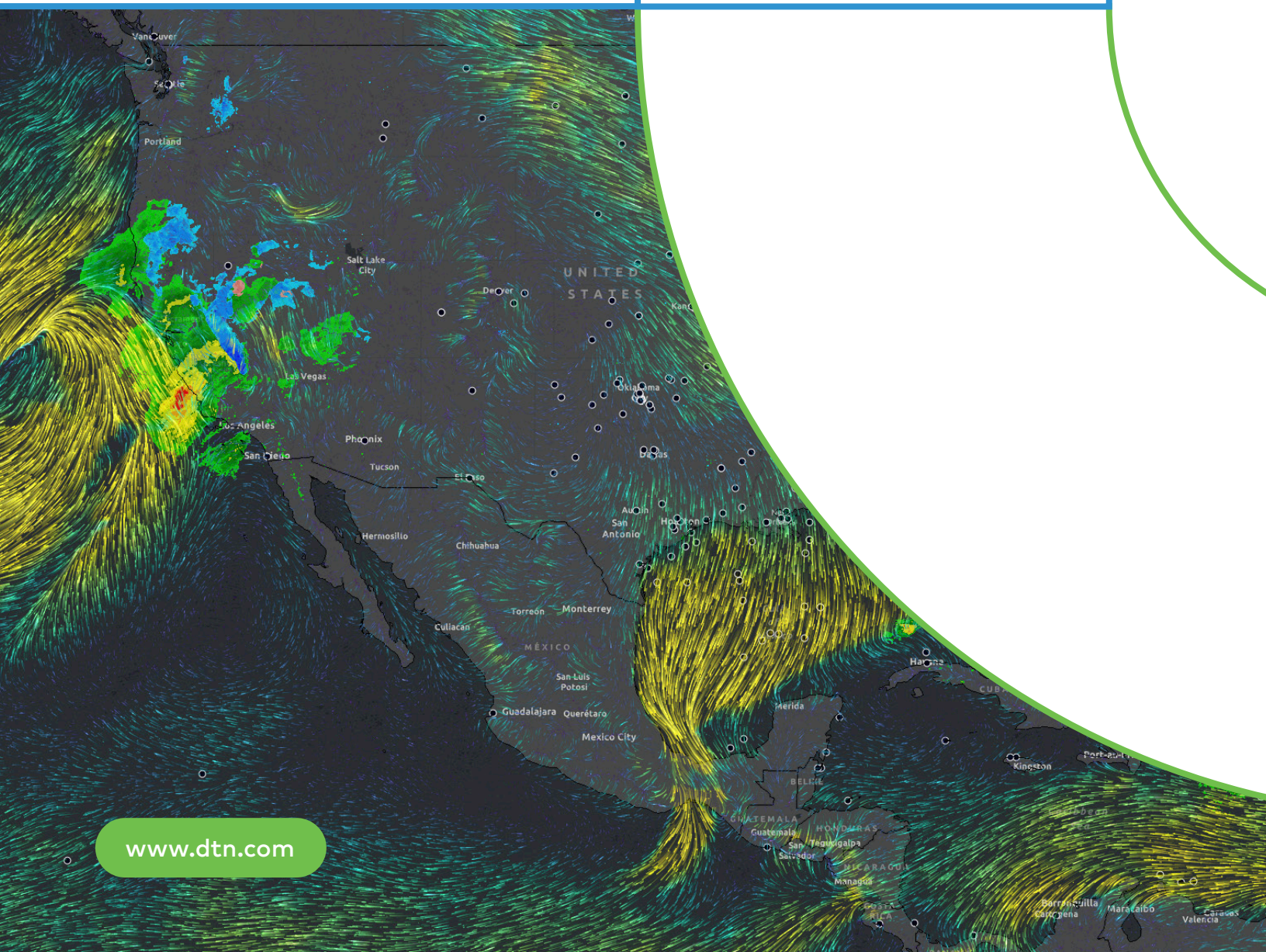
# Geographic Information Systems

A holistic set of mapping information and data services from DTN

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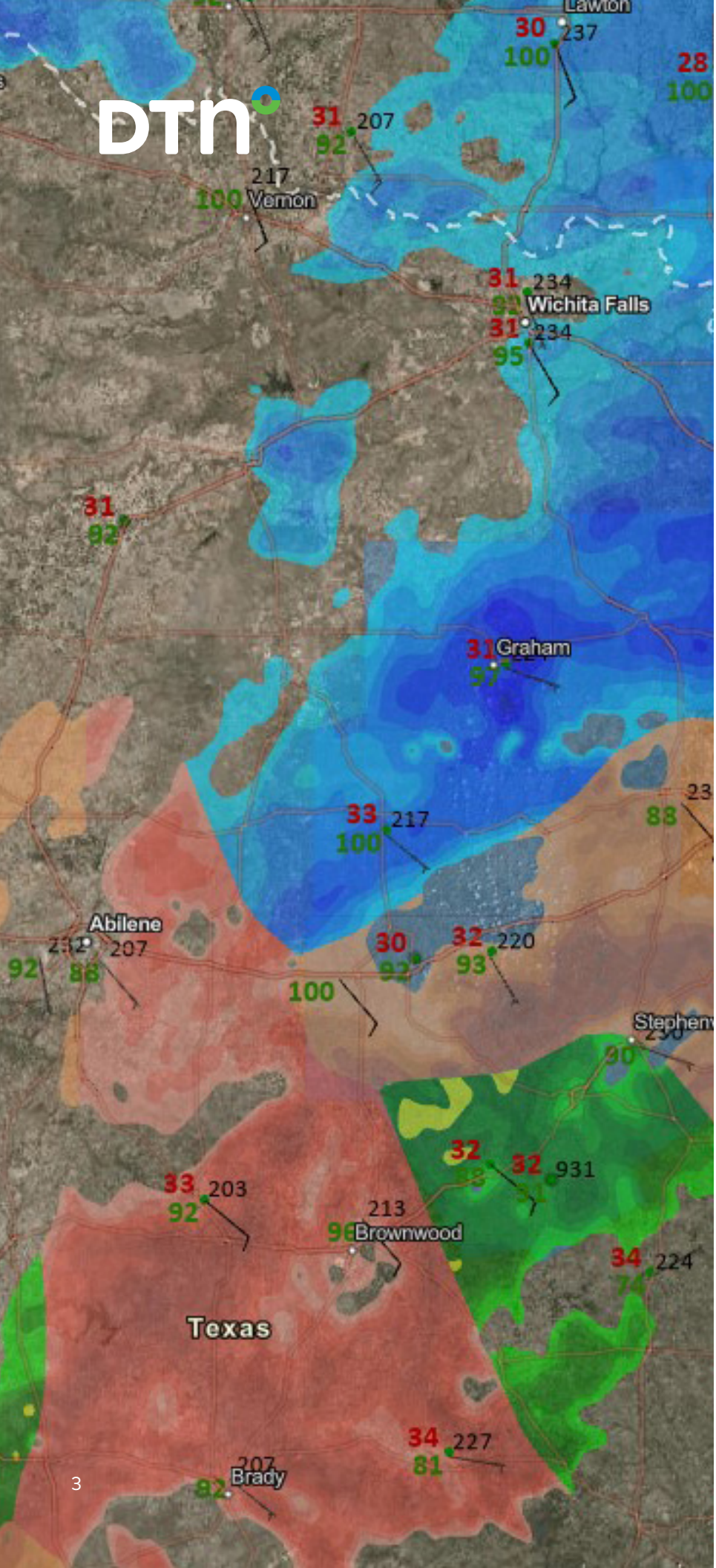
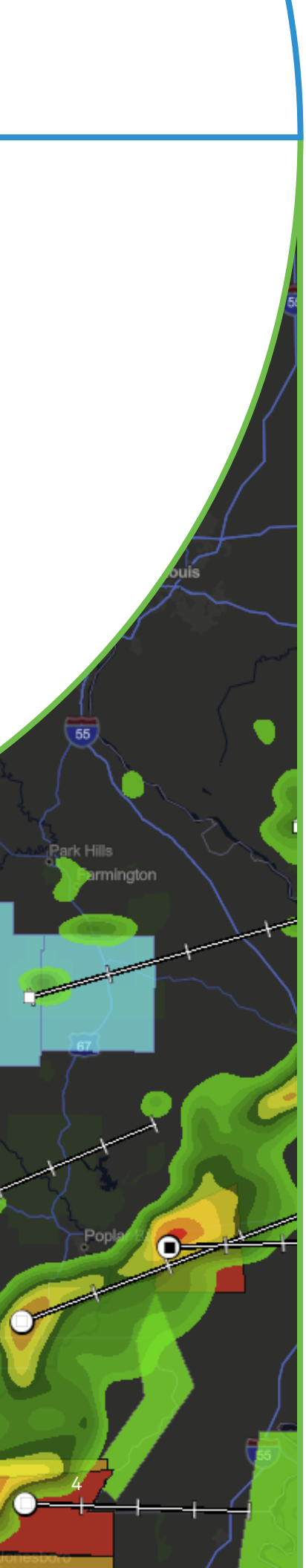



# What is GIS Mapping Technology?

Geographic Information Systems (GIS) create, manage, analyze, and map all types of spatial data. GIS connects data to a map, integrating location data (where things are) with additional descriptive information to provide a foundation for mapping and analysis.

GIS helps users identify and understand complex patterns, relationships, and geographic context. The benefits of GIS include improved communication and efficiency, as well as better decision-making.

At DTN, our GIS solutions provide the largest selection of precision weather mapping in the market today. DTN Map Services are exposed through ArcGIS Server REST endpoints for quickly adding past, present, and future weather to any Esri maps or apps.




# Radar Map Services

## Radar and Radar Mosaics

DTN processes all raw, single-site radar data in CONUS, North America, Australia, Europe, and Japan. Once data is quality-controlled, they are stitched into a single radar mosaic.

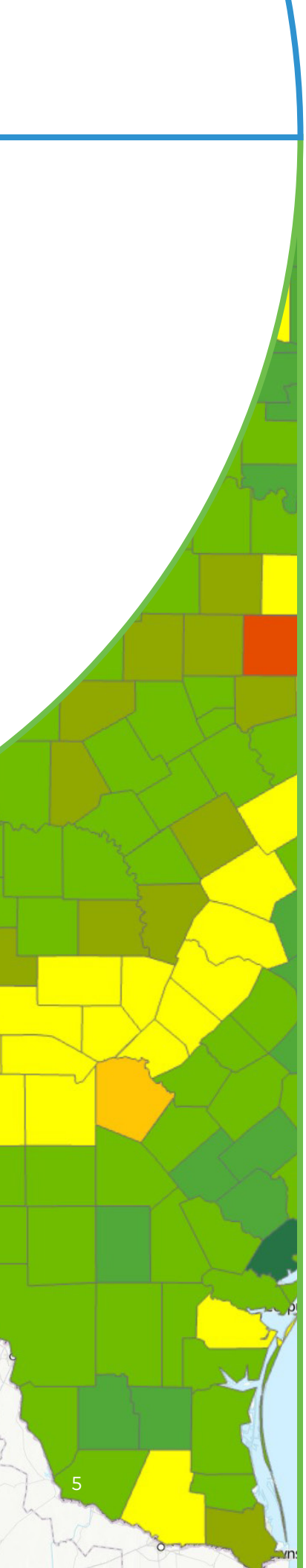
Precipitation type is also represented to distinguish between rain, freezing rain, sleet, and snow. This radar mosaic is available via two REST endpoints per region from DTN ArcGIS Server.

## Storm Attributes (+ Feature Server)

Storm Attributes is a useful metric group associated with a specific storm cell, such as storm speed, direction, maximum hail size, rotation, and storm height (Echo Tops).

These attributes are derived from radar algorithms and update every five minutes.

- **Storm**: The Storm layer identifies unique storm cells. This layer will have all the storm attribute information associated with each specific storm cell.
- **Projected Path**: This data layer provides storm speed in miles-per-hour and direction-in-degrees of a unique storm cell to help estimate when a storm may arrive at a location.
- **Hail Size**: This is an estimate of maximum diameter (in inches) that could be expected within the storm cell. The majority [of hail in the storm] will likely be smaller than this value; this estimate is worst-case maximum size.
- **Tornado Vortex Signature**: This attribute is assigned to a storm cell that has strong rotation as detected by radar. When the rotation is correlated vertically, implying it is well organized, a tornado is possible. This does not mean a tornado is ongoing; rather, that the storm could produce a tornado at any time.



# Storm Risk Analytics

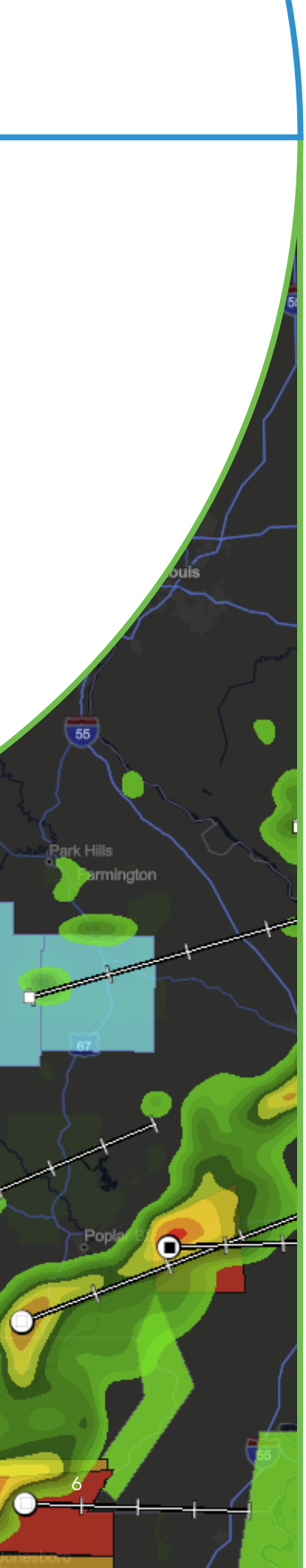
## Storm Risk Analytics

The DTN Storm Risk Analytics (SRA) Data Layers offer a seamless solution for organizations using ESRI software to visualize and mitigate weather-related power outage risks. These layers leverage advanced machine learning algorithms to provide a clear, map-based view of predicted utility outages up to seven days in advance.

Helps weather-sensitive businesses, particularly electric utilities, prepare for storm events and other weather-related incidents. Provides outage risks and predictions up to seven days in advance.

Data Attributes:

- **Outage risk index:** Scale of 1 to 10 for assessing risk
- **Outage prediction:** Predicted outages vs. baseline outages on blue sky days
- **Update frequency:** Every 6 hours




## Storm Corridors

This data set provides a fan-shaped polygon showing the speed and direction of the storm emanating from the center of the storm for all active cells. This service updates every minute effectively providing a real-time, radar-based data service. These polygons show the storm's forecast motion out to 30 minutes. The Storm Corridors include the following attributes:

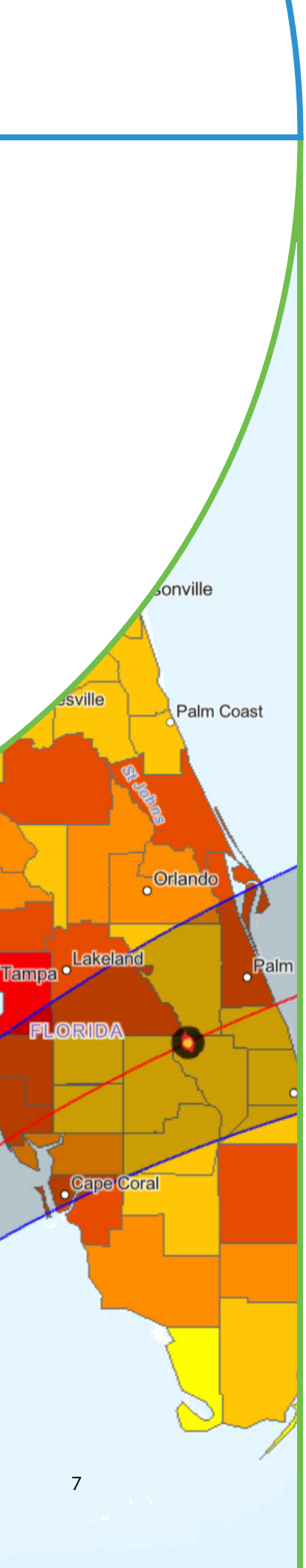
- Date/time
- Radar that identified the storm
- Unique storm ID
- Maximum reflectivity associated with that storm
- Max height (echo top)
- Storm activity (description of storm risk, e.g hail, rotation, tornado risk
- Cardinal storm direction
- Storm direction (in degrees)
- Latitude of storm center
- Longitude of storm center
- Probability of any hail
- Probability of severe hail (>0.75" diameter)
- Maximum expected hail size
- Storm corridor type (most severe feature)
- Storm speed

## TornadoTrax (+ Feature Server)

This important data set analyzes real-time radar data across the U.S. specifically looking for areas of rotation. When an area of rotation is identified, the algorithm can classify the strength of the rotation and plot the intensity in real-time.

TornadoTrax is often used by first responders and emergency managers with multiple assets to manage. Utilities and pipeline operators rely on this information to help identify assets that may have been affected in real-time.

This can reduce the time and resources needed to scout for damage, reduce time needed to restore services, and expedite clean-up and containment efforts for any hazardous materials that may have been impacted.




# Satellite and Tropical Map Services

## Global Infrared

(Current and 6-Hour Loop)

The Global Infrared map service provides satellite data that includes cloud top temperatures. Because cloud top temperatures correlate with cloud height, the height of the cloud can be estimated. Colder temperatures indicate higher clouds which indicate stronger convection (i.e. stronger storms).

## Global Tropical Forecasts

Issued by the National Hurricane Center and Joint Typhoon Warning Center

This data service aggregates forecasts from the National Hurricane Center (NHC) and the Joint Typhoon Warning Center (JTWC) to provide global tropical storm/hurricane forecasts.

This REST endpoint from DTN ArcGIS Server includes:

- Observed locations (starting point where the storm achieves tropical storm criteria)
- Observed track
- Current location
- Forecast locations
- Forecast track (line)
- Forecast error cone
- Forecast wind radii (34kt, 50kt, and 64kt)

Note: Data updates as new forecasts are issued from the NHC and JTWC.

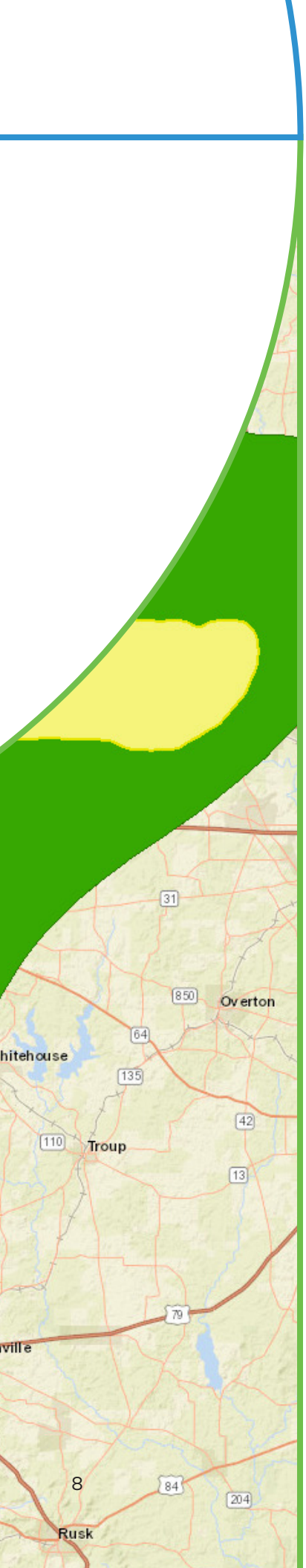
## Global Tropical Forecasts

Issued by DTN Forecasters

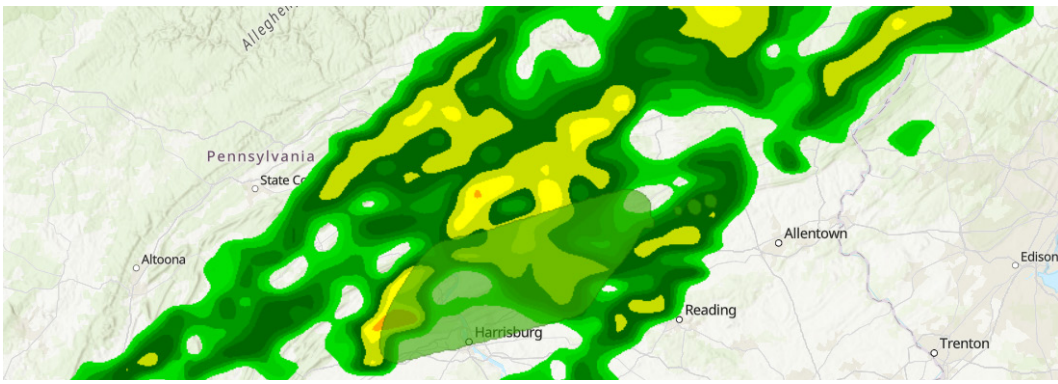
DTN has its own proprietary global forecasting system. It is unique in that the input models are statistically and mathematically blended using machine-learning techniques to constantly adjust and improve the forecast.

DTN Forecasters produce forecasts for tropical storms around the globe using the same parameters as those issued by the National Hurricane Center (forecast points, error fan, and wind swath out to 5 days).

DTN forecasts may deviate from the NHC/JTWC forecasts. DTN Global Tropical Forecasts updates every 6 hours.




# Models (Feature + Map Service)




## HPA: Heavy Precipitation Algorithm

DTN HPA combines radar data and short-term weather forecast models to identify areas of heavy precipitation and forecast where it will move in the next 60 minutes.

The model takes radar mosaics over various time steps to determine the speed and direction of areas of heavy precipitation. DTN then uses the model to determine where heavy precipitation will move as identified by polygons indicating a moderate or high risk.

Updates every five minutes with a revised forecast.

## LAPS: Current Condition Analysis

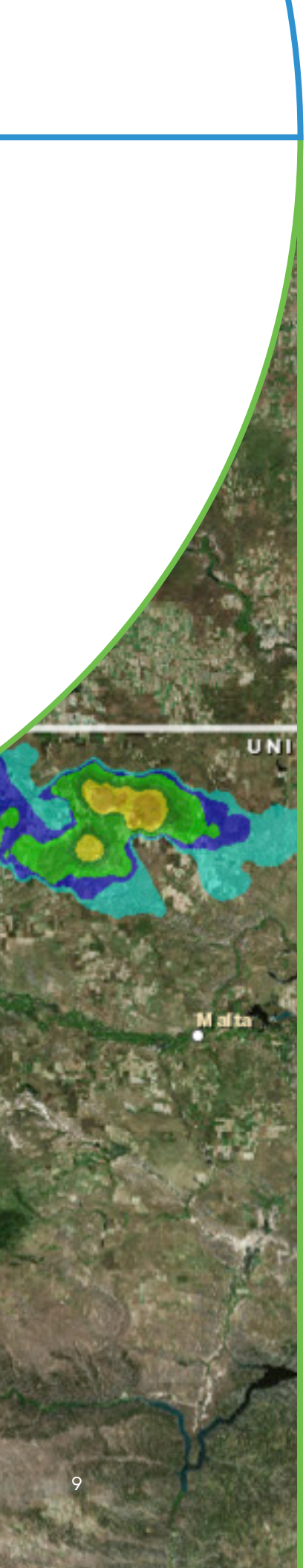
DTN LAPS algorithm combines weather observation point data as well as model data to output a grid of current weather conditions. This algorithm uses quality control routines and physics-based objective analysis schemes to create a grid of current weather conditions regardless of proximity to a weather observation station.

The final product is a contoured polygon data set that is made available as an Esri Map Service.

In the case of our "Wind Speed and Direction" product, the data is made available as a point data set where wind vectors (arrows) are used to symbolize the wind speed and direction. The point represents the center of each grid point.

- **Temperature** (polygon) – in degrees Fahrenheit
- **Dew Point** (polygon) – in degrees Fahrenheit
- **Relative Humidity** (polygon) – in percentage
- **Visibility** (polygon) – in miles
- **Wind Speed** (polygon) – in miles per hour
- **Wind Speed and Direction** (point) – speed in miles per hour and direction in degrees from north

All LAPS Current Condition data updates every 30 minutes.




## LPA: Lightning Prediction Algorithm CONUS

DTN LPA categorically predicts the threat of lightning in the next 60 minutes using moderate and high threats. The polygons are derived and output from an algorithm that combines radar data and detected lightning.

Detected lightning is used to identify the area currently affected by lightning and along the forecast path of the storm cell. Multiple time steps of radar mosaics are used to determine the direction and velocity of all storm cells in the gridded domain.

Updates every five minutes.

## QPE: Quantitative Precipitation Estimate CONUS

DTN QPE utilizes MetStorm® quality-controlled radar data as input. Based on radar data, QPE estimates the amount of rainfall that has occurred across an area over a 1-hour, 6-hour, or 24-hour time period rather than just at a point where a rain gauge is located.

## SPIA Index: Sperry-Piltz Ice Accumulation CONUS

DTN SPIA Index is designed to help electric utilities, cooperatives, and transmission organizations forecast damage to their elevated infrastructure due to the impacts of ice storms.

SPIA's unique combination of forecast ice accumulation and winds creates an easy-to-understand index with values ranging from 1-5 (from isolated impacts to catastrophic damage and outages lasting more than a week).

The SPIA Index is the best tool for supporting operational decisions regarding when/where to stage crews, whether to put contractors on retainer before other organizations, and determine if it's necessary to contact mutual aid partners before an ice storm. It's built on a decade of ice storm figures consisting of both weather and resulting damage.

The SPIA index is currently available as a time-enabled map server and a feature server showing 3-day forecasts in 6-hour increments.

Whether for display in an operations room, executive briefings, or for alerting using the GeoEvent Server, SPIA is a critical tool for GIS professionals supporting electric utilities through the winter months.

# Global (Image Server)

## Global Forecast Service

DTN provides global forecast data services through our ArcGIS Server infrastructure. These time-enabled services provide weather forecast data for up to ten days out and are available via REST endpoints.

These are DTN proprietary forecasts created by combining the best weather modeling solutions from meteorology centers around the world with DTN proprietary weather models.

Below is a list of forecast data services:

**Temperature**

- Hourly
- Daily High (6- and 24-hr)
- Daily Low (6- and 24-hr)

**Precipitation**

- Hourly
- Daily

**Marine** – Hourly

- Swell Direction, Period and Height
- Wave Height
- Wind/Wave Direction and Height

**Precipitation Probability** – Every three hours

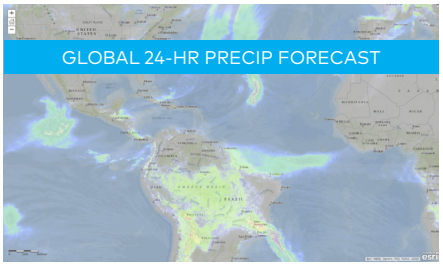
**Thunderstorm Probability** – Every three hours

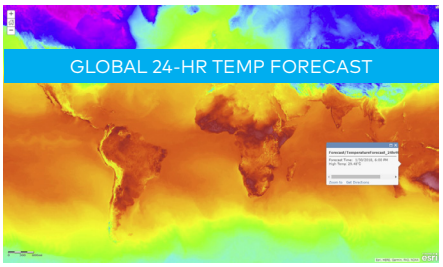
**Snow** – Hourly

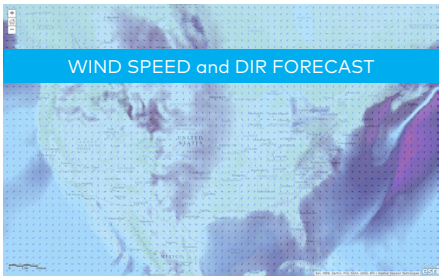
**Relative Humidity** – Hourly

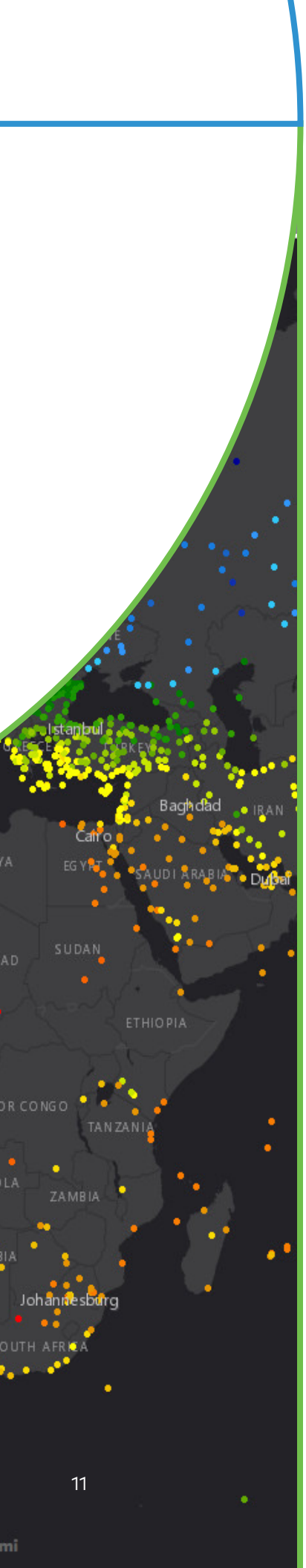
**Cloud Cover** – Hourly

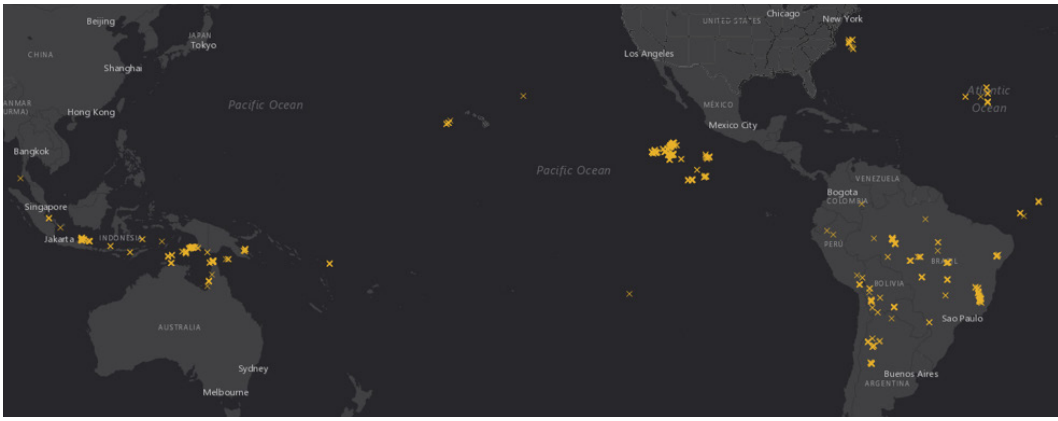
**Wind** (Direction, Speed, Gust) – Hourly






## Global and CONUS Analysis

Surface observations update every five minutes and show the current observations for the following weather variables: temperature, relative humidity, and wind speed and direction indicated by wind barbs.

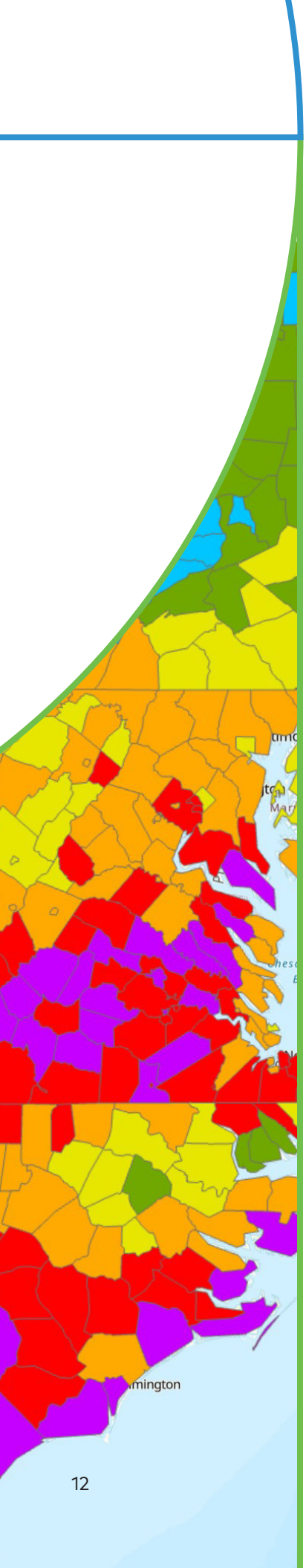
- Temperature – 24-hr High and Low (Global)
- Dewpoint Temperature (Global)
- Evapotranspiration Short and Tall (Global)
- Precipitation – 1-hr and 24-hr
- Relative Humidity
- Solar Radiation – 1-hr and 24-hr (Note: only 1-hr for CONUS)
- Wind Direction and Speed

## Real-time Global Lightning (+ Feature Server)

DTN provides lightning data from the Earth Networks Total Lightning Network (ENTLN), a high precision, extremely reliable lightning detection network with global coverage.

DTN receives a real-time feed of lightning data and makes it available as an ArcGIS map and feature service.

The lightning data service updates every minute and contains the last five minutes of global cloud-to-ground lightning which includes latitude, longitude, amplitude, polarity, and strike time to the millisecond.



# Alerting (Map + Feature Server)

DTN Forecasters issue Alerts for a variety of weather threats. These alerts come from polygons drawn by DTN forecasters with attributes that describe the weather threat and timing.

## National Weather Service Watch/ Warnings and Advisories (WWA)

This REST endpoint from DTN ArcGIS Server is updated as products are issued by the NWS.

NWS WWA includes Severe Thunderstorm Watches, Tornado Watches, Severe Thunderstorm Warnings, Tornado Warnings, Blizzard Warnings, and many others.

As demonstrated, DTN is committed to GIS and Esri map services. These provide a powerful way to share geographic information from ArcGIS to the web and native applications.

DTN plays a critical role in creating interactive weather maps and GIS applications to provide decision-making insights for the utilities, maritime transportation, and aviation industries.

If you're interested in finding new solutions for your weather-based needs, visit our website.

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