COMET

The COMET Innovative Capacity Development Program

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

UCAR | COMMUNITY PROGRAMS

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Introduction

The COMET Innovativve Capacity Development Program

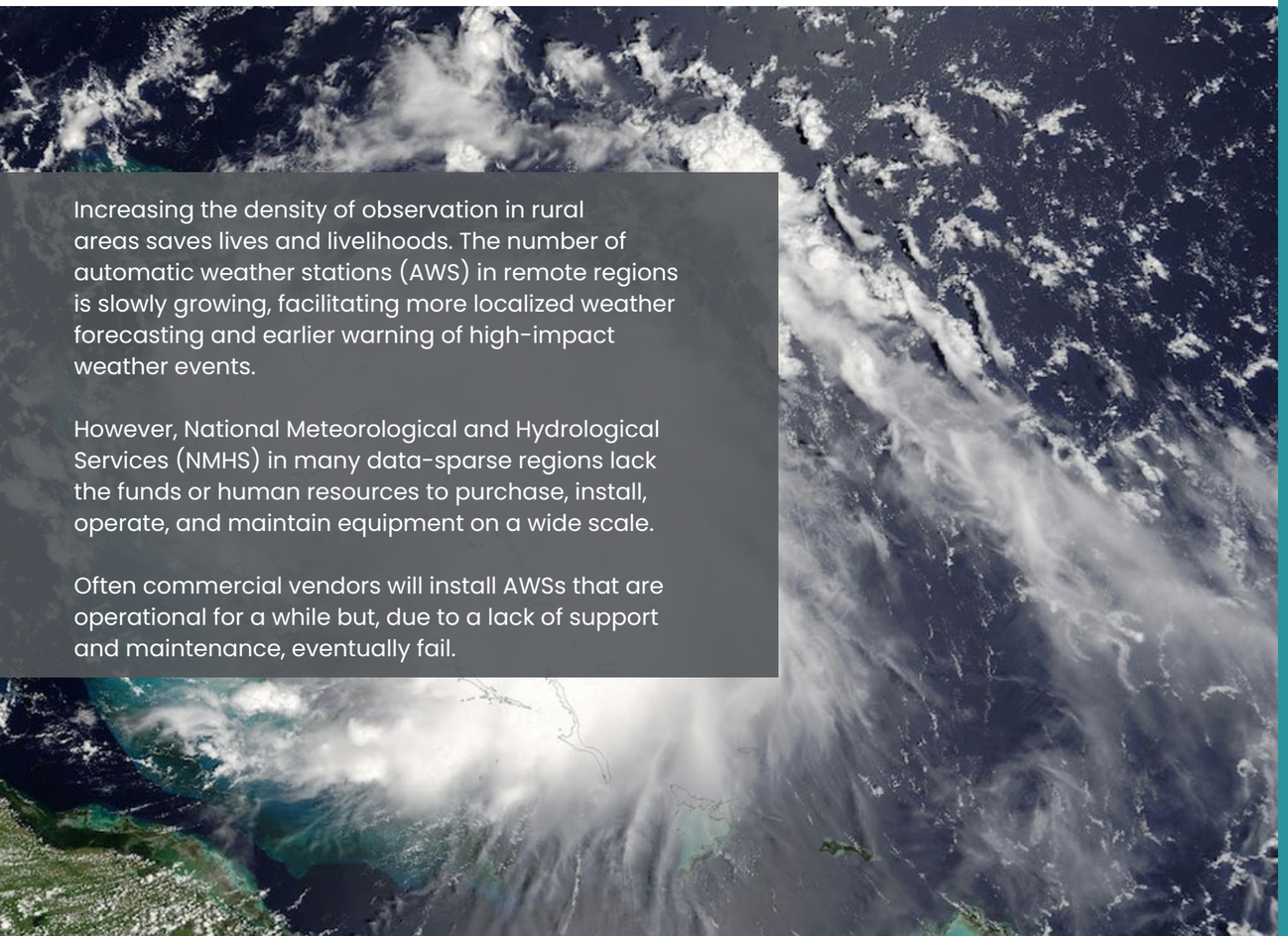
COMET's Innovative Capacity Development Program (ICDP) at the University Corporation for Atmospheric Research (UCAR) focuses on improving monitoring, forecasting, and communication of high-impact hydrometeorological events in rurual and data-sparse regions to reduce risk to their communities. We implement a variety of innovative solutions that include the following:

- Low-cost, sustainable 3D-Printed Automatic Weather Stations (3D-PAWS)
- Regional numerical weather prediction systems
- Impact-based forecasting and decision-support solutions
- Regional application-driven software systems
- Early-alert communication tools
- Customized training and resource development

The Issues

Between 1970 to 2021, an estimated 12,000 hydrometeorological disasters worldwide caused more than 2 million deaths and resulted in over $4.3 trillion in economic damages.[1] These events often devastate communities in LDCs and SIDS.

1 Atlas of Mortality and Economic Losses from Weather, Climate and Water-related Hazards (1970-2021)



Increasing the density of observation in rural areas saves lives and livelihoods. The number of automatic weather stations (AWS) in remote regions is slowly growing, facilitating more localized weather forecasting and earlier warning of high-impact weather events.

However, National Meteorological and Hydrological Services (NMHS) in many data-sparse regions lack the funds or human resources to purchase, install, operate, and maintain equipment on a wide scale.

Often commercial vendors will install AWSs that are operational for a while but, due to a lack of support and maintenance, eventually fail.

Solutions

» Low-cost observation networks

Low-cost AWSs provide useful data to supplement more established long-term stations, and their accuracy and capabilities are improving all the time. Low-cost, reliable microsensors and components that are easy to replace when systems fail enable local partners to take ownership in building and maintaining their observation networks.

» Open access to real-time data

Many AWSs today can report data in real time, upload live readings to cloud-computing and storage environment for shared viewing, and send automated alerts when certain observation thresholds are met. Additionally, AWSs can now observe a widening set of parameters including water level, air quality, and soil moisture and temperature. These data not only provide early warning to vulnerable rural communities for potential threats, but they can also be applied to effectively manage resources to keep farms, businesses, and homes running.

» Local community training

Community members can be trained to take responsibility for day-to-day checks and maintenance, and troubleshooting problems such as cleaning leaves from rain gauges. Schools and universities are excellent places to build AWSs in a controlled, consistent environment that provides capacity development for students. They can also work closely with NMHSs to distribute the AWSs to local communities.

Recommendations

Building capacity through partnerships with rural and data-sparse communities is the most cost-effective and long-term solution to mitigate the effects of severe weather. COMET's Innovative Capacity Development Program (ICDP) provides innovative solutions customized to meet our partners' needs.

Low-cost, innovative 3D-Printed Automatic Weather Stations (3D-PAWS)

To expand observation networks, the COMET developed the low-cost, high-quality 3D-PAWS through funding from the US National Weather Service (NWS) International Activities Office (IAO) and with support from the USAID Bureau of Humanitarian Affairs (BHA).

Benefits of a low-cost 3D-PAWS system

- Uses low-cost, reliable micro-sensors
- Can be assembled locally
- Components can be "re-printed"
- Local agencies take ownership in building and maintaining observation networks

Goals of the 3D-PAWS initiative:

» Build capacity to reduce hydrometeorology-related risks in communities

» Observe and communicate weather & climate information to rural communities

» Develop observation networks and applications to reduce weather-related risk

COMET 3DPAWS
3D PRINTED AUTOMATIC WEATHER STATION

Improving weather data collection in sparsely observed regions with low-cost, innovative technology.

ICDP also develops, implements, and/or facilitates the following innovations to further strengthen capacity development.

Regional numerical weather prediction systems

In many data-sparse regions, mesoscale numerical weather prediction (NWP) models provide vital local guidance for weather forecasters and can thus have an important impact on improving forecast services. COMET works with Weather Research and Forecast (WRF) model developers and trainers at UCAR/NCAR to help deploy this mesoscale model wherever it's needed.

Regional application-driven software systems

The 3D-PAWS systems can also be used for a variety of additional applications including:

- Early alert and regional decision support systems
- Agricultural monitoring
- Health monitoring

Impact-based forecasting and decision-support solutions

COMET facilitates the implementation of the impact-based forecasting techniques outlined by the World Meteorological Organization. Their process, which focuses on helping forecasters deliver more effective forecasts and warnings, is being implemented worldwide.

Early-alert communication tools

The COMET ICDP develops and manages tools that provide emergency weather information to every corner of the world.

- EMWIN/HRIT
- Chatty Beetle
- GEONETCast

Customized training and resource development

COMET MetEd: our world-renowned, free education & training LMS

3D-PAWS Training: in-country training workshops for 3D-PAWS

Operational Training: courses to support operational NMHS capacity development

3D-PAWS in Barbados

Partners in Expanding Weather Observation

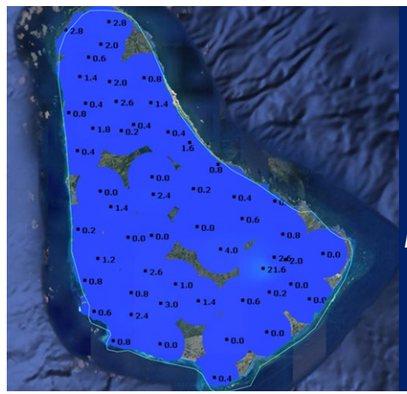
Barbados is no stranger to impactful weather events. Before 2018, however, the Barbados Meteorological Service (BMS) had just two operational weather stations.

Through a partnership with the COMET (ICDP) and support from USAID, the BMS expanded their weather observation network to over 65 stations. The majority of these new observation sites utilize the innovative, low-cost 3D-PAWS.

BMS Tracks Mesocyclone with 3D-PAWS

This 3D-PAWS network soon proved vital to the BMS when a severe mesocyclone impacted Barbados in June of 2021. The BMS was able to track the mesocyclone position due to surface wind observations and pressure drops from 3D-PAWS stations across the island.

A 3D-PAWS rain gauge also showed extreme rainfall rates as high as 250 mm/h. This rain rate seemed unbelievable to forecasters but was confirmed by neighboring 3D-PAWS.



3D-PAWS Rainfall Observations from the BMS's Zamasu platform.

This confirmation helped the BMS produce a more accurate flood forecast for the event.

Helping First Responders

Just a few weeks later, on July 2, BMS forecasters were able to monitor increasing winds on the island from Hurricane Elsa, the first hurricane of the 2021 season. The northern eyewall impacted the southern portion of the island, causing structural damage, but no loss of life. The peak wind observations from the 3D-PAWS helped the BMS quickly direct first responders to the areas that sustained the most damage.

Members of the BMS and COMET ICDP with one of the first 3D-PAWS in Barbados.

A Strong Partnership

Both COMET and the BMS continue to benefit from the partnership. While the COMET team continues to share technical expertise, the BMS has been instrumental in field testing updated 3D-PAWS designs that can be applied in other countries. BMS meteorologist and technical expert Andre Brathwaite also assisted the COMET team in conducting 3D-PAWS training with Trinidad and Tobago Met Service.

Get Involved

Learn More

Learn more about the COMET Innovative Capacity Development Program by visiting our website: **comet.ucar.edu/capacity-development**

Learn about COMET's education and technology solutions for weather, water, and climate enterprises, our University Partnership Program, and more: **comet.ucar.edu**

Access free online courses, resources, assets, and more through our COMET MetEd LMS: **meted.ucar.edu**

Subscribe to COMET's newsletter to stay informed about the latest ICDP projects, COMET MetEd lessons, events, and other COMET news.

Contact Us

COMET Innovative Capacity Development Program (ICDP) Team

Assistant Director
Paul A. Kucera, Ph.D.
pkucera@ucar.edu

Project Manager
Kathryn Payne
kpayne@ucar.edu

Project Manager
Martin Steinson
steinson@ucar.edu

Scientist
Brianna Smith
blund@ucar.edu

Scientist
Rebecca Zieber
rzieber@ucar.edu

Systems Administrator
Bob Bubon
rjbubon@ucar.edu

Instrument Engineer
William Nicewonger
wnicewonger@ucar.edu

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