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MULTI-YEAR GLOBAL CLIMATIC EFFECTS OF ATMOSPHERIC DUST FROM LARGE BOLIDE IMPACTS

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The global climatic effects of dust generated by the impact of a 10-km diameter bolide was simulated using a one-dimensional (vertical only) globally-averaged climate model by Pollack et al. (1). This model necessarily assumed the Earth to be either completely oceanic or completely continental and calculated a single global surface temperature for the planet. Temperature effects in oceanic and continental simulations were widely divergent owing to the much greater heat capacity or "thermal inertia" of the oceans as compared to land. Since that time three-dimensional global climate models that explicitly include atmospheric circulations and the effects of land and ocean have been developed to examine the potential climatic effects of nuclear war. One such model will be used here to simulate the climatic effects of a global stratospheric dust cloud whose characteristics correspond to a hypothetical dust pall created by a 10-km diameter impactor. The goal of the simulation is to examine the regional climate effects, including the possibility of coastal refugia, generated by a global dust cloud in a model having realistic geographic resolution. The climate model assumes the instantaneous appearance of a global stratospheric dust cloud with initial optical depth of 10^4. The time history of optical depth decreases according to the detailed calculations of Pollack et al. (1), reaching an optical depth of unity at day 160, and subsequently decreasing with an e-folding time of 1 year. The simulation is carried out for three years in order to examine the atmospheric effects and recovery over several seasons. The simulation does not include any effects of NO_X , CO_2 , or wildfire smoke injections that may accompany the creation of the dust cloud. The global distribution of surface temperature changes, freezing events, precipitation and soil moisture effects and sea ice increases will be discussed.

References:

(1) Pollack, J.B., O.B. Toon, T.P. Ackerman and C.P. McKay, (1983) *Science*,**219**, pp. 287–289.