

NUCLEAR WINTER ON THE DAY AFTER?

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Who is right? The ABC-TV docudrama "The Day After" shows clear sunshine coupled with deadly radioactive fallout, while a scientific study by Prof. Carl Sagan and colleagues predicts darkness and cold as dust, smoke and fallout spread around the world following a major nuclear exchange, even one involving only one percent of the present nuclear arsenal.

This is just one of many inconsistencies which illustrates the hazards involved in making forecasts about global environmental effects, whether caused by nuclear explosions, major volcanic eruptions, or even the impact of a comet or solid meteorite on the earth.

Item: If earth is covered with dust, smoke, and especially soot, from the combustion of cities, won't the surface become warmer rather than colder? True -- the sun's radiation won't reach

the surface, but the heat radiation from the earth will be retained.

It is precisely such a mechanism that warms the surface of Venus to many hundreds of degrees -- as Sagan and colleagues well know.

Yet they chose to use Mars as an analog, where dust storms indeed lead to surface cooling. But Martian dust has different physical properties, and especially optical properties, than smoke and soot, or even terrestrial dust. And the analog of terrestrial cooling after volcanic eruptions may not be appropriate either, because eruptions put aerosol droplets and dust into the stratosphere (Where they remain for many months and even years), while smoke and soot (from combustion following nuclear explosions) remain close to the surface. True, solar radiation will be reduced, but it may be dark and warm.

Combustion of materials, trees and crops may even inject large amounts of carbon dioxide into the atmosphere leading to a long-term warming.

The smoke and soot, rather than reflect sunlight back out into space (as Martian dust does) would absorb solar radiation and create violent heating of the lower atmosphere. It is well known that this makes the atmosphere unstable, causes mixing and turbulence, promoting cumulus-like cloud formation and intensive thunderstorms and rain. Such convective activity may promote rapid rain out of whatever is contained in the lower atmosphere, much faster than the normal self cleaning process of rain.

But won't the dust kicked up into the stratosphere remain there?
And won't chemical compounds created by the nuclear explosions destroy the ozone shield in the stratosphere and thus allow deadly solar ultraviolet radiation to destroy living things on the land surface?

Here again, there are inconsistencies in the scientific scenarios prepared by Sagan and his colleagues. It should be clear that

there should be no danger from ultraviolet radiation to whatever survives at the surface. Since general solar radiation is screened by dust etc., so is solar ultraviolet. In fact, the explosions and subsequent conflagrations may create low-altitude ozone which acts as a shield. Not only that, stratospheric ozone does not remain destroyed; it reforms constantly and builds up towards its former value. In any case, surface nuclear explosions are not nearly as effective in producing stratospheric changes as would be high-altitude bursts near the top of the atmosphere. But such bursts would not destroy cities and are not likely to be employed in the conventional scenario of nuclear exchange.

From the same military viewpoint, that is, to achieve maximum destruction at the earth's surface, many low-energy bombs are more effective than fewer superbombs. The scientific reason is that a superbomb wastes much of its explosive power by "blowing out" into the stratosphere and beyond. The atmosphere is simply not

heavy enough to contain such a large explosion. Therefore a well-designed nuclear attack would create either stratospheric impact; and by the same token, the after effects on solar screening, climate and fallout should be quite short lived -- days rather than seasons.

The "nuclear winter" scenario may be internally inconsistent for a more fundamental, scientific reason. If indeed the stratosphere is affected and ozone destroyed, this might also destroy the temperature structure of the stratosphere itself and therefore its stability (which enables it to keep dust and aerosols suspended there for years). The former stratosphere would then become simply an upward extension of the troposphere (lower atmosphere) and participate in its instability, rapid mixing and clean up by rain.

A case can therefore be made against "nuclear winter" both from a scientific viewpoint and a military strategic one.