colleague Robert Balling have seen in data from the Eastern Seaboard of the United States. In 16 years of records, they found that 20% more rain fell over the Atlantic on Saturdays and Sundays than on weekdays; over a 50-year period they also logged weaker coastal cyclones on weekends—patterns that could hardly result from any gradual global change. Instead, Cerveny and Balling argued in *Nature* last summer, they reflect a buildup of industrial pollutants throughout the week. The haze, especially heavy at the end of the week, provides condensation nuclei for moisture, fostering the growth of heavy clouds, which shed rain on weekends. Although the weaker cyclones are more of a mystery, the authors believe that they're also tied to the rainfall increase.

Another unmistakably regional effect is seen halfway around the world, where decades of overirrigation have drained the Aral Sea, which straddles the former Soviet republics of Kazakhstan and Uzbekistan. Without the water's moderating effects, summers are hotter and drier, while winter temperatures have dropped.

The handful of scientists working full-throttle on regional climate change think these kinds of findings could ultimately make climate change seem a more immediate issue, and perhaps a more tractable one. "We framed the climate change problem … as a global problem with a global solution," says Roger Pielke Jr., a political scientist at NCAR. It's possible, he and others say, that focusing on how climate is changing by region will goad more individuals into taking action against, for example, deforestation, which could also have a ripple effect on global climate problems. "The global climate is the sum of these regions," says Bonan. "[Regional] change is occurring at a spatial scale that we can respond to. … It's occurring at a time scale that we can respond to." **–JENNIFER COUZIN**

Jennifer Couzin is a former intern at *Science*.

MEETING AMERICAN ASTRONOMICAL SOCIETY

Seeking Lasting Truths Among the Stars

AUSTIN, TEXAS—Thales, the ancient Greek astronomer, is said to have fallen down a well while gazing at the stars and not paying attention to his surroundings. Attendees at the American Astronomical Society meeting, held here from 4 to 9 January, could hardly be accused of the same fault, as they issued dozens of press releases and gave a string of press conferences. Although some results were oversold, some could be for the ages.

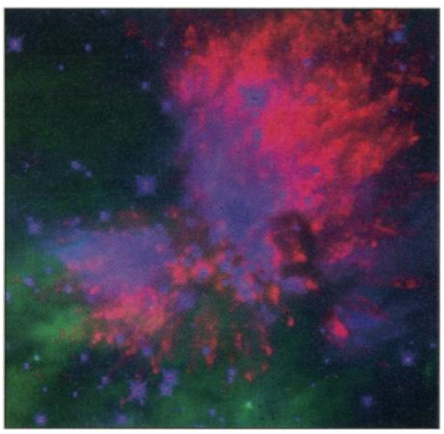
Soggy Cradles of Stars

The birthplaces of stars and planets are surprisingly damp, observations by the recently launched Submillimeter Wave Astronomy Satellite (SWAS) suggest. "We're seeing water everywhere we look," says SWAS principal investigator Gary Melnick of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts.

SWAS, launched by NASA on 5 December, is the first satellite ever to observe the universe at submillimeter wavelengths. This long-wavelength radiation, between the infrared and radio, is emitted by low-temperature molecules, including water, in the cool clouds of gas and dust that collapse to form new stars and planets. At the meeting, the SWAS team reported that their first 2 weeks of observations had revealed about one water molecule for every million hydrogen molecules in these cool clouds—about 10 times as much as expected from older observations made from an airplane.

"Their value for cool water is surprisingly high," says Ewine van Dishoeck of Leiden University in the Netherlands, "although I'm not yet convinced that they've looked at really cold clouds." If it holds up, the discovery of abundant water in the star-forming clouds could answer long-standing questions about the starting ingredients of planetary systems and about how the clouds lose enough energy to collapse into stars and planets.

Infrared satellites like the European Space Agency's Infrared Space Observatory (ISO) had already revealed large amounts of water vapor in the warmest parts (around 100 K) of the star-forming clouds. But submillimeter emissions from water in the cooler parts of the cloud are invisible to ISO. As a result, the chemistry of the cool parts of the clouds—direct precursors to new stars—has been a mystery. No one was sure whether the oxygen and hydrogen there combined to form water, and if they did, how much oxygen would be left to form molecular oxygen or carbon monoxide. Now, says Melnick's colleague David Neufeld of The Johns Hopkins University in Baltimore, the SWAS observations reveal that "almost all the oxygen [in the cool clouds] is in the form of water."



Heart of a cloud. Molecular hydrogen (red) and dust (blue) in the Orion Molecular Cloud.

The finding supports a 30-year-old theory that water molecules are the fundamental cooling agents in molecular clouds, which have to radiate excessive heat while collapsing into stars and planets. Water molecules have lots of energy levels and get easily excited by collisions with hydrogen molecules. When they fall back to their ground state, the energy is radiated away. "This is the first time that we can back up this theory with observations," says Melnick. **–GOVERT SCHILLING**

Govert Schilling is an astronomy writer in Utrecht, the Netherlands.

Superflares From Giant Planets

A giant planet around another star may have announced its presence 100 years ago, although 19th century astronomers did not realize what they were seeing, say two Yale University astronomers. Bradley Schaefer and Eric Rubenstein propose that an interplay between the magnetic fields of the star and a nearby giant planet could have caused a strange brightening of the star. The same mechanism, they believe, may explain similar flare-ups seen in other stars over the years.

In 1899, astronomers noticed a 10-fold brightening of S Fornacis, which lasted for a few hours. Since then, observers have seen a bunch of other apparently unremarkable stars pour out far more x-rays and visible light than usual for a few hours or days. The outbursts resemble solar flares, which go off when the sun's magnetic field suddenly rearranges itself. But these "superflares" are 100 to 10 million times more energetic, and no one has been able to explain them.

Surprisingly, Schaefer found that nine of the superflaring stars are very much like the sun. Any theory must explain why the sun doesn't have them, says Schaefer, and Rubenstein's model does just that.

In their duration and energy, the superflares are very much like the outbursts of a certain type of binary star, known as RS CVn binaries, says Rubenstein. In these systems, two magnetized stars orbit each other so closely

CREDIT: ED ERICKSON, ANGIE SCHULTZ, SEAN COLGAN, AND NASA that their magnetic field lines become entangled. Eventually, the field lines reconnect into a more relaxed configuration, like twisted rubber bands suddenly unsnapping, and energy is released in a tremendous burst of x-rays, ultraviolet radiation, and visible light.

The nine sunlike stars don't have a close companion, but "a similar interaction could occur with a Jupiter-like planet orbiting the star at close distance," says Rubenstein. Over the last couple of years, many of these "hot Jupiters" have been found around sunlike stars. He says the sun is relatively quiet because Jupiter and Saturn, with their strong fields, orbit at a safe distance.

For the model to work, the superflaring stars should have strong magnetic fields. "We've checked the field strengths for two of them" by studying the stars' spectra, says Schaefer, "and they both turn out to have very strong fields." According to Rubenstein, "the model doesn't need any new physics. We know stars with strong magnetic fields exist. We know hot Jupiters exist. And the model provides a natural explanation for the fact that the sun doesn't have superflares."

Solar flare expert Kees de Jager of Utrecht University in the Netherlands is cautious, however. "It's always easy to come up with a qualitative model," he says. "I'd like to see a quantitative analysis" of whether the interaction of a star's magnetic field with a planet's really could lead to the observed energetic bursts. Rubenstein agrees. "I'll have to work on that before submitting a paper," he says.

Meanwhile, Schaefer thinks that watching for flares could guide searches for extrasolar planets. He proposes building a wide-angle telescope with a dedicated camera, which could scan over a million sunlike stars every night. "Superflaring stars might be the ones planet hunters should pay more attention to," he says. –G.S.

Cosmic Expansion, Poco Adagio

An exploding star called Albinoni, shining from when the universe was less than half its present age, is providing astronomers with a fresh handle on a mysterious energy that seems to permeate the cosmos and boost its expansion rate. A preliminary analysis of Albinoni—at roughly 9 billion light-years away the most distant supernova ever seen—hints that at the farthest distances and earliest times yet probed, the expansion may not have been accelerating as it appears to be doing today. That's just what theory predicts, Saul Perlmutter of Lawrence Berkeley National Laboratory in California said at the meeting.

Perlmutter, who leads one of two international teams that discovered the accelerating expansion from less distant explosions (*Science*, 18 December 1998, p. 2156), stressed that "we just have had a chance to look at our discovery image and make a rough estimate of the brightness of the supernova." The apparent brightness of supernovae is a measure of their distance, and therefore of the rate at which cosmic expansion has swept them away over billions of years. The supernovae studied up to now were a little dimmer, and hence farther, than expected, implying that cosmic expansion has sped up since they exploded.

Extremely distant supernovae, shining from well back in cosmic history, should reveal a change in the cosmic push at the earliest times if the background energy, called the cosmological constant, or lambda, is real. That's because the density of this energy throughout space should be constant for all time, so the push it produces to counteract gravity and accelerate expansion is also constant. In the early universe, where the same amount of gravitating matter as today was packed into a smaller volume, gravity would have been strong enough to overwhelm lambda and slow the expansion. Lambda would win out and produce an accelerating universe only in the last few billion years, as gravity's grip weakened.

Albinoni, spotted late last year, seems to be a little brighter—hence nearer—than it would be if the expansion had been accelerating continuously since it exploded. Perlmutter stresses that this conclusion could change with further observations and analysis. But for now, it shows the power of distant supernovae for distinguishing between the cosmological constant and possible confounding factors, such as dust. If a haze of cosmic dust, rather than an accelerating universe, is what dims the nearer supernovae, distant supernovae should also be anomalously dim, not bright, said Robert Kirshner of the Harvard-Smithsonian Center for Astrophysics, a member of the other supernova team who spoke at the same session. "Pushing to bigger [distances] is definitely the way to see the effect of the lambda cosmology as distinct from dust," explained Kirshner, who said that his own team is also chasing remote explosions. –JAMES GLANZ

MEETING AMERICAN GEOPHYSICAL UNION

New Data Hint at Why Earth Hums and Mountains Rise

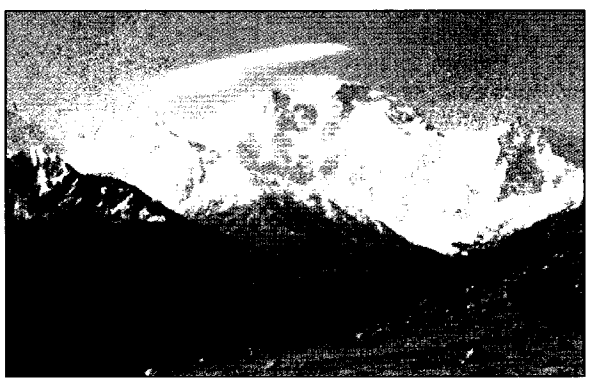
SAN FRANCISCO—Topics ranging from the atmosphere to the inner Earth were served up at the annual fall meeting of the American Geophysical Union here last month. Below, we report two surprising new ideas on how the solid Earth interacts with the atmosphere and with the water on its surface: why Earth hums and how a river may be able to raise a mountain.

Big Rivers May Make Big Mountains

Everyone knows that rivers whittle down mountains, but at the meeting an international team of researchers stood that idea on its head, at least for some of the world's tallest peaks and most powerful rivers. The team concluded that Nanga Parbat, the "killer mountain" of the Himalayas and the sixth highest mountain in the world, reaches its lofty zenith because the nearby Indus River triggers a deep-seated rise in the Earth's crust.

According to a group of geologists and geophysicists led by geochronologist Peter Zeitler of Lehigh University in Bethlehem, Pennsylvania, rapid erosion by the Indus creates a "tectonic aneurysm"—a weak spot in the crust where deep, hot rock bulges upward and carries Nanga Parbat up with it. "They've got a diverse array of evidence that this is real," says geomorphologist Robert Anderson of the University of California, Santa Cruz. "I'm excited about the idea." If the causative link between river and mountain is confirmed, it would be a new way to make the planet's highest ground.

Mountaineers are in awe of Pakistan's 8125-meter-high Nanga Parbat, the last big peak at the western end of the Himalayan chain. And the mighty Indus snaking nearby is a fitting companion. In spring, snowmelt



A river ran it up? Nanga Parbat may owe its towering heights to the Indus River that runs beside it.

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