

Understanding Global Warming

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You have probably heard that the earth is warming, but how is this happening? Where is all the heat coming from? And why does it matter?

Well, let's start from the basics. At the fundamental level the temperature of Earth depends on the energy radiated by the Sun. The higher the radiations received by the Earth, the warmer it will be. For this reason, the composition of the atmosphere is particularly important because some gases and particles suspended in the air affect the flow of incoming and outgoing radiations.

In fact, water vapour and gases known as Greenhouse gases (GHG) allow incoming solar energy to enter, but inhibit infrared (heat) radiations from exiting the atmosphere. Rising levels of GHGs (mainly carbon dioxide, methane and nitrous oxide) have a warming effect because they increase the amount of infrared radiations trapped in the atmosphere. This effect is known as the Greenhouse effect. In essence, these gases impede heat to escape back into space.

Despite its bad reputation, the Greenhouse effect is extremely useful to humans. It increases the temperature of the atmosphere by about 30 degrees. This effect guarantees a stable warm climate on earth, which would otherwise be inhospitable for humans. The real problem of the greenhouse effect is that human activity has been increasing this effect to the point of disrupting the fragile natural equilibrium.

Apart from the emission of GHGs, other less known human causes of temperature rise include the depletion of the ozone layer — which plays a fundamental role in blocking radiations from the sun — and variations in the albedo. The albedo is the reflective capacity of earth superficies and mainly depends on the colour of the surface. Darker surfaces tend to absorb more energy and thus heat up the atmosphere. Changes in albedo occur, for example, if a forest is turned into a field: the darker colour of the dirt will tend to heat up the atmosphere.

But why is a warmer climate a problem? Although the average increase in temperature appears to be deceptively small, the natural, human, social and economic implications of small increases in temperatures are tremendous. As the temperature of the sea and atmosphere increase, evaporation augments and the precipitation patterns are exacerbated. This means that extreme droughts will

be more recurrent in dry areas, increasing the potential for water shortage and food risk. On the other hand, humid areas are more likely to experience severe rainfalls and flooding. We are already witnessing an increase in the frequency and intensity of these extreme events. This month alone, cyclone Idai left a trail of death and destruction in Southern Africa. The impacts of climate change should not be underestimated.

Global warming also causes the melting of glaciers and Arctic sea-ice, which leads to an increase in the sea level. As the level of waters rises, islands are submerged, fresh water is contaminated and river flooding becomes more frequent. Moreover, the shift in climate is a serious threat to agriculture in many developing countries and creates a risk of extinction for numerous animal species around the world. Human carbon emissions are also responsible for the acidification of the oceans, which endangers aquacultures and fisheries in many parts of the globe. To sum up, a change in climate has social and economic relevance on aspects such as income, human health, tourism, fishing, agricultural productivity, energy demand, human migration, and even war.

Global warming is one of the most important challenges facing humanity. Will we be able to preserve our planet?