Meteorological Society, Sim Aberson and James Franklin of the National Oceanic and Atmospheric Administration's (NOAA's) Hurricane Research Division in Miami, Florida, describe the payoff: The 1997 dropwindsonde observations improved storm-track forecasts by 31% 24 hours ahead, by 32% at 36 hours, and by 12% at 48 hours, they report, compared to computer forecasts made without the observations. The tropics were relatively quiet in 1997, prompting just five missions by the Gulfstream-IV, so "you don't want to make too much of the numbers," says Franklin. Still, he says, "we're fairly confident '98 will be like '97."

Along with better data, forecasters have better tools for interpreting the information. Their primary aid is computer modeling that incorporates the latest observations to create a picture of the storm and its surroundings and calculates how the storm will move and develop. "There has been a quantum increase in the skill of the models," says Stephen Lord, a deputy director at the NWS's National Centers for Environmental Prediction in Camp Springs, Maryland.

The prime example has been the hurricane model developed by Yoshio Kurihara, Morris Bender, and Robert Tuleya of NOAA's Geophysical Fluid Dynamics Laboratory (GFDL) in Princeton, New Jersey. The GFDL model works on two scales. Like standard global atmospheric models, it simulates the atmosphere in broad strokes to capture the river of air, thousands of kilometers across, that sets the hurricane's overall course. But it also zooms in on the hurricane's vortex, using the latest satellite and in situ data to model the storm and the way it interacts with its surroundings in fine detail.

In tests prior to becoming operational at the National Hurricane Center (NHC) in 1995, the GFDL model outperformed its predecessor, logging average track errors that were about 12%, 24%, and 28% better at 24, 48, and 72 hours, respectively. Since then, "it's been the best performer" of the half-dozen models that NHC forecasters consult before issuing an official forecast, according to James Gross of the NHC.

Even so, it can be hard to tell whether better data and models are actually improving the official forecasts, because the improved tools are new and forecasters have always had good seasons and bad, depending on the nature of the storms. But meteorologist Colin McAdie of the NHC thinks track forecasts are improving at an accelerating pace. His recent analysis shows that at all forecast times, the predictions improved twice as fast during 1992 to '96, the period when the GFDL model debuted, as they had during the previous 2 decades. The routine dropwindsonde observations that began in 1997 seem to have helped sustain that progress.

Such improvements should allow the NWS to target its hurricane warnings more precisely. When the weather service issues a hurricane warning, prompting an evacuation, it generally includes a stretch of coast three times longer than the section that eventually suffers high winds, just to be sure—which means that hundreds of kilometers are cleared but suffer little damage. With costs averaging half a million dollars per kilometer of evacuated coast, according to the NWS, not to mention a toll in public goodwill, that's an expensive insurance policy. If the improvements of the '90s can be continued, averting hurricane disasters should be cheaper and less disruptive.

–RICHARD A. KERR

BUDGET RESOLUTION

R&D Takes a Hit, But Don't Count It Out

Dividing along party lines, Congress narrowly approved a Republican budget resolution on 15 April that would hold the line on federal spending and, in the process, slash most civilian R&D budgets. The $1.7 trillion budget for fiscal year 2000, which begins 1 October, would channel surplus revenue into tax cuts and the Social Security program while requiring steep reductions in future "discretionary" domestic programs. Over the next 5 years, according to an estimate by the American Association for the Advancement of Science (AAAS, which publishes *Science*), the cuts would range from 6% for the National Institutes of Health (NIH) to 14% at the National Science Foundation (www.aaas.org/spp/dspp/rd/bdgres.htm). But the gloomy resolution comes with a silver lining: There is almost no chance that Congress will stick to its numbers.

Congressional leaders took great pride in getting the budget resolution approved early, only the second time in 12 years that they have met the deadline of 15 April. But legislators are already planning ways of getting around a measure that presents a politically unpalatable set of fiscal options. The first opportunity may arrive in a few weeks as Congress takes up an emergency bill to pay for current U.S. military operations in Kosovo. This "veto-proof" supplemental spending bill could become a vehicle for other budget-busting military ex-

ScienceScope

Diplomatic Overture The State Department wants to have some frank and fruitful exchanges with leading scientists. Under a proposal outlined by Under Secretary Frank Loy last week, members of the diplomatic corps would join with experts in a particular area—such as genetically modified crops—for roundtable discussions designed to increase the envoys' understanding of technical controversies.

The idea is one of five early responses to the findings of a National Academy of Sciences review panel, which last fall concluded that U.S. diplomats lack science savvy. Other potential improvements include appointing a special science ambassador to advise the secretary of state and beefing up science training for the agency's 25,000 employees, of whom 5% hold technical degrees. "We have heard the criticism," Loy said at a Washington conclave sponsored by AAAS, publisher of *Science*.

The plans—which Loy says are moving ahead—please panel leader Robert Frosch of Harvard University. "Sounds like a promising beginning," he says. His committee hopes to release its final communiqué on the issue this fall.

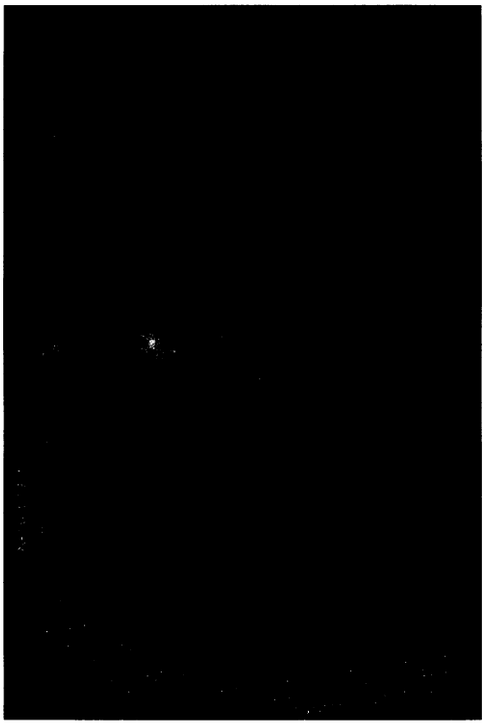
Deep Impact: The Sequel A year after astronomers had to humbly retract one warning of a possible catastrophic asteroid impact with Earth, another doomsday asteroid report has scientists up in arms. The flap began earlier this month, when Benny Peiser, who runs an electronic mailing list on neocatastrophism, found a Web preprint of a paper by Italian astronomer Andrea Milani. Milani concluded that there is a remote chance that asteroid 1999 AN_{10}, discovered last January, will slam into Earth in August 2039. In a press release, Peiser accused Milani's group of hiding the news, "instead of informing the interested public about their potentially explosive findings." The story made headlines around the world, although many reporters emphasized the one-in-a-billion odds of impact.

The attack on Milani and the ensuing coverage have outraged many astronomers. In posting the unpublicized preprint for other researchers to review, "Milani did the right thing," says David Morrison of NASA's Ames Research Center in Mountain View, California. But astronomers could use guidance on how to handle predictions and the press, he adds. He and others will try to hammer out guidelines for releasing potentially scary news at a meeting in Turin, Italy, in June. Says Morrison: "We're still in a learning process."

ASTRONOMY

Starving Black Holes Sound an SOS

An x-ray satellite may have heard the whimpers of dying quasars. The Japanese Advanced Satellite for Cosmology and Astrophysics (ASCA) has picked up feeble high-energy x-rays from six old, nearby galaxies —the distress signals of supermassive black holes starving to death. Or so say American and British astronomers who presented their results last week at the meeting of the High Energy Astrophysics Division of the American Astronomical Society in Charleston, South Carolina.



Cry of the heart. X-rays from the core of the galaxy M87 may reveal a black hole feeding on a trickle of gas.

The results suggest that the giant black holes powering quasars, brilliant galaxylike objects in the early universe, did not shut down completely as their food supply—interstellar gas—dwindled. Instead, say Tiziana Di Matteo of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, and Steven Allen and Andy Fabian of the Institute of Astronomy in Cambridge, U.K., such black holes continue to emit a whisper of x-rays, generated by a slow trickle of very hot gas. Some other researchers aren't convinced by this picture, which the astronomers also describe in a paper submitted to the *Monthly Notices of the Royal Astronomical Society*. But if it's correct, it implies that part of a mysterious glow of x-rays that fills the universe might come from starving quasars.

Astronomers already suspected that the giant elliptical galaxies where ASCA picked up the x-ray signals harbor black holes millions or billions of times more massive than the sun. In five of the six, says Fabian, stars and gas whip around the center at high speeds, apparently in the grip of a powerful gravitational field. But these black holes had seemed quiescent, like those thought to sleep at the centers of our own galaxy and others. The black holes may once have produced the prodigious radio and x-ray emissions that emerge from active galactic nuclei and quasars, but they long ago fell silent.

Or so astronomers thought. Di Matteo, Allen, and Fabian say that the small quantities of high-energy x-rays that ASCA picked up are just what you would expect of a quasar still being fed by a trickle of gas. Instead of forming the flat, dense disk of infalling material thought to surround the black hole in a quasar or active galaxy, the meager infall should form a bloated, tenuous disk, or torus. According to theoretical models, the ionized hydrogen in such a low-density disk would grow very hot, because hydrogen nuclei, or protons, radiate energy slowly. In a denser disk they can transfer energy to electrons, which radiate millions of times more efficiently, but in a rarefied disk, collisions between the protons and electrons would be infrequent. The superheated gas would slowly leak very high-energy x-rays.

"It's a plausible model," says Bram Achterberg of Utrecht University in the Netherlands, "although it's not completely clear that such hot, thick disks can remain dynamically stable over long periods of time." Julian Krolik of Johns Hopkins University in Baltimore also questions the assumption that heat would be bottled up in the protons. "Laboratory experiments indicate that there are many more mechanisms [for electrons and protons] to exchange energy" than the models allow, he says.

Fabian concedes that he and his colleagues also can't be sure the faint x-rays really are coming from the cores of the elliptical galaxies; ASCA's positional accuracy of half an arc minute is simply not high enough. "There's a lot of galaxy in half an arc minute," he says. But he says that NASA's Chandra X-ray Observatory, due to be launched later this year, will "without doubt deny or confirm our model."

If it does hold up, such faint x-ray signals could support astronomers' suspicions that droves of supermassive black holes lurk in nearby galaxies. The murmurs of starving

CREDITS: (TOP) NASA; (BOTTOM) ASCA

ScienceScope

Comet Tale A nifty NASA plan to land a probe on a comet's head appears to be back on track after a budget scare. Researchers at the Jet Propulsion Laboratory in Pasadena, California, want to send the Champollion spacecraft to a 2006 rendezvous with comet Tempel 1. But earlier this month, the $158 million project seemed imperiled by budget strains caused by unplanned expenses in other science programs, including a $76 million emergency repair mission to the Hubble Space Telescope (*Science*, 19 March, p. 1827) and mounting expenses related to the delayed Chandra X-ray Observatory (above). Worried that his dream child would be sentenced to death, project scientist Paul Weissman earlier this month sent a letter to colleagues appealing for help.

This week, however, Weissman said the scare turned out to be much ado about nothing. After presenting a revised design to NASA brass, who were worried that the project was over budget, the cancellation demon is "back in the bag," he says. However, sources say agency officials are still looking for savings elsewhere in the space science portfolio—a threat that has some researchers looking over their shoulders.

AIDS in Spain Stepping up its fight against AIDS, Spain—the nation with Europe's highest per capita AIDS rate—last week created a new fund to support research into the disease. Five international drug companies have teamed with the Spanish government to establish the Foundation for Research and Prevention of AIDS, which will spend $3 million a year on peer-reviewed basic research, clinical trials, and public health studies.

The foundation starts with a $600,000 kitty, endowed equally by the Ministry of Health and the five companies: Abbott Laboratories, Bristol-Myers Squibb, Glaxo Wellcome, Merck Sharp & Dohme, and Roche. Each firm will chip in another $670,000 a year, starting next year. About 120,000 Spaniards were infected with HIV in 1998; another 53,000 have AIDS. AIDS researcher Josep Mallolas of the University of Barcelona Hospital Clinic calls the new foundation "very good news—not only for AIDS research but also for [Spain's] biomedical sciences in general."

Contributors: David Malakoff, Govert Schilling, Xavier Bosch