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Supporting Fire Weather Decision-Making with Station-Based Wind Percentiles

Introduction : A Growing Risk for Utilities

For utilities, managing grid infrastructure and minimizing risk during fire weather conditions is no longer a problem restricted to the western U.S. From California to New Jersey, Texas to Greece, as the severity of dry and gusty conditions increases and the risk frequency expands to the entire calendar year, utilities are under more pressure than ever to keep electricity flowing while safeguarding against infrastructure-sparked fires.

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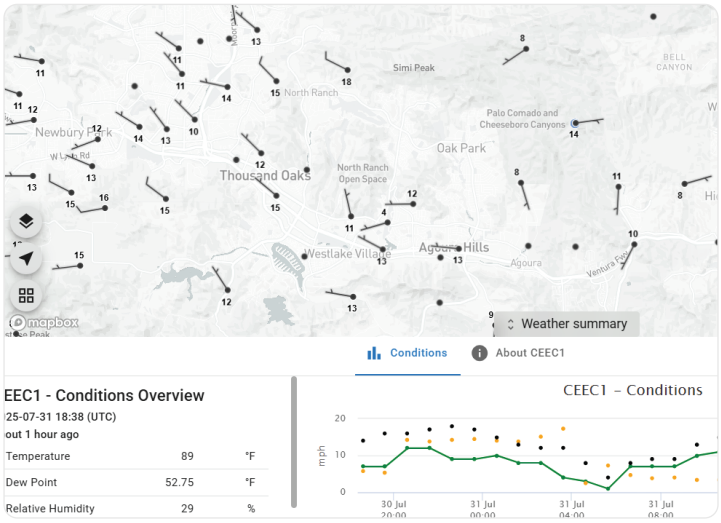
The Role of Data in Fire Weather Response

Utility manager decision making surrounding public safety power shutoff events during high impact weather events is informed by a range of diverse data. Vegetation classifications, wildfire spread analyses, and modeling inform areas predisposed to elevated risk. Short term model forecasts give insights into expected conditions hours to days in advance, increasing the time for preparedness. But the moment-to-moment decision making during the event is heavily informed by the real time observations measured on the ground. For many managers, the environmental variable of greatest impact is wind, which not only has a direct impact on infrastructure and vegetation integrity that can control ignition, but also controls fire spread.

Real time wind gust observations are therefore imperative for decision makers during times of critical fire weather, as demonstrated by the continued expansion of utility-owned weather station networks in areas of risk. For many network managers, the severity of observed conditions and threshold for action is determined by comparison of observed conditions against the location's historical baseline. In other words, the historical conditions at a station provide critical context for assessing the severity of current conditions.

A Gap in Resources for Historical Context

Many utilities lack the capacity and staffing to generate and maintain a set of historical wind gust percentiles to provide context against which real time conditions can be compared. Historical data must be archived and available, observation quality must be assessed, and percentile distributions must be kept up to date as the real time data stream continuously expands the archive.



Synoptic Data's Percentiles Service fills this critical gap, providing access to up-to-date, station-based percentile distributions for wind gust (as well as air temperature and wind speed) alongside the real time data stream available from Synoptic's Weather API. Data providers contributing data to Synoptic's platform can access percentile information from their own stations alongside all other publicly available networks aggregated by Synoptic. And with automated monthly station percentiles processing, users can focus on utilizing the data product without dedicating time and labor to maintenance.

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How It Works: Accessing Percentile Data

The Percentiles Service is built upon Synoptic's station data archive; only observations passing our real time Quality Control service are used in processing. In addition to wind gust percentile distributions based on the station's entire data archive, distributions are also computed from the daily maximum value archive, which removes potential bias from stations reporting at different frequencies and ensures the derived product reflects daily extremes.

Data endpoints for percentiles information are intended to satisfy the need to incorporate the information into spatial and temporal visualizations for analysis. Percentile distributions are available from a dedicated API endpoint and can be coupled with timeseries data requests to facilitate assessment of trending conditions to important extreme thresholds which trigger action (Figure 1). An argument has also been added to the Weather API's /latest service allowing users to return the latest gust values within their percentile distribution. This facilitates the quick placement of observations in their historical context, supporting rapid interpretation of conditions throughout a utility's service area (Figure 2).

Figure 1

Example timeseries of wind gust values from the Cheeseboro station in central California, part of the RAWS network, during the 2025 LA fires. Increasing winds during Jan. 7 exceeded the 95% of the daily maximum wind gust archive for the station and remained elevated above the 99% for most of Jan. 8, demonstrating the historical nature of the weather conditions during the event.

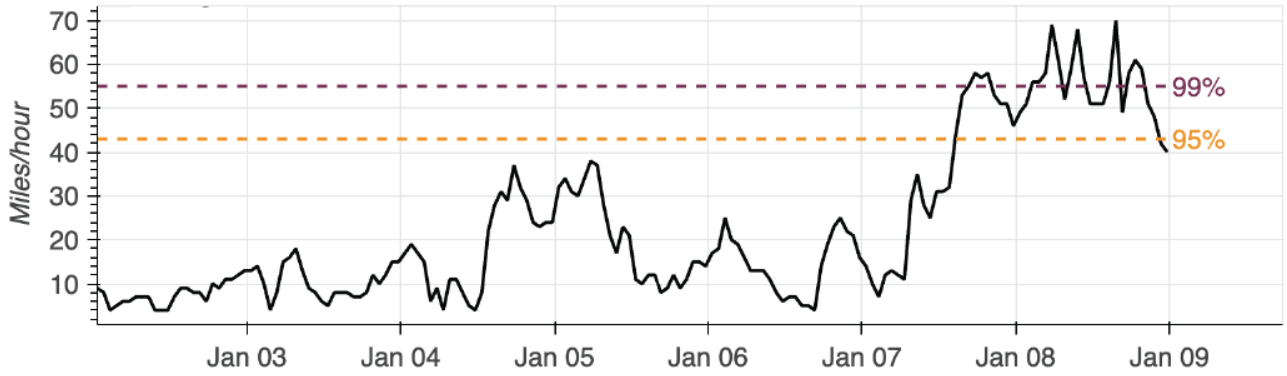

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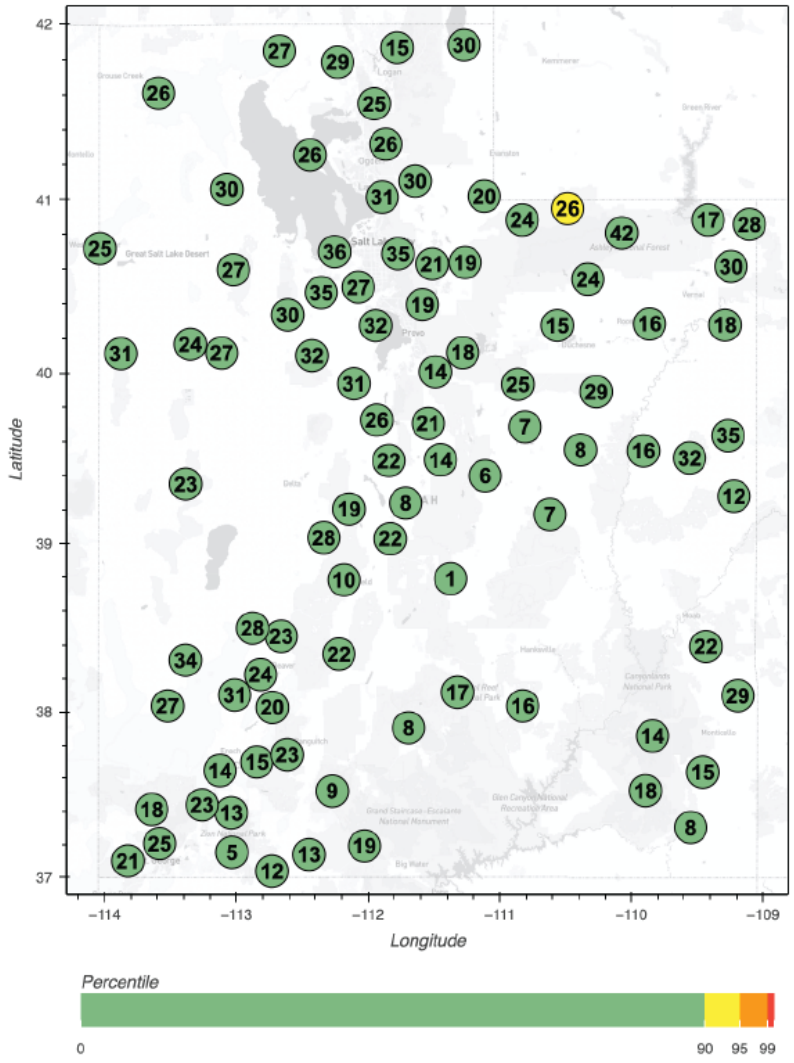
Figure 2

Example of wind gust values for select networks in Utah on July 21, 2025 and the gust severity relative to each station's percentile distribution. Marker values are reported wind gusts in miles per hour. Percentile values of the wind gust reports are reflected in the marker color. All gust values fall below the stations' 90th percentile, with the exception of a single station reporting 26 mph.



Conclusion: Turning Data into Action

With growing energy demand and continued population growth accompanying the increasingly common risk of high impact fire weather events, utility managers across the United States and beyond are facing more complex challenges than ever to maintain operations during times of increased fire risk. Observational data is a single source of truth that is imperative to situational awareness. The introduction of Synoptic's Percentiles Service to the Weather API gives utility managers a critical tool to place the real time observation stream in historical context and turn data into action.