brazilian and Portuguese students’ perceptions and conceptions about climate change”

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Factual analysis of identified misconceptions

Greenhouse effect as a synonym for global warming

The two phenomena are related but distinct. The greenhouse effect is a natural process that occurs when certain gases in Earth's atmosphere, such as carbon dioxide, methane, and water vapor, trap some of the infrared radiation emitted by the Earth's surface, keeping the planet at a habitable temperature. Without the greenhouse effect, the Earth would be much colder and inhospitable. Global warming refers to the observed increase in average global temperatures of the atmosphere and oceans over the last centuries, especially since the late 19th century. This warming is attributed to human activities that increase the concentration of greenhouse gases in the atmosphere, such as burning fossil fuels and deforestation.

Ozone layer as a synonym (or cause) of global warming

The ozone layer is in the stratosphere and is crucial for life on Earth because it absorbs most of the sun's ultraviolet (UV) radiation, protecting living organisms from its harmful effects. Its degradation is caused by chemical compounds like chlorofluorocarbons (CFCs) and increases exposure to UV radiation, which can lead to issues such as skin cancer and environmental damage. The degradation of the ozone layer and global warming are both influenced by human activities but are caused by different types of emissions and have distinct effects on climate and the environment.

"Ozone hole" being literally a hole

The term "ozone hole" is a metaphorical expression used to describe a significant reduction in the ozone concentration in the stratosphere. It is not a physical hole or an empty space in the atmosphere but rather a region of thinning where the ozone layer is less dense.

Atmospheric pollution generating the greenhouse effect

The greenhouse effect is a phenomenon that exists naturally, even before anthropogenic action. Atmospheric pollution does not create the greenhouse effect but rather contributes to global warming. Furthermore, atmospheric pollution consists of many types of gases, and not all of them significantly contribute to global warming.

The greenhouse effect is responsible for glacier melting

The greenhouse effect is a naturally occurring phenomenon, even before anthropogenic influence. The responsible factor for the increased rate of glacier melting is the increase in global warming, which is indeed anthropogenic in nature.

Litter on the streets has a direct and significant relationship with climate change

Incorrectly disposed litter in the streets is not a primary factor in climate change, such as greenhouse gases. It does contribute indirectly through decomposition and gas emissions, affecting soil health and ecosystems, but statistically speaking, it is not the major impact factor for global warming and climate change.

Increase in cancer cases due to global warming

The increase in cancer cases is related to ozone layer depletion, not global warming.

Oxygen, hydrogen, and nitrogen are greenhouse gases

The major greenhouse gases are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), water vapor, and some hydrofluorocarbons (HFCs). The most significant ones are CO₂ (76%), CH₄ (16%), and N₂O (6%).

Global warming is related to earthquakes and tsunamis

Earthquakes and tsunamis are inherently geological phenomena, and global warming has no direct relationship with them. Even the sea-level rise, a correct consequence of global warming, would not influence the frequency or intensity of tsunamis.

Pollution as a consequence of global warming

The correct relationship is the reverse: global warming is a consequence of certain types of pollution, notably the release of CO₂ into the atmosphere.

Nuclear waste is directly related to climate change

Nuclear waste is not directly linked to either of the climate change phenomena: global warming and ozone layer depletion. Nuclear power plants do not emit greenhouse gases and may release small amounts of radioactive noble gases like krypton and xenon, but these do not pose a risk to human health or the environment.