

OZONE AND CARBON DIOXIDE – A Case Of Déjà Vu

By Dr Timothy Ball

A major tenet of the environmental paradigm assumes almost all change is due to human activity. This triggers a search for the human cause of any environmental change by ignoring natural change. Measurements of ozone in Antarctica by the British Antarctic survey team in the early 1980s determined levels were lower than measures taken in 1957. I recall the press reports on this event and especially the British scientist who warned people not to rush to judgment. His words were ignored. It was deemed an unnatural change and the search for a human cause began.

Sherwood and Molina (1974) lab experiments showed how chlorine is the active ingredient in chlorofluorocarbon that destroys ozone. Their findings quickly became a *cause célèbre* for the environmental movement as they were linked to predictions of reduced ozone and increased harmful radiation reaching the surface. The rush to judgment was on and - as with global warming and climate change - natural mechanisms and natural variability were effectively sidelined.

In fact, there are no holes in the ozone; there were none when it became a political issue and there are none today. This is not a matter of semantics, but an important fact in the relationship between scientific accuracy, public perception and political reaction and subsequent policy. The amount of ozone in the ozone layer varies considerably in different regions and over time. The so-called “ozone hole” is a region in the ozone layer generally located over Antarctica in which the ozone level is the lowest during the Southern Hemisphere winter. Even at this time the thickness of the ozone layer is approximately 1/3 of the global average.

The ozone issue is worth revisiting because of the parallels between its origins and evolution and the current global warming and climate change debate. Both continue to evolve but the ozone issue offers valuable lessons about how to establish the scientific reality about climate change currently suppressed by exploitation of fear and lack of understanding. Prediction failures and credible natural explanations of the natural variability of ozone levels now exist. For example, recently University of Waterloo physics and astronomy professor, Qing-Bin Lu published a paper showing that cosmic rays are the major cause of variations in the extent of the so-called ozone hole.

Today the failed predictions are essentially ignored. The issue has publicly faded. It has attention because Montreal Protocol is cited as an example of how government policy can solve environmental problems. The truth is it only appears

to have worked because natural cycles and mechanisms reasserted themselves. Levels of ozone continue to vary within natural ranges, but not in the way predicted. Exactly the same is occurring with climate change as natural cycles continue and a cooling trend begins. Public understanding is essential to prevent politicians pursuing expensive and totally unnecessary climate change policies.

Ozone and chlorofluorocarbons

Ozone is the product of the photo-disassociation by portions of ultraviolet light of free atmospheric oxygen. As solar energy penetrates the atmosphere ultraviolet light strikes oxygen (O₂) molecules splitting them into single oxygen (O) atoms. These single atoms quickly combine in groups of three, which we identify as ozone molecules (O₃). They also separate very quickly to reform as oxygen (O₂) molecules. These processes occur in a portion of the upper atmosphere from approximately 40 km to 15 km known as the Ozone Layer. The height and thickness of this layer varies with latitude and season. As the density of free oxygen molecules (O₂) increase the amount of ozone increases. One of the facts rarely presented to the public is that ozone levels were varying at different levels. Generally only decreases were reported, particularly those over Antarctica. By 15 km above the surface over 95% of the ultraviolet radiation has been expended in the creation of ozone. It is important to note the Ozone Layer is essentially a self-correcting system because if more ultraviolet radiation is able to penetrate deeper into the atmosphere it confronts more free oxygen. This explains why there is little variation in the ultraviolet levels reaching the surface.

Chlorofluorocarbons were introduced as a relatively cheap inert gas for refrigeration. It tackled the serious problem of food spoilage. In developing nations it is estimated that 60% of all the food produced does not make it to the table. The figure is 30% even for developed nations. Reduction in loss is due to reduced losses in the field, during transportation, but particularly in storage. India and China's position was: you have reduced your losses through refrigeration now we want to reduce ours. They said, you produce this product now identified as an environmental hazard so we suggest you reduce your levels and we increase ours to achieve the same benefits. The answer was no! As a result India and China refused to sign the Montreal Protocol to reduce CFCs.

In the 1990s I was summoned to appear before a Canadian Parliamentary committee investigating the ozone issue. I initially declined the invitation, but was quickly informed of the committee's quasi-judicial powers and the summons was a legal order. The reason I did not want to attend was because I knew from previous experience that the politicians did not understand the science, were not interested in the facts, and merely wanted to make green political points in this era of environmental hysteria. Sadly, all my suspicions were confirmed as follows.

1. The major participants were in groups. There were five people appearing as members of the environmental group Friends of the Earth, Representatives of the DuPont chemical company producers of the chlorofluorocarbons (CFC), and three scientists including myself.
2. It was clear the Friends of the Earth group did not understand the science. They accepted without question the hypothesis that human produced chlorofluorocarbons where the cause of ozone depletion and creation of the ozone hole. They exploited fear with claims of increased skin cancer especially among children.
3. Du Pont representatives said very little, which surprised me. I later learned they were already phasing out CFCs and had a replacement product in preparation. So they did not directly accept the blame or even challenge the claims of ozone destruction by their product. Instead, they saw an opportunity to look good by producing a supposedly less harmful product and make more money.
4. One of the scientists produced data funded by government that purported to show varying levels of ozone over Toronto. I realized very quickly the data he was showing was not real measurements but computer model output. There were no measurements for the period he was displaying. It was also clear the parliamentarians thought it was real data. I do not know why the scientist chose not to make clear his data was not real.
5. I scrapped my original presentation. There was no time to explain the entire process of ozone formation so I simply explained that what was being presented was an unproven and illogical hypothesis. I provided an example by presenting a few scientific facts and drawing a world-threatening conclusion. I also pointed out that ozone is created by the ultraviolet portion of solar energy, and the assumption that solar energy is constant forces research away from the most likely cause of variation. I was told, "Galileo would be ashamed of you." While I was flattered, it underscored politicians did not understand the role of Galileo in science.
6. I also pointed out that the Western nation's proposal to eliminate CFCs was already being rejected by China and India. They did not sign the Montreal Protocol. This parallels today's rejection of any Kyoto type targets for CO2 reduction by the same countries.

From the beginning it is assumed the level of ultraviolet radiation is constant. This parallels the false assumption that a CO2 increase causes a temperature increase that underpins prevailing climate science. If ultraviolet radiation is considered constant you are forced to assume any variation in levels of ozone are caused by some other mechanism. This parallels the effective exclusion of the sun as a major cause of global warming and/or climate change. Sherwood and Molina's 1974 prediction was used and the spotlight was intensely focused on chlorofluorocarbons almost to the exclusion of any other possible explanation. This focus culminated in the Montreal Protocol and the accompanying United Nations designation of Ozone Destroying Chemicals (ODC). There was no

attempt to determine if chlorofluorocarbons or any of the other ODC's was actually causing ozone depletion at any level in the ozone layer. It is simply sufficient to show that they can do this in very artificial laboratory conditions.

Bureaucracies were established, laws passed and punishments determined for anyone caught using CFCs. It took on draconian proportions. A substitute product HCFCs was produced and became the standard especially in automobile systems. The Montreal Protocol calls for the reduction of HCFC use 65% by 2010 and 99.5% by 2020. The Heating Refrigeration and Air Conditioning Institute of Canada ((HRACI) says, *"The most widely accepted replacement option for HCFCs is the use of hydrofluorocarbons (HFCs). Ammonia is also a replacement option in the large commercial air conditioning and refrigeration sectors. These refrigerants do not deplete the ozone layer and can replace both CFC and HCFC uses."* The irony of ammonia as a major replacement is that CFCs were originally introduced to replace ammonia.

http://www.hrai.ca/hcfcphaseout/hcfc_alternatives.html

Was there a need to replace CFCs?

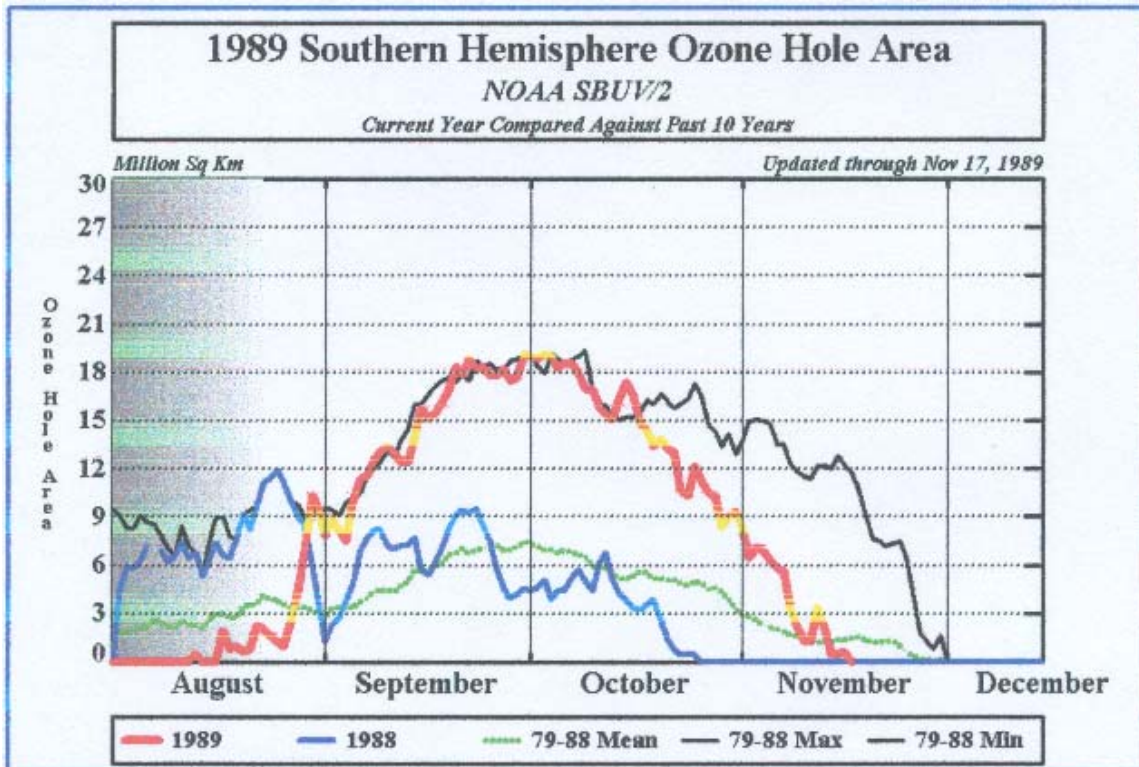
Despite the universal public and political acceptance of the claim CFCs were creating a hole in the ozone layer some scientists continued to question the issue. One of the first factors identified as a major cause in the size and extent of the Antarctic ozone hole was the intense wind patterns and circulations associated with the extensive Antarctic high-pressure zone and the surrounding wind pattern known as the Circumpolar vortex. A second factor was identification of Polar Stratospheric Clouds (PSC). These were formed when gases including water vapour sublimated directly to crystals. People became aware of the intensely low temperatures (-70°C and below) and pressures over the South Pole.

You can read about the standard responses to ozone destruction here, but there are many unanswered questions.

http://www.ucar.edu/learn/1_6_1.htm

There is no point in detailing the problems and severe limitations of the explanations provided on the UCAR website. They are all superseded by the fact that claimed reductions in CFCs in the atmosphere have not changed the annual variability in the amount of ozone or the size of the "ozone hole". Ironically, in 1989 the same year the Montreal Protocol was implemented the argument accusing CFC's for causing ozone destruction was totally undermined when

ozone levels were higher than pre-Protocol levels. Here is a plot showing the extent of the 1989 ozone hole.



Source:

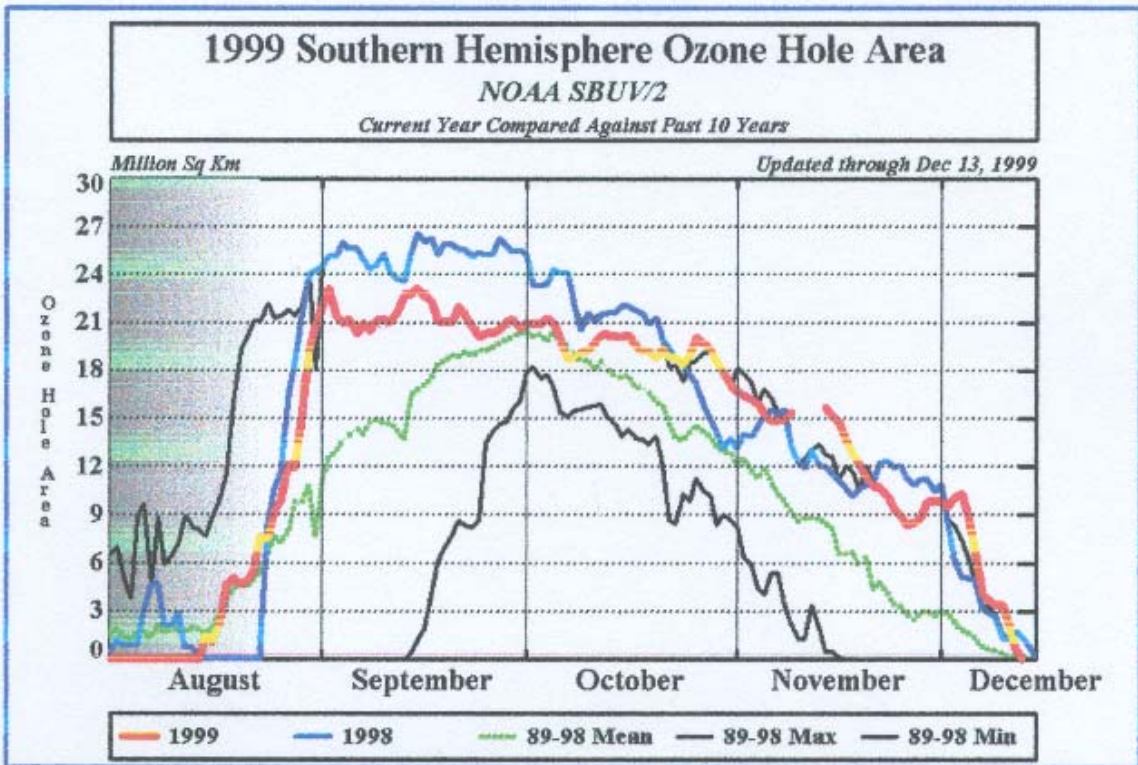
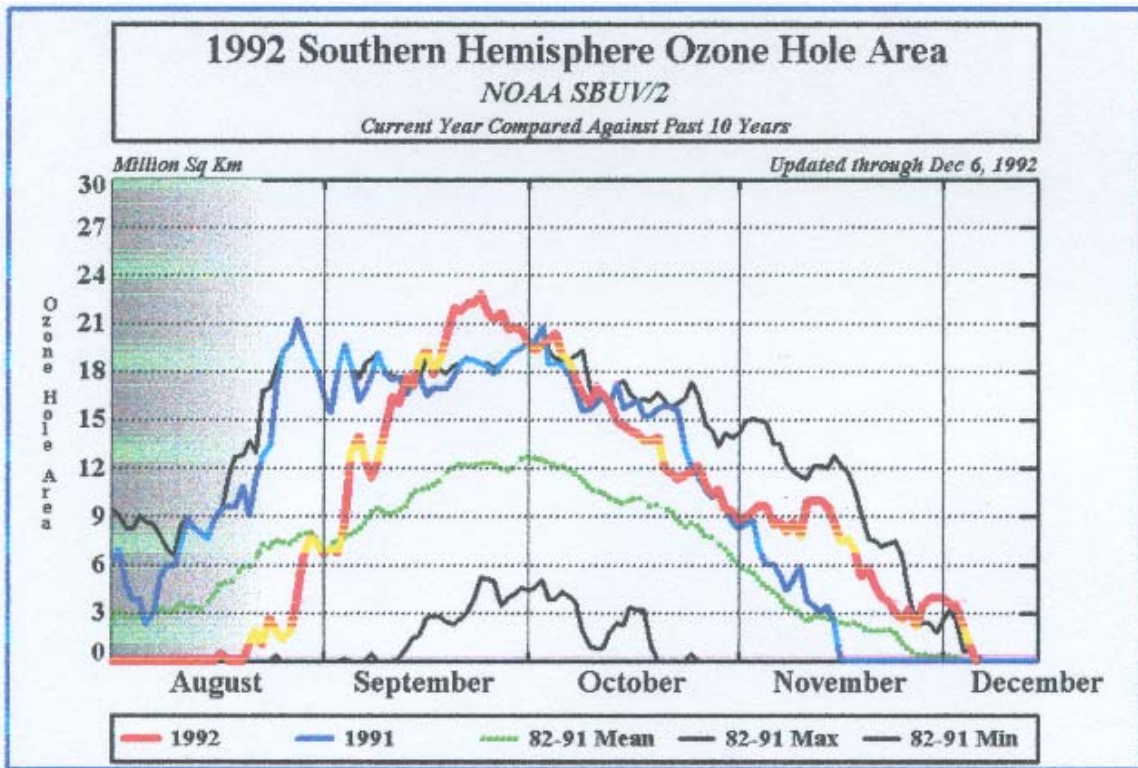
http://www.cpc.ncep.noaa.gov/products/stratosphere/polar/gif_files/ozone_hole_1989.png

The pattern of variability continues showing CFCs were not the cause, but what was? We now know the original assumption of constant sunlight and therefore constant ultraviolet radiation is incorrect. As a NASA Report explains,

Though UV solar radiation makes up a much smaller portion of the TSI than infrared or visible radiation, UV solar radiation tends to change much more dramatically over the course of solar cycles.

http://earthobservatory.nasa.gov/Library/SORCE/sorce_04.html

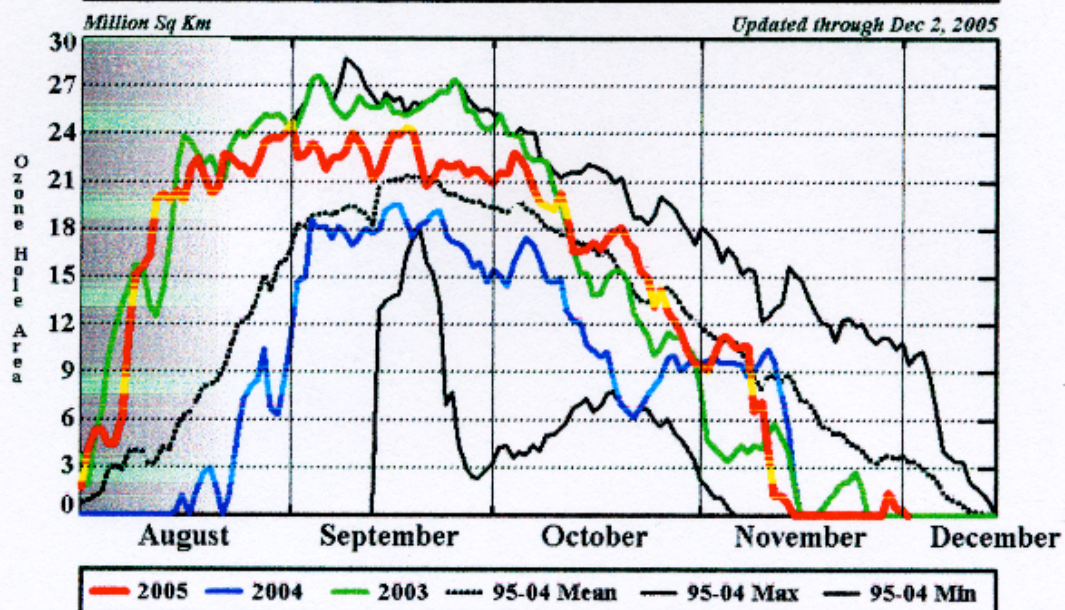
A selection of various plots of the size of the ozone hole shows the range of variability of the hole:



2005 Southern Hemisphere Ozone Hole Area

NOAA SBUV/2

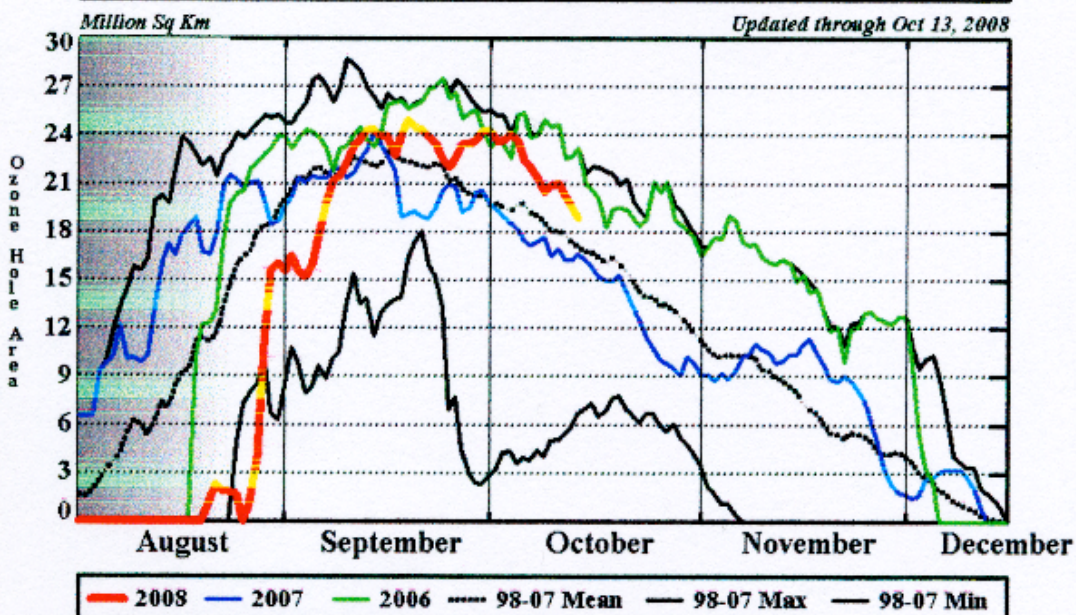
Current Year Compared Against Past 10 Years



2008 Southern Hemisphere Ozone Hole Area

NOAA SBUV/2

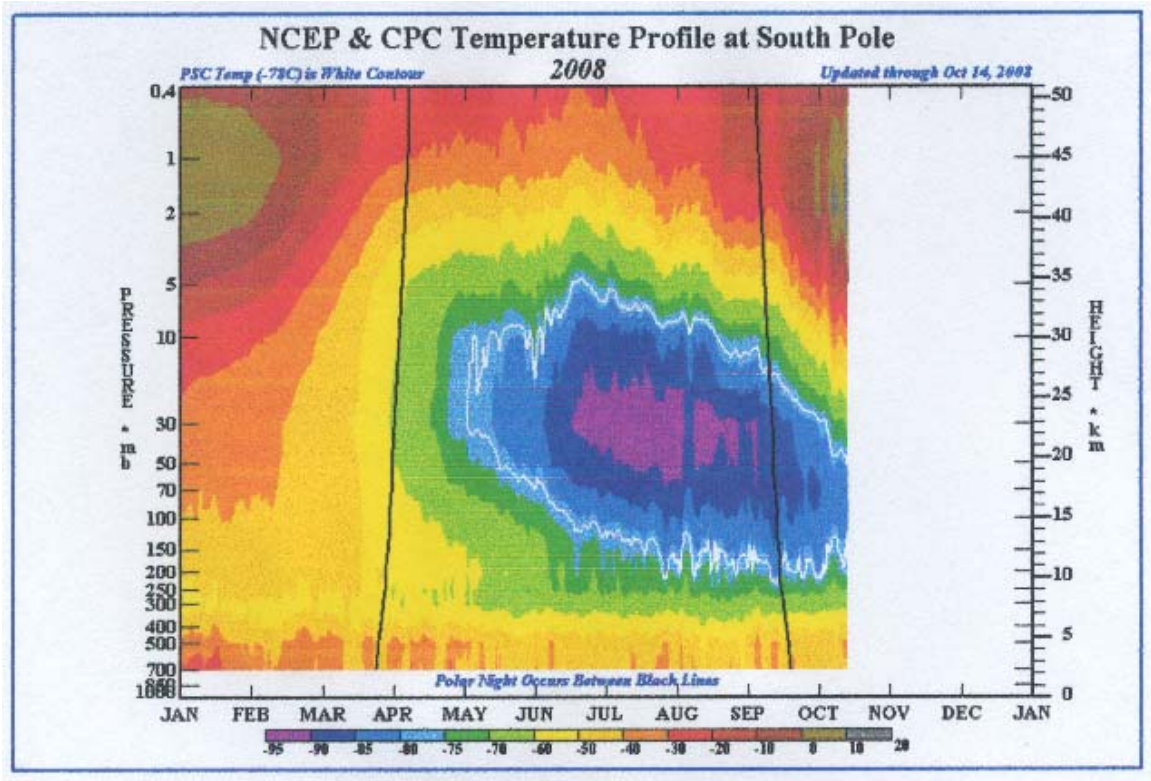
Current Year Compared Against Past 10 Years



Source of all plots;

<http://www.cpc.ncep.noaa.gov/products/stratosphere/polar/polar.shtml#plot4>

The NOAA website also provides diagrams of those regions of the Antarctic where temperatures are -78°C or below. Here is the diagram for 2008. Temperatures below -78°C are contained within the white line.



It appears the relationships between very cold temperatures, the circumpolar vortex and the formation of Polar Stratospheric Clouds are all interrelated, and therefore an increased extent of the ozone hole would coincide with the warmer temperatures recorded from the mid-1980s.

A major problem for the hypothesis that human CO_2 is causing temperature change is that the reality doesn't match the predictions. CO_2 levels continue to increase while global temperatures decline. A similar problem exists in the differences between the sunlight related photochemical model protections and the observed ozone depletion. Professor Qing-Bin Lu at the University of Waterloo argues that a

strong correlation exists between ozone depletion and cosmic ray intensity. He claims that lab measurements provide a mechanism by which *"...cosmic rays cause drastic reactions of ozone depleting chlorine inside polar clouds."*

<http://newsrelease.uwaterloo.ca/news.php?id=4997>

The difficulty is it is another lab measurement attempting to explain a correlation. This is no different than the entire CFC debacle in which lab experiments showed how one part, chlorine, destroyed ozone. This was then applied to the correlation between increasing human production of CFCs and a decrease in atmospheric ozone particularly over the Antarctic. Lu's hypothesis is not rejected because of this relationship with previous approaches. It, like all hypotheses, requires testing. Unfortunately, Lu has put his hypothesis immediately in jeopardy. He predicts *"...the severest ozone loss – resulting in the largest ozone hole – will occur over the South Pole this month."* As you can see from the diagram of total ozone hole area for 2008 the extent did not match 2006 and is already decreasing.

Hysteria, politics, determining the fate of science?

Nurtured by environmental hysteria and the determination to show all changes in the natural world are due to human activity, the claim CFCs were destroying ozone jumped directly from an unproven hypothesis to a scientific fact. All the other ingredients were at hand. The big nasty corporation, the dangerous product, refrigeration, that improved quality of life at the expense of the environment, and the fear factor of increased skin cancer especially among children among other threats.

The political juggernaut was set in motion as fearful people demanded action from the politicians. Most of these actions did not and could not deal with the claimed problem. In fact, they produced real and potential problems because the research and testing was pushed aside. DuPont already had a replacement in place for CFCs, which subsequently was equally as problematic. Other companies turned production of sun blockers into a multibillion-dollar industry even though their product did not for most of the early years deal with those portions of ultraviolet radiation that are harmful to the skin. Claims of increases in skin cancer cases failed to take into account the increase in life expectancy or such anomalies as the lowest levels of skin cancer

occurred in Colorado the state with the highest levels of ultraviolet radiation due to altitude. They also neglected to warn people humans require ultraviolet radiation to produce vitamin D in the body. Inadequate levels lead to various diseases including bone problems such as rickets in children and scrofula a form of tuberculosis in adults. We have recently seen increases in these diseases.

There are still no holes in the ozone but there is an area over Antarctica where due to natural conditions ozone levels are approximately 1/3 of the global average. This area varies in size from year to year also because of natural conditions. Science still doesn't have a full understanding of the variability in ozone yet the claim is still made that the actions invoked by the Montreal Protocol saved the day. Many people point to the Protocol as proof we can stop global warming and/or climate change if we use it as an example. It is only an example of spending billions of dollars, disrupting people's lives and economies, to solve a nonexistent problem.

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