

GLOBAL ENVIRONMENTAL EFFECTS OF IMPACT-GENERATED AEROSOLS: RESULTS FROM A GENERAL CIRCULATION MODEL;

C. Covey, S.J. Ghan, Lawrence Livermore National Laboratory; P.R. Weissman, Jet Propulsion Laboratory

Cooling and darkening at Earth's surface are expected to result from the interception of sunlight by the high altitude worldwide dust cloud generated by impact of a large asteroid or comet, according to the one-dimensional radioactive-convective atmospheric model (RCM) of Pollack et al. (1). An analogous three-dimensional general circulation model (GCM) simulation obtains the same basic result as the RCM but there are important differences in detail. In the GCM simulation the heat capacity of the oceans, not included in the RCM, substantially mitigates land surface cooling. On the other hand, the GCM's low heat capacity surface allows surface temperatures to drop much more rapidly than reported by Pollack et al. These two differences between RCM and GCM simulations were noted previously in studies of "nuclear winter" (2, 3); GCM results for "comet/asteroid winter," however, are much more severe than for "nuclear winter" because the assumed aerosol amount (the "standard case" of Pollack et al.) is large enough to intercept all sunlight falling on Earth. In our simulation the global average of land surface temperature drops to the freezing point in just 4.5 days, one-tenth the time required in the Pollack et al. simulation.

In addition to the "standard case" of Pollack et al., which represents the collision of a 10-km diameter asteroid with Earth (4), we will consider additional scenarios ranging from the statistically more frequent impacts of smaller asteroids to the collision of Halley's comet with Earth. In the latter case the kinetic energy of impact is extremely large due to the head-on collision resulting from Halley's retrograde orbit.

REFERENCES

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