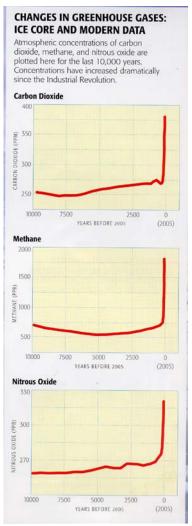
Our Ocean Backyard — Santa Cruz Sentinel columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.

#27 April 25, 2009 Greenhouse gases and climate change



The concentrations of three major greenhouse gases have increased significantly since the beginning of the Industrial Revolution in the late-1800s.

Fortunately for all of us, the Earth's atmosphere contains natural greenhouse gases that have made the Earth a habitable planet by keeping it warmer than it would be otherwise. Our atmosphere behaves much like the windows in your car. Short wave solar radiation passes through the glass. The interior heats up and reradiates long wave back radiation. But the glass windows don't allow it to escape, so the inside of your car can get pretty hot.

The Earth works much the same way, only instead of glass we are surrounded by an atmosphere that naturally contains small amounts of greenhouse gases, primarily carbon dioxide, methane, nitrous oxide and fluorocarbons. These greenhouse gases trap most of the long wave back radiation, increasing the temperature of our atmosphere and making life bearable.

But, we've been seriously messing with the atmosphere for well over a century. In the past 150 years, burning fossil fuels and deforestation has increased the amount of CO2 by about 38%. Methane, although only about 1/6 as abundant as carbon dioxide, can trap about 20 times more heat. It is generated by livestock, coal mining, rice cultivation, oil drilling and landfills and has nearly doubled in concentration since 1850.

Instead of rolling down your car windows an inch to let some of that heat escape, adding more greenhouse gases to the atmosphere is like rolling up the window a little tighter. The Earth is slowly getting warmer, and there are signs of this nearly everywhere you look across the planet. Perhaps the most visible are centuries old ice shelves breaking up in Antarctica and the reduction in the ice cover of the Arctic Ocean. While Australians have routinely weathered dry spells, the current seven-year drought is the most devastating in the country's 117-year history.

Some have questioned whether the human activities just described are capable of producing the changes we are now observing. Can this warming be due to natural patterns? While the Milankovitch cycles in the Earth's rotation and orbit can explain climate variations over very long time scales (tens of thousands of years), these cycles do not explain variability in climate on the scale of tens or hundreds of years. Variability at smaller time scales is driven by other factors, such as CO2 and other greenhouse gas concentrations. We cannot produce the warming patterns we have been measuring over the past 150 years by relying solely on variations in solar radiation.

I suppose there are two possible scenarios at this point: either the climate changes we are beginning to experience and the effects these will have on our lives are all natural and there is absolutely nothing we can do but suffer and learn to adapt; or the changes we are experiencing are due primarily to the accumulation of greenhouse gases, and by substantially reducing those we can reduce our suffering. The EPA last week formerly declared CO2 and five other heat trapping gases as pollutants that endanger public health and welfare, setting in motion for the first time a process that will lead to regulation of the release of these gases.