Atmospheric carbon dioxide levels reach new heights

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Daily concentrations of carbon dioxide measured by the National Oceanic and Atmospheric Administration at Mauna Loa, Hawaii exceeded 400 parts per million (ppm) on May 9 for the first time since measurements began there in 1958. Furthermore, geochemical studies indicate that this is the highest level of CO2 for at least 800,000 years and possibly the highest level in the past 3 million years.

Mauna Loa is the oldest site that has continuous measurements of carbon dioxide and thus acts as the benchmark for all other monitoring stations worldwide. Every hour it measures the number of molecules of carbon dioxide per every 1 million molecules of dry air (mostly oxygen and nitrogen). Over the past several weeks, hourly readings have spiked above 400 ppm, but last Thursday was the first time that the carbon dioxide concentration averaged over the day exceeded 400 ppm, a result that has been expected for some time.

Carbon dioxide concentrations are used as a measurement for global warming because they are closely linked with global temperature changes. Other greenhouse gases, such as water vapor and methane, are relatively stable in Earth's atmosphere. Carbon dioxide levels, however, change over time. More energy from the Sun is trapped in Earth’s atmosphere when CO2 concentrations are higher. Thus the levels of CO2 are closely linked with the global temperature. (See: “The growing impact and dangers of global warming”)

To study atmospheric carbon dioxide levels over hundreds of thousands of years, scientists look at the air trapped in ancient ice found in the Arctic and Antarctic. After determining the age of a layer of ice, they extract the air and perform the same techniques used to count carbon dioxide molecules at Mauna Loa on the air trapped in the ice. Using this technique over a large sampling of ice, research has shown that over the past 800,000 years, the carbon dioxide levels were between about 180 ppm during ice ages and 280 ppm during interglacial warm periods.

The last period of interglacial warming, known as the Holocene era, occurred approximately 11,500 years ago and continues to the present day. However, the CO2 concentrations measured are far above what could be considered natural causes. In fact, all measurements from before the industrial revolution indicate that the global average of carbon dioxide concentration was in fact 280 ppm.

The levels today are a result of human activity, of pumping billions of tons of carbon dioxide into the atmosphere each year, primarily through burning fossil fuels (coal, petroleum and natural gas) for fuel and power. The NOAA notes, “Today’s rate of increase [of atmospheric carbon dioxide] is more than 100 times faster than the increase that occurred when the last ice age ended.”

As a result, the natural mechanisms Earth has to remove carbon dioxide from the atmosphere are simply overwhelmed, unable to cope with changes that naturally occur over hundreds of thousands of years, not decades.

This has led to a sharp increase in global temperatures. A recent study in *Science* by Shaun Marcott *et al.* reconstructed the global temperature over the past 11,300 years. The basis for the study was the need to differentiate changes in temperature based on natural variability from anthropogenic (human induced) effects. They found that while temperatures in the Holocene era have exceeded what they are today, never before has the acceleration of the increase of temperature been as great as in the past century. In fact, the Earth was cooling over the past 5,000 years before the temperature spiked back up.

Furthermore, the temperature increases are not a result of natural phenomena outside of human activity. In the past six years, a variety of studies have looked at the three main ways that the global temperature could be changed in that way: the El Niño/Southern Oscillation, volcanic activity and the variable energy output of the Sun. All reports indicate that while these have seasonal impacts, they are overwhelmed in the long term by the general anthropogenic temperature rise.

The consequences of global warming are becoming ever more clear. A recent NASA-led climate modeling study used 14 different computer simulations to study rainfall patterns over the Earth over the past 140 years. They found that, as a result of global warming caused by rising levels of carbon dioxide, areas that receive large amounts of rainfall will see increases in heavy precipitation while arid regions will become drier. In essence, global weather patterns will become more extreme, as seen in initial form last year. (See: “2012 was hottest year recorded in US”)

These are only the initial changes caused by global warming. A subtler feature is that a large portion of the warming goes into the oceans rather than the atmosphere, causing the water to heat up and expand. Measurements of coastal waters have already shown increased water levels, up around a third of a meter from a century ago. A more dire prediction is that ice sheets from Antarctica or Greenland will slip into the ocean, causing a sudden tidal surge to coastal cities and jumping water levels ten meters or more.

The solutions to global warming do not involve abandoning industry and technology in an attempt to ignore the problem. Rather, the same industry and technology that have caused the problem must be marshaled, together with the full intellectual and physical resources that humanity can harness on a global scale. That such critical projects are not undertaken speaks to the reactionary domination of capitalism over industry and the need for a revolutionary transformation in social life.