Is Earth Pelted by Space Snowballs?

Images from a NASA satellite suggest that Earth is bombarded every day by thousands of house-size snowballs, a previously unknown type of interplanetary object. These frozen missiles break up high above Earth's surface and send down a gentle cosmic rain, according to a controversial report.

The evidence, reported this week in Baltimore at a meeting of the American Geophysical Union, appears to vindicate, at least in part, the ideas of Louis A. Frank of the University of Iowa in Iowa City, who for a decade has withstood the disbelief of colleagues.

"My attitude has changed from one of very great skepticism to one of fascination. We've got a very interesting problem to cope with," comments Thomas M. Donahue, a space scientist at the University of Michigan in Ann Arbor who has examined the new data.

Frank first detected signs of these interplanetary snowballs in the early 1980s, while examining ultraviolet (UV) images of Earth's atmosphere taken by the Dynamics Explorer 1 satellite. In the daytime, oxygen in the atmosphere emits UV light, creating a glow that satellites can detect when looking down on Earth. Frank found thousands of tiny dark spots in images of this glow. He interpreted the spots as clouds of water vapor high in the normally bone dry atmosphere.

To explain the water vapor, Frank hypothesized in 1986 that a previously unknown group of what he called "small comets" was pelting Earth and bringing water into the upper atmosphere.

Other researchers found the proposal hard to stomach. Frank's theory demanded revisions of long-accepted ideas about water on Earth, Venus, and Mars. It suggested, for instance, that Earth has been continually gaining water and may have acquired several oceans' worth over geologic time.

"Its influence in several fields of science will be profound," Alexander J. Dessler told SCIENCE NEWS in 1986. At that time, he was editor of GEOPHYSICAL RESEARCH LETTERS and had accepted Frank's report for publication.

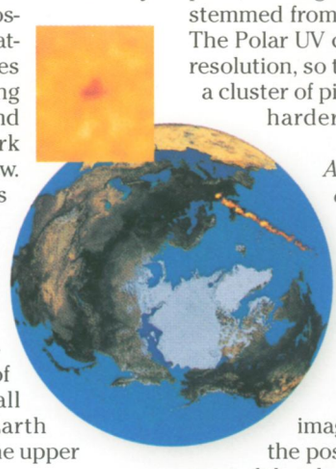
Other scientists later published 11 critical replies to Frank's work, and Dessler attacked the theory in 1991. Since then, many scientists have regarded the idea as dead.

Meanwhile, Frank was working on imaging equipment to fly on NASA's Polar satellite, launched in early 1996. The satellite's main mission is to study the solar plasma, but Frank designed his set of cameras to look for the suspected "small comets" as well.

Images from the Polar cameras have not only confirmed the original observations but provided even stronger evidence of these objects, Frank reported at the meeting. "When we first saw all these things, it just amazed us. I feel happy that it's confirmed. It's been a hard battle," he says.

The new evidence comes from Polar's Visible Imaging System, a set of three different cameras run by Frank's team. One camera, which senses UV light, has detected dark spots in Earth's normal UV glow—the same kind of spots first observed years ago by the Dynamics Explorer 1 satellite.

Many scientists discounted those earlier images because the dark spots usually spanned only one picture element, or pixel, raising the possibility that they stemmed from a problem in the camera. The Polar UV camera has a much higher resolution, so the dark spots spread over a cluster of pixels, making the blotches harder to explain away.

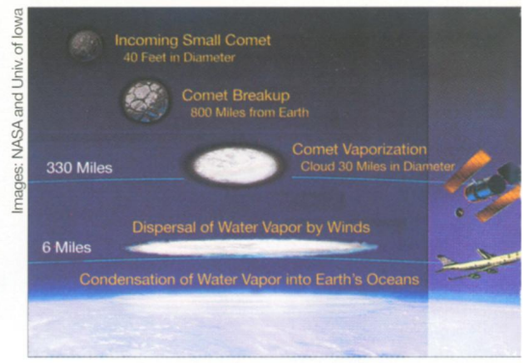


A bright streak, captured by an ultraviolet camera on the Polar satellite, may indicate a large icy object plummeting toward Earth. Inset shows dark spot in an image of Earth's normal ultraviolet glow.

In addition, Frank has images that appear to show the postulated snowballs hurtling toward the planet. When the UV and a visible-light camera look just above Earth's atmosphere, they detect long streaks of bright light. Frank interprets the streaks as sunlit clouds of water vapor and other gases coming off some of the snowballs as they near Earth.

The images were convincing enough to persuade several former skeptics that some new type of water-bearing object is pelting Earth's atmosphere. "You have to accept that these things are bringing water to this planet, at least in the present epoch," says Donahue. "It's exciting that a guy who was pretty badly pilloried is going to be vindicated, at least as far as the observations are concerned."

Robert R. Meier of the Naval Research Laboratory in Washington, D.C., comments that "they've certainly vindicated the old observations. I'm convinced now that [Frank] is seeing something, and now we need more data to really understand what this phenomenon is."



Images: NASA and Univ. of Iowa

The fate of the hypothesized small comets entering Earth's atmosphere.

Both Donahue and Meier caution that the new observations do not necessarily confirm Frank's original hypothesis, with all its sweeping implications.

It is unclear, for instance, exactly what these objects are. "These things look like comets, and they quack like comets. But they can't possibly be comets in the traditional sense," says Paul D. Feldman of Johns Hopkins University in Baltimore.

If the small objects were comets, their gradual evaporation should have added significantly to the amount of hydrogen in the space between Earth and Mars. Scientists detect no such enrichment. To circumvent this problem, Frank has proposed that the snowballs are covered with a carbon skin that keeps them from vaporizing until they get within 2,000 kilometers of Earth, close enough for gravity or electrical forces to tear them apart.

The new data have not silenced all of Frank's former critics. Until an independent team confirms the observations, Dessler says, he will remain doubtful. "There's too much evidence against the small comet theory," he says.

For instance, scientists studying the moon have found no evidence of craters created by the impact of these snowballs. What's more, seismic detectors left on the moon by Apollo astronauts have not detected any crashes of the hypothesized bodies, even though each would equal a 15-kiloton blast, says Dessler.

The Polar satellite is carrying another UV camera that could, in theory, provide independent confirmation of Frank's observations. The team operating that camera has not been able to provide corroboration thus far, but the camera has only operated in the appropriate mode for a few hours. —*R. Monastersky*