

What to make of nuclear winter

3 pages ✓

The International Council of Scientific Unions (ICSU) report on nuclear winter, the supposed aftermath of nuclear warfare, is the best on this subject so far. But the policy implications are not clear.

So do we know what are the policy effects of nuclear war? The question is naturally prompted by the appearance last week of the monumental report by the working party called the Scientific Committee on Problems of the Environment (SCOPE) set up three years ago by the International Council of Scientific Unions (ICSU). There are two senses in which the answer can only be hesitant assent, neither of which detracts from the value of what the committee has done. First, like all previous studies in this field going back to the then invaluable document published by the government of India in 1957, and to nobody's surprise, such documents inevitably draw attention to problems whose solutions are not to hand, but whose reality had not previously been apparent. Second, there is an uncertainty of a different kind arising because nobody can be really sure how a nuclear war would be conducted by the military. The usual starting assumption is that the amount of nuclear explosives used would be a substantial fraction of the arsenals of the major powers, which is fair enough. The conclusions are usually (as in the SCOPE study) that a nuclear war would be a near-catastrophe, from which some go on to conclude that the steps that some governments take to limit anticipated damage (such as civil defence) are quite beside the point. But there are all too many reasons for believing that nuclear wars falling short of full-scale catastrophe are the most likely — an unhappy circumstance because it can lead to the concept of a "winnable" nuclear conflict.

None of this diminishes the value of the SCOPE study, which is best regarded as the latest contribution to a sequence of studies still far from complete. (Last week's report, like many of its predecessors, is also an agenda for research.) But this study, to SCOPE's credit, has been carried out in an open fashion. There have been opportunities for those who have had special knowledge to speak up at workshops and seminars, the functions of which have been advertised in advance. As a model for the conduct of inquiries in fields in which the uncertainties are so huge, SCOPE seems to have broken useful new ground. That the actual release of its report should have fallen into the hands of publicity managers more free with press releases than with copies of the full text (not yet available) is probably best explained by the need in the United States to shout even to be heard.

Fallout

It is nevertheless a pity that the SCOPE report will be distinguished from its predecessors chiefly because it provides an assessment of the proposition that nuclear winter may follow nuclear war. The other sections of the document, for example that dealing with the estimation of the effects of radioactive fallout after the explosion of several megatons of bombs near the surface of the Earth, is in itself an important argument that should not be overlooked. (The conclusions are more gloomy than some previous calculations.) Yet nuclear winter needs pride of place (and gets it) because it is a novel idea only recently imported into the discussion of what will happen to those unfortunate enough to survive the immediate effects of a nuclear war. The case deserves a hearing, which it will get at least from those who may hitherto have thought that geography would insulate them from the most damaging effects of nuclear war.

What SCOPE says about nuclear winter does not differ qual-

itatively, or in other significant ways, from the earlier accounts of nuclear winter (see Turco *et al.* *Science* **222**, 1283; 1983). Smoke from fires ignited by nuclear explosions will be lifted high into the troposphere, the Sun will be obscured, the surface of the Earth will be cooled, photosynthesis will be stopped in many places and animals (including people) will die. The effects will be global, extending beyond the frontiers of the states directly involved with the war (which is why states such as India are alarmed). Nuclear winters may also be seasonal, with smoke from summer wars spreading more quickly. Given the uncertainties of calculating nuclear winters, it is neither here nor there that SCOPE's estimates of the severity, duration and distribution of the effects of nuclear winter are on the cheerful side of those of Turco *et al.* The differences are small, and not important. For the time being, the nuclear winter must firmly be listed among the consequences of substantial nuclear wars, remembering that time (but, it is hoped, not experience) will show that even present fears are immoderate. SCOPE's antecedents require no less.

Uncertainties

It is also important that the uncertainties should not be buried by last week's razzamatazz. The SCOPE report acknowledges that the severity of a nuclear winter will be a function of the quantity of smoke remaining in the atmosphere, which is most probably not a linear function of the amount injected but rather an S-shaped function rising to a plateau. The quantities are huge, measured in tens of millions of tons of elemental carbon in the form of micrometre-sized particles. Fifty million tons will be more than enough to make a serious nuclear winter. (The upper range of the SCOPE estimates is some 30 million tons of smoke in the atmosphere.) Twice as much will not make things very much worse. The crucial question for the theory of the nuclear winter is the proportion of the smoke that can be expected to stay in the atmosphere. SCOPE properly lists the now familiar uncertainties, the effects of rain-clouds generated by rising plumes of heat, coagulation and so on. The report also allows that little is so far known of the atmospheric processes on the mesoscale (between that of a smoke plume and that of a continent) which may have an important influence on the removal of smoke, but from now on it will probably be wise to follow SCOPE's conclusion that nuclear winter is a probable consequence of nuclear war.

So what? The SCOPE report, for all its bulk, has steered clear of taking up the implications of its conclusions. But Sir Frederick Warner, chairman of the steering committee warned that the policy implications cannot be ignored. But what are they? For forty years, many people and most governments have behaved as if they believed nuclear war to be such a potential catastrophe that international relations should be moulded so as to avoid it. These good intentions have not been conspicuously successful. The possibility now that the effects of nuclear war will be spread beyond the territory of the combatants gives non-nuclear countries an even greater interest in persuading the nuclear powers to arms control. But the countries concerned are already crying with frustration at their inability to persuade their bigger brothers down the path of mutual restraint. The certainty that billions might die in neutral populations is no more likely to