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Where the world stands on ozone

The Ozone Trends Panel which reported last week has confirmed that the expected downward drift in stratospheric ozone is under way, but not as yet catastrophically. The next three years will tell.

For most of the world, stratospheric ozone is understandably an abstraction. That there is ozone in the stratosphere at all is, for most people, simply hearsay; they have to take other people's word for it. And although the first measurements of stratospheric ozone go back more than half a century, for most of that time the measurements have been so unrealiable that even those responsible have not known what to make of them. For the world at large, stratospheric ozone came into its own only when, in the early 1970s, the eventually successful lobby against a US plan to build a fleet of supersonic aircraft raised the scare (probably unfounded) that nitrogen oxides from burning fuel would reduce the average concentration of ozone.

The lobby succeeded not because of the threat to the ozone layer, but because the economic case against supersonic aircraft was overwhelming. But soon, more substantial — and permanent — mechanisms by which ozone, itself produced by solar radiation in the stratosphere, might be catalytically destroyed by the products of some of the artificial constituents of the atmosphere, the halogenated hydrocarbons in particular. To the world at large, it cannot but seem another occasion when unseen causes pose unconnected threats.

The report (see page 293) of the Ozone Trends Panel convened by the US National Aeronautics and Space Administration should go a long way to make the argument about the threat to natural ozone (and thus, by low-energy solar radiation, to people) at once more sober and less panicky. First, it is no longer possible to dispute that there have been some significant changes in the concentration of stratospheric ozone during the past two solar cycles (the present cycle has two or three years to go to its maximum). The theory that the changes observed are consequences of artificial chemicals such as halogenated hydrocarbons in the stratosphere is most convincingly borne out by rough correspondence between the predictions and observations at different latitudes. That is the bad news.

Good news

The good news, for the time being, is that the magnitude of the reduction of stratospheric ozone so far is comparable with natural variation between the trough and the peak of the solar sunspot cycle. So much is suggested by the expectation that, in the years before the present cycle peaks, the declining trend of stratospheric ozone in the Northern Hemisphere will probably be temporarily reversed. There could hardly be a more natural and convincing yardstick to tell what variations of transmitted low-energy ultraviolet radiation are physiologically tolerable. If the secular reduction of stratospheric ozone so far can be swamped by the effects of the sunspot cycle, it cannot so far have done much damage. The next solar sunspot cycle could, of course, be a different case.

The report of the Solar Trends Panel also vividly illustrates the difficulties confronting those who would more accurately monitor changes of ozone concentration in the stratosphere. A decade ago, it was generally hoped that ozone measurements would not thenceforth depend on ground-based measurements (mostly of the solar spectrum reaching ground level), but on instrumentally more sensitive and certainly more continuous measurements from satellites. In the event, and a little ironically, the panel has been forced to the need to calibrate the satellite-borne instruments by the use of data from the much-despised Dobson network. This is not the first occasion when people trying to make sense of remote sensing measurements have been forced back onto old-fashioned ways, and will probably not be the last. That is why one of the most convincing of the secular trends now reported is the decrease of temperature (about 4°C) in the middle stratosphere at mid-latitudes.

The lesson to be learned, ideally by the time of the review conference of the Montreal Convention due in 1991, is that there is an urgent need for better instruments that can be calibrated more reliably. To be fair, public sources of research funds have been generous in their treatment of research projects in the field during the past decade, but it would now make sense to give special attention to schemes for improving on the sensitivity of the measurements now being made.

Ozone hole

Two puzzles remain, of which the most conspicuous is the famous Antarctic springtime ozone 'hole', first recognized three seasons ago and successively more marked in succeeding seasons. This dramatic phenomenon is a special if instructive case. Events have shown that the marked reduction of ozone in the low-lying spring stratosphere within the polar vortex out to a latitude of 60 °S is indeed associated with high concentrations of the chemical ClO long suggested as the principal catalyst of ozone destruction, which goes a long way to support the notion that artificial chemicals are responsible. But, naturally, if there had to be a phenomenon of this kind, it could not be better placed than in the Antarctic. The second puzzle is that so little is so far known of the means by which the halogenated chemicals are removed from the stratosphere. While some gloomy forecasts assume that chlorinated hydrocarbons remain permanently in the stratosphere once they have found their way there, that cannot be literally the case. Is it even possible that the Antarctic hole may help to remove ozone from the stratosphere? While people improve their instruments, they might also pay some attention to this question, certain to become more pressing are chlorinated hydrocarbons continue to accumulate.

Meanwhile, it is fortunate that there is now a convention on the Protection of the Ozone Layer. The US Senate ratified the treaty last week. Last week's report should persuade reluctant governments (and their chemical manufacturers) to comply with the modest restrictions so far required of them — to freeze production of chlorinated hydrocarbons for the time being, and to reduce them by a half a some later stage. What has emerged, in the extremes represented by those who say that the damage done by the disappearence of the ozone layer would be counteracted if people in sunny climates carried sunshades and those who regard any sign of global anthropogenic change as an offence against nature, is a sober case for caution. And while skin cancer (among people) is often curable, the convention now on the books is an invaluable precedent for the much more contentious document that will be needed if and when it becomes necessary to contain carbon dioxide emissions. □