Hurricane-forecast satellites will keep close eyes on the tropics

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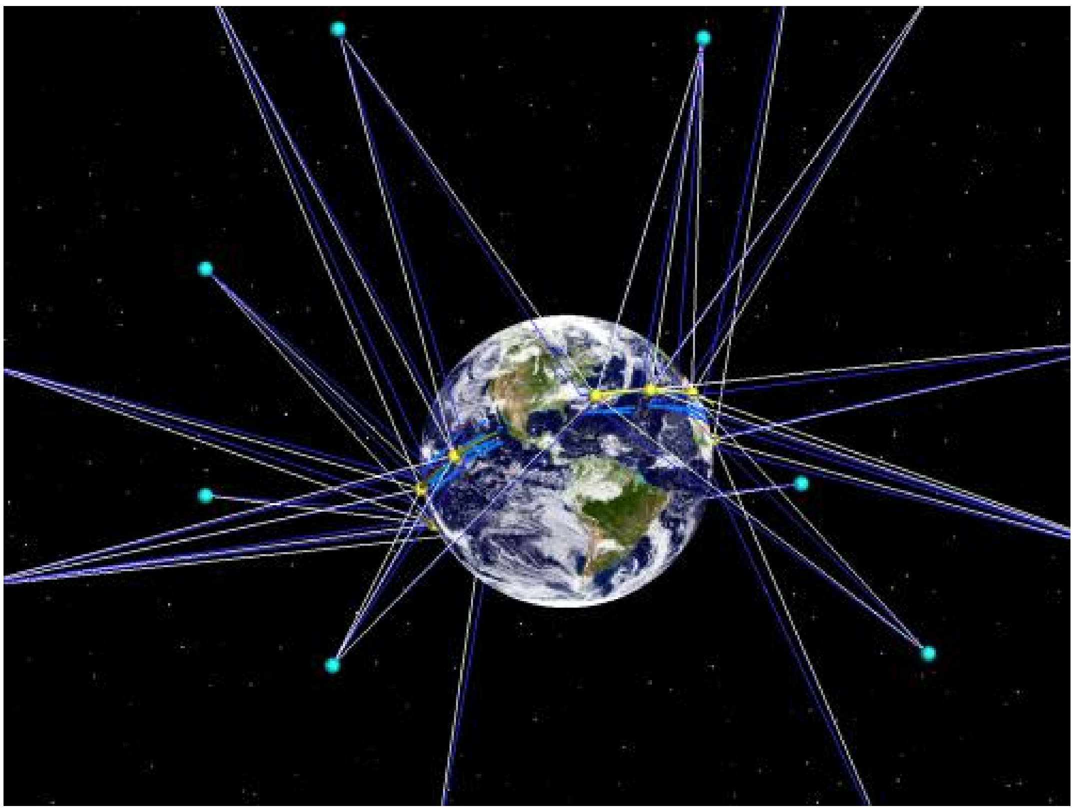

A set of eight satellites -- each about the size of a microwave oven -- will launch in 2016 and provide scientists unprecedented information about the formation and evolution of hurricanes. Credit: Aaron Ridley

A set of eight hurricane-forecast satellites being developed at the University of Michigan is expected to give deep insights into how and where storms suddenly intensify—a little-understood process that's becoming more crucial to figure out as the climate changes, U-M researchers say.

The Cyclone Global Navigation Satellite System is scheduled to launch in fall 2016. At the American Geophysical Union Meeting in San Francisco this week, U-M researchers released estimates of how significantly CYGNSS could improve wind speed and storm intensity forecasts.

CYGNSS—said like the swan constellation—is a $173-million NASA mission that U-M is leading with Texas-based Southwest Research Institute. Each of its eight observatories is about the size of a microwave oven. That's much smaller than a typical weather satellite, which is about the size of a van.

The artificial CYGNSS "constellation," as researchers refer to it, will orbit at tropical, hurricane-belt latitudes. Its coverage will stretch from the 38th parallel north near Delaware's latitude to its counterpart in the south just below Buenos Aires.

Because of their arrangement and number, the observatories will be able to measure the same spot on the globe much more often than the weather satellites flying today can. CYGNSS's revisit time will average between four and six hours, and at times, it can be as fast as 12 minutes.

Conventional weather satellites only cross over the same point once or twice a day. Meteorologists can use ground-based Doppler radar to help them make predictions about storms near land, but hurricanes, which form over the open ocean, present a tougher problem.

"The rapid refresh CYGNSS will offer is a key element of how we'll be able to improve hurricane forecasts," said CYGNSS lead investigator Christopher Ruf, director of the U-M Space Physics Research Lab and professor of atmospheric, oceanic and space sciences.

"CYGNSS gets us the ability to measure things that change fast, like extreme weather. Those are the hardest systems to measure with today's satellites. And because the world is warmer and there's more energy to feed storm systems, there's more likelihood of extreme weather."

Through simulations, the researchers quantified the improvement CYGNSS could have on storm intensity predictions. They found that for a wind speed forecast that is off by 33 knots, or 38 miles per hour—the average error with current capabilities—CYGNSS could reduce that by 9 knots, or about 10 mph.

Considering that the categories of hurricane strength ratchet up, on average, every 20 mph, the accuracy boost is "a very significant number," Ruf said.

"I'd describe the feeling about it as guarded excitement," he said. "It's preliminary and it's all based on models. People will be really excited when we get up there and it works."

The numbers could also improve as scientists update weather prediction tools to better use the new kind of information that CYGNSS will provide.

For people who live in common hurricane or typhoon paths, closer wind speed predictions could translate into more accurate estimates of the storm surge at landfall, Ruf said. That's the main way these systems harm people and property.

"The whole ocean gets higher because the wind pushes the water. That's really hard to forecast now and it's an area we hope to make big improvements in," Ruf said.

Researchers expect the satellite system to give them new insights into storm processes. Hurricanes evolve slowly at first, but then they reach a tipping point, says Aaron Ridley, a professor of atmospheric, oceanic and space sciences.

"The hurricane could be meandering across the Atlantic Ocean and then something happens." Ridley said. "It kicks up a notch and people aren't exactly sure why. A lot of scientists would like to study this rapid intensification in more detail. With a normal mission, you might not be able to see it, but with CYGNSS, you have a better chance."

The satellites will operate in a fundamentally different way than their counterparts do. Rather than transmit a signal and read what reflects back, they'll measure how GPS signals from other satellites bounce off the ocean surface. Each of the eight CYGNSS nodes will measure signals from four of the 32 Global Positioning System satellites.

They'll also be able to take measurements through heavy rain—something other weather satellites are, surprisingly, not very good at.

Provided by University of Michigan

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