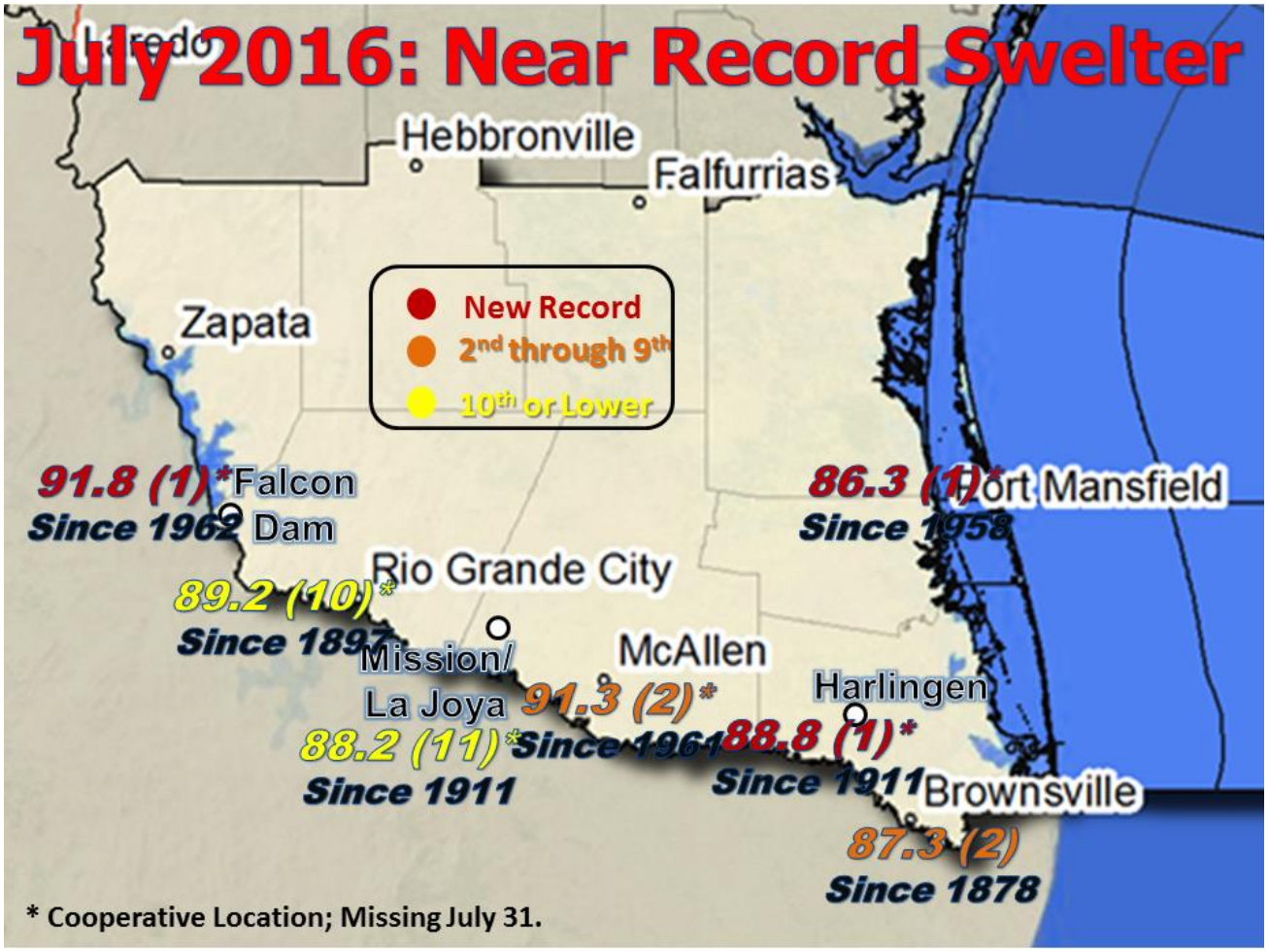
July 2016 Quick Review



Helter-Skelter, July Swelter

Hottest July on Record In Parts of RGV Brings Back Memories of 2009

Oh yes, it *was* that hot!

A nearly stationary ridge, or "dome", of high pressure deep into the atmosphere that parked over West Texas, New Mexico, and northern Mexico – the "La Canícula" position – brought record to near record heat across the Rio Grande Valley in July 2016. While the pattern of "La Canícula" is quite common from early July to mid-August (when the constellation Sirius, or the "Dog Star", rises with the sun) and leads to some of the hottest and driest days of the June to August meteorological summer, a year like 2016 is unusual. In 2016, similar to 2009, the ridge was *stronger than average* and suppressed precipitation while locking in a *surface (*ground-level) high pressure ridge across the eastern and central Gulf of Mexico. Southerly low level winds on the west side of the ridge maintained a "blast furnace" effect of heat across the Valley for the first 18 days of July, and after a very brief respite, returned for most of the remainder of the month. Even a broad upper level disturbance that provided welcome rainfall from San Antonio to Houston during the first half of the final week of the month only left a glancing blow of isolated to scattered "sea breeze" thunderstorms, mainly across the ranchlands north of the Valley. The few days of afternoon rain did nothing to quell the heat; McAllen/Miller Airport, for the only the second time on record, only failed to reach triple digits (100°F or higher) on ***one day*** in July 2016. 2009 was the only other year for such a record. For the Valley as a whole, temperatures ranged from 2 to 5°F above average – impressive when you consider the lesser range (standard deviation) of summer temperatures compared with other seasons.

Brownsville

Rank	Value	Ending Date	Missing Days
1	87.5	1980-07-31	0
2	87.3	2016-07-31	1
3	87.2	1969-07-31	0
4	87.1	1998-07-31	0
5	87.0	2009-07-31	0
6	86.9	1982-07-31	0
7	86.8	1978-07-31	0
8	86.3	2004-07-31	0
9	86.3	1996-07-31	0
10	86.0	2005-07-31	0
Period of record: 1878-01-01 to 2016-07-30			

Harlingen*

Rank	Value	Ending Date	Missing Days
1	88.8	2016-07-31	1
2	88.1	1998-07-31	1
3	87.9	2009-07-31	3
4	87.4	1943-07-31	0
5	87.3	1946-07-31	2
6	87.3	1945-07-31	0
7	87.2	1960-07-31	0
8	87.0	1953-07-31	0
9	87.0	1957-07-31	0
10	86.6	1950-07-31	0
Period of record: 1912-02-07 to 2016-07-31			

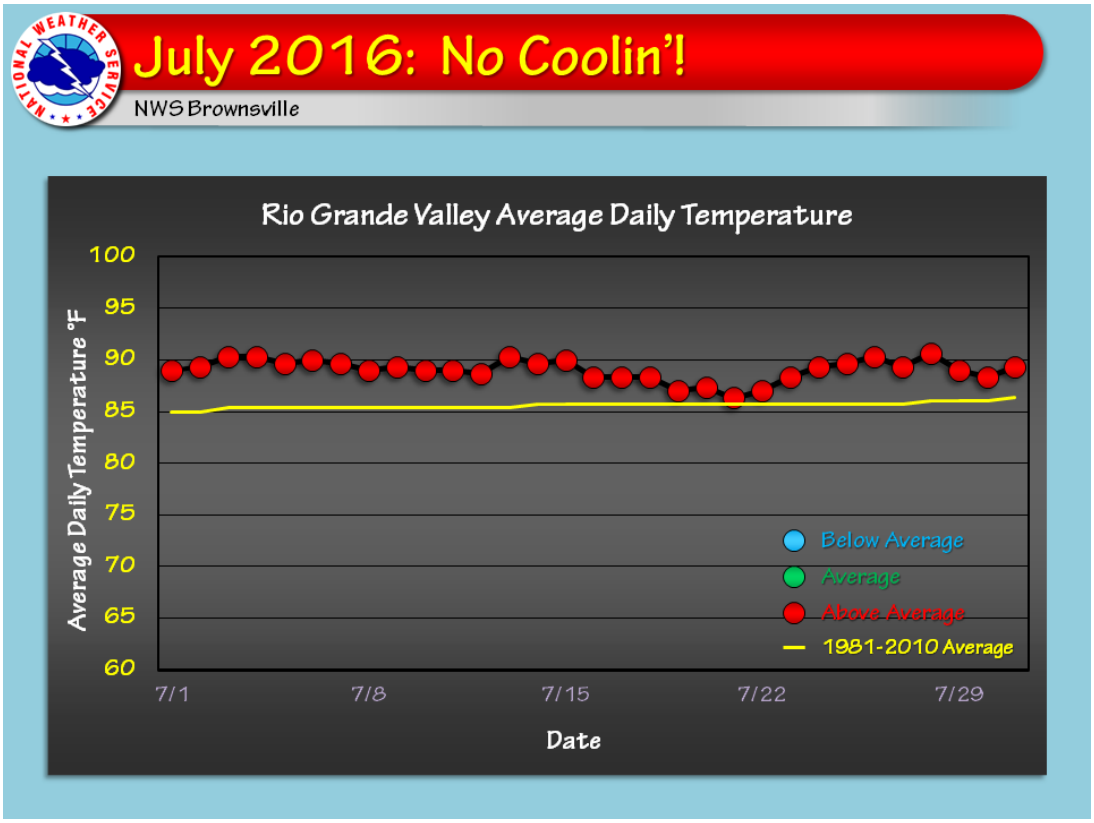
McAllen/Miller

Rank	Value	Ending Date	Missing Days
1	92.8	2009-07-31	0
2	91.3	2016-07-31	1
3	90.1	1998-07-31	0
4	89.6	1980-07-31	0
5	89.1	2015-07-31	0
6	89.1	1996-07-31	0
7	89.1	2012-07-31	0
8	88.5	1994-07-31	0
9	88.3	1979-07-31	0
10	88.3	2000-07-31	0
Period of record: 1961-01-14 to 2016-07-30			

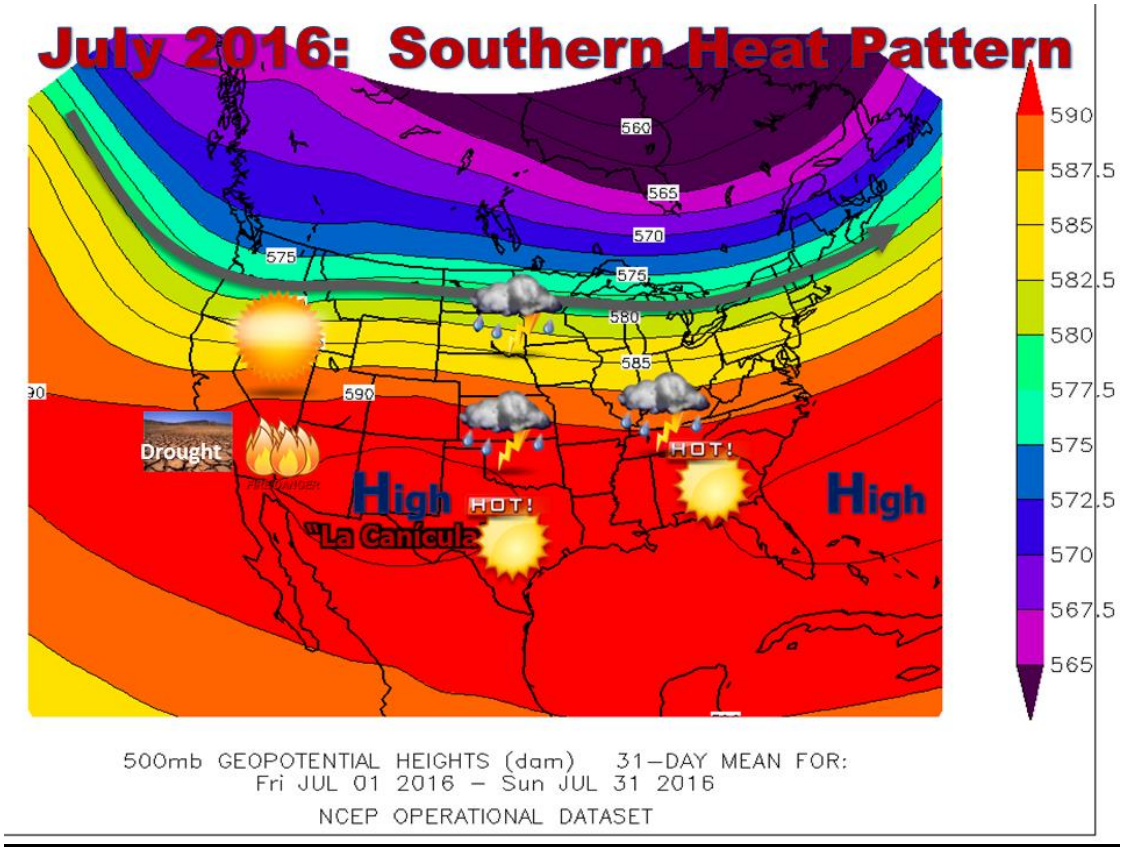
Why So Hot?

We believe a combination of atmospheric puzzle pieces fit together just right to create a repeat of 2009, and to some degree, 1998, in July 2016.

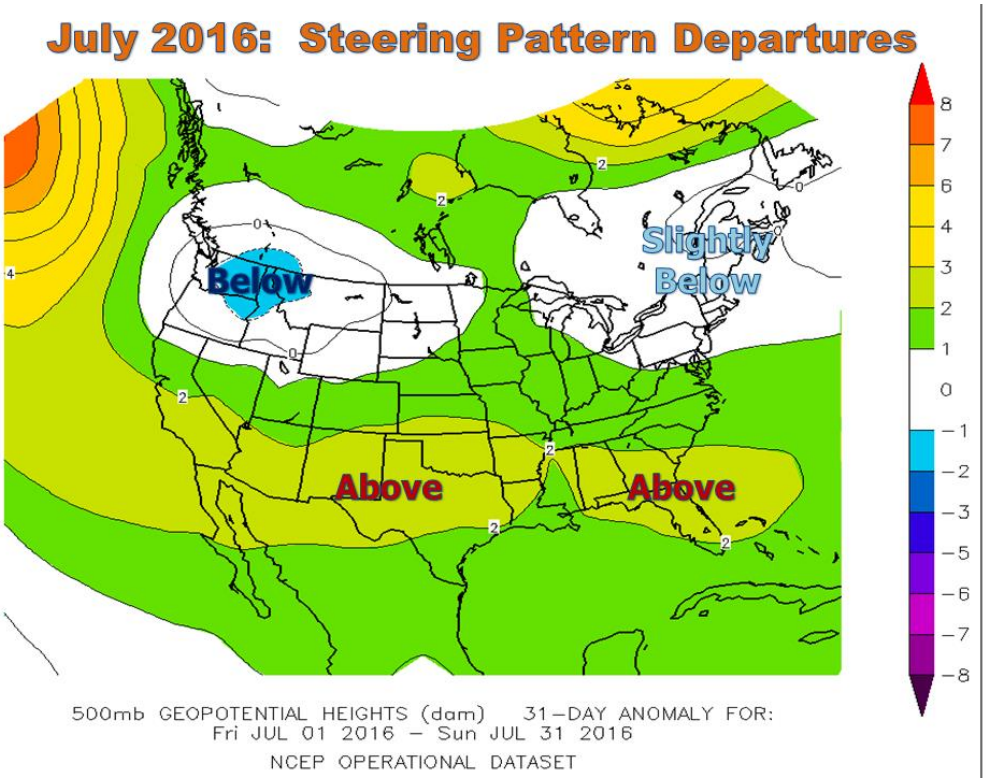
- ***El Niño/Southern Oscillation*** likely had less to do with the outcome than other "teleconnections". For one, the Oscillation switched from positive to neutral in late spring and early summer, then "leaning" toward La Niña, by mid-summer. But July 2015 was also hotter than average as El Niño was becoming moderate. For sake of comparison, the rapid change from strong El Niño to a weak La Niña between late winter and late summer 1998 correlated with one of the top-five hottest July's, but this may be where the comparison ends.
- ***North Atlantic Oscillation Negative Phase (-NAO).*** In 2009, a pronounced –NAO was in play through the summer. In 2016, NAO turned from persistently positive in winter and early spring to persistently negative from late spring through July. –NAO tends to favor an eastern or northeastern U.S. trough in the winter, and often a "shadow" trough in the summer. An eastern/northeastern U.S. trough tends to bump up the Great Plains and/or southwest (Canícula) ridge, enhancing compressional heating at the hottest time of the year.
- ***Positive Phase of the Pacific Decadal Oscillation (PDO).*** While there is much more uncertainty on the impact of a +PDO, the persistence of above the much above average eastern Pacific sea surface temperatures, and depth of said temperatures, tended to strengthen an atmospheric high pressure ridge along the California coast through winter, spring, and early summer. Eastward extension of the ridge *may* have been a catalyst for a stronger-than-average "Canícula" ridge.



This line chart says it all: Every day in July 2016 was above the 1981-2010 average across the Rio Grande Valley.



Above: Heat dominated the southern half of the United States, as atmospheric high pressure, or a "heat dome", was unrelenting. Farther north, proximity to the jet stream brought periodic dangerous thunderstorms and flooding to the southern/central Great Plains, Mid- Mississippi Valley, and occasionally the Mid-Atlantic States and northeast U.S.



The value of the height of the 500 mb (~18,000 foot) equal pressure surface was only 2 decameters above average, but made all the difference when comparing with the slightly below average values across the Pacific Northwest and especially the Northeast states. The flat, southern ridge suppressed precipitation and compressed air to near or above record levels in much of south Texas in July 2016.