WMO report: Greenhouse gas levels accelerating at record pace

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A report released last week by the World Meteorological Organization found that concentrations of greenhouse gases in the atmosphere rose to record levels last year, continuing on a trajectory far above what climate scientists consider safe. However, it is not just that concentrations continue to rise, a long-term trend that will persist for the foreseeable future, but the rate of increase that is cause for alarm.

The release of the report by the United Nations agency was timed to coincide with preparations for next week's UN Climate Conference in New York, where over 125 heads of state are expected. It is the latest in a series of international scientific assessments that underscores the urgency of the climate crisis—one which governments the world over have proven incapable of abating.

The annual WMO report, which is based on data from monitoring stations spread around the globe, recorded a year over year growth rate that spiked to the highest level since 1984. Between 2012 and 2013, the globally averaged carbon dioxide concentration in the atmosphere rose by 2.9 parts per million, far surpassing the average annual increase of 2.1 ppm over the previous decade. During the 1990s, the average annual increase was 1.5 ppm.

The rise in CO2 concentrations, which soared to 142 percent of pre-industrial levels last year, is in large part due to increasing fossil fuel combustion. Billions of tons of the gas which causes global warming are pumped into the atmosphere annually, where they can persist for decades, if not centuries.

Last year's record growth can only partially be explained by recent emissions from burning coal, oil and natural gas, however. This finding has raised concerns that the earth's natural ability to sequester carbon may be diminishing. "If the oceans and the biosphere cannot absorb as much carbon, the effect on the atmosphere could be much worse," remarked Oksana Tarasova of the WMO to the *Washington Post.* Once emitted into the atmosphere, carbon dioxide undergoes a series of chemical exchanges with terrestrial ecosystems and the oceans. On balance, approximately half of the CO2 emitted persists in the atmosphere. A quarter ends up in the oceans, the other quarter taken up by plants on land.

To help understand these interactions, the report considered the isotope ratios of carbon dioxide, not just the total concentrations. Since carbon dioxide from fossil fuel combustion has a different isotopic profile from the average in the atmosphere, analyzing these ratios can reveal information about the interactions between carbon sources and sinks. According to the WMO, "preliminary data indicated that [last year's record growth rate] was possibly related to reduced CO2 uptake by the earth's biosphere in addition to the steadily increasing CO2 emissions."

Land ecosystems both take up and release huge amounts of carbon. Understanding the mechanisms and long-term trends is an area of active research by climate scientists. A changing climate is altering the flux of carbon dioxide in various ways. For example, warming temperatures may stimulate plant growth, drawing additional carbon out of the atmosphere, but it may also lead to a release of carbon stored in melting permafrost.

The other major greenhouse gas sink, the ocean, has absorbed carbon dioxide—and in the process become more acidic—at a rate "unprecedented at least over the last 300 million years," according to the report. A long-term decline in the ocean's near-surface capacity to take up more carbon dioxide has already been detected. At present it is down to 70 percent of pre-industrial

levels, and could decline to only 20 percent by the end of the century.

Still, whether the oceans and terrestrial biosphere continue last year's trend of reduced CO2 uptake over the long term is far from a settled question. There can be significant variability year to year due to weather patterns and ocean warming cycles. Further observations and research are needed to discern the lasting changes in the earth's carbon sinks. Hampering this understanding, however, is the dearth of long-term monitoring stations, particularly throughout the ocean's entire water column.

On the other hand, there is no ambiguity that in the long term global temperatures will continue to rise in response to increasing atmospheric concentrations. "We know without any doubt that our climate is changing and our weather is becoming more extreme due to human activities such as the burning of fossil fuels," WMO Secretary-General Michel Jarraud explained.

Yet higher temperatures are not the only impact of growing CO2 concentrations. For the first time, the annual WMO report assessed the impact that rising carbon levels are having on the acidity of the ocean. "For many organisms, calcification declines with increased acidification," the report states. This is a major concern for corals, mollusks, and some types of algae and plankton. Other impacts on marine life cited include "reduced survival, development and growth rates, as well as changes in physiological functions and reduced biodiversity."

"If global warming is not a strong enough reason to cut CO2 emissions, ocean acidification should be, since its effects are already being felt and will increase for many decades to come," Wendy Watson-Wright, Executive Secretary of the Intergovernmental Oceanographic Commission of UNESCO said. "We are running out of time."