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SCIENCE & TECHNOLOGY

## Rainmaking Has Its True Believers -- And Skeptics

Weather modification isn't just about giant storm systems. Rainmaking and hail prevention are considered established arts in some countries. China has 35,000 people engaged in weather management, and it spends \$40 million a year on alleviating droughts or stemming hail that would damage crops. Russian officials claim to order up clear skies for Moscow's May Day parade. It's done by saturating clouds with dry ice, producing so many tiny droplets that drops can't grow big enough to fall as rain -- at least for a while.

In the U.S., though, there is no clear consensus on how well such techniques work, or if they work at all. In the 1970s the U.S. plowed \$20 million a year into cloud-seeding research, but almost all federal funding has since dried up.

Nevertheless, dozens of state, local, and private operations continue in 10 states, including California, Idaho, Nevada, and Utah. Vail Mountain in Colorado and many other ski resorts pay for cloud seeding, and Vail estimates that teasing more precipitation from clouds boosts its snowpack by 15%.

While modern rainmakers and their clients believe the technology works, convincing the skeptics will be difficult. For the statistical proof that science normally requires, the data on weather-modification efforts might need to span 60 years or more -- at least two of earth's 30-year weather cycles. Only a few of the cloud-seeding programs, including one in Saudi Arabia and one in Wyoming, are now collecting rigorous data.

Perhaps the most controversial technology comes from Russia and Mexico. In 1996, Russian space and weather-control scientists hooked up with Gianfranco Bisiacchi, then head of Mexico's space efforts, and founded Electrificación Local de la Atmosfera Terrestre (ELAT). Nominal results from the three ground stations set up by ELAT in 1998 were so impressive -- rainfall was reported to increase by as much as 30% -- that Mexican state governments were soon clamoring for more facilities. There are now 13, with additional ones being installed in Baja California and the state of Puebla.

ELAT claims credit for ending the severe drought in northern Mexico. Since 2000, says Bisiacchi, the amount of annual rain in the region has been "30% to 35% greater than what it was during the 1990s. In fact, the lakes of the region that were dry are now full." When operations in the northern states of Sonora and Chihuahua started in 2004, he adds, most lakes were around 8% full. "We've now gone to levels of 85% to 90% -- in just one year."

ELAT says its technology is more efficient than regular cloud-seeding methods. "Milking" clouds is usually done by sprinkling them with particles of silver iodide. The particles provide a site where the clouds' ice crystals accumulate in clumps too heavy to stay aloft. Bisiacchi and his team take a different tack: They generate charged ions on the ground and point them skyward. That, they claim, fosters clumping on both airborne dust particles and ice crystals touched by a charged ion.

This technology has plenty of skeptics. "Personally, I think it's a hoax," says Roelof T. Bruitjes, a weather-modification expert at the National Center for Atmospheric Research (NCAR) in Boulder, Colo. "It has no scientific

basis."

Bisiacchi isn't fazed. "Look," he says, "this is new technology -- a new scientific hypothesis. It's the same whenever you try to do something really new." ELAT aims to change the prevailing negativism. The company is now setting up ground stations that will be used for research, including one south of Laredo, Tex. It will host a yearlong test by ELAT's U.S. licensee, Ionogenics Corp. in Bedford, Mass. "We hope to collect enough data to validate the concept that ionization does, in fact, affect the behavior of atmospheric physics within a certain proximity of the station," says Ionogenics Corp. CEO Phillip T. Kauffman.

NCAR's Brintjes figures that regular cloud seeding will soon turn respectable. "In the next 5 to 10 years, I definitely think we're going to see great changes," he says. New radar technology, advanced computer modeling software, and much faster supercomputers "will provide a whole new view of cloud seeding -- and be able to quantify cloud seeding's effectiveness," he maintains.

Rainmaking's potential at one point even tantalized a blue-ribbon science panel convened by the National Academy of Sciences. In its October, 2003, report, the group called for a concerted national research program to settle the dispute over cloud seeding. It hasn't happened yet. The technology is not even on the Administration's long-range radar screen. For the moment, all federal funding for cloud-seeding research is gone.

By Otis Port

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