Committee VI
Global Environmental Problems

Discussion Paper

by

Hugh W. Ellsaesser
Lawrence Livermore National Laboratory
P. O. Box 808
Livermore, CA 94550

on

Andrew A. Lacis and Sergej Lebedeff's

discussion of

Devendra Lal's

GLOBAL EFFECTS OF METEORITE IMPACTS AND VOLCANISM

The Twelfth International Conference on the Unity of the Sciences
Chicago, Illinois November 24-27, 1983

Comment's on Lacis and Lebedeff Discussion

Hugh W. Ellsaesser

I am encouraged to hear the reservations of Lacis and Lebedeff regarding the climatic effects routinely attributed to volcanic eruptions. I recently had cause to again review the evidence in this field (Ellsaesser, 1983) and concluded that: published climatogenic effects attributed to volcanoes primarily represent cases of mistaken identity.

There is no question but what volcanic eruptions and subnormal temperatures are statistically correlated — apparently on all time scales (Rampino et al., 1979). However, all who have looked closely have found discordant data which appeared to defy the presumed cause and effect relationships. Mitchell (1961) noted cooling even after non-explosive eruptions. Many have noted, as did Lacis and Lebedeff, that the cooling was generally underway before the eruptions. In the case of Tambora (1815) the available temperature records show cooling even on a hemispheric scale was underway for about 50 years before the eruption and the entire period from 1799 to 1817 was substantially cooler than any period since 1605 to 1610. The New England crop failures of the notorious "Year Without a Summer" or "1816 and Froze to Death" were due to three isolated severe storms bringing killing frosts in each of the three summer months — June, July and August. Weather between the storms was normal to unseasonably warm (Milham, 1924). Much the same occurred in England. I for one am at a loss to explain such weather on the basis of a persistent dust layer in the stratosphere from a volcanic eruption occurring in 1815.

Lacis and Lebedeff said in part: "We can with reasonable confidence identify the temperature decrease due to Agung..." It should be noted that Starr and Oort (1973) created quite a stir when they called attention to an apparent 0.6°C cooling of the northern hemisphere 1000-500 mb layer between May 1958 and Apr 1963. How can anyone be confident that any cooling subsequent to the Agung eruption of March 1963 was not due to the same cause as that responsible for the unexplained cooling occurring over the 5 years preceding the eruption? Angell and Korshover (1983) after having examined the data several times stated: "There is

evidence for an 0.3°C decrease in Northern Hemisphere surface temperature following the Agung eruption of 1963, but there was no obvious influence on Southern Hemisphere temperatures, cooling occurring before the eruption and continuing after the eruption." How does one reconcile this as a cause and effect relationship when the Agung dust cloud was reported to be an order of magnitude thicker in the Southern Hemisphere than in the Northern (Dyer and Hicks, 1968)?

Self et al. (1981) and Rampino and Self (1982) noted two serious discrepancies in the cause and effect relationship. They found that the series of 6 major eruptions from 1881-1889 and 5 in 1902-1903 produced no greater response in the temperature record than did individual isolated eruptions. They also pointed out that Tambora (1815), Krakatoa (1883) and Agung (1963) with relative eruption magnitudes of 150:20:1 and sulfate aerosol magnitudes of 7.5:3:1 appeared to produce comparable temperature responses, reflecting no differences in the intensities of the presumed perturbing factors.

In a recent study Sear and Kelly (1982) found the maximum hemispheric cooling within two months after major volcanic eruptions. This contrasts strongly with most previous studies which claimed to find the maximum cooling one to three years after the eruption.

One of our most powerful means for distinguishing that which we know from that which we merely believe is the test of consistency. It is my considered opinion that the published studies on the climatic effects of volcanic dust veils in the stratosphere do not pass this test.

REFERENCES

Angell, J. K. and J. Korshover, Global temperature variations in the troposphere and stratosphere, 1958-1982, Mon. Wea. Rev., 112, 901-921, 1983.

Dyer, A. J. and B. B. Hicks, Global spread of volcanic dust from the Bali eruption of 1963, Quart. J. Roy. Met. Soc., 94, 545-554, 1968.

Ellsaesser, H. W., Isolating the climatogenic effects of volcanoes, paper presented at Meeting of Experts on Anthropogenic Climatic Change, 4-10 July 1983, Leningrad, USSR, UCRL-89161, Lawrence Livermore National Laboratory, Livermore, CA 94550, 1983.

Milham, W. I., The year 1816 — The causes of abnormalities, Mon. Wea. Rev., 52, 563-570, 1924.

Mitchell, J. M., Jr., Recent secular changes of global temperature, Ann. N.Y. Acad. Sci., 95, 235-250, 1961.

Rampino, M. R. and S. Self, Historic eruptions of Tambora (1815), Krakatua (1883) and Agung (1963), their stratospheric aerosols and climatic impact, Quaternary Research, 18, 127-143, 1982.

Rampino, M. R., S. Self and R. W. Fairbridge, Can rapid climate change cause volcanic eruptions?, Science, 206, 826-829, 1979.

Sear, C. B. and P. M. Kelly, The climatic significance of El Chichon, Climate Monitor, 11, 134-139, 1982.

Self, S., M. R. Rampino and J. J. Barbera, The possible effects of large 19th and 20th century volcanic eruptions on zonal and hemispheric surface temperatures, J. Volcanology and Geothermal Research, 11, 41-60, 1981.

Starr, V. P. and A. H. Oort, Five-year climatic trend for the Northern Hemisphere, Nature, 242, 310-313, 1973.

HWE:clm