

Earth Sciences

From the Norman D. Watkins Symposium on "The Environmental Impact of Volcanism" at the University of Rhode Island in Kingston

Volcanoes, El Niños: Climatic ties?

Scientists have long recognized the link between volcanic eruptions and climatic changes. Benjamin Franklin may have been the first to suggest such a link in 1784 after the Laki volcano in Iceland erupted, sending a blue haze over Europe. Franklin suspected that the haze shielded the land from the sun's rays and resulted in an unusually severe winter. But researchers have not always found the predicted tropospheric cooling after major eruptions. A few months following El Chichón's large eruption in 1982, for example, global air temperatures actually rose.

"The evidence for cooling is rather mixed, to put it mildly," says James K. Angell, a meteorologist at the National Oceanic and Atmospheric Administration (NOAA) in Silver Spring, Md.

Now Angell proposes a reason: The cooling effect of volcanic aerosols has been overwhelmed by the occurrence of an El Niño, an unusual warming of Pacific waters that also warms the air (see p. 184). "Looking back at past eruptions, there's at least a hint that this is plausible," he says. "Eruptions followed by El Niños are the ones for which evidence of cooling is pretty weak." By subtracting the temperature increases due to the 1982-83 El Niño, Angell was able to show in a simple calculation that El Chichón by itself would have caused cooling.

Paul Handler, a physicist at the University of Illinois at Urbana-Champaign, thinks the interfering effects of El Niños are no coincidence. He has argued that eruptions of volcanic aerosols into the stratosphere actually trigger El Niños (SN: 5/5/84, p. 287). Now he says there is an even stronger statistical link between eruptions and the strength of Indian monsoons, another weather change thought to be related to El Niños.

According to Handler, who also presented a paper at the symposium, the monsoons can be thought of as a giant sea breeze in which moist air is carried from the ocean onto the land, producing clouds and rain. When volcanic aerosols shade the land, the land temperature drops and so does the temperature difference between the land and sea which drives the monsoon winds. A large volcanic eruption at low latitudes would cause a weaker monsoon. The injection of aerosols from high latitudes would strengthen the monsoon, says Handler. These effects, he notes, don't become evident unless aerosols are in the stratosphere for three to six months and solar radiation at the ground has decreased by at least a few tenths of a percent. "From 1942 through 1984, the Indian monsoon can be explained [in this way] without a contrary case," he says.

Handler's ideas about volcanoes, El Niños and now perhaps monsoons have been somewhat controversial. Handler himself thinks the reason other scientists haven't accepted his theory is that it is so simple. He also argues that one reason climatologists have been unable to see clear trends in the climatic effects of volcanoes is that their studies lump all eruptions together, regardless of latitude. He notes that, as he predicted, sea surface temperatures off the coast of Peru have now begun to rise, three months after an eruption in Colombia.

Other scientists, such as J. Murray Mitchell at NOAA, question the statistical validity of Handler's results since there have been so few major volcanic eruptions in the last century. "I think it's too soon to know if his conclusions will stand the test of time," says Mitchell.

Mitchell and others say they are most concerned about the climatic effects of volcanoes because these effects can obscure the potentially more serious climatic changes resulting from carbon dioxide and other "greenhouse" gases (SN: 9/14/85, p. 170). In order to show policymakers that "we're facing an important greenhouse warming in the future, we have to show that this warming is already taking place," says Mitchell. "Volcanic eruptions can confound that picture and delay the day we can pin down these effects to carbon dioxide."

Science & Society

Tighter controls on supercomputers

Even after many months of discussion, the federal government has yet to come up with a final policy governing the access of Soviet-bloc scientists and exchange students to university supercomputers. So far, universities and the National Science Foundation (NSF) have reluctantly agreed to accept visa controls to keep visiting Soviet-bloc researchers away from federally funded facilities (SN: 9/21/85, p. 181). The government would be responsible for enforcing this ban.

Still in dispute, however, is whether exchange students allowed into the United States should be barred from enrolling in courses that use supercomputers. University officials insist that they don't want to be put into the role of policemen for the Pentagon.

Last month, the American Institute of Physics, based in New York City, issued a statement strongly opposing any government control over access to unclassified laboratories. The statement notes that while attention now focuses on NSF-funded supercomputer centers, "hundreds of other facilities at U.S. universities and industrial laboratories can and inevitably will be upgraded to the supercomputing level."

The statement continues: "Existing procedures already protect technical data and other files at computing centers. Further restrictions that limit access to the facility itself are unnecessary and counterproductive."

Meanwhile, in the Feb. 12 Federal Register, the Department of Defense (DOD) proposes a new rule governing the dissemination of information resulting from DOD-sponsored unclassified research. This policy is intended to reduce the incidence of last-minute censorship of technical papers scheduled for presentation at professional meetings (SN: 4/20/85, p. 247; 10/19/85, p. 248).

The draft policy includes a mechanism for speedy review of papers intended for unclassified sessions at meetings. However, it also allows DOD to insist that some unclassified papers be presented only in special export-controlled sessions. Several scientific and technical societies have objected to these sessions, which restrict attendance to U.S. citizens and "authorized" foreign nationals.

Superfund delays

By the end of last year, both the House and Senate had passed legislation authorizing a new, tougher Superfund program for cleaning up abandoned toxic-waste dumps (SN: 12/21&28/85, p. 390). But the bills were different enough to require lengthy negotiations between the two bodies before a compromise version could be presented to President Reagan for signing into law. Those discussions are still going on.

The biggest problem is deciding whether most Superfund money should come from a tax on petrochemical feedstocks or from a broader tax on manufactured goods. Meanwhile, with no new funds coming in, the Environmental Protection Agency has threatened to stop all current work at toxic-waste sites and to lay off staff beginning April 1.

The safety of private dams

Of 80,000 privately owned dams in the United States, at least 2,000 are unsafe and could fail, according to a recent report prepared for the Federal Emergency Management Agency. These faulty dams may be improperly designed, may have deteriorated to a dangerous condition or cannot adequately hold back floodwaters, the report says.

The situation may be even worse, says civil engineer Bruce Tschantz of the University of Tennessee in Knoxville, who conducted the survey. Only a small percentage of the 80,000 dams have actually been inspected, he says. Many states lack adequate programs for regulating private dams.