



Downburst over the South Mountains, looking SSE from Sky Harbor Airport, 07-18-2016, Bryan Snider

Flood Control District of Maricopa County

Engineering Division, Flood Warning Branch

Season Recap: Monsoon 2016



According to the FCDMC ALERT rain gage network, the 2016 monsoon season was characterized as being near normal. When averaged across 277 of the oldest county mesonet rain gages, 2.65” of rain fell which was 87% of the mean value of 2.99”. An image showing the full 34 year period of record can be viewed [here](#). It’s worth noting below average rainfall was recorded at Sky Harbor Airport for the first time since the 2011 season. The official rain total as reported by the NWS Phoenix office was 2.49” which was 0.22” below the period average of 2.71”. Click [here](#) to see a technical summary plot from Sky Harbor Airport covering the monsoon season courtesy of the University of Arizona CSAP/CLIMAS organization. Figure 2, below, offers a more comprehensive picture of the rainfall distribution across the MSP forecast area. This figure was generated using preliminary FCDMC ALERT rain gage data from around the county. The shaded contours depict precipitation totals from June 15th – September 30th.

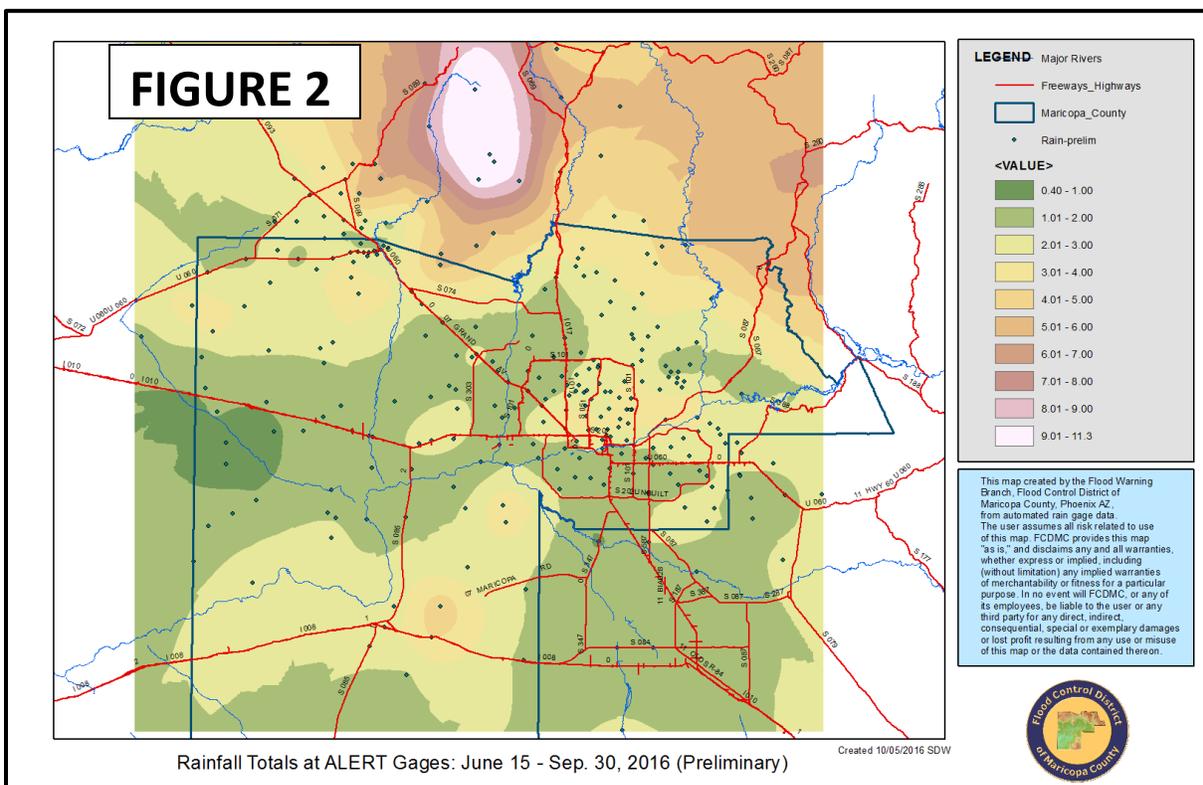
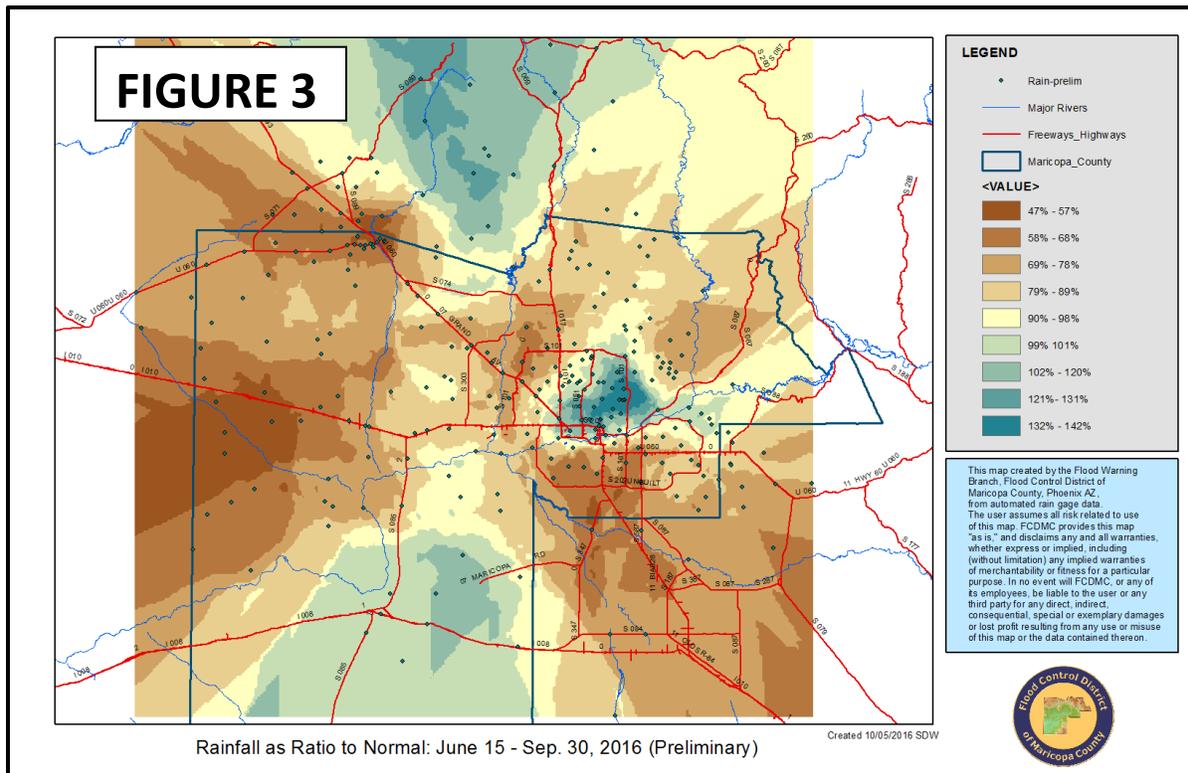
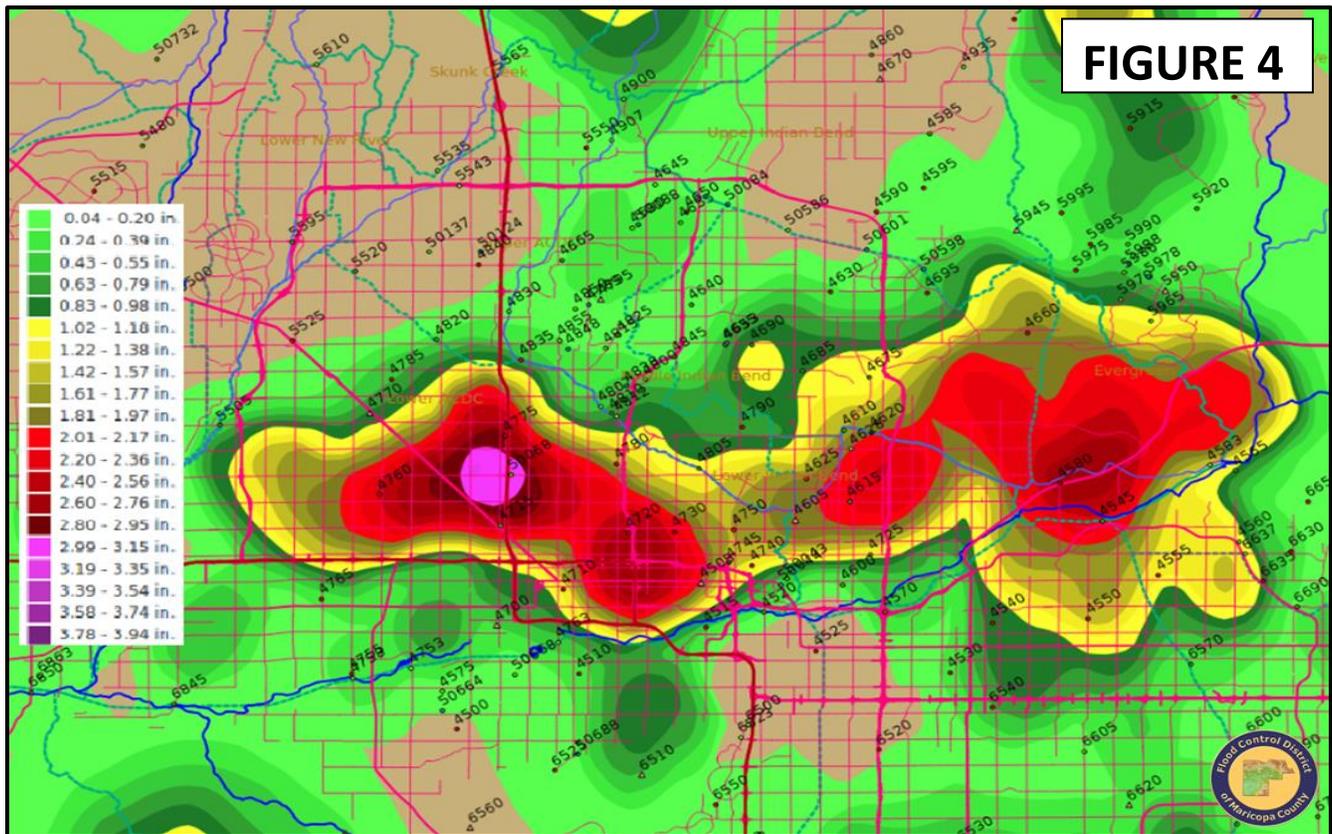


Figure 3, on the next page, shows the ratio of 2016 monsoon precipitation versus average monsoon precipitation. Similar to Figure 2, contours were generated using preliminary FCDMC ALERT rain gage data from around the county. Areas extending west from Wickenburg through Palo Verde saw below to well below average rainfall totals for the season. Similarly southcentral portions of the Valley were equally as dry. Above average rain fell across a large swath of the central Valley including much of metro Phoenix, south/central Scottsdale, and east Mesa. Southwestern portions of the County were also wetter than average. These two figures serve as a strong reminder to the importance of having a widely distributed rain gage network in order to fully capture the distribution of monsoon rains.



The season got off to a hot start (literally) with an abnormally strong monsoon ridge building north across the state during the third week in June. Daily temperatures eclipsed the 110°F mark from June 18th -23rd with new daily record high temperatures of 118°F on June 19th and 116°F on June 20th observed at Sky Harbor Airport. The ridge of high pressure settled across the Four Corners region through the remainder of the month helping the operational season (historical onset July 7th) get off to another early start. The first MSP message statements were issued on the evening of June 29th as localized heavy rain fell across the eastern half of the county with portions of Fountain Hills, East Mesa and Userly Mountain Regional Park getting hit the hardest. A large inverted trough then lifted northth out of Mexico and into AZ June 30th - July 1st. Light rain fell across portions of the county on the 30th, before a severe thunderstorm outbreak developed across southwestern portions of the county on July 1st.

The following four weeks of July remained rather quiet as we entered our first extended “break” period to the monsoon during an otherwise historically active period. The only noteworthy event occurred on July 18th as downburst, over the Phoenix South Mountains, dropped localized heavy rain and caused flooding problems for residents in Ahwatukee and South Phoenix. An image of the storm taken from local photographer/storm chaser, Bryan Snider, can be viewed [here](#). Despite a mostly quiet July, activity continued to ramp up during the final week in the month. This period was highlighted by a widespread severe weather event on the evening of July 29th as an organized line of thunderstorms rolled off the higher terrain of eastern AZ into the Valley. Severe wind gusts and heavy rain were observed all across the Valley capped off by torrential rains and flooding over the Maricopa Mountains east of Gila Bend. Two more active days around the County followed as July came to an end.



August picked up where July left off as a very moist and unstable air mass remained in place across southcentral AZ. The County's most notable rain event this summer unfolded on August 2nd where anywhere from 1.00"-3.00" of rain fell across most of the Phoenix urban corridor (Figure 2 above). Portions of I-10, I-17, Loop-202, and many city other streets were shut down for brief stints due to urban flooding. More details on this event can be accessed in the NWS Phoenix WFO storm recap [here](#). This event was quickly followed up by two more heavy rain episodes. The first occurred during the afternoon/evening hours of August 3rd across northcentral portions of the county. The second, more significant event, unfolded during the morning rush hour on August 5th. Two distinct clusters of t-storms developed across metro Phoenix before rapidly intensifying as they moved northeast into central and north Scottsdale. Anywhere from 1.00"-2.00" of rain fell in short duration causing runoff in local washes and streams. A large number of unbridged road crossings had to be shut down along Scottsdale, Tatum, and Pima roads north of the Loop 101 due to flooding.

Following another brief "break" period, a large influx of tropical moisture associated with Tropical Storm Javier brought heavy rains from the Superstition Mountains west through metro Phoenix during the morning of August 9th. Activity continued the following evening from the I-17 corridor west through the White Tank Mountains before one final pulse during the morning of August 11th across the Southeast Valley. When all was said and done, many areas around the county picked up an additional 1.00"-3.00" of rain during the 3-day period before conditions finally dried out.

The third week of the month brought the next active period as a large, nearly stationary, trough developed across the western US sending repeated embedded shortwave disturbances east across the state. Heavy rain fell across western portions of the county during the overnight hours on the 17th, the 18th, and again on the 19th. The active period continued with widespread storms and rain across most of the county on the 20th and then again on the 22nd before the system finally exited the state on the 24th. A fast moving follow-up disturbance brought one more round of storms to the northern half of the county during the morning hours on the 26th. Overall, this period was highlighted by unusually cold temperatures aloft (for mid-August), modest moisture levels, and a pattern more closely resembling late September. Despite several multi-day periods of rain, only localized minor flooding problems occurred around the County. The remainder of August came and went quietly with mainly dry conditions and above average temperatures.

Activity picked back up the first week of September. Localized heavy rain fell across portions of Gila Bend, South Phoenix, and Chandler areas the evening of September 1st. Later that week, tropical system Newton quickly developed off the coast of Mexico before moving north towards Baja Sur and making landfall as a Hurricane near Cabo San Lucas. All attention then turned towards the Desert Southwest as the system continued to track north through the Sea of Cortez and into Arizona as a post-tropical system on the 7th (click [here](#) to see track graphics from National Hurricane Center). Ultimately, the system's center moved northeast across Santa Cruz, eastern Pima, and Cochise counties dropping torrential rainfall before becoming decoupled from its convective bands. In and around the county, heavy rain fell across southwestern locales including Gila Bend, Rainbow Valley, Palo Verde, and Buckeye. These locations picked up anywhere from 0.50"-1.50" which lead to flash flooding in area washes (Sand Tank, Rainbow, etc) during the morning of the 7th. Most locations in and around the Phoenix urban corridor recorded much lower totals mostly below 0.30". Remnant moisture across southcentral AZ led to isolated strong storms the following afternoon south of the Aguila and Wickenburg areas before mainly dry and quiet weather conditions through the middle of the month.

The next period of unsettled weather arrived September 19th-22nd as a cut-off low pressure system across the northern Baja and weak ridging across southern Texas helped draw moisture north from tropical system Paine into Arizona. Widespread light to moderate rain fell across most of the state on the 20th and 21st before a fall disturbance, originating out of the Pacific Northwest, brought a strong cold front across region on Thursday the 22nd. This event was highlighted by strong thunderstorms rolling through the central Valley dropping anywhere from 0.40"-0.75" of rain across Buckeye, metro Phoenix, Scottsdale, and Tempe. Active weather, courtesy of another cut-off system, continued through the last week of the season. The most notable event unfolded on the evening of the 27th as a line of thunderstorms, originating out Tucson, moved north into the County bringing a late season large dust storm to the Southeast Valley and central Phoenix urban corridor. This event was followed up with periods of beneficial rain across portions of the County each day until the official close on the 30th.