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Towering thunderstorms regularly roll over central Argentina.

ATMOSPHERIC SCIENCE

Inside Argentina's mega-storms

Massive project aims to improve severe-weather predictions in shadow of the Andes mountains.

BY ALEXANDRA WITZE

Some of the worst thunderstorms on the planet are about to give up their secrets.

Deadly downpours, grapefruit-sized hail and severe lightning regularly pepper the eastern side of the Andes mountains in Argentina. These storms often flood towns and destroy the vineyards of the region's wine industry, but remain poorly understood. About 160 atmospheric scientists — mostly from the United States, Argentina and Brazil — have descended on central Argentina to change that.

Their ultimate goal is to improve severe-weather warnings, so that people know to avoid areas where flash floods are likely, or to prepare their vineyards for a hailstorm.

The US$30-million project kicked into high gear on 1 November, as researchers headed to the centre of the country with storm-chasing equipment, including radar scanners mounted on trucks. The atmospheric-sciences experiment, called Remote sensing of Electrification, Lightning, And Mesoscale/microscale Processes with Adaptive Ground Observations (RELAMPAGO, which is Spanish for lightning), is the biggest of this type ever conducted outside the United States.

"It's the craziest activity I have ever been in in my life," says Paola Salio, an atmospheric scientist at the University of Buenos Aires and the Argentina lead on the project. "But it is also like a dream come true."

"What we're seeing in South America could be more like what we will see in a future climate."

From now until mid-December, the scientists hope to chase at least a dozen severe storms to study air temperature, wind speed and direction, rainfall amounts, the number of lightning strikes and other factors. They want to use those data to improve models of how descending air on the eastern side of the Andes triggers towering thunderstorms that regularly reach 18 kilometres into the atmosphere. Such storms are more powerful than typical thunderstorms elsewhere, which might grow 12 kilometres high.

The lines of thunderstorms that often form along the Andes look very similar to the ones in the central United States that usually produce tornadoes. But the Argentinian storms are larger and, for some reason, don't spawn tornadoes nearly as often as the US storms do.

"That's one of the mysteries we want to answer, why there are so few tornadoes," says Steve Nesbitt, an atmospheric scientist at the University of Illinois at Urbana-Champaign who heads RELAMPAGO.

In addition, the researchers will drive hundreds of kilometres southwest of their base near Córdoba to target systems that produce strong hail in Mendoza province.

A second, related project called CACTI (Cloud, Aerosol, and Complex Terrain Interactions) will focus on how atmospheric particles such as dust or haze influence storm development. Funding for both projects comes from national research agencies and institutions in the United States — such as the National Science Foundation and the Department of Energy — Argentina and Brazil.

The work would not have been possible a few years ago, before Argentina beefed up its national weather radar system. Workers installed the first of the upgraded radars in Córdoba in 2015, says Celeste Saulo, director of Argentina's weather service in Buenos Aires. There are seven other such radars operating around the country, and three more should be up and running by December, she adds.

RELAMPAGO scientists plan to compare the data from the Córdoba radar with those from their truck-based instruments — which can reach more rural areas and capture additional information on how storms grow — to gain a better picture of how severe weather works in central Argentina.

During the project, the weather service will test a type of forecasting system that continually ingests updated weather data to improve forecasts. It's similar to ones used by meteorologists in the United States and Europe. Argentina's weather agency wants to use the system going forward, Saulo says.

RELAMPAGO could even provide a glimpse of the future, says Kristen Rasmussen, an atmospheric scientist at Colorado State University in Fort Collins. As global temperatures rise, the warming atmosphere will provide more energy to feed thunderstorms around the world. Rasmussen's computer simulations show that those changes could result in storms similar to the powerful ones now seen in Argentina (K. L. Rasmussen and R. A. Houze Jr *Mon. Weather Rev.* **144**, 2351–2374; 2016).

"What we're seeing in South America could be more like what we will see in a future climate," she says. This means that other parts of the world could soon get a taste of the storms that Argentina knows so well. ■