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3D-printed weather station initiative enhances local monitoring in Southern Africa

Humans have endeavored to predict the weather since time immemorial. Far from a mere perk, our ability to accurately forecast has been tied to our very survival. And as meteorology developed into an actual science, it has given us the ability to take advantage of good weather and better prepare for extreme conditions.

Scientists at UC Santa Barbara are supporting a major expansion of weather observation networks in Southern Africa. The project, led by the Famine Early Warning Systems Network (FEWS NET), will help meteorological services in Malawi, Zimbabwe and Madagascar strengthen their capacity to monitor extreme weather and improve early warning of acute food insecurity.

The Enhancing Meteorological Networks Partnership is a collaboration between FEWS NET, UC Santa Barbara Climate's Hazards Center (CHC) and the University Corporation for Atmospheric Research (UCAR) COMET program. The team is helping local meteorological agencies fabricate, install and maintain low-cost, 3D-Printed Automatic Weather Stations (3D-PAWS), while also enhancing these countries' meteorological services.

These stations provide critical real-time data on rainfall, temperature, relative humidity and other atmospheric conditions, complementing satellite observations to

improve forecasts and preparedness for weather hazards.

“Building the capacity to monitor weather locally is key to protecting communities from acute food insecurity,” said CHC Director Chris Funk. “Reliable weather station observations are fundamental to increasing data quality and improving local forecasting of rainfall, agricultural production and food emergencies. By strengthening these observation networks, we are restoring the data needed to provide timely, evidence-based early warning. For example, when communities face critical decisions — such as planting precious seeds or allocating scarce resources ahead of potential floods — timely, trusted rainfall observations are essential to informing effective action.”

The number of functioning weather stations across parts of Africa has declined significantly in recent decades. As observation networks drop offline, it becomes much more difficult to accurately track rainfall, detect extremes and forecast both agricultural outcomes and future acute food insecurity.

“Through this partnership, FEWS NET is working with national meteorological services to help rebuild and strengthen these networks, restoring critical data streams that underpin early warning and response,” Funk said.

Because 3D-PAWS stations can be fabricated and maintained at a fraction of the cost of commercial systems, national meteorological services can take full ownership of their networks, building, repairing and sustaining them independently. This affordability and local, end-to-end fabrication and operation is critical for long-term resilience.

In Malawi, a two-week 3D-PAWS training concluded in January 2026, during which participants installed two operational stations and began fabricating additional sensors. The Malawi Department of Climate Change and Meteorological Services aims to install three more stations by late March, targeting 25 station deployments by the end of 2026 to strengthen monitoring ahead of the next rainy season.

In Zimbabwe, 20 of the initial 25 weather stations were recently deployed, with the remaining five set for installation by the beginning of April. Plans are underway with the Meteorological Services Department of Zimbabwe to expand the number of stations to a 50-station network to enhance weather monitoring for humanitarian and agricultural decision-making.

In Madagascar, FEWS NET, UCAR, and Meteo Madagascar recently held a kickoff meeting to launch the country's Enhancing Meteorological Networks Partnership 3D-PAWS initiative. An initial two-week fabrication training is scheduled for August 2026 to begin establishing a locally managed observation network.

The expansion of 3D-printed automatic weather station networks in Southern Africa is already improving real-time monitoring of rainfall and temperature extremes. In Zimbabwe, for example, newly deployed stations have strengthened local capacity to verify heavy rainfall events and dry spells during the agricultural season, providing ground-truth data to support national advisories and FEWS NET's food security analysis. These stations have increased the number of rapidly accessible stations from zero in 2024 to around 45 in 2026.

"The progress we are seeing in Malawi, Zimbabwe and Madagascar demonstrates the value of locally managed weather observation networks," said Paul Kucera, assistant director of UCAR's COMET program. "These stations not only fill critical data gaps, but through close partnership with national meteorological services, they strengthen local ownership, build technical capacity in-country, and enhance the long-term resilience of observation networks."

This story was produced in collaboration with Hannah Button at the Famine Early Warning Systems Network.

Tags
Disaster Management

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