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Issues in Atmospheric Science

"Everybody talks about the weather, but nobody does anything about it." Atmospheric science includes understanding and predicting weather, of course, but it encompasses much more than that. Many chemical reactions in the atmosphere involve very small concentrations and occur at conditions of pressure and temperature that are difficult to obtain in laboratory measurements of rate constants. Coupled with complicated mass transport as well as photochemistry, this makes for an extraordinary set of problems, requiring both exotic laboratory procedures and great physical insight. *Science* regularly reports significant advances in all of the atmospheric sciences; the AAAS–Newcomb Cleveland prize for outstanding articles published in *Science* was awarded recently for two papers (one authored by Molina, Tso, Molina, and Wang; the other by Tolbert, Rossi, Malhotra, and Golden) in the atmospheric sciences that address the problem of important reactions occurring on particulate matter, especially ices, in the stratosphere.

In spite of the rather fatalistic remarks about doing nothing about the weather, in recent years we have actually been doing quite a lot. And much of what we have been doing about the atmosphere and our climate is apparently undesirable. In this issue on atmospheric sciences we present overviews of four areas in which major advances have occurred in our understanding of the chemistry of the atmosphere and the impact that various human activities are having on it. The articles view aspects of atmospheric problems on scales that range from local urban areas to the entire global atmosphere. In this all-encompassing view, we see, for example, that ozone can be both good and bad. It acts as a significant pollutant locally, while at high altitudes it provides a valuable photochemical screen whose destruction plays an important role in overall global climate warming. Each of the authors addresses not only the causes and consequences of various activities, but also possible ways of attacking some of the problems.

Seinfeld discusses urban air pollution, a critical problem for everyone who lives in a large city. Seinfeld characterizes the urban atmosphere as a giant chemical reactor in which a variety of undesirable materials are formed. A good deal of what is occurring is now well understood, but uncertainties remain.

Schwartz deals with a regional problem: acid deposition. In this arena of regional-scale air pollution, the difficulties are magnified because of the high density of emission sources and mutual zones of influence. Although much is now understood about the basic nature of the problem, it is not yet possible to put forward a credible source-receptor scientific model. It is clear that reduced emissions will, however, result in reduced deposition.

McElroy and Salawitch address the changing composition of the global stratosphere. Models show excellent agreement for many of the species. Ozone is a key compound here, and the effects of human activity, especially with regard to halocarbons, play an important role in the chemistry.

Finally, Schneider addresses global climate warming, the "greenhouse effect." Is there one? What are its consequences? It is clear from other work, some recently published in *Science*, that short-term climatic problems, such as last year's drought, are a result of other effects. Schneider, however, makes the case that we are likely to see a rise in global temperature, and even a modest increase is predicted to have a substantial impact. Consequences and ways of dealing with the problems are presented.

Atmospheric science is an area in which scientific understanding is critical to our long-term quality of life. The progress that has been made recently has been remarkable. We need to respond now to what we know, while continuing to develop the knowledge base. Simply describing what is happening, however, should be only part of the story.

—JOHN I. BRAUMAN