rather than undoing all the canals, levees, and dikes that have diverted the water to agriculture and cities, the idea is to pump the water they carry into more than 330 wells drilled in the Florida aquifer and then release it during dry spells. Congress approved a down payment of $1.4 billion for the 20-year restoration last fall, and the Army engineers plan to begin two pilot projects in 2003 that will involve drilling test wells and collecting water-quality and geological data.

But some ecologists and hydrologists have taken issue with the idea, arguing that it would be better to remove more barriers to natural water flows. The NRC's Committee on the Restoration of the Greater Everglades Ecosystem (CROGEE) was set up a year ago in response to such criticisms.

In its first report, a review of two planned aquifer pilot projects, the CROGEE notes that the overall aquifer plan, which would require storing up to 6.3 million cubic meters of water per day, is "unprecedented" in scale. Showing that it will work "will require studies that go beyond the scope of the proposed ... pilot projects," the report says. It urges agencies to go forward with a proposed regional modeling study of how the new wells would affect the aquifer. The panel also recommends that more data be collected during the pilot projects, including studies of whether storing water in the aquifer would degrade the water quality, leading to harmful effects on ecosystems.

Corps officials say they've already begun responding to these comments since they were aired at a CROGEE workshop last fall. "It's a good report. It gives us some good guidance," says Stu Applebaum, ecosystem restoration chief for the corps in Jacksonville, who says the agency expects to carry out the regional study when the pilot projects begin.

Those data, however, will be only a beginning. CROGEE's first report notes that more analysis, including an assessment of energy costs and evaporation rates, is needed to determine whether aquifer storage is preferable to surface storage. And the committee is now reviewing the environmental measures that will be used to assess whether restoration is working. **–JOCELYN KAISER**

PLANETARY SCIENCE

Caltech Picks Insider To Lead JPL

The Jet Propulsion Laboratory (JPL) in Pasadena, California, has had a hard time of it in the past 18 months. Two prominent Mars failures sullied its formidable reputation, its longtime director stepped down, and its dominant position in solar system exploration is being threatened by NASA's decision to open up a Pluto mission to competition.

But the center soon will have a new leader who promises to confront the lab's troubles. Charles Elachi, now chief of space and earth science programs at JPL, will take over as director on 1 May. "I'm not afraid of competition," he said at a 31 January press conference. He said he plans to spend the interim developing a plan to handle a bevy of smaller missions within NASA's constrained budget.

The decision by the California Institute of Technology (Caltech), which runs the lab under contract from NASA, surprised many in the space science community who assumed the job would go to an outsider. But Elachi's knowledge of the lab, scientific credentials, and vision vaulted him to the top of a list of 74 candidates. "We're not merely anointing a prince here," said Caltech President David Baltimore. "He simply provided insurmountable competition."

Propelling JPL. New Director Charles Elachi says he's "not afraid of competition."

Elachi has had a management role in the Mars program, which had to be revamped after the failures of the Mars Polar Lander and the Mars Climate Orbiter in late 1999. But several NASA officials and space scientists say that Elachi's responsibility for those failures was minimal. "He was the fall guy," adds one senior researcher who knows the lab well. The departing director, Ed Stone, was blamed by NASA officials for failing to speak out more publicly about the lab's responsibility. Stone, age 65, will return to teaching at Caltech after 10 years as head of the lab.

The 53-year-old Elachi studied physics, geology, and business administration and earned his electrical engineering doctorate from Caltech before joining the lab in 1971. He helped develop a series of radar instruments used on the space shuttle that revealed archaeological sites just under Earth's surface in Egypt, China, and Saudi Arabia. He also is team leader for a radar experiment on the Cassini mission to Saturn.

At the press conference, NASA Administrator Dan Goldin told Elachi exactly what he must do: "Figure out how to double the number of missions with a similar workforce—and maybe double that again." One former NASA official who has worked with Elachi says he's up to the task. "Elachi

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ScienceScope

Climate Costs How hard will greenhouse warming hit the global pocketbook? The United Nations Environment Programme (UNEP) has an answer: $304.2 billion per year in 2050, according to a study released this week by insurance company members of UNEP's financial services initiative. The big number prompted UNEP executive director Klaus Toepfer to plead at UNEP's Governing Council meeting in Nairobi for more funds to implement his organization's work.

But the $304.2 billion figure is hardly as imposing as the decimal point would imply, economists say. It works out to just a few tenths of a percent of world gross domestic product (GDP), notes economist James Edmonds of the Washington, D.C., office of the Pacific Northwest National Laboratory; the United States already spends about 2% of its GDP on pollution control. And most experts would not even attempt to put a price tag on global warming. "There are just so many difficulties in making that kind of estimate," says Neil Leary of UNEP's Intergovernmental Panel on Climate Change (IPCC) office in Washington, D.C.

On 19 February, the IPCC working group that Leary manages will be releasing its own 5-year report on the impacts of climate change. But he promises that "there won't be any dollar cost"—with or without decimal points—in the report.

Aftershocks India is scrambling to conduct a "scientific postmortem" of the Bhuj quake last month that killed more than 20,000 people in the western state of Gujarat. The research program will include extensive monitoring of the surface with global positioning system units for clues to what may be happening deep within the Indian plate, some 30 kilometers underground near the quake's epicenter. "A major event like this can cause long-term changes in the Indian plate, and we do not want to miss the opportunity to understand them," says V. S. Ramamurthy, secretary of the Indian Department of Science and Technology. He also promised "rapid, interim clearance" for proposals to help scientists sidestep the "long, drawn-out" review process. The region has been the subject of ongoing paleoseismic studies by the Center for Earth Science Studies in Thiruvananthapuram, Kerala.

noise turned out to be humongous particles containing nitric acid. The polar stratospheric cloud (PSC) particles that form in the extreme cold of polar winter generally run a few tenths of a micrometer to a micrometer in diameter and are made of water and nitric and sulfuric acids. But these new, oversized particles, more than 3000 times the usual mass, ranged from 10 micrometers to 20 micrometers. "These things are rocks" compared with the usual PSC particles, says Fahey. They are most likely made of solid nitric acid hydrates. Atmospheric chemists aren't sure yet how they formed, says Fahey; "no one was expecting to see" such large particles.

The discovery of PSC rocks is catching researchers' attention because of their potential role in removing nitrogen from the stratosphere. All PSCs provide surfaces where chlorine and bromine can be liberated from their inactive forms to enter their ozone-destroying forms. But PSCs that contain nitric acid can also play an indirect role in ozone destruction by taking nitrogen out of circulation. Because nitrogen can tie up chlorine and bromine in inactive, harmless forms, when it becomes tied up in PSCs—a process called denitrification—more chlorine and bromine can remain active to destroy ozone. And because PSC rocks fall far faster than feathery-light PSC particles, the rocks can efficiently ferry nitrogen out of some layers of the stratosphere.

Researchers had found denitrified air over the poles before, but there was no evidence to prove how it was happening. The discovery of PSC rocks is "the first time we've clearly seen reactive nitrogen being stripped from the polar arctic stratosphere," says James Anderson of Harvard University. The rocks are so big that they sink 1.5 kilometers per day compared with 0.1 kilometer per day for ordinary PSCs, Fahey and his colleagues calculate. Although relatively rare, the particles are so massive that in only a few days, their sinking could have removed about half the nitric acid above an altitude of 20 kilometers. "The removal is more widespread than we expected," says Anderson. Last year it seemed to cover an area the size of the United States.

"Now the most important question is how this system will respond to greenhouse loading," says Anderson. Fahey and his colleagues point out that the atmospheric models used to simulate denitrification are now obviously inaccurate, because they don't properly account for rocks. By allowing more chlorine and bromine to remain in their active forms, denitrification could help keep ozone destruction going over the Arctic even after PSCs disappear in the spring. And increased greenhouse gases would likely enhance that process: Although they keep heat in lower down, greenhouse gases cool the stratosphere by radiating heat to space, encouraging the cold that leads to denitrification. Also, levels of stratospheric water vapor are rising along with greenhouse gases, which would also encourage the formation of the water-rich PSC rocks.

CREDIT: ARC/NASA

Pretty but dangerous. Polar stratospheric clouds with "rock" particles may destroy more arctic ozone.

Denitrification "doesn't portend massive ozone losses" like the Antarctic's, notes Susan Solomon of NOAA, Boulder. But Fahey and his colleagues do note that it could delay recovery of ozone over the Arctic as chlorine and bromine emission controls take effect. "If you want to calculate the response of the Arctic to climate change," says Fahey, "the existence of these large particles says you need a rather sophisticated model." The next step in building such a model will be figuring out how rocks start to grow in the first place.

–RICHARD A. KERR

GENOME RESEARCH

Progress for the 'Mouse Gene Encyclopedia'

TOKYO—The imminent publication of the draft sequences of the human genome will be a major milestone in the history of biology. But many researchers regard having the sequence as the first, not the last, step in understanding how the genome works. It's also necessary to identify the genes, which constitute only a small fraction of the human genome sequence, and determine what they do. An international consortium led by Yoshihide Hayashizaki of the RIKEN Genomic Sciences Center in Yokohama, Japan, has now provided the first installment of what promises to be a key resource for filling this gap.

Beginning in 1995, the group set out to produce a complete set of complementary DNA (cDNA) copies of all the mouse genes transcribed into messenger RNAs—that is,

ScienceScope

The Ideas of March The new chair of the House Science Committee is promising to move quickly to get his panel involved in the three E's—education, energy, and the environment. Representative Sherwood Boehlert (R–NY) last week said that the panel, which oversees the gamut of U.S. nonbiomedical civilian science, will hold hearings on the topics beginning next month. He also promised scientists that he will be "your staunchest ally and your fairest critic."

After ascending to the panel's top spot last month (*Science*, 12 January, p. 222), Boehlert outlined his agenda in a 31 January speech to the Universities Research Association, a group of 89 research institutions. First priority, Boehlert said, will be to examine ways to improve precollege math and science education—from creating incentives for top students to teach, to examining the impact of standardized tests on learning. On energy, he'd like to shore up support for research into renewables. And his committee will become "a central forum to learn about the science behind" environmental controversies such as global warming and genetic engineering, he vowed. Hearings will include diverse points of view, he added, "unlike those at which [lawmakers] don't want to be confused by the facts."

Talent Hunt The new InterAcademy Council (IAC) research organization—an international version of the study-producing U.S. National Research Council (*Science*, 19 May 2000, p. 1149)—has gotten its first assignment. Science academy presidents meeting in Davos, Switzerland, last week decided that the IAC's inaugural study should focus on developing better ways to promote scientific talent and research capacity, especially in developing countries. The presidents—led by IAC co-chairs Bruce Alberts, president of the U.S. National Academy of Sciences, and Indian Academy president Goverdhan Mehta—also hired law professor Albert Koers of the University of Utrecht in the Netherlands as the group's executive director.

The study, to be funded by a Sloan Foundation grant and written by an e-mail–linked expert panel nominated by member academies, "will focus on developing young scientific talent worldwide," says Koers. A final product is due later this year. The IAC will have a small "core staff" in Amsterdam to help coordinate such projects, he added, but otherwise will be run as "a virtual organization."

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