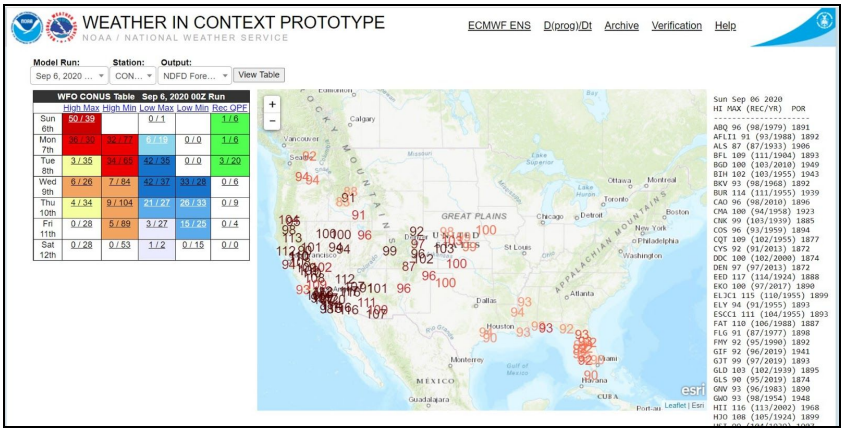
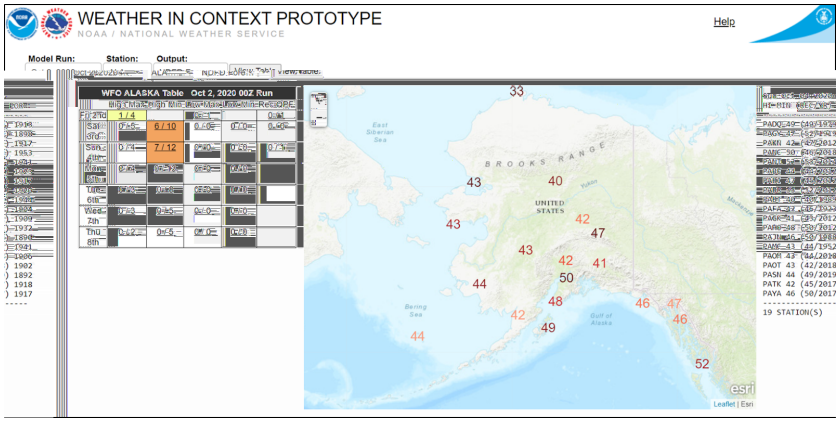
Weather in Context
Usage Manual

Overview

The Weather in Context (WIC) tool displays forecast information within a climatological context to alert a forecaster to when a record or near-record breaking event is possible.

The main display (for both the contiguous United States (CONUS) and Alaska) contains a table highlighting when the National Digital Forecast Database (NDFD) is nearing or breaking a station record. The stations compared come from the ThreadEx project that include records of daily precipitation, maximum temperature, and minimum temperature. Clicking on a cell in this table produces a map that displays the locations of these stations as well as other potentially record breaking stations according to the NDFD forecast.





Individual stations can be further interrogated to see where the NDFD forecast falls with respect to an ensemble of model forecasts as well as the station records. Selecting an individual station from the **Station** menu generates a 7-day forecast table for that station that is color coded by

how close the NDFD comes to breaking the record. Selecting a cell from that table produces a violin plot that provides forecast consensus and probabilistic information.

Usage

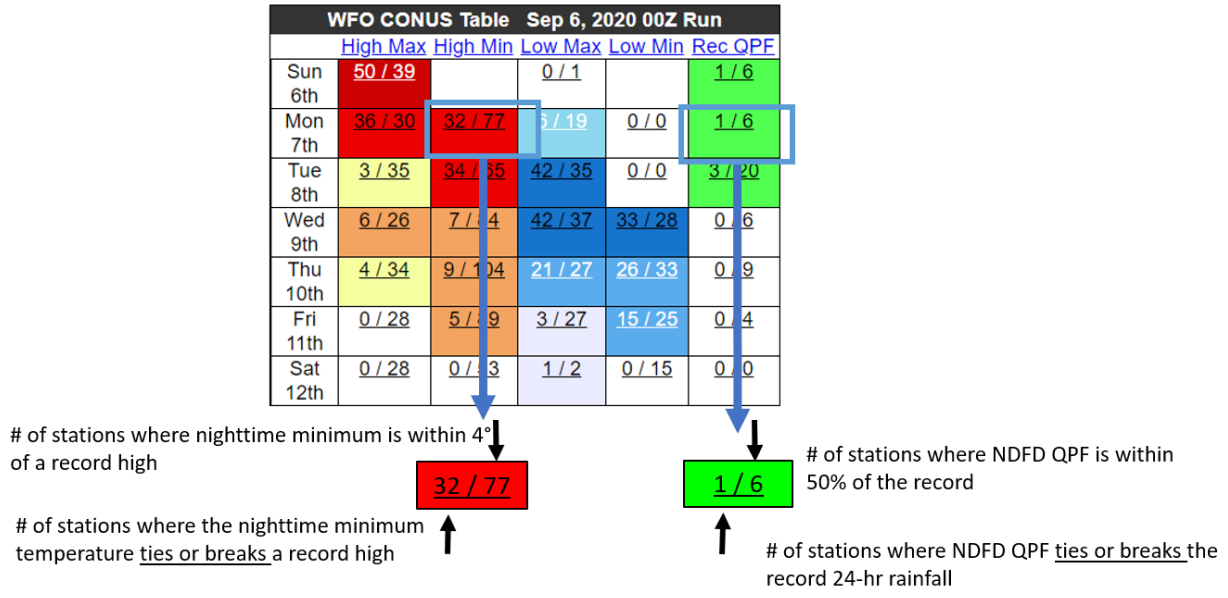
The initial display is an NDFD Records comparison table that is color coded based on how many stations in the CONUS/Alaska domains have a NDFD forecast that either ties or breaks the record.

More Than 50 Record Max or High Mins
31-50 Record Max or High Mins
16-30 Record Max or High Mins
6-15 Record Max or High Mins
1-5 Record Max or High Mins

More Than 50 Record Min or Low Maxes
31-50 Record Min or Low Maxes
16-30 Record Min or Low Maxes
6-15 Record Min or Low Maxes
1-5 Record Min or Low Maxes

More Than 50 24-Hour Precipitation Records
31-50 24-Hour Precipitation Records
16-30 24-Hour Precipitation Records
6-15 24-Hour Precipitation Records
1-5 24-Hour Precipitation Records

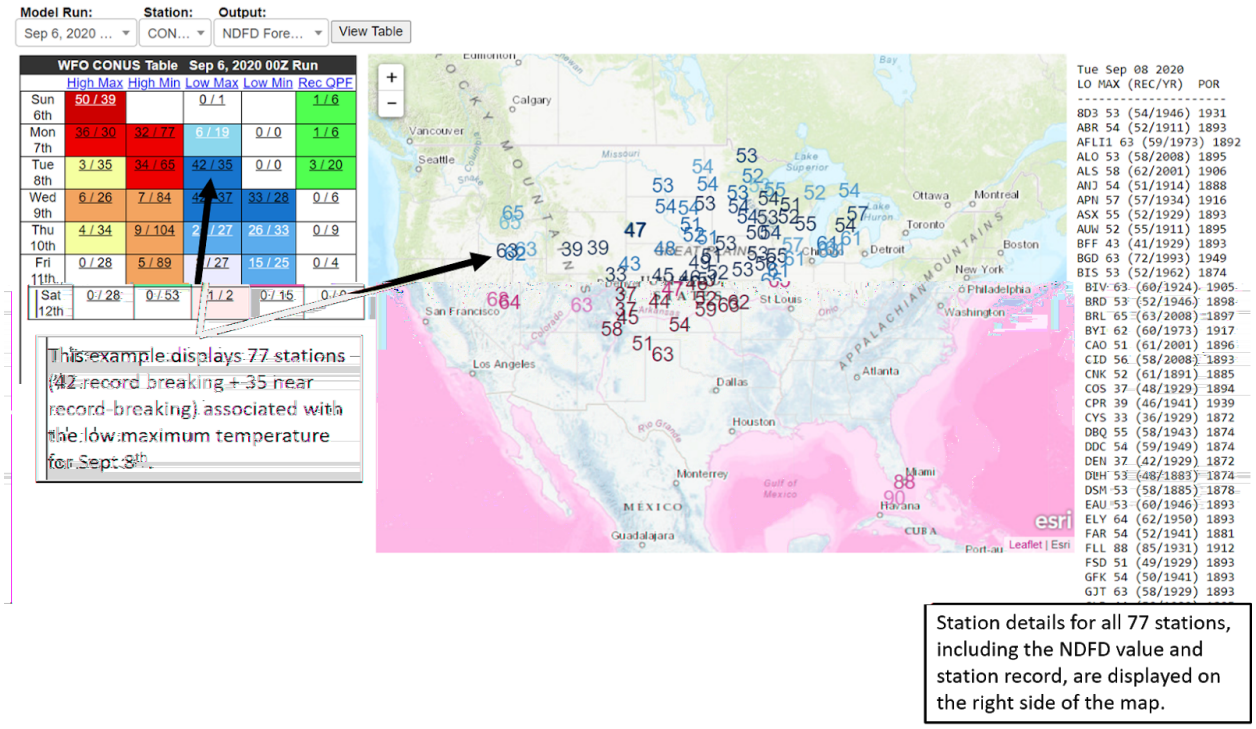
The data that populates the tool comes from gridded NDFD that is linearly interpolated to each station latitude and longitude. Each cell contains two numbers separated by a forward slash: **the number on the left represents the number of stations that tie or break the record; and the number on the right is the number of stations that are approaching the record (see example below)**. A station is considered "approaching the record" when the NDFD forecast is within 4 degrees Fahrenheit of the record daily maximum or minimum high/low temperature.



The "High" label above the first two columns represents the daytime maximum or nighttime minimum temperatures in reference to how close they come to breaking a record high.

Conversely, the “Low” label in the second two columns represents the daytime maximum or nighttime minimum temperatures in reference to how close they come to breaking a record low. For QPF, the station is approaching the record when the NDFD forecast is within 50% of the record 24-hr rainfall.

Clicking on any one of the cells in the table brings up a zoomable map highlighting the locations of significant values marked by the NDFD value for the forecast parameter selected (see example below).



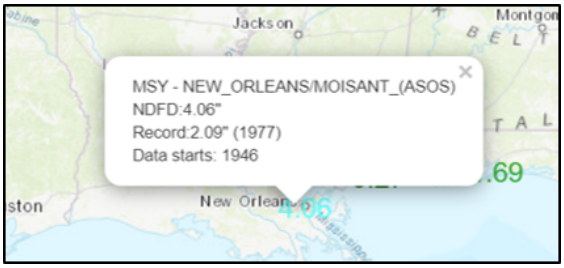
The significant station values highlighted on the map are color-coded based on the following key:

Break Record Max or High Min
Tie Record Max or High Min
1 Degree from Tying Record Max or High Min
2 Degree from Tying Record Max or High Min
3 Degree from Tying Record Max or High Min
4 Degree from Tying Record Max or High Min

Break Record Min or Low Max
Tie Record Min or Low Max
1 Degree from Tying Record Min or Low Max
2 Degree from Tying Record Min or Low Max
3 Degree from Tying Record Min or Low Max
4 Degree from Tying Record Min or Low Max

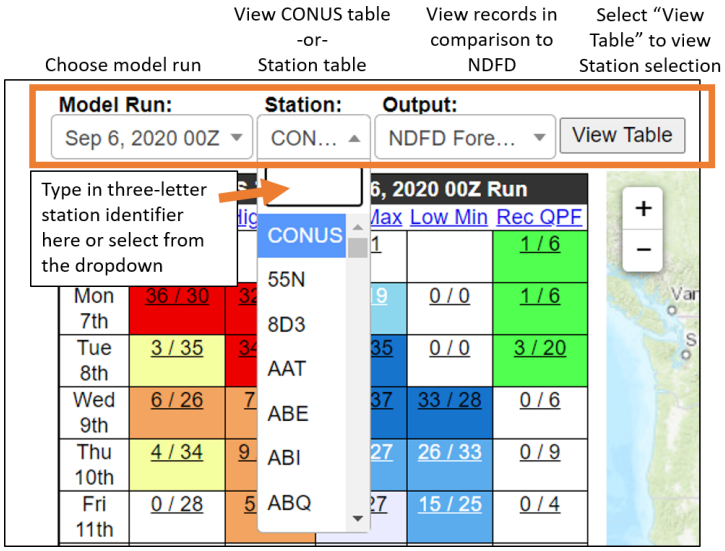
150% or Record Precipitation
125% of Record Precipitation
100% of Record Precipitation
75% of Record Precipitation
50% of Record Precipitation

Clicking on a value on the map gives information on the three-letter station identifier, full station name, NDFD value, record value and record year, and date that the record starts.



Once the user has identified a station of interest, they can select the station from the dropdown menu located above the table (see example below).

Typing the three-letter identifier into the “Station:” dropdown and selecting the **View Table** button brings up a 7-day forecast table that highlights when the NDFD Max T, Min T, or QPF either breaks or nearly breaks a record for that individual station.



The user can **return to the NDFD CONUS/Alaska table** by repeating this action with CONUS (or ALASKA) selected from the **Station** dropdown.

The station tables are color-coded based on the key below (i.e., same key for map values above):

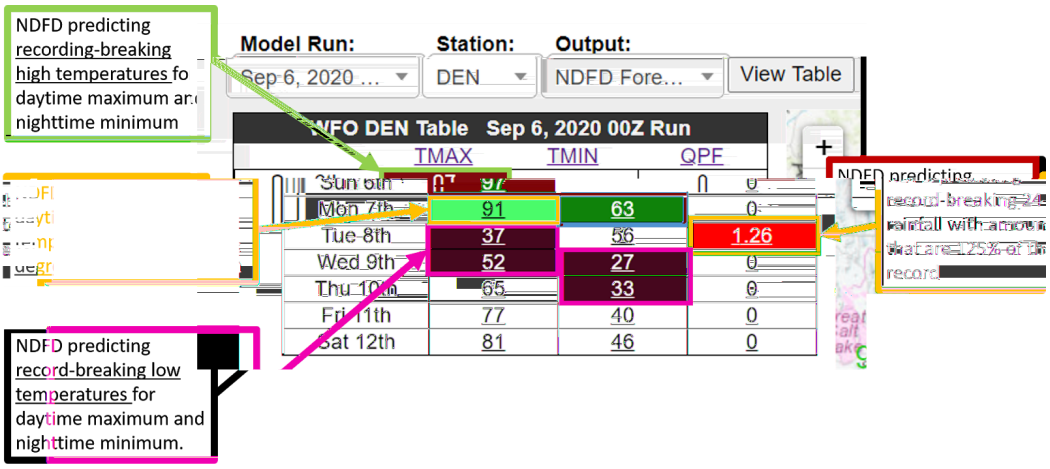
Break Record Max or High Min
Tie Record Max or High Min
1 Degree from Tying Record Max or High Min
2 Degree from Tying Record Max or High Min
3 Degree from Tying Record Max or High Min
4 Degree from Tying Record Max or High Min

Break Record Min or Low Max
Tie Record Min or Low Max
1 Degree from Tying Record Min or Low Max
2 Degree from Tying Record Min or Low Max
3 Degree from Tying Record Min or Low Max
4 Degree from Tying Record Min or Low Max

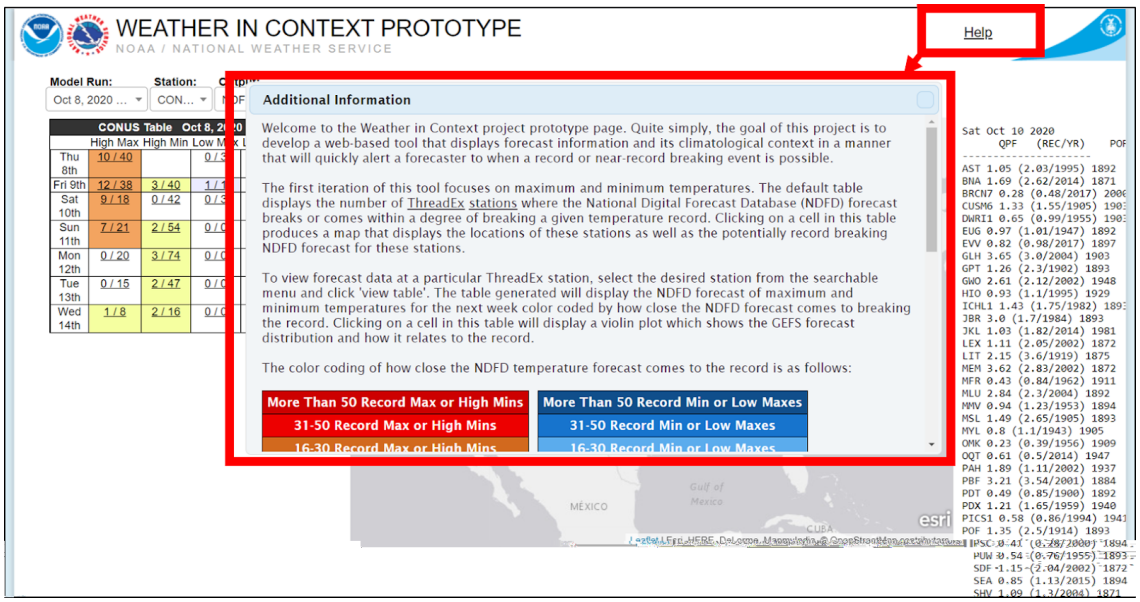
150% or Record Precipitation
125% of Record Precipitation
100% of Record Precipitation
75% of Record Precipitation
50% of Record Precipitation

This color chart can be used to quickly identify when the NDFD maximum or minimum temperature breaks or comes close to breaking the high/low record for that station. For QPF, the user can identify when the NDFD breaks the record for 24-hr precipitation and by how much. The value of the NDFD forecast is displayed in each cell, regardless of whether or not the cell is significant according to the color chart.

The example below displays the table for Denver, CO (DEN) when a strong cold front passed through between 7-8 Sept 2020.

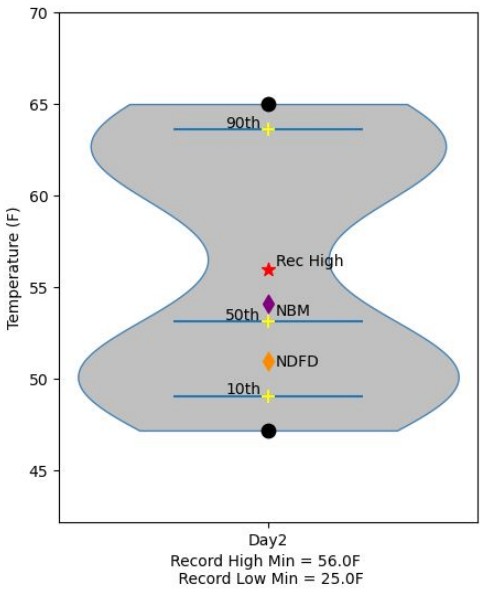


The user can pull up the color charts when viewing any of the tables at any time by selecting the **Help** tab on the upper right corner of the page.



Violin Plot

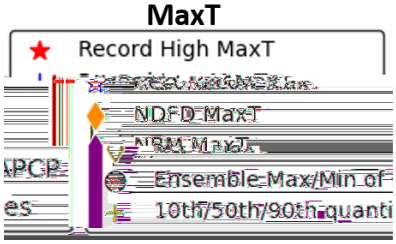
Once a cell is selected, a violin plot is produced that graphically displays where the NDFD falls within an ensemble of model forecast data in addition to the record. A violin plot is similar to a box plot in that it graphically displays statistical quantities that describe the distribution of a dataset. Quantities generally displayed include the spread, median, quantiles (usually the first and third quartile), and outliers. A violin plot takes the box plot a step further by also showing the vertically-oriented probability density smoothed with a kernel density estimator (i.e., kernel density plot). This additional information allows the user to identify if there is clustering of data at multiple values in the dataset. Wider sections of the violin plot represent a higher probability that members of the dataset will take on the given value; the skinner sections represent a lower probability.



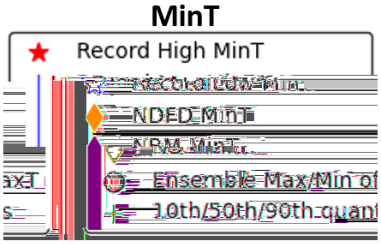
In the WIC tool, several quantities are used to describe the distribution of forecast data from a multi-member ensemble, which includes the NDFD and National Blend of Models (NBM). The information is displayed in comparison to the station record when the station record falls near or within the multi-member ensemble. The statistical quantities displayed include the maximum and minimum, the 10th and 90th quantiles, and the median (i.e., 50th quantile). Significant values highlighted in each plot include NDFD and NBM forecasts in addition to the station record. The following keys can be used to facilitate the analysis of each violin plot.

Violin Plot Legends

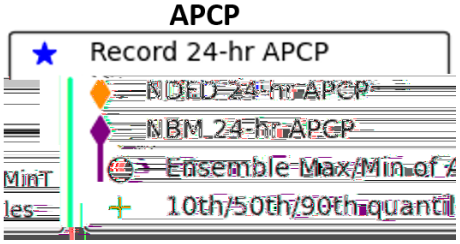
MaxT



MinT



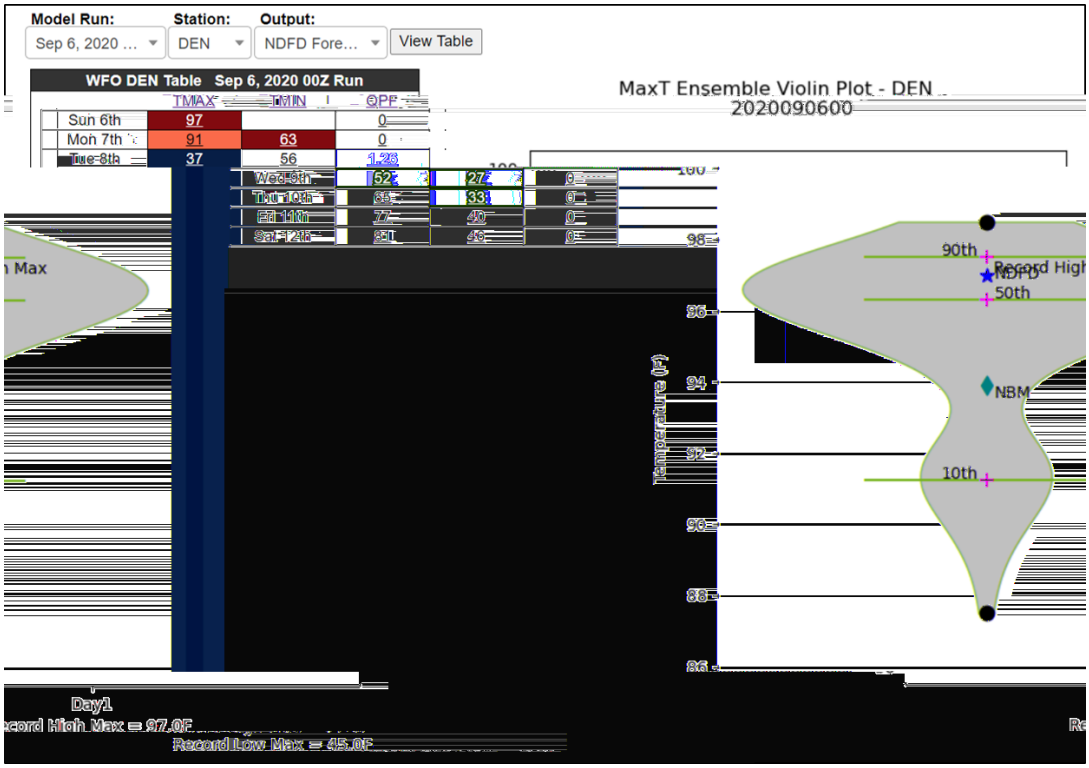
APCP



The data contained in the MaxT/MinT violin plots include:
Bias-corrected CMC control
20 bias-corrected CMC perts
Bias-corrected GEFS control
20 bias-corrected GEFS perts
NDFD
NBM deterministic
= 44 total members

The data contained in the QPF violin plots include:
CMC control
20 CMC perts
Bias-corrected GEFS control
20 bias-corrected GEFS perts
NDFD (except Day 3-7 QPF uses WPCGuide)
NBM deterministic
= 44 total members

The example below shows the violin plot corresponding to the Day 1 maximum temperature (MaxT) valid 00Z 6 September 2020 for Denver, Colorado.



This plot provides an example of a dataset with a bimodal distribution. The outer shape of the violin indicates a large cluster of values around 96.5 F, which is very close to the median (i.e., 50th quantile), and slightly less than the 90th quantile. A small cluster of values exist near 91 F, which is near the 10th quantile. The larger cluster of values is also located near the record high maximum temperature observed for Denver. With this information, one can have increased confidence that a record high maximum temperature will be reached for the Day 1 forecast at this station based on the 44 member ensemble. At the same time, the NDFD is equal to the record high max, which is in good agreement with the majority of the other members in the forecast ensemble.

Gotchas

- Notice that when the NDFD forecast equals the record high max, the symbol for the record high max on the violin plot covers the symbol for the NDFD. In all plots, the record high or record low will always be plotted on top of any other symbol when equal to that symbol's associated value.

- When interpreting the station table, TMIN corresponds to the minimum temperature reached from the previous overnight low temperature associated with the label for that day. So, in the station table above for Denver, CO, the TMIN of 63 F on Monday, 7 September corresponds to the overnight minimum reached sometime between Sunday 6 September and Monday 7 September.

- The NDFD does not provide 24-hr QPF for Days 3-7. In the CONUS version, these values are provided by 24-hr QPF from WPC Guidance, and the violin plot legend is updated to reflect that change. The Alaska version does not contain values for QPF in the Day 3-7 period.