



Conveying Medium Range Uncertainty Forecasts to Diverse Stakeholders



Erik Pytlak, NOAA/National Weather Service, Tucson, AZ
 Michael Crimmins, Christopher Castro and Gregg Garfin, University of Arizona, Tucson, AZ
 Erin Jordan, KOLD-TV, Tucson, AZ

The Local Consortium

- NOAA/National Weather Service, Tucson, AZ
- NOAA/National Weather Service, Climate Prediction Center
- Department of Atmospheric Sciences, University of Arizona
- Department of Arid Land Studies, University of Arizona
- Arizona Cooperative Extension Service
- Climate Assessment for the Southwest (CLIMAS)
- NOAA/National Center for Atmospheric Research, Research Applications Lab, Boulder, CO
- CONAGUA/Servicio Meteorológico Nacional, Long Range Forecast Branch, Mexico City, MX
- Willing local media interested in longer range forecasting

Our Objectives

- Add region-specific, intra-seasonal, resolution to the official NWS 90-day outlook
- Reach consensus between regional climate forecasters, thus providing a unified message to key stakeholders and the public
- Share expanding understanding of seasonal monsoon forecasting science
- Share information on the societal impacts of developing and ongoing monsoon trends

Our Local Stakeholders

- **Level 1:** Stakeholders with strong desire for yes/no answers
 - General public, general print and broadcast media
- **Level 2:** Stakeholders with preference for a mix of deterministic and probability information:
 - Local emergency managers, ranchers, farmers, local drought task forces, broadcast meteorologists
- **Level 3:** Stakeholders with high tolerance for uncertainty and understanding of probability information:
 - State emergency managers, state drought task forces, water resource planners, forest managers

Delivery Methods

The team not only worked together to provide consensus value added material to each monsoon forecast, it also collaborated on the most effective means to share the information. This was more of an iterative process where many delivery methods were tried to reach the variety of stakeholders.

Media	Target Audience	Results
Local Newspapers	Level 1	Mixed results. Stories generally oversimplified into stark contrasts; writers occasionally tried to create "he said, she said" controversy between consortium members. Newspaper graphics, though, adapted consortium graphics and safety information for full-page monsoon coverage stories, which were then praised in "letters to the editor"
Local Television	Level 1 and 2	Highly variable coverage ranging from very little to extensive. Many graphics adapted to broadcast. Some stations did follow-up interviews with UofA and NWS consortium members.
Local Radio	Level 1 and 2	Only one station covered the outlooks (NPR based at UofA), which sought out a series of interviews, and produced extended stories including interviews with with all stakeholders.
CLIMAS Webinar	Level 2 and 3	Considerable give-and-take questions from stakeholders. Stakeholders then referred their stakeholders to the recorded briefings and individual consortium members for even more detailed info.
CLIMAS Newsletter	Level 3	Circulated within land departments. Information in the newsletters found their way into tactical planning documents for the upcoming monsoon season.
NWS Webcast	Level 1, 2 and 3	Highly mixed results. Thousands of "hits" to the website thanks to newspaper and broadcast meteorologists. However, in 2010, several anti-government blogs were then posted on newspaper websites in response to the outlook.

Sharing the Science

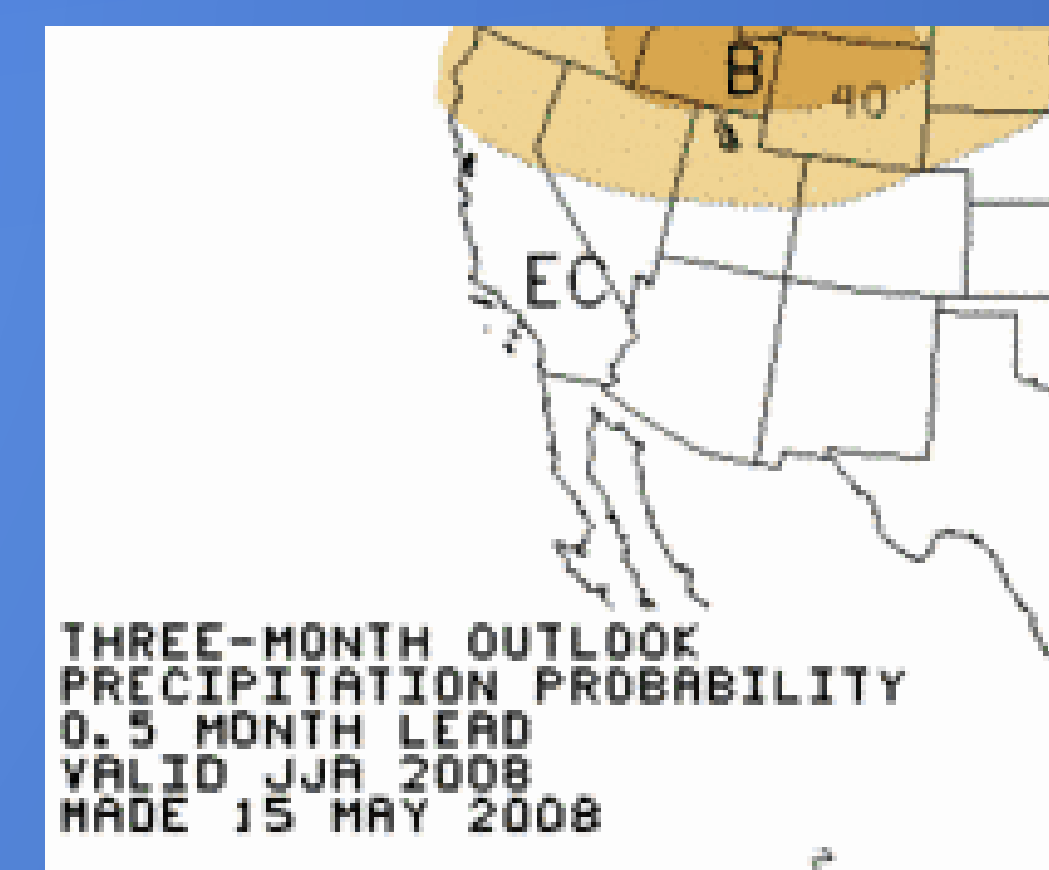
Each season, and for each outlook update, the group also used the opportunity to explain one or two NAME-related research advances when they had an impact on the forecast. Topics like the importance of land surface memory, monsoon high evolution, ENSO cycles, Madden-Julian Oscillations, and eastern Pacific tropical cyclone impacts were some examples. These also allowed local broadcast media to further distill these ideas and convey them to their viewers to increase their confidence in the outlooks, and educate them on what the monsoon is.

Three NOAA/NWS CPC Monsoon Forecasts, Three Value-Added Forecasts, Three Outcomes

Since beginning this effort in 2008, value-added forecasts were prepared each April by the local consortium, with the Climate Prediction Center forecast as the starting point. The forecasts are then updated a day or two after subsequent CPC 90-day forecast releases in May, June, and sometimes July. In all three years, CPC forecasted "equal chances" of above or below average rainfall for the season as a whole. However, intraseasonal trends and uncertainties, which were shared by CPC either through their text discussions or by collaboration with the local user group, were included and explained by the local group when preparing and presenting their consensus seasonal forecasts. Most of the value was added through lessons learned during and after the North American Monsoon Experiment in 2004. Group members with the University of Arizona provided regional modeling expertise, provided advice on how the messages were likely to be interpreted, and arranged contacts with critical stakeholders in the land management and media communities.

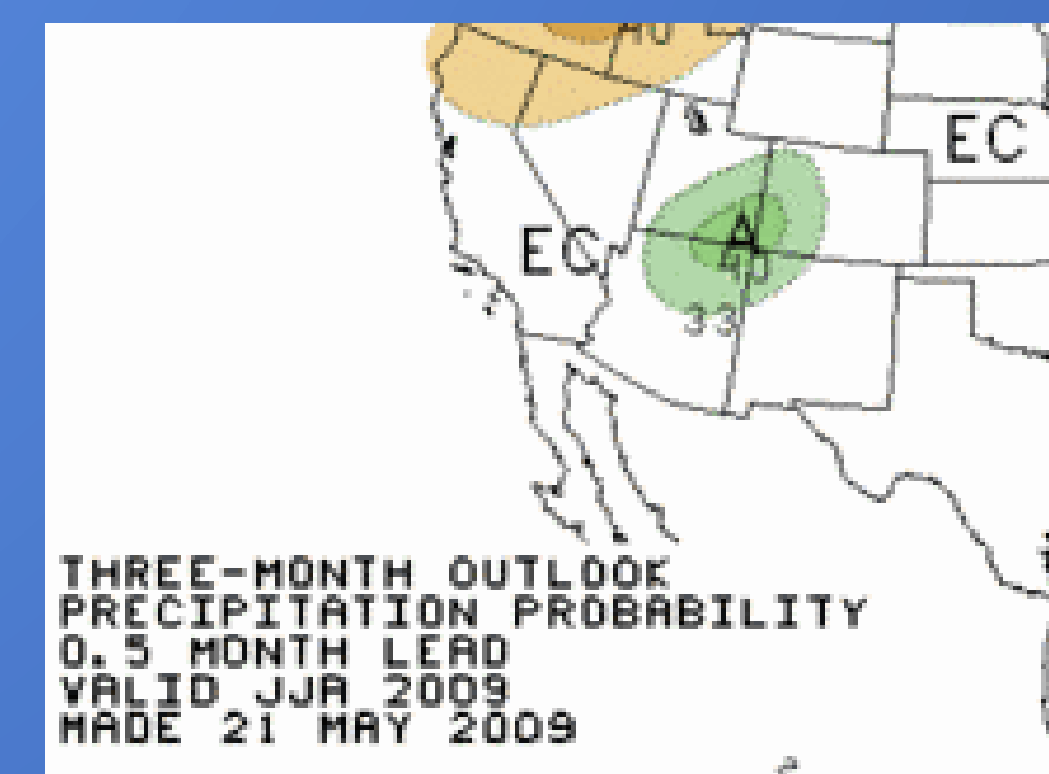
CPC 90 Day Forecast

2008



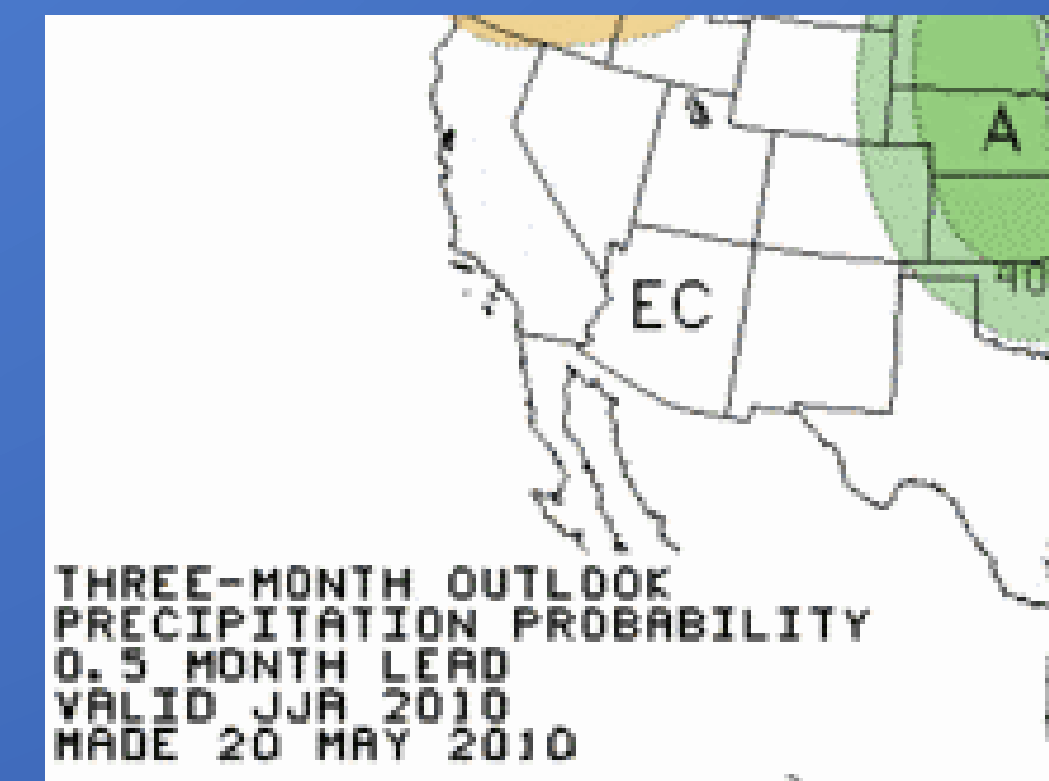
- Some elements of a weak La Niña present, including somewhat depressed SSTs in Eastern Pacific
- Low soil moisture in the Plains suggested earlier onset and stronger upper level high
- MJO was very active and could lead to sharp swings in activity
- Early monsoon arrival likely
- Unless SSTs remained low, monsoon would be near average

2009



- Initial CPC outlook called for a wet summer, but rapid El Niño development prompted a change to "EC"
- Lingering La Niña would support an early and strong start
- If El Niño continued to develop, a rapid flip to dry conditions was possible
- Highly uncertain forecast due to possible rapid ENSO flip during the season
- If rapid flip occurred, late season tropical cyclone risk would increase
- Rainfall should average out near normal

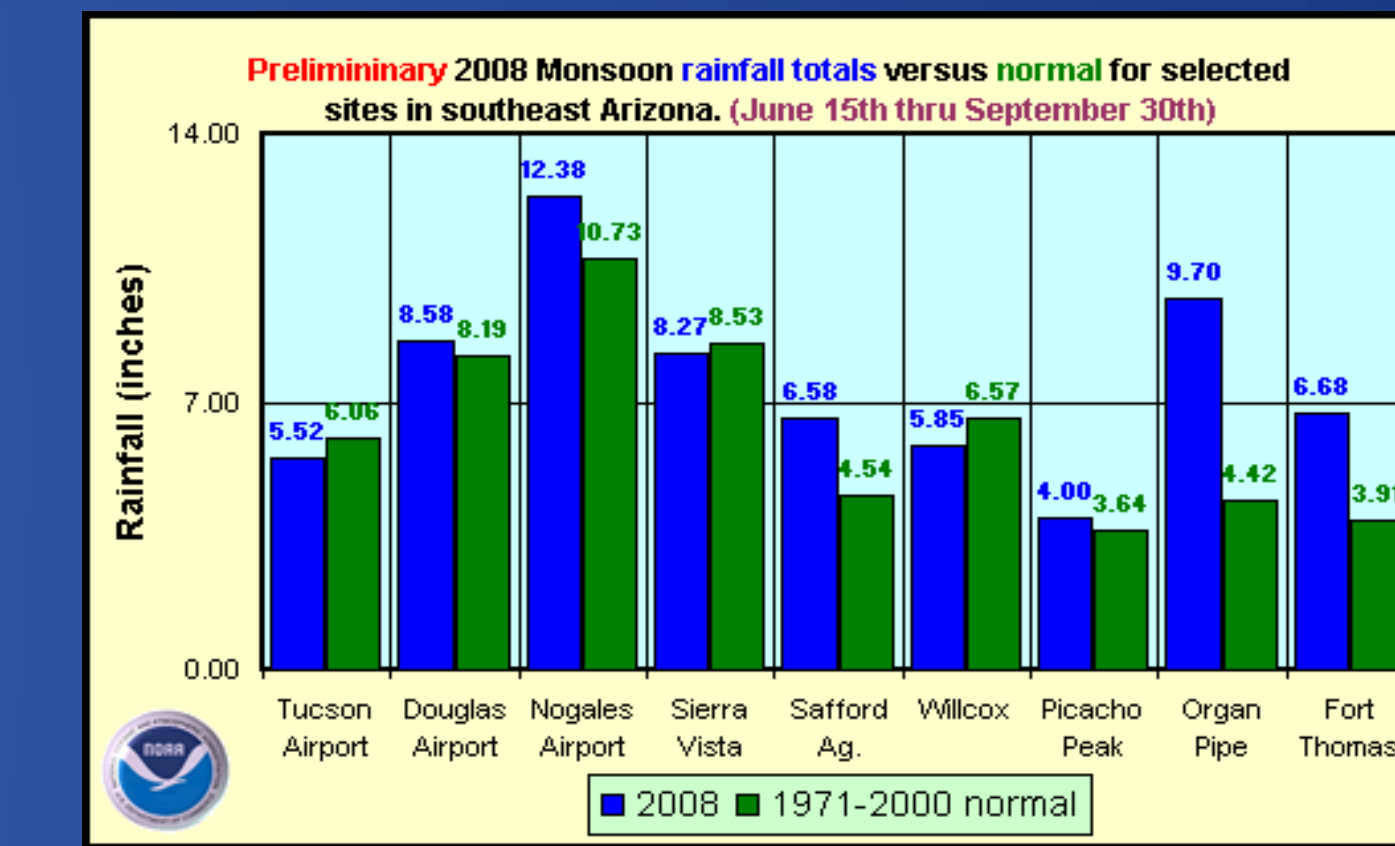
2010



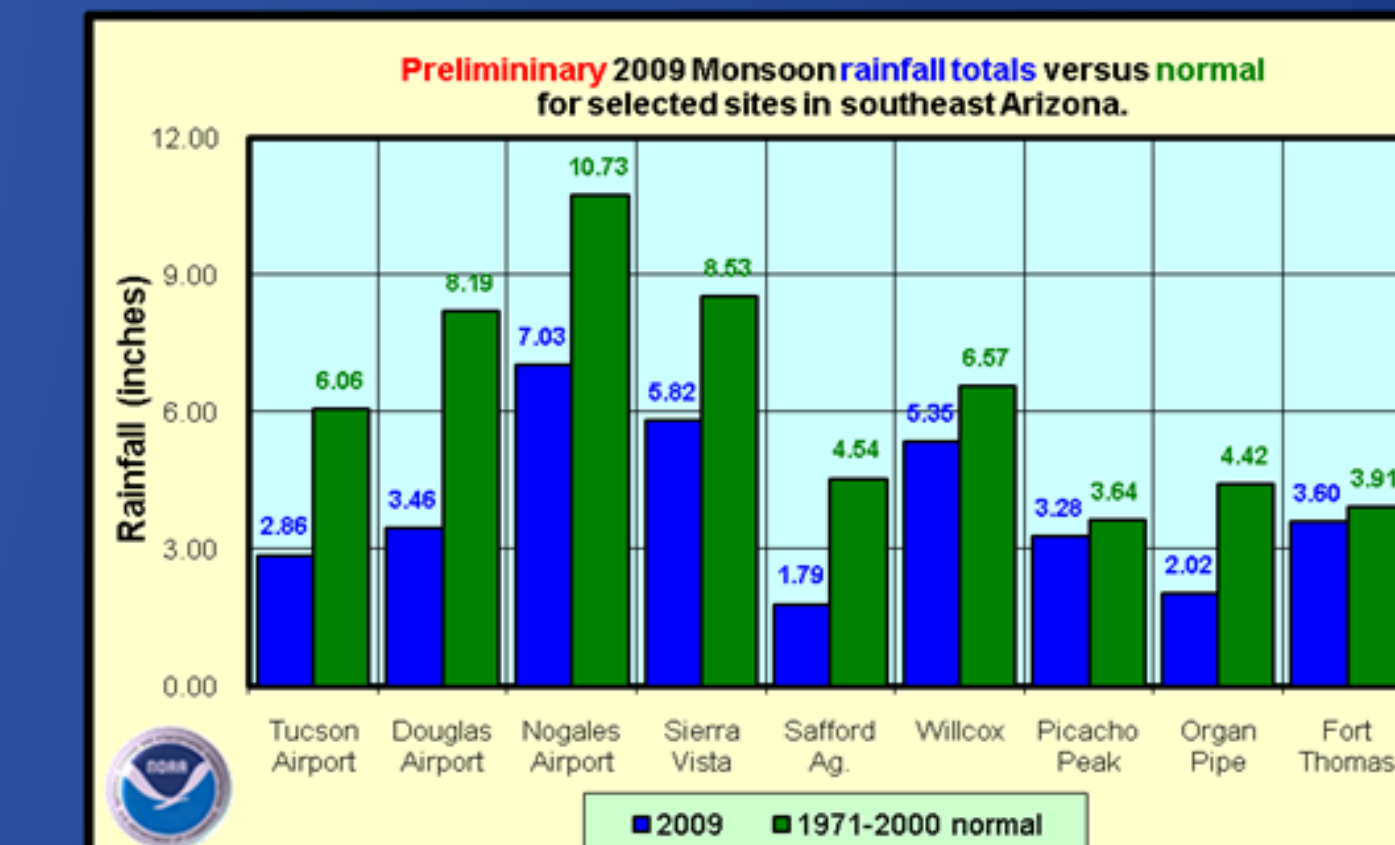
- Very similar rapid ENSO flip situation during 2009 monsoon, but in the opposite direction
- Lingering El Niño impacts on jet stream and soil moisture indicated a late arrival
- Depending on how fast La Niña developed, the second half of the monsoon would likely be active and wet
- The first place for a sudden increase in monsoon activity would be in Mexico, then spread north
- With a weak first half and strong second half, rainfall would average out near normal

Local Adaptation

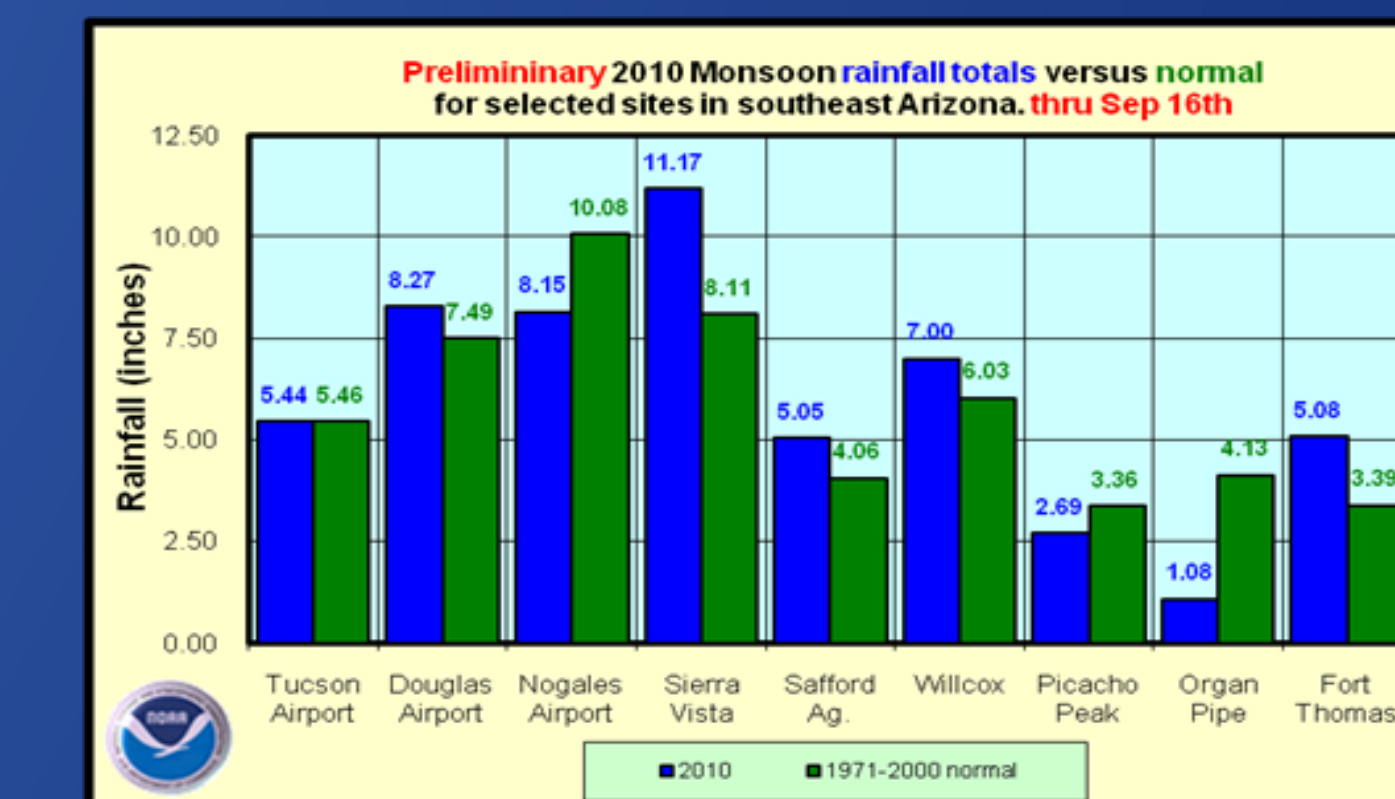
Outcomes



- Early and strong start
- Persisted much of the summer, but with three sharp bursts between late June and mid August
- Weak La Niña behavior continued
- **Near-Above average monsoon, but most stakeholders remembered the sharp bursts and associated flash flooding in July and early August**



- Early and strong start
- Very weak finish
- Rapid El Niño Onset
- Local users keyed in on the "rapid flip/uncertainty" part of the forecast
- Special July outlook warned that the rapid ENSO flip had occurred
- **Below average monsoon**



- Highly variable monsoon
- Weak start, strong finish
- Monsoon in Mexico sputtered until mid July, then increased rapidly
- Rapid La Niña Onset
- Concern developing for
- **Near average monsoon rainfall**

