the policy office describing the flow of scientists and engineers through the educational pipeline. At issue is a policy analysis widely cited by former NSF chief Bloch and other NSF staffers during their campaign to win a bigger NSF budget from presidents Reagan and Bush. Critics have questioned the credibility of the analysis.

These studies were prepared under Peter House, then director of the Division of Policy Research and Analysis. They predicted that the United States would experience a "shortfall" of technical expertise at the end of the century unless steps were taken quickly to increase the number of students receiving bachelor of science and Ph.D. degrees. House was so proud of this work that he took credit, as reported by Jeffrey Mervis in *The Scientist* last October, for publicizing a forecast that he claimed "helped to justify President Reagan's proposal to double the NSF budget over 5 years."

House's analysis since then has run into harsh criticism from economists and labor statisticians who fault its methodology. One early skeptic, Alan Fechter, a director of the National Research Council's office of scientific and engineering personnel, wrote that the studies differed from most economic analyses because they did not consider possible changes in demand. The result, Fechter claimed, is that the NSF created a theoretical (but unsubstantiated) specter of a "shortfall" in the supply of researchers by the end of the century—one that would disappear if different demand assumptions were used. This analysis, Fechter wrote, was "not very useful for policy formulation," though it clearly was useful for NSF officials seeking a bigger budget.

Massey told *Science* last week that the investigation into these matters is "a distraction" for the staff. It's a distraction he professes to be baffled by, since NSF sleuths have probed some of the same issues and failed to dig up any violations of law or significant procedural abuses. "I just have no idea what the motivation" for the inquiry is, says Massey. The mood on Capitol Hill is quite different. Indeed, the picture one aide painted is that of NSF officials flipping out over what is nothing more than a standard oversight inquiry.

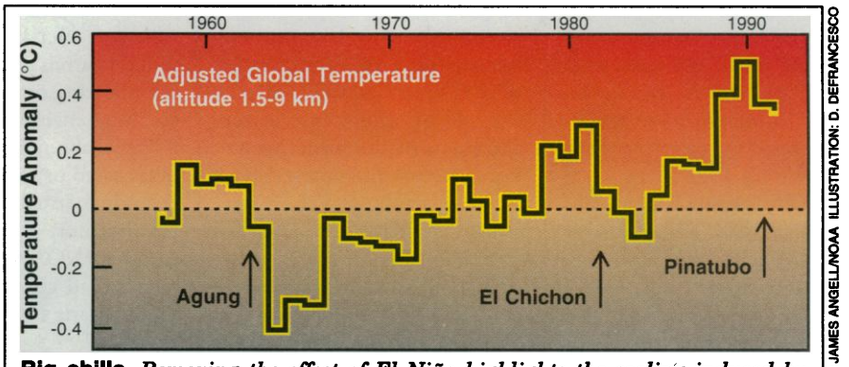
Those opposed viewpoints are also reflected in what various parties think the outcome of the current investigation is likely to be. NSF staffer Joel Widder says he thinks the dispute over the pipeline paper is just a case of "policy analysts chewing each other alive." Wolpe's staff clearly disagrees. The investigation is expected to grind on for 2 or 3 months before the public finds out how Capitol Hill interprets the goings on at NSF.

■ JOSEPH PALCA and ELIOT MARSHALL

1991: Warmth, Chill May Follow

Earth was still running a fever in 1991, but relief, albeit temporary, may be here. Following on the heels of 1990's record temperatures, last year ended as the second warmest ever recorded. But it might have set yet another record had it not been for the eruption of Mount Pinatubo. The layer of sun-blocking haze spewed by the Philippine volcano is sending a chill through the climate system that may already have shown up in the temperature record.

This volcanic cooling, which could last a couple of years, should also temporarily chill the debate about whether the greenhouse effect is behind the warming of recent years. It's been hard enough to draw firm conclusions about any greenhouse warming from world temperature data, and Pinatubo's masking effect should make it harder still during the next few years. But the cooling episode may advance the science of climate prediction indirectly. It will give scientists an opportunity to check out their computer greenhouse models by seeing how well they do at predicting the volcano-induced climate change. The stakes are high, says modeler James Hansen of NASA's Goddard Institute of Space Studies (GISS): "Either we're going to see a [temperature] signal, or [our] model is wrong."



SOURCE: JAMES ANGELL/NOAA ILLUSTRATION: D. DEFRANCESCO

Big chills. *Removing the effect of El Niño highlights the cooling induced by volcanic eruptions. (Last year was the fourth warmest in this tropospheric record.)*

If the model is right, a long-term warming trend is due for a reversal. Helene Wilson of GISS and Hansen note that the 8 warmest years in their 110-year record of land surface temperature all occur within the past 12 years. And the warming of the past 25 years has been more rapid than during any comparable period in the record.

Last year the heat stayed on. All three groups compiling global surface temperature observations—GISS, NOAA's Climate Analysis Center, and a joint effort by the British Meteorological Office and the University of East Anglia—pegged last year's global temperature at just below the record warmth of 1990. The continued heat wave may have been bolstered by the unusually warm waters that collected in the western tropical Pacific, points out climatologist James Angell of NOAA in Silver Spring, Maryland. The Pacific warming began more than a year ago, even though it was not until last fall that it became extensive enough to trigger a full-blown El Niño—the warming of the tropical Pacific that is already bringing floods to Texas and unseasonably mild temperatures to the northern tier of states.

Can the El Niño overcome Pinatubo's cooling effect during 1992? Climatologists say the odds are against it. Even a strong El Niño warms the globe by only 0.1 to 0.2°C, while Hansen's computer model predicts that the debris lofted into the stratosphere by Pinatubo should block enough sunlight to cool the world by about 0.5°C, an amount equal to all the warming of the past 100 years. "It's not clear the man in the street will see the signal so clearly," says Hansen, "but it's a nice model test."

If the world cools less than predicted, for example, it might be because the system is less sensitive to climatic influences than has been assumed. Greenhouse warming might then fall short of the potentially disastrous heating that many models now predict. It's too early to say how well the GISS prediction is holding up, but by year's end the GISS record shows that the global temperature curve had edged downward by several tenths of a degree. Check these pages this time next year to see how the models, and Earth, are faring.

■ RICHARD A. KERR