

Weather Source Core Capabilities

Weather Source is a leading provider of weather and climate technologies for business intelligence. We make hyper-local weather and climate data accessible around the globe and across industries partnering with companies to leverage weather and climate data to reduce waste, increase ROI, fine-tune logistics, optimize marketing strategy, and improve resource planning. This document provides a thorough overview of Weather Source products, solutions and other capabilities including customer support, data delivery options and supported parameters.

The OnPoint® Platform

Weather Source's patent-pending OnPoint Platform powers all of our dynamic products and services by seamlessly managing the complexities of ingesting, cleansing, and delivering weather and climate data for business intelligence.

Weather Source spent more than a decade perfecting its data quality processes to ensure your data is gap-free, easy to use, and globally uniform. It can be tedious and time-intensive to manually correct for inconsistencies when data is collected from numerous, disparate sources. The OnPoint Platform ensures your weather data is homogeneous and ready for immediate analysis.

Most weather data providers rely solely on airport observation station data and then use simple interpolation methods to extend the information from those stations to your location. This is ineffective for several reasons: (i) oftentimes these airport observation stations are often too far from your location to provide meaningful insight; and (ii) up to 25% of the data generated at these airport observation stations have gaps or errors.

The OnPoint Platform includes the high-resolution OnPoint Grid which covers every land mass in the world and up to 200 miles offshore. At each one of the 1.6 million grid points, Weather Source ingests all of the best weather sensing technologies including NOAA and NWS data, satellites, radar and airport observation station data onto the OnPoint Grid and then homogenizes and gap fills the data with the end result being a statistically consistent and globally uniform grid of weather data.



Figure 1. Most providers rely on weather stations that may be too many miles away from your location of interest to be actionable (as represented to the left). Weather Source's high-resolution grid means your location is always in the immediate proximity of a Weather Source grid point or virtual station (as represented to the right).

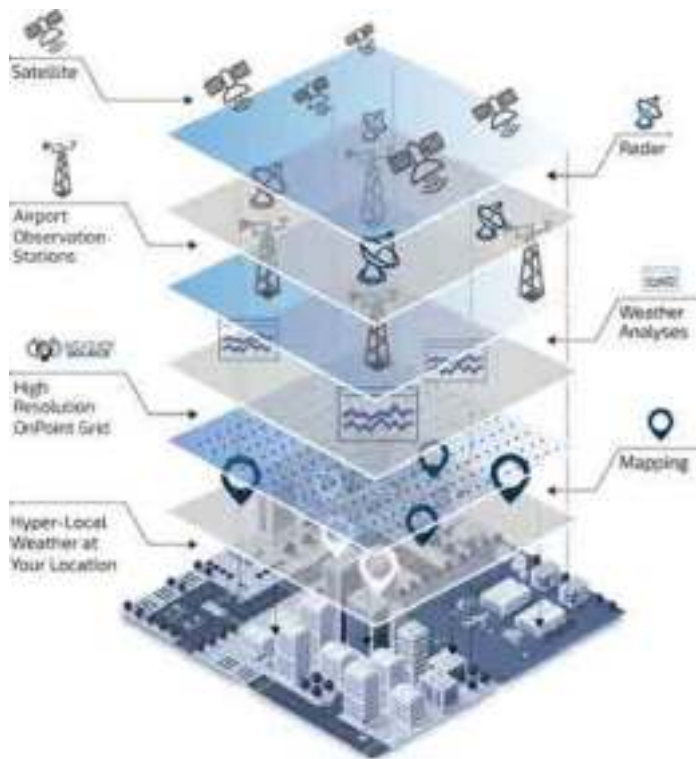


Figure 2. Weather Source data is derived from a variety of reliable inputs.

Each grid point—1.6 million in total—represents a “virtual” weather station with a unique OnPoint ID from which weather data can be mapped. From these globally uniform grid points, we can map weather down to your precise location(s) of interest including lat / lon coordinates or geographically bounded areas such as ZIP or Postal Code, DMA, MSA, Census Block or Tract, etc. At a resolution of 5 kilometers, the OnPoint Grid ensures that even if your location of interest falls directly in the center of a grid cell, your location of interest is never more than 2.2 miles away from an OnPoint ID—as opposed to potentially hundreds of miles away from the nearest airport observation station.

Weather Source has been processing, quality testing, and correcting weather observations for more than a decade. Data problems are inherent to any real-time data collection network, and up to 25% of the data collected via the global network of weather sensing technologies routinely report gaps or errors.

Weather Source ingests and processes data from thousands of North American and international weather-sensing inputs continuously then tests and corrects errors in real-time. The quality control process executes a battery of tests that include: observation consistency (i.e., it can’t snow at 70°F); tests against companion datasets (i.e., scan next forecast hour or historical actuals); and analyses. Observations that are missing or determined to be erroneous are replaced with estimates derived from surrounding data.

OnPoint® Product Suite

OnPoint® Weather

OnPoint Weather can be described exactly as it sounds, properly collocated weather data for any location at any point in time. Our curated continuum of data offers a single source of truth for all your weather information needs. OnPoint Weather consists of several datasets, including:

- Historical
- Present/Previous Day
- Nowcast
- Forecast (GFS & ECMWF)
- Historical Forecast (GFS & ECMWF)
- Airport Reporting Station Data

OnPoint Weather Historical

OnPoint Weather Historical data provides hourly and daily weather values from the year 2000 to present. This database is a stable source of historical information because once the data is archived no changes or edits are made.

OnPoint Weather Nowcast

Current weather conditions at any point in time for any location.



Figure 3. Weather Source data is homogeneous and ready for immediate analysis.

OnPoint Weather Forecast

The standard OnPoint Forecast is based on the National Centers for Environmental Prediction (NCEP) Global Forecast System (GFS). The GFS forecast is processed by Weather Source then staged on our OnPoint Grid for statistical consistency with our other datasets. The GFS-based OnPoint Forecast currently provides a forecast of 240 hours or up to 15 days in daily format. This data is fully refreshed every six hours.

• NCEP Forecast

In addition to the NCEP-based OnPoint GFS Forecast, Weather Source provides forecasts from other NCEP models such as the North American Mesoscale (NAM) forecast, the Rapid Refresh (RAP) forecast, and the High-Resolution Rapid Refresh (HRRR) forecast.

• OnPoint ECMWF Forecasts

Weather Source also offers European Centre for Medium-Range Weather Forecasts (ECMWF) data.

ECMWF Short/Mid Range currently provides a forecast of up to 240 hours in hourly format and up to 10 days in daily format.

ECMWF Long Range currently provides a forecast of six weekly views going out to 42 days. This forecast is updated two times per week and includes expected future atmospheric and oceanic conditions, averaged over periods of one to three months.

OnPoint HRRR Forecast

Weather Source is one of the only weather providers to have integrated the HRRR (High Resolution Rapid Refresh) forecast weather model into its API and as a result we are able to offer one of the highest resolution forecasts in the world instantly and on demand. With a spatial resolution of 3km and a temporal resolution of 15 minute, the OnPoint HRRR forecast weather model is built on the GFS forecast. The HRRR forecast includes a forecast forward view of 18 hours that is refreshed hourly. The HRRR forecast is presently available only in North America.

Dynamic Elevation Adjustment

The concept of elevation adjustment is unique to Weather Source, our Dynamic Elevation Adjustment applies true meteorological modeling to accurately adjust for terrain variations. With the addition of Dynamic Elevation Adjustment Weather Source is now able to dynamically resolve differences in elevation between the elevation of a location of interest and the elevation of the weather inputs. User defined alerts are also available.

OnPoint Historical Forecast

Access the following historical forecast data:

- **GFS Forecast** – Back to January 15, 2015;
- **ECMWF Short/Mid Range Forecast** – Back to July 1, 2017;
- **ECMWF Long Range Forecast** – Back to January 1, 2014.

Airport Reporting Station Data

Weather Source has "cleaned" data for all global Airport Reporting Stations, including discontinued stations, dating back to 1973 (or earlier depending on when the station was initialized). The Airport Reporting Station Data is available in both hourly and daily format. Because data quality is essential, Weather Source employs a suite of intelligent weather data error detection and correction methods, to ensure our clients are using the most accurate data possible.

OnPoint® Climatology

Climatology is the statistical representation of weather over time. OnPoint Climatology offers valuable information such as what is "normal" or "average" (mean) weather for any location at any point in time; departures from normal (standard deviations); and frequency of occurrence for specific weather parameters such as precipitation.

Frequency of occurrence insights reveal how often certain conditions occur at your location of interest. For example, how often it snows within the range of one to two inches or how many times it typically rains on a given day. A road salt distributor is more concerned with how many unique snow events are "normal" on a particular day than with how many inches it is likely to snow on said day. This information is extremely useful for business and resource planning.

OnPoint Climatology allows organizations to identify these departures from normal and create business intelligence and discover how consumers or businesses respond during "normal" or "average" conditions and more importantly, how they respond during "departures from normal." Often, departures from normal have the biggest influence on consumer behavior and businesses.

In addition, OnPoint Climatology is also useful as a long-range forecasting tool. Having an understanding of the climatological mean allows organizations to look forward for longer periods including full seasons.

Average Maximum Temperature 2019-06-28

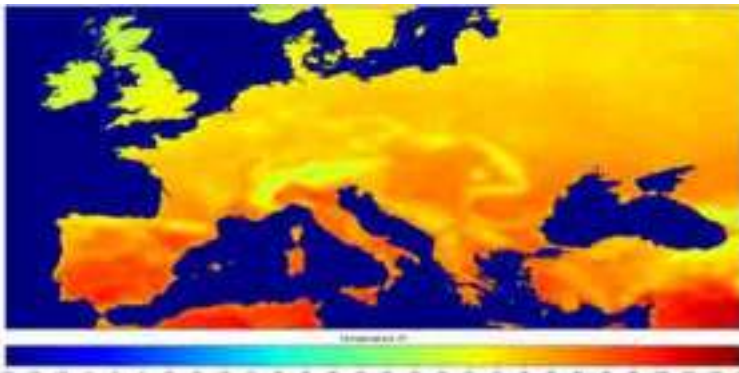


Figure 4. Average daily maximum temperature for June 28. Based on OnPoint Climatology data.

Daily Maximum Temperature 2019-06-28

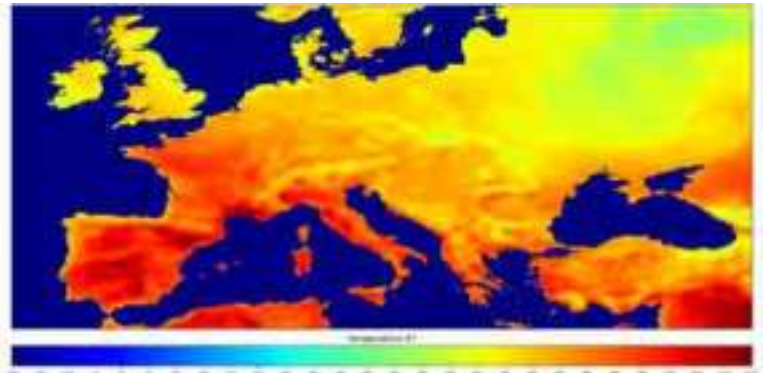


Figure 5. Actual daily maximum temperature for June 28, during the record-breaking European heat wave. Based on OnPoint Historical Weather data.

Daily Maximum Temperature Anomaly 2019-06-28

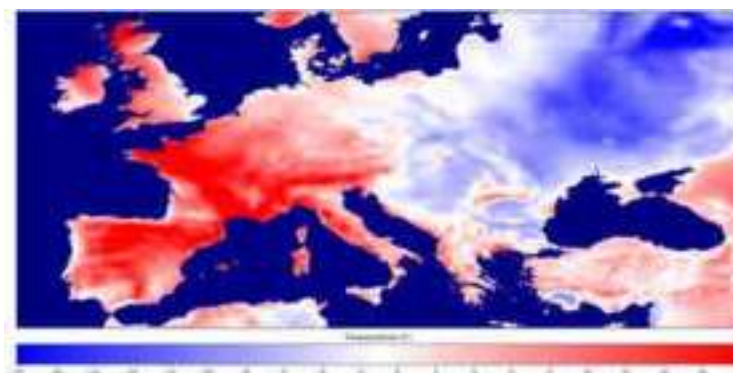


Figure 6. Daily maximum temperature anomalies for June 28, during the record-breaking European heat wave. Based on joining OnPoint Climatology data with OnPoint Historical Weather data.

OnPoint® Geospatial

Weather Source can provide its dynamic weather and climate data in a variety of geospatial products, including geospatial files and GIS layers for ease of integration into any GIS application or environment. OnPoint Geospatial products help your organization effectively visualize weather and climate trends. For example, geospatial products can illustrate what path a hurricane took on a particular day or where in a region people will be affected by certain temperatures. OnPoint Geospatial products can incorporate deep, historical data with present and forecast data to provide powerful context.



Figure 9. Projected spaghetti tracks for Hurricane Dorian, 2019.

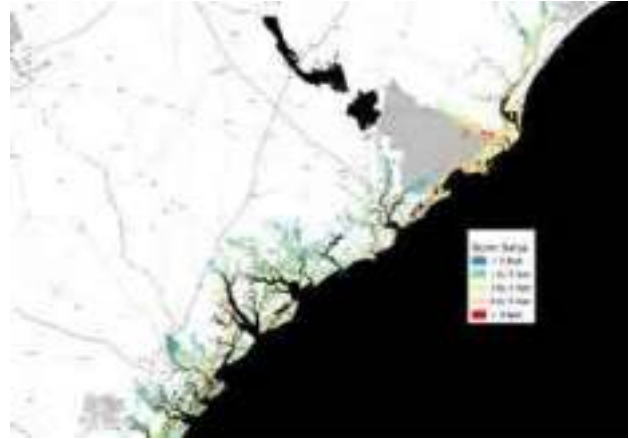


Figure 10. Projected storm surge along the Carolina Coasts during Hurricane Dorian, 2019.

OnPoint® Machine Learning (ML)-Ready Weather

OnPoint ML-Ready Weather is an extension of Weather Source's OnPoint Weather that is engineered for direct use in AI- and machine learning (ML)-based applications. Incorporating weather data into AI and ML workflows has been historically difficult because of varying weather values and the challenge of providing context for anomalies.

OnPoint ML-Ready Weather uses feature engineering to create a suite of datasets (storm, temperature, wind, cloud cover, and more) that help organizations analyze the effects of specific weather conditions on a wide range of weather-sensitive activities.

For example, the ML-Ready Storm dataset provides a location-based time series of storm activity that reflects the variations of storminess at a location over time. This information includes the level as well as whether the level is above or below normal and by how much. Additional options include the ability to weight workdays and non-work days differently (i.e., theme parks are more financially sensitive to severe weather conditions on weekends).

ML-Ready Weather datasets are also available in formats beyond the traditional daily and hourly—to include weekly, monthly, and quarterly—offering greater flexibility for industries such as finance.

Weather Impact Modeling System (WIMS)

WIMS is a system of weather data and analytics that will operate on internal, transactional, and other third-party data (including publicly available) to quantify the impact of weather on business, consumers and assets. The valuable insights gained through these analyses may be applied for the benefit of the customer and the businesses and consumers they serve.

By leveraging and extending our Weather Insights Platform (WIP), Weather Source is developing an automatic Weather Impact Modeling System (WIMS) and a number of Weather Impact Indices that are related to various industries that will allow the customer to analyze an industry as a whole target vs. individual businesses.

WIMS automatically determines the relationship (i.e., as described through "Insight Features") between weather, climate and a target variable such as a customer's transaction data (i.e., lat, lon, time, placeid, merchant name, merchant category, merchant size, transaction revenue, transaction number) as well as historical Weather Source weather and climate data for training and testing of models with the goal of predicting specified target performance related to recent and/or forecasted weather to provide "Insight Features" for a target.

Weather Impact Indices

The Weather Impact Indices build on our current datasets which are homogeneous across space and time and all of our data share a common schema, common headers and header definitions. Further, with our continuum of global data from the past to the present, and into the future we ensure that the highest quality data is available regardless of your business location. The data used in these indices is detailed, accurate and concise and Weather Source has designed indices for both consumers and businesses.

- **Consumer Impact Indices** which include: outdoor activities indices, winter sports indices, summer fun indices and commuting indices;
- **Business Impact Indices** which include: construction & building supply, retail & restaurants, insurance and energy & utilities.

Additionally, Weather Indices provide a better impact signal by factoring in compounding Weather Conditions, OnPoint Climatology and Business/Activity Specific activities.

The Weather Impact Ranking System (WIRS®)

The Weather Impact Ranking System (WIRS) is a patent pending turnkey web application that enables your business to identify weather conditions or perils that have the potential to impact operations or to cause damage to physical assets. WIRS works by establishing a baseline for how weather affects your organization. Using OnPoint Climatology and OnPoint Weather Historical data, WIRS ranks the potential impact of each weather parameter or peril and then monitors conditions in real-time and provides notifications tailored to your business.

WIRS is highly configurable to nearly any industry, empowering you to identify and track the weather conditions most relevant for your business needs. Maintain real-time communication with your management, staff, contractors, and customers to maximize the most efficient use of company resources. WIRS visualizes your business locations and weather rankings in an interactive and dynamic dashboard that includes:

- Real-time monitoring of weather events and perils that exceed your designated WIRS ranking thresholds.
- The ability to efficiently view and monitor all of your locations of interest, including facilities, distribution points, supply routes, and more, all from a single pane of glass.
- Automated notifications via email, text messages, or text to speech.



Figure 11. The Weather Impact Ranking System (WIRS) dashboard.

The Weather Insights Platform™ (WIP™)

The Weather Insights Platform (WIP) is a dynamic, web-based application designed to provide a competitive edge for retailers, restaurants, and e-commerce. Leverage WIP to track operations and sales against weather and ultimately to increase revenue. Plot and track assets and locations to understand how each is affected by weather. Create sales forecasts, review model performance, quantify the impact of weather on sales, and more with easy-to-use modules accessed via a single dashboard. Demographics and geo-fenced location data is also available.



Figure 12. An example of the WIP Weather Correlation dashboard.



Figure 13. An example of the WIP Sales Prediction dashboard.

Condition-Based Ad Triggering (C-BAT™)

This conditions-based ad triggering system provides customers the ability to showcase relevant product messaging within predetermined weather conditions. Apply hyper-localized targeting to connect customers with your brand where and when it matters most. Select any type or combination of weather values, such as precipitation amounts or pollen levels, as well as length of time.

C-BAT integrates with all major advertising exchanges so that you can efficiently launch and manage effective, condition-based advertising.

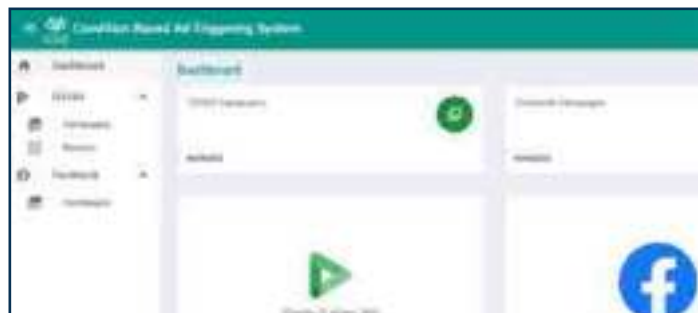


Figure 14. The Condition-Based Ad Triggering (C-BAT) dashboard.

Dynamic Weather Alerting Service (DWAS)

With Weather Source's Dynamic Weather Alerting Service (DWAS) you can now easily configure and receive notifications and alerts for any user-defined weather parameter or extreme weather warning issued by various global government agencies such as the U.S. National Weather Service and Canadian Ready Alerts that have an impact on your business locations.

DWAS is a highly configurable web-based application that ensures your business is never surprised by a weather event at your location(s) of interest. DWAS allows a business to plot their business locations and then set predetermined weather triggers and/or receive alerts when an issued weather advisory, watch, warning or weather event has the potential to impact your business or asset. Alerts and notifications are available for any location around the globe and include the exact time an alert is issued, becomes active and will expire.

User-defined alerts allow DWAS users the ability to set alerting thresholds and rules for all supported weather parameters (i.e., alert me when rain exceeds 1 mm per hour or wind speed is below 20mph, etc.) including weather events that normally would not rise to the level to trigger a government warning, watch or advisory (e.g., alerts are generally not issued for wind speeds under 30mph but hot-air balloon companies definitely need to be alerted when wind speed is under 30mph). Through DWAS your business will receive alerts when the forecasted or actual weather exceeds the predetermined threshold for the selected weather parameter.

For government issued alerts (i.e., tornado warnings) DWAS allows users the ability to select both the phenomena (e.g., flooding, dense fog, blizzard) and the anticipated level of significance (e.g., advisory, watch, or warning).

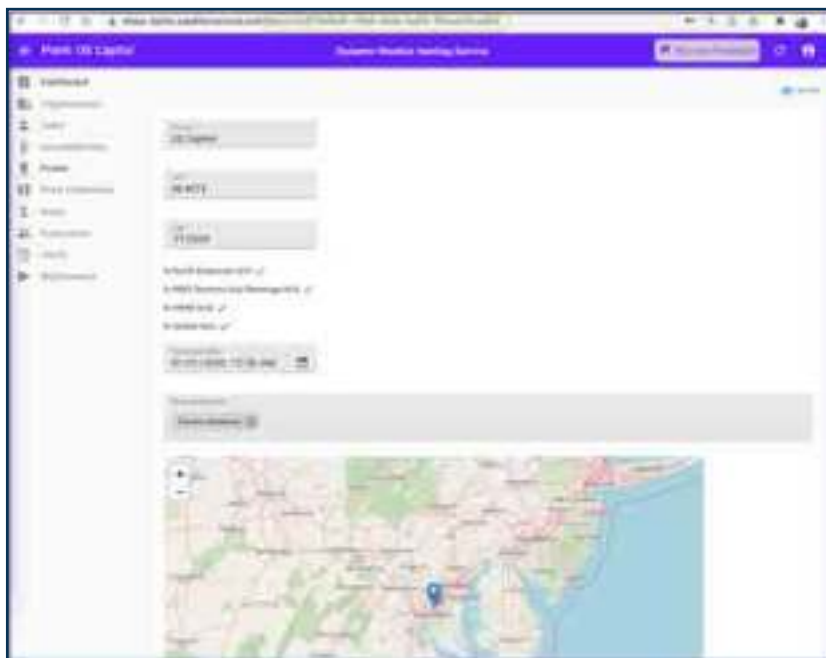


Figure 15. The Dynamic Weather Alerting Service dashboard.

Alerts

DWAS alerts can be delivered in real-time using the following:

- Email and SMS alerts are utilized to receive messages in real-time of when an alert is issued for your location or when the forecast meets your defined criteria.
- API to API.
- Weather Impact Ranking System (WIRS) may be configured to continuously monitor weather and climate data at your locations of interest and to provide alerts in near real-time via the online dashboard.

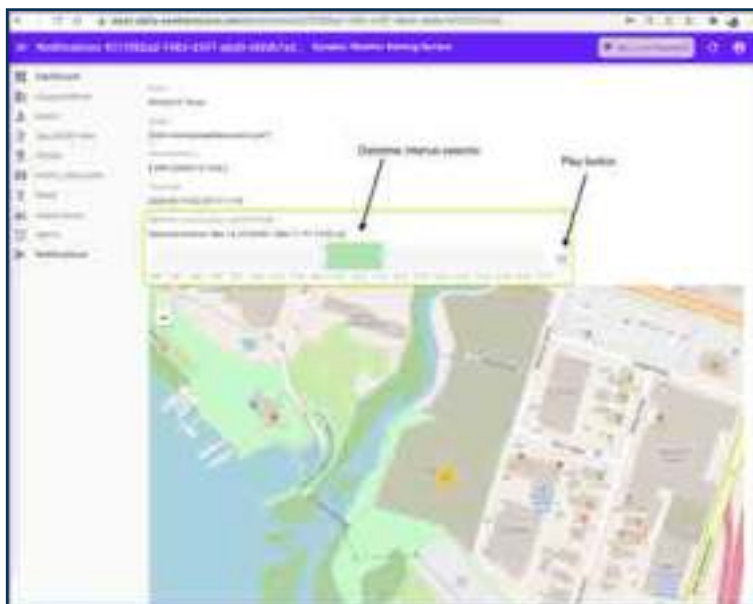


Figure 16. An image showing a Dynamic Weather Alerting Service notification.

Data Delivery

All Weather Source data can be accessed via our OnPoint API or as CSV files. Weather Source data is also available within leading business intelligence platforms such as Snowflake, BattleFin, Eagle Alpha, S&P Global Data Marketplace, Bloomberg, Google Cloud Platform, Looker, Crux, Mobito and Qlik.

Supported Weather Parameters

- Air Temperature
- Wet Bulb Temperature
- Dew Point Temperature
- Feels Like Temperature
- Wind Chill Temperature
- Heat Index Temperature
- Relative Humidity
- Specific Humidity
- Surface Pressure
- Pressure Tendency
- Mean Sea Level Pressure
- Wind Speed
- Wind Direction
- Cloud Cover
- Solar Radiation
- Precipitation Amount
- Probability of Precipitation
- Precipitation Indicator
- Snowfall Amount
- Snowfall Depth
- Probability of Snow
- Snow Indicator

Supported Weather Perils and Hazards

- Blizzard
- Earthquake
- Extreme Temperatures
- Hail
- Hurricane/Tropical Cyclone
- River Flooding
- Severe Convective Weather (Thunder & Lightning)
- Storm Surge
- Tornado
- Wildfire
- Volcanic Activity
- More

Support

24/7/365 Call Center

Weather Source offers a meteorological call center that is staffed 24 hours a day, 7 days a week, 365 days a year. We are available around the clock to assist customers with any technical, customer support, or meteorological questions.

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