Why a small increase in carbon dioxide content in the atmosphere makes a critical difference to the Earth's climate

Carbon dioxide (CO_2) is a powerful trace gas. Its concentration in the atmosphere was at its normal interglacial maximum level of 280 parts per million (ppm) for the many previous interglacial periods from one million years ago until 1750 when the industrial age began. It had dropped to its normal minimum of 180 ppm during the many ice ages over the last one million years. It reached 400 ppm in 2013. This is an increase of over 40% on the maximum which had not changed for one million years until 1750. CO_2 concentration of about 400 ppm will cause global warming of 2° C (3.6° F) and 450 ppm will cause global warming of 3° C. So why does small increase in carbon dioxide (CO_2) content in the atmosphere makes a critical difference to the actual global surface temperature of the Earth?

The atmosphere is transparent to visible radiation from the Sun. When the sunlight is absorbed by the Earth's surface, it is re-emitted as heat (Infrared radiation), and is almost entirely absorbed (over 90%) by the CO_2 in the atmosphere. The CO_2 instantly re-emits the heat in all directions heating the surrounding atmosphere. Most (some 60%) goes downwards towards the lower atmosphere and ground.

Although water vapour and clouds together absorb 75% of the Earth's heat radiation they cannot determine the temperature of the atmosphere. Water vapour and clouds depend on temperature and air circulation in ways that CO_2 does not. They condense and cannot maintain a temperature structure for the atmosphere. CO_2 accounts for 80% of the non-condensing gases that maintain the temperature structure of the Earth and acts as the control knob of the Earth's thermostat. It controls the amount of water vapour and clouds.

The Earth is absorbing 0.5 Watts/m^2, more than it is radiating to space. As we add more CO_2 to the atmosphere this absorption increases. If we multiply this rate by the surface area of the Earth (5.100656×10^{14} m^2) we find that the Earth is accumulating heat at a rate of 2.6×10^{14} Watts (or Joules per sec). Given the Hiroshima atomic bomb yielded an explosive energy of 6.3×10^{13} Joules, this is equivalent to *four Hiroshima bombs of heat per second*. This really compounds over a decade or more. Since 1998 our climate has absorbed over 2 billion such bombs in accumulated energy.

Our climate in 2013 absorbed 126,227,704 such bombs in accumulated energy. Humans added a further 36 billion tons of CO_2 in 2013 (the hottest year ever recorded in Australia) but the natural systems could only handle 15 billion tons of CO_2 per year so the rate of heating increases each and every day. As the ocean absorbs over 90% of carbon dioxide, it becomes more acidic. This combined with increasing ocean temperatures, diminishes its ability to continue absorbing CO_2.

On 9 January 2014 Niagara Falls partially froze over. How did global warming make this extreme weather event even worse? The jet stream or polar vortex that forms a circular band of high speed winds (160km/h or 100mph) around the Arctic region holds the colder Arctic air in place protecting the region further south. As the Earth warms and the Arctic sea ice melts, the polar region warms faster than the region further south towards the Equator. This causes the jet stream to slow down (and meander) pushing further south than usual and bringing freezing cold weather to North America.

Over the last 35 years the number of severe storms worldwide has doubled. Their wind speed and destructive potential has increased significantly.

More information

www.worldstormcentral.co

www.globalwarmingequation.info