

How ASU researchers are measuring what really cools Arizona cities

By Marshall Terrill , ASU News
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University research often conjures images of laboratories, libraries and computer screens. But for Arizona State University scientists studying extreme heat, the work often happens outside, hauling equipment and taking measurements under the Arizona sun.

At ASU's [Center for Hydrologic Innovations](#), the city itself is the laboratory.

The center's work takes researchers into parks, neighborhoods and other urban spaces, where lawns, trees and the built environment become part of an experiment unfolding across one of the hottest metropolitan regions in the country.

Through partnerships across the university and beyond, the center has created a network of real-world observation sites. Towers installed across the Valley continuously measure how irrigated landscapes influence heat while tracking evapotranspiration and the exchange of carbon between the land and atmosphere.

The measurements capture more than a snapshot of Arizona's hottest months. Collected year-round, the data will show how landscapes respond as temperatures and seasons change, giving researchers, policymakers and communities a clearer picture of what works.

Their findings could also help shape how Arizona adapts to a hotter future while balancing the need for cooler cities with the realities of living in the desert.

"Phoenix is America's hottest city and conditions are worsening over time. This basic research helps us understand how different urban land covers affect the heat affecting our

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communities,” said Enrique Vivoni, ASU Fulton Professor of Hydrosystems Engineering and director of the Center for Hydrologic Innovations. “From this baseline, we can engineer improved outdoor environments that use our limited water to maximize cooling benefits. The innovations developed and tested here in Phoenix will be vital to other regions as heat worsens globally.”

The following photo essay gives a firsthand look at how that work is done.

Photos by Samantha Chow/Arizona State University

ASU Assistant Research Technologist Alonso Haros straps into a harness before climbing an eddy covariance tower at the Desert Botanical Garden in Phoenix on July 28. With lightning in the distance and a thunderstorm building overhead, Haros climbed the 23-foot tower for routine maintenance.

“These are super sensitive pieces of equipment that require a fair amount of maintenance in order for us to harvest quality data,” Haros said.

ASU Research Assistant Professor Nidia E. Rojas-Robles (back) and hydrosystems engineering PhD student Khayrun Nahar Mitu work on a laptop to check the tower's measurements. The tower captures the constant exchange of heat, water and carbon between the landscape and atmosphere, giving researchers a closer look at how vegetation shapes conditions in the desert city.

“Phoenix is a very heterogeneous city, like most metropolitan areas, so we need to understand how different types of land cover influence heat. That data can help people develop strategies and ways to cope with the heat,” Rojas-Robles said. “In this setting, the plants are capturing CO₂ through the process of photosynthesis. But they also are releasing carbon through respiration.”

An eddy covariance tower rises above the landscape at Encanto Golf Course in Phoenix on July 30. At about 20 feet tall, it is the shortest of three towers ASU researchers use to collect weather and atmospheric data across different urban landscapes.

Surrounded by grass, mature trees and residential neighborhoods, the Encanto site provides researchers with a contrast to Phoenix's hotter, more developed areas. Rojas-Robles said it is the coolest of the three research locations.

“Because of the vegetation and the surrounding residential neighborhoods, the energy balance is proportioned,” she said. “It's noticeably cooler in this location than the other two sites.”

Solar panels sit at the base of the Encanto tower. Harnessing Arizona's abundant sunshine, the panels provide power for the tower's instruments as they continuously collect data from the surrounding environment. The self-sustaining system allows researchers to track atmospheric conditions and exchanges of heat, water and carbon across the landscape.

Haros points to a rain gauge mounted on the eddy covariance tower at Encanto Golf Course. He maintains the sensitive instruments at all three ASU research sites, where changing weather and unexpected equipment problems can turn a routine inspection into hours of troubleshooting.

During the summer, he typically begins his rounds at 6:30 a.m., working to diagnose problems and keep the instruments collecting reliable data before the Valley's punishing heat intensifies.

“I never know what I’ll face at each site,” Haros said. “Some days it might take 20 minutes to conduct an inspection. Other times, it might take two or three hours to find the source of the issue.”

Donning a sun hat and sunglasses, Rojas-Robles makes adjustments to instruments at the Encanto site. Funded by the U.S. Department of Energy’s Southwest Urban Integrated Field Laboratory, the data they collect helps Arizona policymakers make critical decisions about how to reduce extreme heat, strengthen the city’s sustainability and prepare for a changing climate.

“Once we get the science behind us, we can better understand what is going on, and people from the state can see what we’ve done with our data,” Rojas-Robles said. “Then, hopefully, they can use it for good purposes.”

Rojas-Robles adjusts a maze of wiring in a data logger box connected to an eddy covariance tower in Phoenix’s Maryvale neighborhood on July 30. Rising nearly 65 feet above one of the West Valley’s oldest and busiest neighborhoods, the tower is the tallest of ASU’s three research sites and provides a sweeping vantage point to collect data across the surrounding urban landscape.

Rojas-Robles’ work takes her from analyzing research data in the lab to troubleshooting equipment in the field, often under the intense summer sun. Along the way, she brings students into the process, giving the next generation of scientists and engineers hands-on experience studying the complex relationship between cities, water and extreme heat.

Mitu checks instruments at the base of the tower at the Maryvale site. Her research focuses on hydrology, climate change and urban water sustainability, using remote sensing and geographic information systems to examine how cities manage water and respond to the pressures of the harsh climate.

“Coming to the United States to study under someone like Professor Rojas-Robles was something I could not get in my home country,” she said. “I’m getting a world-class education at ASU in a field that will become my vocation.”

Haros cleans a gas analyzer near the top of the Maryvale tower. High above the surrounding homes, streets and businesses, he carefully services the sensitive instrument, which is just one piece of a complex network of equipment he maintains on the tower, including a sonic anemometer, radiometer, humidity sensors and solar panels.

Before Haros began maintaining the three towers, he had to be certified by Occupational Safety and Health Administration (OSHA) and the American National Standards Institute (ANSI). The ascent takes him only about two minutes, but hauling his body weight up the steel structure in the summer heat makes every rung count. Haros compares the physically demanding climb to a full workout at the gym, one that comes before he can even begin inspecting and maintaining the sensitive instruments positioned high above the city.

“I’ve lost about 30 pounds since we started collecting data in 2024,” Haros said. “And every one of them was earned.”

This story originally appeared on [ASU News](#).

Main image



ASU Assistant Research Technologist Alonso Haros climbs an eddy covariance tower in the Maryvale neighborhood of Phoenix on July 30. Photo by Samantha Chow/Arizona State University

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