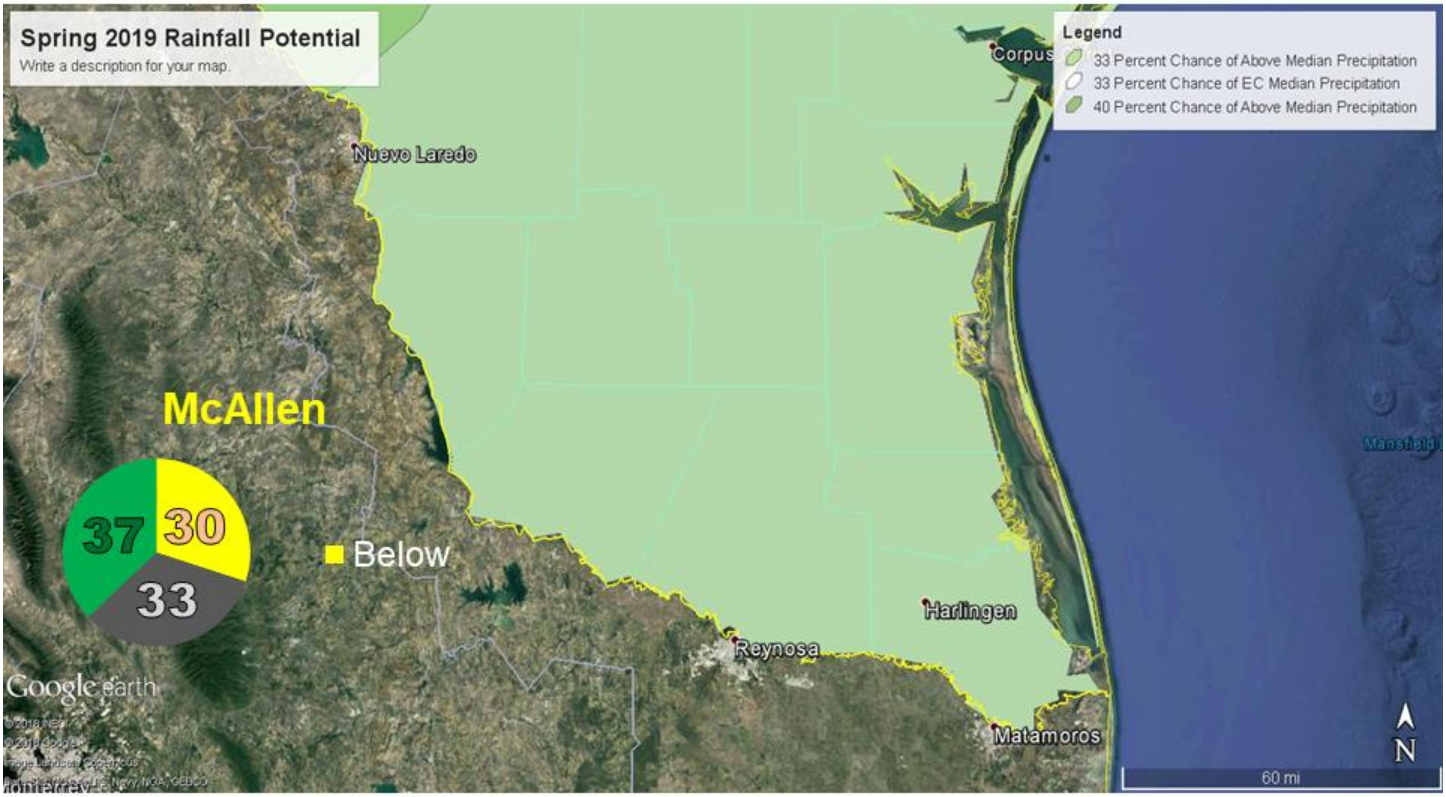
A Little Wet...A Little Stormy?



Rio Grande Valley Average for March-May (based on 1981-2010)
Precipitation: Ranges 4 ½ inches Mid/Upper Valley to 5-6 inches Ranchlands and Lower Valley

El Niño to Keep Pattern Active

As Temperatures Gradually Warm, Stormy Weather May Follow

"Up and Down" Temperatures Likely into March; Thunderstorm Season May Be Active

Overview

As winter (December 2018 – February 2019) headed for the finish line, the season would not be remembered for any single major weather event but rather the frequency of changeable conditions due to 'northers, which numbered (22) at the end of the season. Despite the frequent changes, warmer than average periods outpointed cooler to colder periods, and the winter would end up 2 to 3 degrees above the 1981-2010 average. The winter may be remembered for frequent cloudy periods, with plenty of drizzle and light rain but totals across the Valley running at one-third to one-half of average. The combination of mild and damp weather with no significant prolonged dry spells or freezes allowed trees and grasses to get a jump on spring, with blooms starting at the end of January and peaking in late February.

The spring outlook remains fraught with uncertainty. A weak to potentially moderate El Niño (see section below) looks to remain established through spring, which is likely to keep the impressively speedy mid latitude jet stream cruising along through March and perhaps into April, with the strongest flow gradually receding north

as the season progresses. Initial long range forecast into March suggest a lack of a deep subtropical connection, which would tend to favor a general west to east upper level flow pattern, with a few "dips" bringing several more 'northers but with less pronounced cold influence. Such a pattern would favor a "lean" toward slightly above average temperatures in March (average daytime temperatures range from the upper 70s to lower 80s and morning temperatures in the upper 50s to lower 60s). March precipitation, which is among the lowest on average for the calendar year (~1 inch or so) could end up above average, courtesy of one stationary or slow-moving front with increased low level moisture lifted by a disturbance that drifts by close enough to create the necessary lift – hence the "lean" toward above average rainfall which is a low bar to cross given the predicted pattern in March.

April and May are true "wild cards", simply because the persistent westerlies across the mid latitudes will lift slowly and "buckle" infrequently. This literally means equal chances for above or below average rainfall, with a continue expectation of at least slightly warmer than average temperatures. Should a flat ridge pattern develop across northern Mexico, and extend at times into southern New Mexico and south Texas, the Valley will see more frequent hot days with century-mark afternoons across the upper Valley and ranchlands possible between late April and May. A flatter flow aloft would tend to limit the number of hot days – though still a couple degrees above average – which has the story in winter.

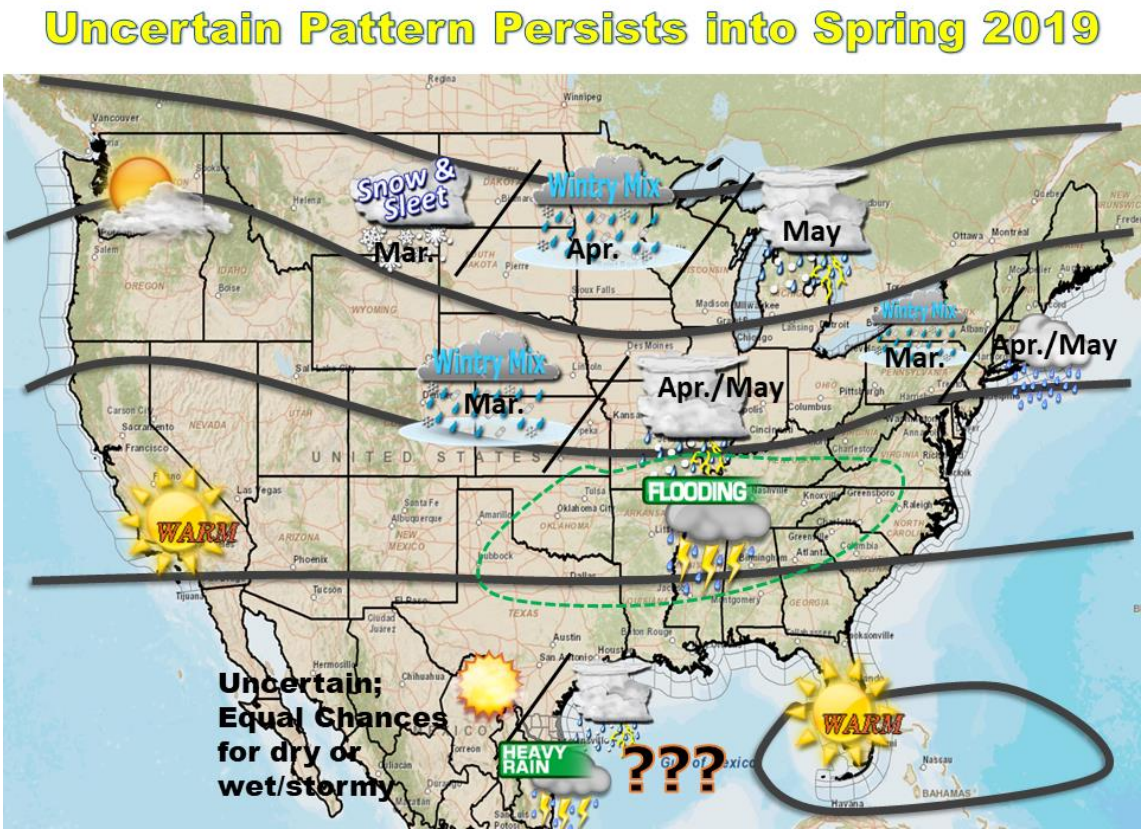


Figure 2. Potential mean steering pattern at 500 mb (~18,000 feet) for the USA during spring 2019. Uncertainty remains dominant on both the pattern and location/duration of individual elements with it.

Pattern Matters

Zonal (West to East) Flow Keeps Frequent Changes into March; Beyond is Uncertain

- A few more "gray" (more likely) and "blue" (infrequent but occurring) 'northers is expected through March
- Fewer fronts in April; uncertain if they "lean" dry or wet, but as upper level ridge (above) noses farther north in time, any fronts would tend to be drier.
- The Arctic Oscillation (AO) turned positive in February, while the North Atlantic Oscillation (NAO) remained parked in neutral with a slight positive lean. There were no signs of a significant negative phase (-AO, -NAO) which could be a signal for fewer "dry" fronts and rather a general rain-free situation

as spring moves into April and May, but with modest to fairly high relative humidity. Unlike for winter, the impact of AO/NAO is less pronounced regarding cold/warm or rainy/dry outcomes.

- While the probability of above average rainfall remains on the high side (first page), much will depend on the ultimate position and duration of atmospheric pressure systems in the southwest U.S. and northwest Mexico. Winter showed virtually no tap of deep tropical moisture, and this trend continued into early March. For the March-May period, the primary delivery of rainfall to produce at or above average totals for the season is likely to be in the form of mesoscale convective systems. These thunderstorm clusters can drop a spring season's worth of rainfall in just a few hours, as was seen in March 2012 on the day of the McAllen hailstorm.
- There remains some uncertainty in whether there will be a tropical connection later this spring. Typically, when winter and early spring have none, it is difficult for one to develop by late spring. Long lead outlooks for late spring through summer show above average temperatures returning in force, which would be related to an early onset of "La Canícula" and the end of an eastern tropical Pacific Ocean tap.

Teleconnections: Weak to Moderate El Niño Near Certain for the Period. The rest? Uncertain!

After a brief dip in early winter, eastern tropical Pacific water temperatures rebounded a bit in February and continued to maintain a solid warm nose (Figure 3) that initially surged in September and October 2018. All Niño regions were warmer than normal, with the Niño 3+4 region rebounded back above the Oceanic Niño Index of 1.0. The latest forecast (Figure 4) matches nicely with the persistence of downward Kelvin Waves (Figure 5). The early March forecast from NOAA's Climate Prediction Center continues a 55 to 65 percent likelihood of El Niño conditions through spring, but expected to begin dropping off by April or so. With the recent uptick, as well as another downwelling Kelvin Wave, confidence is high for some degree of El Niño to prevail through the March-May period.

Trends in other teleconnection patterns, such as the NAO, AO, Pacific-Decadal Oscillation (PDO), and Pacific-North American (PNA), have been difficult to pin down this winter. As mentioned above, the NAO has been largely parked close to "neutral" since the start of 2019, with just a slight lean into the +NAO direction. Little change to this trend was expected through March, and the NAO's influence later in spring tends to lessen (though it can help impact 'La Canícula" in summer). The AO, on the other hand, has been a bit more strongly positive through the winter – and may have had some influence on the persistent fast-moving mid latitude flow that has largely kept persistent cold or warm weather from impacting the Valley. Finally, the PDO, which had a prolonged negative trend from late 2007 through mid-2013 (which may have been a background contributor to more severe/extreme/exceptional drought periods during that time), followed by a nearly four year period of notably positive (+PDO) trends through mid-2017 (a time of limited and/or prolonged drought), has also gone "quiet" since, with barely positive values through late 2018.

With little to bank on from teleconnections which can either assist or be enhanced by El Niño, confidence in the spring seasonal outlook is best based on a continuation of the fast-moving *mid-latitude* flow, which will inevitably lift northward as March turns to April and April turns to May. This would actually favor near to *below normal* rainfall, with limited chances of a persistent tropical connection that would create a situation similar to late March through May 2012, where at least eight separate severe weather episodes (hail, followed by wind and a few tornadoes) impacted some part of the populated Rio Grande Valley. Still, the fact that a fast mid-latitude flow is expected to continue for a good part of spring means that it would only take one instance of puzzle pieces coming together – an instance or two of a subtropical event feeding into the mid latitude jet to produce heavy rains in South Texas, or a diving upper level system into northern Mexico that draws deep tropical moisture northward from the eastern tropical Pacific and Bay of Campeche – to produce single or multiple event rains, in the form of thunderstorm clusters or systems, to easily push totals over or well over average. This also occurred in 2015 (weak El Niño headed to strong) with near record spring rains, and at times in 2016 (strong El Niño tapering off) with fewer "big" rains but still enough to minimize dryness.

Stay tuned.

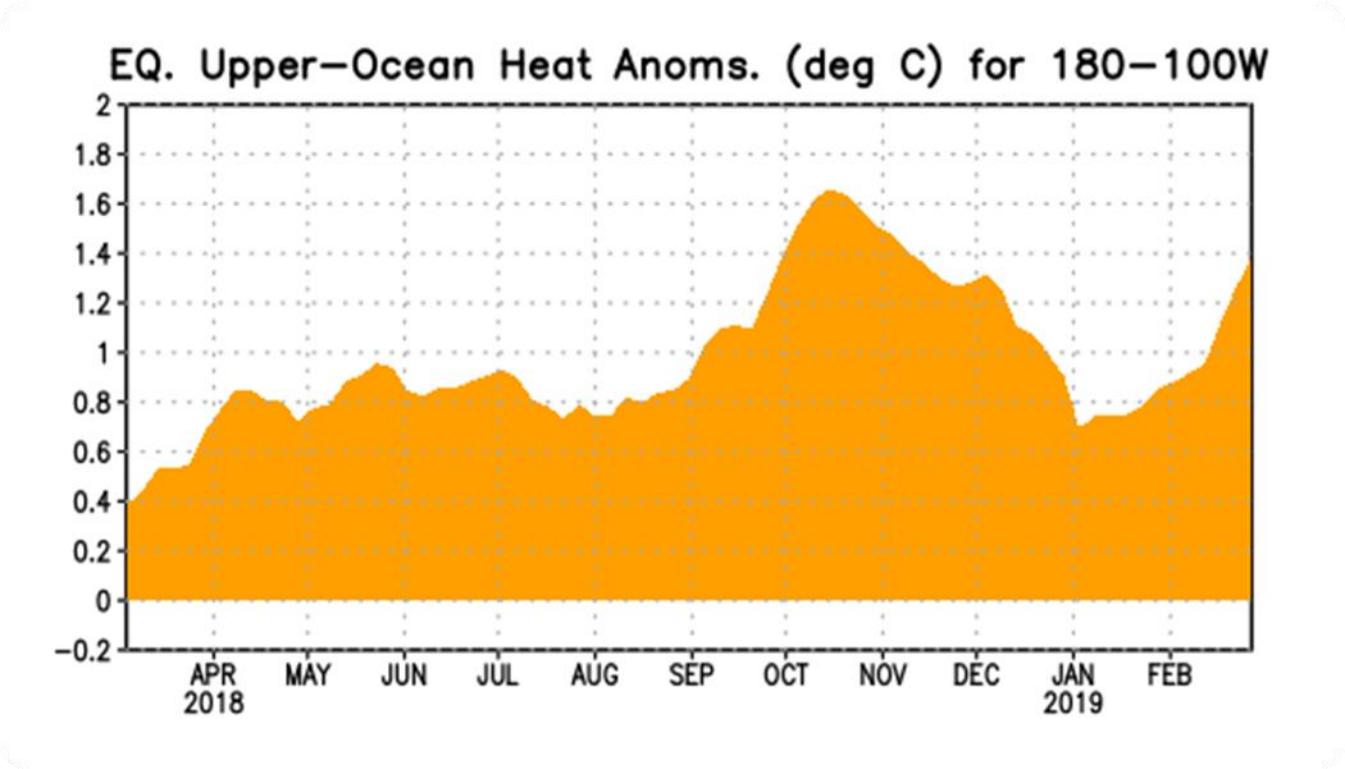


Figure 3: Upper oceanic heat content in the ENSO zone (generally equator to 5˚N or so latitude) dipped briefly in December and January, but has surged in late February and early March, and sign that at least a weak to moderate El Niño will continue through spring 2019.

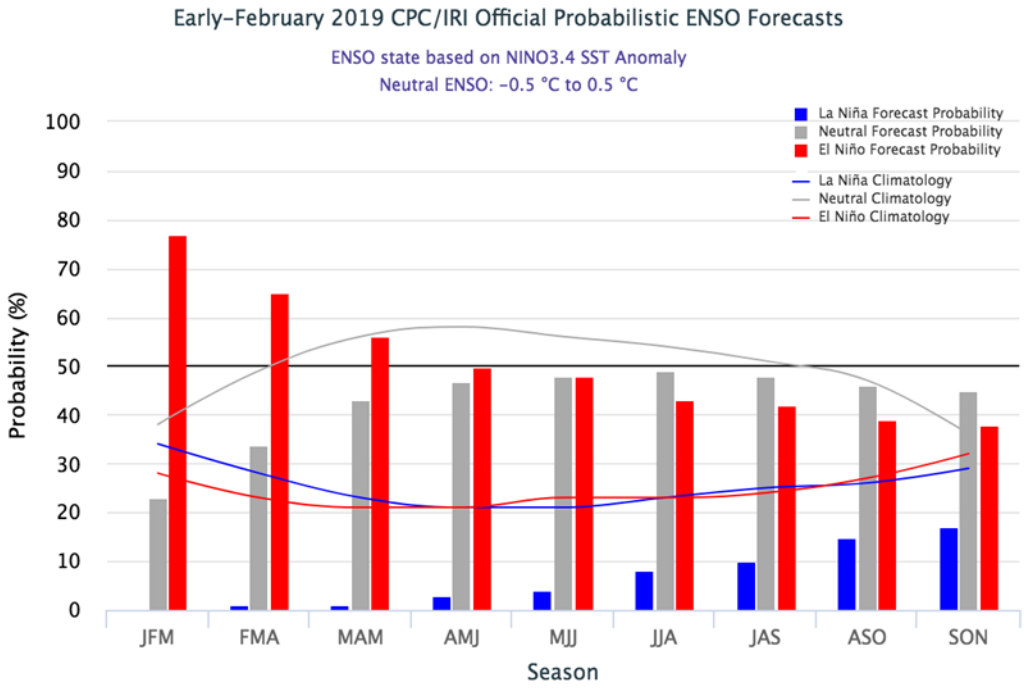


Figure 4: Multi-model consensus forecasts maintained the probability of a weak to potentially moderate El Niño through spring 2019.

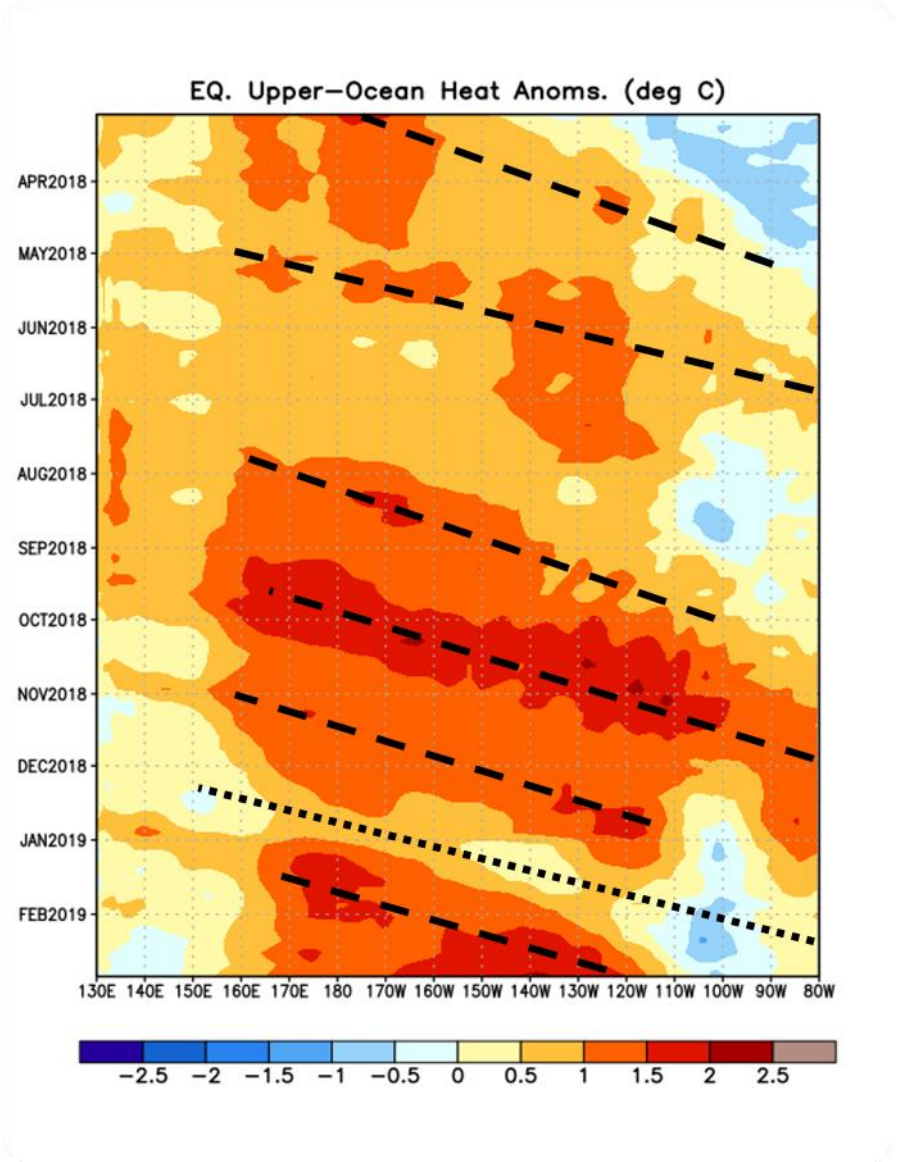


Figure 5. 12 month Kelvin wave trends (since March 2018). Warm, downwelling waves have dominated much of the year, and one of the strongest was moving through the central Pacific in February 2019, increasing the possibility for a short-fused moderate El Niño while ensuring a five three-month period of ONI values of +0.5 or higher (as of February, the previous four three-month periods had reached this criteria).

What to Watch For: (More) Changeable Weather through March, then a "lean" toward warmer to hotter and drier in April and May

The following situations are expected to predominate through the remainder of spring (March-May):

- *March shifting from lambs to lions and back again.* Or, a "roller coaster" of weather changes. The first full weak of March began with a late spring lamb (March 3) then crashed into winter (March 4-6) before rapidly recovering to summer warmth and record temperatures by the end (March 9). A warm week to follow was expected to get cooler to perhaps chillier by mid month, with a slow recovery toward or just above average thereafter. The month has equal chances to end above average, average, or below average for temperatures.
- *Dry and warm/hot to follow, with a wary eye on dangerous thunderstorms?* There are decent chances that spring will favor limited convective (thunderstorm) activity with a lean toward warm to hot and dry weather – but with an active mid latitude jet, one needs to keep a close eye on any "dips" that come over an eastern (mid-latitude) A Pacific high pressure ridge and drop into the southwest U.S. before headed east. One or more "dips" just far enough south could be the impetus for one or more squall line / thunderstorm "system" setups in April and May, which is always a concern for vulnerable communities of the Valley when it comes to damaging wind, large hail, excessive lightning, and local flooding.

- *Drought.* Abnormally dry to moderate drought conditions have been pesky across Deep South Texas and parts of the Valley, favoring Starr, Zapata, and Jim Hogg for most of the winter. Should rains remain light in March, severe (level 2) drought will arrive across the upper Valley and parts of the ranchlands. A lifting of the mid latitude pattern (while remaining "flat") into April and May would guarantee severe to locally extreme drought for many by the end of spring. Conversely, one or more squall lines/thunderstorm systems (aided by "dipping" jet events described above) would keep drought in check with overall rainfall from just two events sneaking over the three month average.

Outlook: Spring 2019

March began with a roller-coaster through the 10th, with a warm start followed by a much colder than average streak that ended with a much warmer than average couple of days, with the result temperatures about two degrees or so below average after 10 days. That roller coaster is expected to continue for the middle to latter weeks of the month, with a warm start and a cooler than average finish. The final week was "leaning" cooler but with very low confidence. The potential for a rare "near normal" month, temperature wise, was likely. Rainfall continued to track below average with significant events dumping big totals across central/north/east Texas while leaving the Valley largely dry. March is typically dry (~1 inch or rain on average) so just one event would be enough to push totals to or above average – and this is possible, even as drought may trend toward moderate to severe levels.

April favors a lifting mid-latitude jet pattern that would also favor at least an above average temperature month with a slight lean toward below normal precipitation. While this is the "lean", confidence is medium-high for temperature based on current trends, but only low on precipitation. Just two southwestern U.S. dipping jet stream events that can bring fronts with leading moisture into or through the area would be enough to produce at or above average rainfall, which could be in the form of severe weather in the form of damaging wind, large hail, and flooding (in case of slower-moving thunderstorm 'systems'.

May favors further lifting of the mid latitude jet, with a potential for early season "La Canícula" ridging to set in by mid to late month. This has been a recent trend since 2014, and with many background puzzle pieces in a "neutral" zones, there is little to argue against this. Still, the pattern could "break" with another southwestern U.S. low pressure system pumping up deep tropical moisture through mid month, which would ensure a month of at least average rainfall. Yet again, confidence continues on the low side for precipitation potential.

Preparedness, Awareness

The forecast is high confidence for changeable weather in March and perhaps stretching into April - which is medium to high confidence for one or more significant impacts. But low confidence in exactly which impacts those will be! Below are shown the impacts one should keep in the "better safe than sorry" back of the mind category for Spring 2019

- ***Wildfire Danger.*** High values of the Keetch-Byram Drought Index (above 500) were seen across most of Deep South Texas by early March, with a couple of pockets of 600+ values in the agriculturally rich Lower Valley region. A spring with below average rainfall and above average temperatures would accelerate these values into the danger zone (600 to 800) which, combined with a decent green-up season and modest growth of rangeland grasses and brush, following a modestly cured winter for most of winter in locations such as northern Hidalgo, southern Brooks, central Jim Hogg, and central/northern Zapata County, the threat for rapid to explosive growth wildfire becomes very real during cases of dry, hot "fronts" similar to those which occurred in April 2011. This will be highly dependent on drought evolution, which remains uncertain.

- ***Drought Severity.*** Falcon Reservoir has the water they need to assist with any spring irrigation that may be required should the mid to late spring warm and dry "lean" bear out. That said, smart **conservation**

should always be part of everyone's water use plans in our ever-growing Valley. Crop and livestock irrigation remains somewhat likely during the remaining spring 2019 growing season based on the expectation of increasing moderate and pockets of severe drought, with some possibility of ***severe*** to even ***extreme*** drought come May. The saving grace would be a continuation of "just in time" moderate to heavy rainfall. That possibility looks to be uncertain (leaning toward no, but with low confidence) for the remainder of spring 2019.

Drought Severity Classification

			Ranges				
Category	Description	Possible Impacts	Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: ▪ short-term dryness slowing planting, growth of crops or pastures Coming out of drought: ▪ some lingering water deficits ▪ pastures or crops not fully recovered	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	Moderate Drought	▪ Some damage to crops, pastures ▪ Streams, reservoirs, or wells low, some water shortages developing or imminent ▪ Voluntary water-use restrictions requested	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	▪ Crop or pasture losses likely ▪ Water shortages common ▪ Water restrictions imposed	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	▪ Major crop/pasture losses ▪ Widespread water shortages or restrictions	-4.0 to -4.9	3 to 5	3 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional Drought	▪ Exceptional and widespread crop/pasture losses ▪ Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

- ***Hail, Damaging Wind…Tornadoes?*** Probabilities are mixed through the remainder of March. The "lean" favors fronts to come through either dry (with deeper moisture displaced well north of the Rio Grande Valley) or as another one or two "gray" 'northers. That said, as the lower levels of the atmosphere continue to warm with increasing sun angle, the opportunity for a severe weather event (mainly hail, but potentially damaging winds) does exist if an upper level low can "dive" into northwest Mexico before ejecting toward Texas. April and May should see few if any of these types of events, but they can't be ruled out completely – again a result of the continued fast-moving jet stream that can spawn a rogue diving wave or two. If they do occur, a more unstable (effectively warmer and more humid) awaits in south Texas, which would increase the opportunity for squall lines rolling in from the Sierra Madre and the Rio Grande Plains. Such a season was spring 2015; other years featuring spring squalls were 2010, 2012, and 2016. 2010, 2015, and 2016 were El Niño springs.

  Take advantage of quiet times to build resiliency to your home, including roofs, walls, windows, doors, and garages. Details on home severe weather readiness can be found at the Federal Alliance for Safe Homes website.

- ***Flooding Rain***. Spring thunderstorms fed with upper level energy can produce not only dangerous hail, wind, and perhaps a tornado – but also excessive lightning and locally intense short-period rainfall and high rainfall rates. In 2015 – a period of weak spring El Niño that led to a strong El Niño by the end of summer which continued into spring 2016 – several thunderstorm "systems" left local flooding in pockets of the Valley and ranchlands between April 10th and May 31st with near record to record rainfall across Deep South Texas (favoring the Brush Country ranchlands) that left nearly all of the state in "exceptional wetness" by June 1. It's always safe to be flood prepared as it only would take one or two deluges to turn dry/drought conditions into a "lake".