Experiment on Monsoon Season Rainfall Lives Up to its 'Name'

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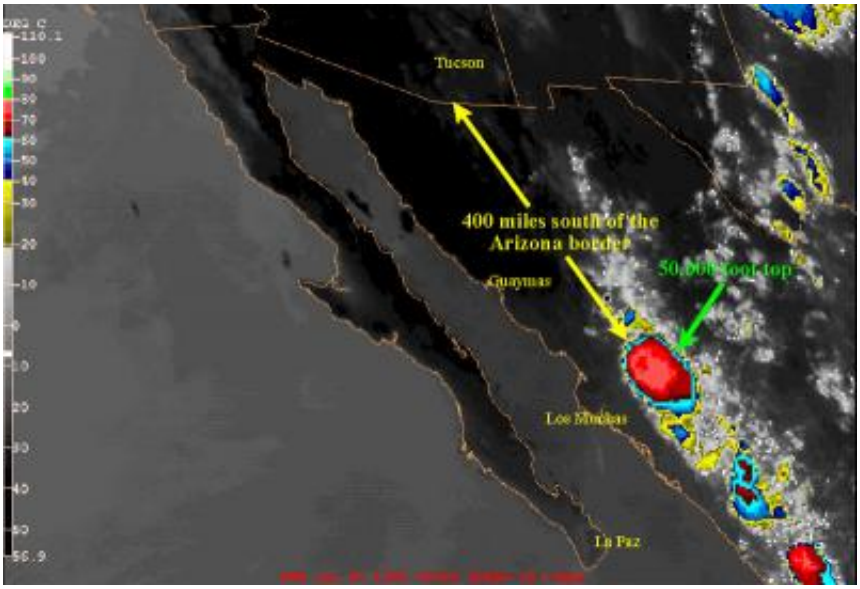
Monsoonal Thunderstorm over Arizona. Credit: NOAA

For many people, a monsoon brings to mind images of intense rainfall and high winds in faraway places. Actually, monsoons occur all over the globe, including North America. These seasonal reversals of winds trigger dramatic changes in rainfall and other weather events within a short period of time.

The North American monsoon affects large areas of the southwestern United States and northwestern Mexico. This rainy season brings with it much more than torrential downpours from July to mid-September. The North American monsoon is one of the key natural events that defines the warm-season climate over the region. It is important that researchers better understand the key physical processes at play that determine the

life cycle of the monsoon. That knowledge should make it possible in the future to forecast warm-season rainfall over North America more accurately.

Throughout the summer of 2004, researchers from NASA and other U.S. government agencies led by the National Oceanic and Atmospheric Administration (NOAA) joined an international team of scientists from Mexico, Belize and Costa Rica to carry out an intensive field campaign as part of the North American Monsoon Experiment (NAME). NAME is a study aimed at improving the ability to observe and simulate monsoons over North America. NAME gave the science team an unprecedented opportunity to gather extensive atmospheric, oceanic, and land surface observations in the core region of the North American monsoon. The early findings from NAME were published in a recent issue of the Bulletin of the American Meteorological Society.



This satellite image from the National Oceanic and Atmospheric Adminstration's Geostationary Operational Environmental Satellite (GOES) shows rainfall during the beginning of monsoon season in Mexico. This is an infrared image, taken the night of June 23, 1998. The red area depicted shows a cold area, indicating a

high cloud top (50,000 feet high), indicating a strong thunderstorm. Credit: NOAA

"This was our first chance to gather results from such intensive observations of the North American monsoon season, using sensitive instruments from 20 different vantage locations like NASA satellites, aircraft, research ships, radar, balloons, buoys, and ground stations," said Siegfried Schubert, a meteorologist at NASA's Goddard Space Flight Center, Greenbelt, Md., and member of the NAME science team. "The results should put us on a fast track to improving the accuracy of our predictions of warm-season precipitation in North America, and the lessons we learn here can be applied to many other parts of the world."

During the NAME mission, scientists took a large and frequent number of measurements of winds, humidity, soil, ocean heat fluctuations, and rainfall accumulation over six weeks using several instruments mounted in platforms in the sky, space, ocean, and on the ground. The team will combine this information with other measurements, including those from the Advanced Microwave Scanning Radiometer - EOS (AMSR-E) on NASA's Aqua satellite and the TRMM Microwave Imager (TMI) on NASA's Tropical Rainfall Measurement Mission (TRMM) satellite.

NAME and other scientists are now using the measurements to, among other things, analyze warm-season convective processes, otherwise described as the natural actions that transfer heat and moisture into the atmosphere through strong upward motion. They are looking at how convection changes over different types of land surfaces (like mountains or hilly areas), and at the response of the warm-season patterns of air and moisture flow in the atmosphere to the more slowly changing, potentially predictable conditions at the boundary between land surfaces and the

atmosphere. The science team is using the observations and comparing them with baseline measurements to create better models that they hope will more accurately forecast future monsoon events.

"By 2008, we should have enough analysis from observations and the global and regional models created from those 2004 observations to make it clear whether our modeling is far closer to what we've been after," said Myong-In Lee, a research scientist at Goddard and member of the NAME science tea. "I think the data from NAME is moving us all closer to the bull's eye."

Forty to 80 percent of the rainfall over the U.S. Southwest and Northwest takes place during the monsoon season. The climate changes brought on by monsoons tend to set off weather hazards like flash flooding and drought because of the area's extreme terrain and inability of its soil to hold much moisture. These problems cycle to negatively affect infrastructure, agricultural production, hydroelectric power generation, and water supply, and worsen with population growth.

"Our success in improving monsoon forecasting can have significant socio-economic impact," said Jim Laver, Director of NOAA's Climate Prediction Center, Camp Springs, Md. "Knowledge gained from the NAME observations has the potential to increase society's ability to plan for and respond to monsoon-related extreme events such as flooding rains, dust storms, hail and dry lightning, and help protect lives and property."

NAME is an international effort involving 30 organizations: NASA, NOAA, the U.S. Department of Agriculture, the National Science Foundation, U.S. and international universities, and several Mexican scientific organizations.

Source: Goddard Space Flight Center