Earth's magnetic field is important for climate change at high altitudes

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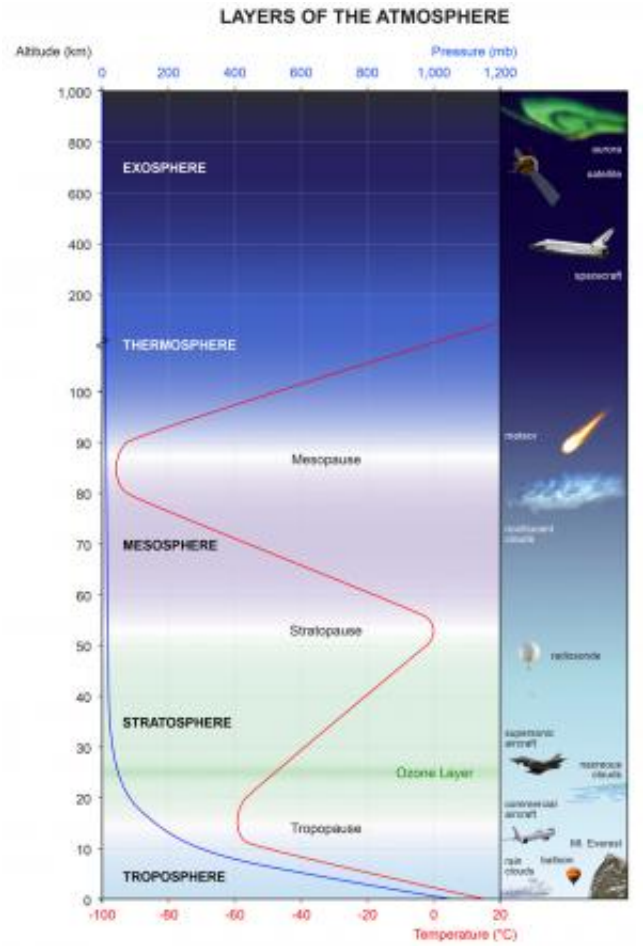

New research, published this week, has provided scientists with greater insight into the climatic changes happening in the upper atmosphere.

Scientists found that changes in the Earth's magnetic field are more relevant for climatic changes in the upper atmosphere (about 100-500 km above the surface) than previously thought. Understanding the cause of long-term change in this area helps scientists to predict what will happen in the future. This has key implications for life back on earth.

A good understanding of the long-term behaviour of the upper atmosphere is essential; it affects a lot of satellite-based technology, such as global navigation systems and high-frequency radio communication systems. Some satellites even operate within the upper atmosphere itself.

The increase in atmospheric CO_2 concentration has been thought to be the main cause of climatic changes at these high altitudes. This study suggests that magnetic field changes that have taken place over the past century are as important.

Both increasing levels of CO_2 and changes in the Earth's magnetic field affect the upper atmosphere, including its charged portion, also known as the ionosphere. Dr. Ingrid Cnossen from the British Antarctic Survey used computer simulations to compare the effects of these two factors over the past century.

While CO_2 causes heat to be trapped in the lower atmosphere, it actually cools the upper atmosphere. The simulations show that the increase in CO_2 concentration over the past 100 years has caused the upper atmosphere, at around 300 km altitude, to cool by around 8 degrees. At the same altitude, changes in the Earth's magnetic field caused a similar amount of cooling over parts of North America, but caused a warming over other parts of the world, with the strongest warming, of up to 12 degrees, located over Antarctica.

Dr. Ingrid Cnossen said: "Computer simulations are a very important tool in understanding the causes of climate change at high altitudes. We

still can't explain all of the long-term trends that have been observed, but it helps that we now know how important the magnetic field is."

The new simulations also indicate that rising CO_2 levels have caused the densest part of the ionosphere to lower by about 5 km globally. Changes in the Earth's magnetic field can cause much larger changes, but they are very dependent on location and can be either positive or negative; over the southern Atlantic Ocean a decrease in height of up to 50 km was found, while an increase in height of up to 20 km was found over western Africa.

The findings are published in the *Journal of Space Weather and Space Climate*.

Provided by British Antarctic Survey