

## Update on the 2006 North American Monsoon

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The North American Monsoon is a prominent feature of the climate of the Southwest U. S. including a significant part of the Intermountain West region. The monsoon is an important feature of the atmospheric circulation over the North American continent, and its effects are noticeable over a large portion of western United States, particularly Arizona, New Mexico, and to a lesser degree, Utah and Colorado. Monsoon circulation plays a significant role in the hydrological cycle of the arid southwest U. S., with parts of Arizona and New Mexico receiving 40-50% of their annual precipitation from the summer monsoon (Douglas et al. 1993). Also known as the Southwest U.S. monsoon, Mexican monsoon, or the Arizona monsoon, the North American Monsoon is a pronounced increase in rainfall in the region from an extremely dry June to a rainy July over large areas of southwestern U. S. and northwestern Mexico. This increase in precipitation typically begins in northwest Mexico and Arizona in early July, then the precipitation gradually works its way northward, eventually reaching Utah, Colorado and into the Front Range by early to mid-July. These summer rains typically last until mid-September when a drier regime is reestablished over the region.

The monsoon extends into the southwest U.S. as it matures in mid July when an area of high pressure, called the monsoon ridge, develops in the upper atmosphere over the four corners region, creating an easterly to southeasterly wind flow. This wind flow pattern directs moisture originating in the Gulf of Mexico, Gulf of California and the tropical Pacific into the region, setting off brief, but sometimes torrential thunderstorms. The NWS, Grand Junction, notes that "once the monsoon season is underway, the southwesterly circulation does not produce thunderstorms everyday, but rather consists of a pattern that undergoes a series of "bursts" and "breaks" (definitions by climatologist Andrew Carleton). While the monsoon thunderstorms can bring beneficial rains to eastern Utah and western Colorado, they can also result in flash flooding, one of our deadliest weather events."

### Southwest Monsoon and Flash Floods

Several historical flash floods of note along the Front Range of southern Wyoming and northern Colorado (Big Thompson 1976, Cheyenne 1985, and Fort Collins 1997) have occurred during late July and early August, with each strongly tied to the southwest monsoon. A study by Weaver and Doesken (1990) showed that the recurrence probability for a catastrophic severe weather event along the Front Range was greatest during this period. This is especially likely during very active monsoon seasons. Monsoonal "bursts", the convectively unstable periods of the event, can be particularly wet and enduring during La Niña years. During cold phases in the Eastern Pacific (JMA SST index is 0.5C below average for six consecutive months), enhanced

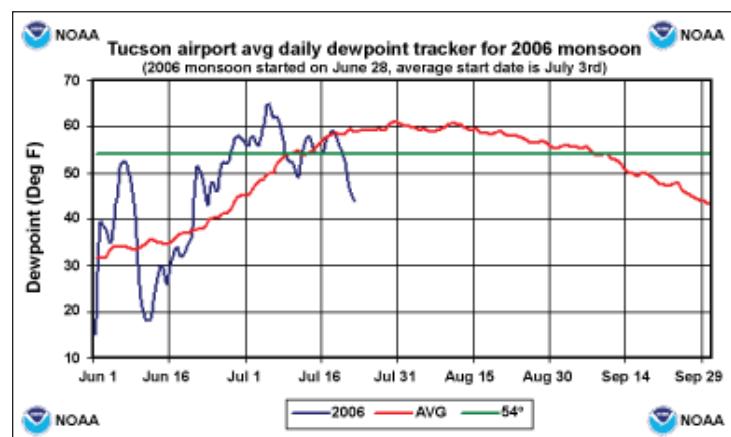


Figure 14a. 2006 monsoon daily average surface dewpoint at Tucson International Airport. The red line shows historic average daily dewpoint and the blue line shows the average daily dewpoint values for 2006.

tropical activity and intensity associated with La Niña often increases the available moisture for transport into the southwest United States (Bove et al. 1998).

### Tracking the 2006 Monsoon

One guideline for determining the onset of the monsoon season is when the average daily dew point there reaches, or exceeds, 54° F for 3 or more consecutive days. Because the monsoon is a phenomenon that moves northward, there is no single start date. According to the NWS, this year the monsoon began in Tucson, Arizona, on June 28th, which was 5 days earlier than the average start date of July 3rd in Tucson (Figure 14a). The earliest start date recorded in Tucson is June 17, 2000 and the latest start date is July 25, 1987. Start dates are a little later further north, with the average start date in Phoenix is July 7, while the average ending date is September 13. To continue tracking the monsoon, see the "Monsoon Tracker 2006" at [http://www.wrh.noaa.gov/twc/monsoon/monsoon\\_info.php](http://www.wrh.noaa.gov/twc/monsoon/monsoon_info.php)

### References:

- Bove et al., 1997; Effects of El Niño on U. S. landfalling hurricanes revisited, *Bulletin of American Meteorological Society*, 79, no. 11. 2477-2482.
- Douglas, DM, Maddox RA, Howard K,(1993) The Mexican Monsoon. *J. Clim* 6; 1665-1677.
- Weaver J. F., and N.J. Doesken, 1990: Recurrence probability- a different approach. *Weather*, 45, 333-339.

### On the Web

- The North American Monsoon Experiment: <http://www.joss.ucar.edu/name/>
- NWS Phoenix Monsoon webpage: <http://www.wrh.noaa.gov/psr/general/monsoon/>
- NWS Flagstaff Monsoon webpage: <http://www.wrh.noaa.gov/fgz/science/monsoon.php?wfo=fgz>
- NWS Tucson Monsoon webpage: <http://www.wrh.noaa.gov/twc/monsoon/monsoon.php>

