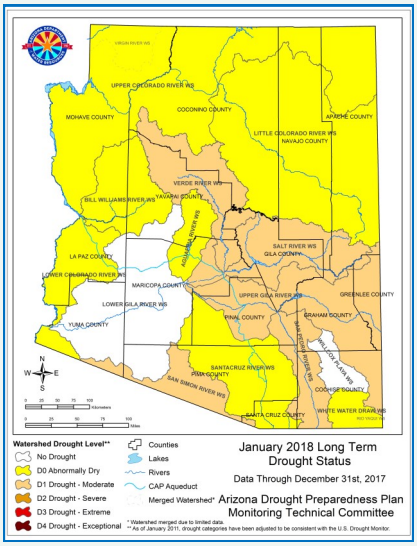
Long-Term Drought Map– Old Vs. New

The Drought Monitoring Technical Committee (MTC) is proud to present you with a new long-term drought map to be used for the Arizona Long-term Drought Status Reports. The details below provide more information on the previous watershed-based long-term map including its drawbacks, and explanation on the benefits of the new gridded SPI-SPEI map.

Previous Watershed-based Long-term Map:



The watershed long-term drought map used watershed-average precipitation from rain gauges within each watershed to calculate the Standardized Precipitation index (SPI). These maps use data from 1971 through the most recent month and are calculated for 24-, 36- and 48-month periods. These longer periods are used to represent hydrologic drought– essentially the effect on water resources, both surface and groundwater. The SPI ranks the most recent 24-, 36-, and 48-month periods with the historical records to determine which percentile the current period falls in. For example, an SPI value in the lowest 2% would correspond to Exceptional Drought, while values above the 30th percentile would correspond to No Drought.

Two drawbacks of this method are the spatial resolution & length of record:

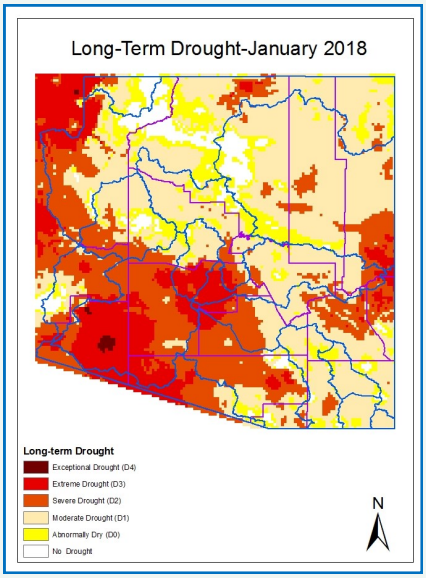
1. The lack of spatial resolution requires precipitation to be averaged and the entire watershed is represented in the same drought condition, which is often not the case.
2. The historical period used is quite short, at 46 years, and as Arizona enters its 23rd year of drought, dry years overwhelm the record, so the "normal" is represented as much drier than if considering a longer period.

New Gridded SPI & SPEI Long-term Maps:

To improve spatial resolution and length of record, the MTC is starting to use a new gridded map, which incorporates both the SPI and SPEI maps.

Gridded SPI Map: Data used in this map is derived by the PRISM Group, Oregon State University, using algorithms that account for terrain, rain shadows and other complex processes in the climate system. While this interpolation may not be perfect, it provides a better representation of precipitation variability across the watersheds. In addition, the period of record for this data is available from 1895 through the most current month, providing 76 additional years of data.

Gridded SPEI Map: While the SPI map uses only precipitation data, the Standardized Precipitation Evapotranspiration Index (SPEI) map includes both precipitation and evapotranspiration data by incorporating temperatures, according the Thornthwaite method. The addition of evapotranspiration data to the map can be useful, however in a desert environment where dry conditions are normal, this may overestimate the drought because once the soil and vegetation have dried out, additional high temperatures will not dry it further.



Because neither of these maps provide a perfect representation of reality, the best representation is somewhere between the SPI and SPEI data.

After looking at the monthly gridded maps of various SPI and SPEI combinations over the past year and comparing them to impacts noted around the state for long-term water resources, the MTC decided the map shown here provides the best drought depiction at this time. It uses the same 24-month, 36-month and 48-month averages of SPI and SPEI, and essentially subtracts ½ of the SPI values from the SPEI values at each grid cell.