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**Two UW scientists study clouds and haze for clues to global warming**

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Researchers need to get their head in the clouds if they're going to understand global warming.

Polluting "greenhouse gases" that catch and hold heat are one set of players in climate change, but the role of clouds and other atmospheric particles are just as important to figuring out what the future may hold, experts say.

Two University of Washington scientists are trying to clear up some of the mystery with a \$200 million satellite. The unique instrument will circle 435 miles above the Earth, creating the first-ever high-resolution 3-D images of clouds and haze, and how they form, dissolve and affect climate.

But a Boeing Co. strike and battery troubles -- the most recent in a string of delays -- have kept the promising project grounded. It's frustrating local researchers, and even NASA officials call the holdup "dismaying."

"There is a great deal at stake, and we really need to get this satellite launched," said Robert Charlson, one of the UW scientists. "We're going to find surprises and that's an exciting thing."

Clouds and particles that create a haze -- including smoke, desert dust, pollution from burning fossil fuels and volcanic ash -- can reflect the sun's radiation, helping cool the planet. Some particles, such as soot or airborne soil dust, can absorb heat, contributing to warming.

The cooling or warming effect of the particles depends on their attributes -- where they're located in the atmosphere, what they're made of, plus how they're layered with other clouds and haze. They can also change the density and reflection of clouds.

"We should understand the reflectivity as well as we do the 'greenhouse effect' -- and we don't," Charlson said.

That's not for a lack of trying.

Charlson, a chemist and atmospheric scientist, has been trying to unravel the nature of airborne particles for more than 40 years.

In 1998, he and UW colleague Tad Anderson received an ongoing grant from NASA to undertake a project allowing the first direct observations of clouds and haze reflecting solar radiation.

It requires the launch of a satellite named CALIPSO, which will join a train of orbiting satellites, all collecting different kinds of data.

Simultaneous results from the satellites will build a more complete picture of what's happening in the

atmosphere.

Satellites have a limited lifespan, heightening the urgency of the CALIPSO launch.

The NASA-led project has cost more than \$200 million, plus a contribution of up to \$75 million from the French government.

A team of 25 international scientists are working on the research project. Besides the UW, other participants include Hampton, Colorado State and Oregon State universities; the universities of Wisconsin-Madison, Maryland, Arizona and Alaska; and multiple NASA centers and French institutes.

The satellite will use a radar mapping technology called LIDAR that employs light waves to plot where the clouds and other particles are in the atmosphere. It creates images that show their thickness and exact height and location relative to each other. CALIPSO should operate for at least three years, scientists say.

The original hope was to launch the satellite -- which will be sent up with another called CloudSat -- in April 2004.

Then it was bumped to April 2005. Embossed invitations to a Sept. 29 launch were mailed, but that plan was hampered by a Department of Defense launch that took priority, followed by the battery problem and strike.

Developmental delays on "one-of-a-kind" spacecraft and instruments "are not unusual," said Steve Volz, NASA's program executive for CALIPSO (Cloud Aerosol LIDAR and Infrared Pathfinder Satellite Observation).

But, he added: "The last six months have been incredibly unusual. ... It is upsetting."

About 1,500 Boeing machinists in California, Alabama and Florida went on strike Nov. 2.

Some of these workers are needed to launch the rockets that shuttle the satellites into space.

A key sticking point is whether new employees will be eligible for retiree medical benefits. After a monthlong strike ending in September, Boeing machinists here approved a contract that included those benefits, a union negotiator said.

"We feel that we've given them an extremely generous offer," said Dan Beck, a Washington, D.C.-based spokesman for the aeronautical company.

Both sides say they're sorry for the launch delay.

"Tell those folks at the university that I'm sorry for their situation, I truly am," said Gary Quick, chairman of the union negotiating committee in Huntington Beach, Calif.

"I wish we were back launching rockets."

The batteries are being rechecked this month to make sure they're working correctly, NASA's Volz said.

But even if the strike ended tomorrow and the batteries worked, the earliest possible launch is now mid-

February.

There's a backlog of launches and California's Vandenberg Air Force Base -- CALIPSO's launch site -- will shut down soon for regular maintenance.

Once in orbit, CALIPSO will send back data that should be ready for analysis in only a few months' time, researchers predict.

It could turn out, said the UW's Anderson, that reflectivity has "masked" the warming caused by greenhouse gases.

That would mean that the climate is more sensitive to manmade changes than presently believed -- and that global warming could be more dramatic in the future, or perhaps natural temperature fluctuations are larger than realized.

Warned his colleague, Charlson: "We have perturbed the climate system in very substantial ways and we don't know the consequences."

## **LEARN MORE**

Read about the CALIPSO project and see the images it will generate based on data from a test run:  
[www-calipso.larc.nasa.gov](http://www-calipso.larc.nasa.gov)

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