



COMMON MISCONCEPTIONS ABOUT ATMOSPHERIC ENVIRONMENTAL ISSUES

by Dagmar Cronn

Whether sitting next to another passenger on an airplane or grading the work of students, several misconceptions about current environmental issues crop up regularly. Global warming and stratospheric ozone depletion are major environmental issues much in the news at present. Confusions about these issues prevent many people from understanding much of what they hear. Some of the most common difficulties are presented here.

The most common and least helpful confusion is the lack of separation in people's minds between two distinctly different atmospheric issues—global warming and ozone depletion. The characteristics of the two issues are very different. They occur in different regions of the atmosphere. Ozone depletion occurs in the stratosphere while global warming is a tropospheric phenomenon. Most of the chemical compounds involved differ. Ozone depletion involves ozone (O_3), oxygen (O_2), chlorofluorocarbons (CFCs), and other chlorine- and bromine-containing compounds including the CFC replacements, the hydrochlorofluorocarbons (HCFCs). Important to global warming are so-called greenhouse gases such as water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4) and dinitrogen oxide, commonly called nitrous oxide (N_2O). Some gases are both greenhouse gases and ozone depleters, and un-

fortunately this often causes misunderstandings about the differences between the two issues. For example, ozone and CFCs are also greenhouse gases.

The part of the electromagnetic spectrum involved in these two issues also differs. Greenhouse gases heat the atmosphere by absorbing and then re-radiating in the infrared region. Ozone absorbs incoming ultraviolet radiation from the sun. And, the anthropogenic compounds that contribute to ozone depletion absorb ultraviolet light, which dissociates them into the smaller fragments that react to destroy ozone molecules.

The detrimental effects of these two issues differ, too. Increasing concentrations of greenhouse gases cause warming of the atmosphere. This in turn can cause the myriad of observed effects including melting of glaciers, rise in ocean levels, more extremes in weather, spread of disease-causing insects, elimination of species from their normal habitats and so forth. Decreases in stratospheric ozone result in increased exposure to UV radiation at the earth's surface. The result for humans is more sunburns, more skin cancers, more cataracts, and more damage to immune systems.

The differences in the sources of the problems have made one of the issues more tractable than the other. Scientists have developed alternative compounds to replace the original CFCs. The HCFCs also contribute to ozone depletion, but to a smaller extent. But the main source of the greenhouse gases that contribute to global warming is the use of fossil fuels, mostly for electric power generation and transportation. These uses are so ubiquitous that finding substitutes for these is a much larger endeavor than substituting HCFCs for CFCs.

Even the attempts to mitigate against these two issues get mixed up. The Montreal Protocol has been an amazingly successful international accord, which has brought about the cessation in emissions of the CFCs. The atmospheric burdens are starting to decrease, and there is optimism that ozone levels will return to their pre-World War II levels by the end of the

century. Contrast that with the Kyoto Protocol. Sufficient countries have agreed to reduce their greenhouse gas emissions to put the Protocol into place. But, the largest contributor to the emissions, the United States, has withdrawn from the agreement.

There are other areas not clear to many people.

Global warming is expected to raise earth's average temperature in the range of a few degrees this century. Since everyone has personally experienced ranges in temperature of as much as 100 degrees Fahrenheit, many people assume a change in the earth's *average* temperature of a few degrees could not possibly be important. This is confusing weather and climate. Weather is short-term variations while climate is long-term variations. Extremes of temperature and the *average* temperature are not the same.

Another area that gets confused has to do with issues of smog and stratospheric ozone. Ozone is a secondary pollutant in the lower atmosphere, formed when primary emissions react in the presence of sunlight in a very complicated set of reactions to form ground-level ozone. Ozone is a health hazard for humans. So it is "bad down here." But, the existence of the same molecule in the stratosphere is crucial to the development and continued existence of life on the surface of the earth. So, it is "good up there." Another frequent presumption is that the ozone at ground level and in the upper atmosphere must mix from here to there. Not true. The atmospheric life of ozone is too short for it to persist long enough to be transported from troposphere to stratosphere or *vice versa*. Ozone in the stratosphere is formed and destroyed there. Ozone at ground level is a separate population of molecules.

Finally, the confusions about the Antarctic ozone hole need to be mentioned. The Antarctic is, of course, the continent at 90° South, not to be confused with the Arctic, which has no continent and is North of Alaska and Canada! The Antarctic ozone hole is also a seasonal phenomenon, which raises still another difficulty for the unwary. Many people forget that the seasons are opposite between the hemispheres. The Antarctic

ozone hole forms in October and November, in the austral springtime. There is a small ozone hole observed in the northern hemisphere in our spring (April, May) but the existence of the continent at the one pole is part of the reason the phenomenon is so much stronger there.

Being able to understand and make decisions about atmospheric environmental issues requires an unclouded understanding of some of the basic features of the problems. Hopefully, understanding of global warming and ozone depletion will be stronger as people learn to sort out the misconceptions held by many.