Getting Started with APIs and Data

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Introduction

Welcome to the Spire Weather API. This document will guide you on the first steps of using our API, and help you understand all the capabilities available.

For further reference, please refer to:

- Our online documentation at https://developers.wx.spire.com/
- The developer resources at our website, including FAQs and Tutorials
- Our GitHub channel for more advanced examples of how to use the API.

Note: This document is constantly updated as the product evolves, so please contact us for new versions as needed.

Discovering Spire Weather & Climate

Spire Weather products cover 3 "time periods":

1. **Past - Historical Weather**: A 30+ years archive of historical weather data;
2. **Present - Current Weather Conditions**: An hourly updated high-resolution overview of the current global weather conditions;
3. **Future - Weather Forecast**: The predicted weather from now to the next few days. Spire offers three solutions for different use cases:
    a. **Global Weather Forecast**: Our proprietary global weather forecast powered by Radio Occultation collected from our satellites;
    b. **Optimized Point Forecast**: A hyperlocal forecast, optimized for a single location - available at airports, ports, or your own static points of interest;
    c. **High-Resolution Forecast**: A proprietary regional high-resolution weather forecast, initialized with Spire proprietary satellite data, that is run over predefined geographic regions based on customer needs.

Spire Climate products currently refer to our Soil Moisture insights offering and cover 2 "time periods":

1. **Past – Historical:** A 45+ years archive of soil moisture data
2. **Present:** soil moisture data from the past 180 days

The soil moisture product offering consists of three separate products:

a. **D-MSSM**: Daily Medium-Resolution Surface Soil Moisture, with a 6 km spatial resolution
b. **D-ESSM**: Daily Enhanced-Resolution Surface Soil Moisture, with a 500 m spatial resolution
c. **D-HSSM**: Daily High-Resolution Surface Soil Moisture, with a 100 m spatial resolution
d. **FPSM**: Fused Profile Soil Moisture, a value-added product with a 6 km spatial resolution

Historical Weather

Spire Weather historical data is a global high-resolution re-analysis product - providing customers with gridded historical weather data anywhere on the planet from 1990 to the present day.

Here are the main features of the product:

- **Coverage Area**: Global (gridded)
- **Spatial Resolution**: 1/8th-degree (roughly 12 km)
- **Temporal Resolution**: One data point per hour, starting from January 1st 1990 to the present day

- **Weather Variables**: Dozens of weather variables are available - see the data description section of this document for more details
- **Data Extraction methods**:
    - **Area-based**: Offline bulk extraction for global or large areas in GRIB, or small areas in JSON or CSV
    - **Point-based:** Offline bulk extraction for individual locations in JSON or CSV
    - **Route-based**: API-based extraction for historical data over a past asset (ie. a vessel or a truck) trajectory

Current Weather Conditions

The Current Weather Conditions is a global overview of the weather now. It is a gridded product with a 3 km resolution (one data point every ~3km) that is updated once per hour and features a few of the most common surface weather variables.

- **Coverage Area**: Global (gridded)
- **Spatial Resolution:** 3 km
- **Variables:** Temperature (at 2 m), Dewpoint Temperature (at 2 m), Relative Humidity (at 2 m), Wind Speed and Wind Direction (at 10 m) (*), Wind Gust Speed (at 10 m), Precipitation Rate, Mean Sea Level Pressure, Precipitation Type and Effective Cloud Cover.
- **API Endpoints:** The data is available as a coordinate by coordinate request (in JSON format), or as a pre-defined area-based request (in GRIB2 format)
- **Data Updates:** Data is updated every hour, available at the API around 35 minutes after the top of the hour

Weather Forecast

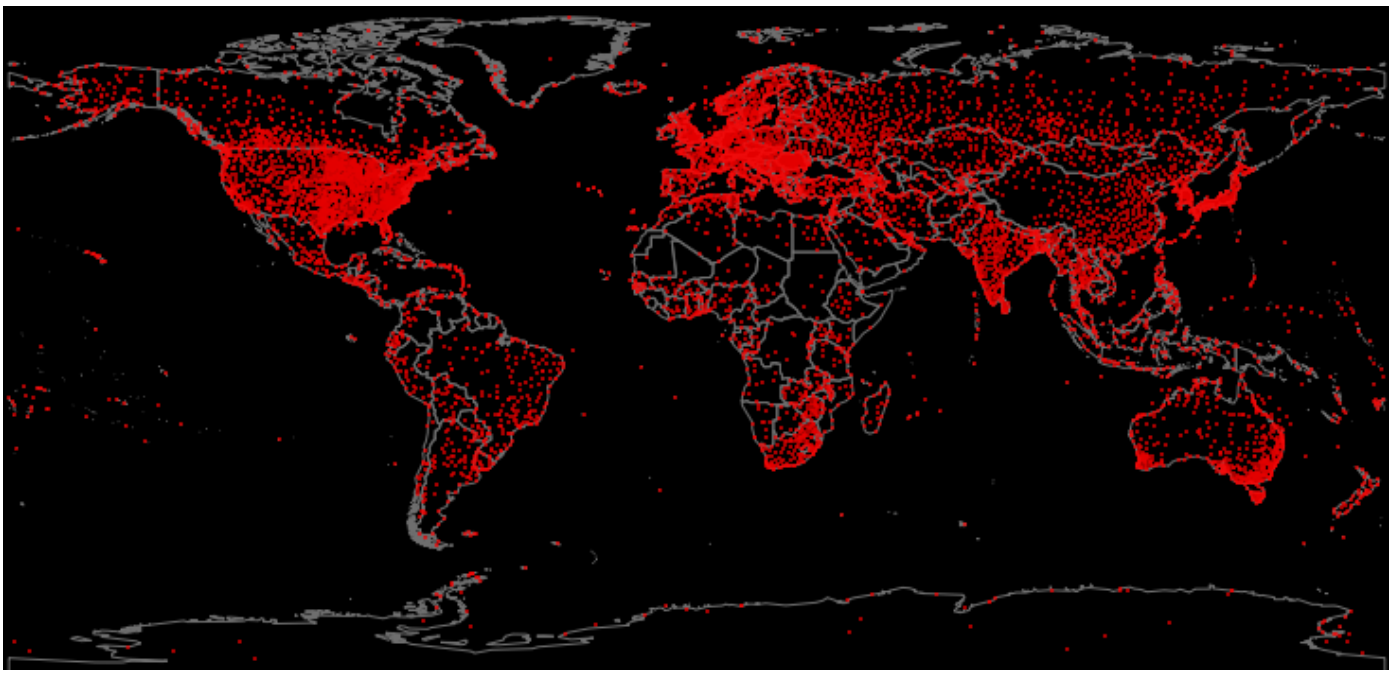
The core of Spire Weather's forecast is our proprietary global weather, powered by our satellite data. We have three different models: the global dataset, available anywhere in the world, the optimized point forecast and high resolution forecast domain(s).

Global Forecast:

- **Coverage Area**: Global (gridded)
- **Spatial Resolution**: 1/8th-degree (roughly 12 km)
- **Temporal Resolution**: Hourly data for the first two days (48-h), 3-hourly data for the first 5 days (120-h), and 6-hourly data for the next 15 days (360-h).
- **Weather Variables**:
    - **Deterministic Forecast**: Dozens of weather variables are available both at the surface and upper levels of the atmosphere. For instance, the surface temperature in New York will be 10 degrees tomorrow at 10 am.
    - **Probabilistic Forecast**: A few variables are available as probabilistic forecasts. Informing the probability of certain weather events or thresholds. For instance, there is a 20% chance of freezing temperatures in Paris tomorrow at 8 pm.
    - Probabilistic forecasts are not yet available for days 11 to 15.
    - See the data description section of this document for more details
- **API Endpoints:** The data is available as a coordinate by coordinate request (in JSON format), based on a future route (in JSON format), as a pre-defined area-based request (in GRIB2 format), or as a map layer (in WMS format).
    - *Not all data packages are available at all endpoints. Please refer to the data description for details.*
- **Data Updates:** Data is updated every 6-hours (see details at the global forecast update section) of this document.

Note: Tides forecast is a special case of the global forecast, it is available at a 1/16th-degree resolution with one data point per hour, both historical and forecast data.

Optimized Point Forecast:
The Optimized Point system is based on Spire's global model but is optimized for specific point locations by leveraging machine learning, multiple forecast systems, and local or nearby observation sources. Since this process is dependent upon accurate, reliable, and well-maintained weather stations, Spire is very selective about the local sources it uses. The Optimized Point API is integrated with airports or well-known weather stations - thousands of them are currently available - to ensure the highest possible quality of information.



This forecast is available by default in over 10.500 locations including airports, maritime ports, and weather stations in strategic locations. Additionally, the system can be tailored to specific locations defined by our customers such as wind or solar farms, construction sites, mines, or other assets. For these custom locations, Spire uses data from nearby weather stations and applies advanced statistical optimization techniques to produce accurate, location-specific forecasts. Spire can even integrate sensor data provided by clients directly into the machine learning models which further improves the forecast accuracy.

To provide accurate forecasts for solar radiation incident on solar panels, specific details about the panel setup like the **tilt angle**, **azimuth angle**, and **tracking system** configuration (e.g., fixed, single-axis, or dual-axis) are required. For tracking systems, the **axis direction** (e.g., north-south or east-west) and the **minimum and maximum tilt angles** and the **minimum and maximum azimuth angles**, are also important.

- **Coverage Area**: One or more individually optimized coordinates
- **Spatial Resolution**: Does not apply - the forecast is created for each individual coordinate
    - For the optimization, this product uses Spire's global model (12-km resolution), plus other global models (resolution varying from 10-km to 26-km) and regional models in selected locations (resolutions varying from 3-km to 6-km).
- **Weather Variables**: 3 data packages available,
    - **Core Package**: Common surface fields such as precipitation, temperature, winds, and some special fields such as the probability of thunderstorms or probability of fog
    - **Wind power**: Hub-height winds

    - **Solar power**: Global Horizontal Irradiance, Direct Normal Irradiance, Plane Of Array Irradiance.
- **Temporal Resolution**:
    - **Core package**: Hourly data for the 15 days (360-h)
    - **Wind and solar power packages**: 15-minutes weather forecast for the next two days (48-h)
- **API Endpoints:** The data is available:
    - With a request per location ID and response in JSON format,
    - With a bulk extraction API, allowing any number of locations to be downloaded all at once in JSON or CSV formats
- **Data Updates:** Data is updated every hour

High-Resolution Forecast:

- **Coverage Area**: Europe, CONUS, and other predetermined regions
- **Spatial Resolution**: Varies, between ~3km and ~1km gridded resolution
- **Temporal Resolution**: Varies, between 1-hourly and 15-minute forecast output
- **Weather Variables**:
    - Partly configurable. Currently forecast parameters are provided for the most common surface and upper-air fields, including 2-m temperature, dew point temperature, total precipitation, cloud cover, wind at 10m/80m/100m, upper-air wind and vorticity, and many more.
    - See the data description section of this document for more specific details on available fields.
- **API Endpoints:** The data is available as a pre-defined area-based request (in GRIB2 format)
- **Data Updates:** Configured based on customer need. Updates can occur as often as every hour, or as infrequently as once per day.

Tides:

The Tides API shows the altered height of the sea above its normal level due to the effects of the earth's rotation and the gravitational pull of the sun and moon. It has a separate model and API endpoint, with the following characteristics.

- **Coverage Area**: Global (gridded)
- **Spatial Resolution**: 1/16th-degree (roughly 6 km)
- **Temporal Resolution**: Hourly (from 1990 to 2025)
- **Weather Variables**: Tides height - The sea level height in comparison to mean sea level (MSL)
- **API Endpoints:**
    - **General Tides*:*** Provides hourly tides height
    - **Summarized Tides*:*** - Provides high and low peak points (max and min heights)

Power Production Forecasts

Power Production Forecasts for renewable energy generation are available via Spire Weather API. The forecasts are generated for a specific geographic region using machine learning, and the output is a forecast of total aggregate power output from that geographic region, for either wind power or solar power generation, over a specified period (typically hourly). The Power Production Forecasts utilize Spire's High Resolution Forecast model domain(s) as the weather input and are trained using aggregated historical wind and solar power generation data and historical forecast data. The result is a power production forecast at an hourly granularity with a 6-day look ahead time. Since this forecast relies on our high-resolution forecast model as an input, the timing of the Power Forecast update occurs immediately after the conclusion of the most recent NWP model run.

- **Coverage Area:** Austria, France, Germany, Hungary, Netherlands, UK
- **Spatial Resolution:** Not applicable, as this is an aggregate forecast for the entire region specified in the API call.

- **Temporal Resolution:** Hourly out to Day 6, or f144 of the forecast
- **Variables:** Megawatts
- **API Endpoints:** /forecast/power
- **Data Updates:** Twice per day at 06 UTC and 12 UTC

Insights

"Insights" is an API-based service that enables a user to query the outcomes of weather for specific use cases or questions.

The initial release of Insights is focused on Maritime use cases. As an input, the user sends characteristics of the vessel, load, and desired route to check. Spire will take all of those, calculate the varied heading of the vessel along the route, and combine it with its weather forecast data. All of these will be used, for instance, to calculate the expected risk of the voyage or the expected vessel performance.

Insights is based on Spire's proprietary global forecast model, so it shares similar characteristics in terms of the coverage (global), the spatial and temporal resolution of the data, and others.

Soil Moisture Observations

In addition to the soil moisture information that is available in the Spire weather data (historical/forecasts), Spire also provides advanced soil moisture insights through a dedicated soil moisture product. The product is powered by measurements collected by the Spire constellation of nano-satellites. The Spire satellites collect soil moisture readings using a technique called GNSS-Reflectometry. The data is combined with soil moisture measurements from other satellites and gridded into a global and daily observation data set.

Here are the main features of the product:

- **Coverage Area**: Global (gridded)
- **Spatial Resolution**: 6 km, 500 m or 100 m
- **Temporal Resolution**: One data point per day, starting from November 1st 1978 to the present day
- **Variables**: Surface Soil Moisture and Fused Profile Soil Moisture
- **API Endpoints**:
    - **Near real-time data:** Data not older than 180 days available through synchronous region or point API.
    - **Historical data**: Data older than 180 days available through asynchronous region or point API.
- **Data Format**: NetCDF, JSON
- **Data Latency**: 4 days

Spire Weather API - Introduction

API URL

The Spire Forecast API endpoint, which API calls will be built upon, is `https://api.wx.spire.com`

Authentication

Our API uses an API key to authenticate each request. Your key is informed in your welcome email. It must accompany all requests in the `spire-api-key` header.

Attempting to make requests to the API without a valid Key will result in the return of an HTTP 401 Not Authorized response code.

Example - Get a list of forecast files

To retrieve a list of available forecast files using CURL:

```
curl -X GET 'https://api.wx.spire.com/forecast/file' -H 'spire-api-key: <YOUR API KEY>'
```

Note: For Windows, use double quotation marks


```
{
  "meta": {
    "count": 9
  },
  "files": [
    "sof.20190307.t00z.0p25.basic.global.f000.grib2",
    "sof.20190307.t00z.0p25.basic.global.f006.grib2",
    "sof.20190307.t00z.0p25.basic.global.f012.grib2",
    "sof.20190307.t00z.0p25.basic.global.f018.grib2",
    "sof.20190307.t00z.0p25.basic.global.f024.grib2",
    "sof.20190307.t00z.0p25.basic.global.f030.grib2",
    "sof.20190307.t00z.0p25.basic.global.f036.grib2",
    "sof.20190307.t00z.0p25.basic.global.f042.grib2",
    "sof.20190307.t00z.0p25.basic.global.f048.grib2"
]}
```


Sample API response

Note: Spire Weather APIs use the REST architectural style. A user can interact with the APIs using any HTTP client, including command-line utilities such as curl or graphical utilities like Postman.

API Endpoints Overview

Here is a short summary of all the available API endpoints. They will be further described in the following sections of this document.

Historical Weather APIs:

- **"/archive/route":** retrieves historical weather data over a past route (trajectory).

Current Weather APIs:

- **"/current/weather/file"** retrieves grib2 files containing the current weather conditions for an entire region or globally;
- **"/current/weather/point"** retrieves the current weather conditions for a single lat/long coordinate;

Weather Forecast APIs:

- **"/forecast/file"** retrieves grib2 files containing forecasts for an entire region or globally;
- **"/forecast/point"** retrieves forecasts for a lat/long coordinate;
- **"/forecast/route":** retrieves forecast weather data over a future route (trajectory).
- **"/forecast/power":** retrieves forecasted power generation from renewable sources (wind or solar).
- **"/ows/wms"** retrieves weather map layers using the OGC WMS standard;
- **"/forecast/point/optimized"** retrieves forecasts for a weather station, airport, maritime port, or customer location from our optimized point forecast system;
- **"/forecast/optimized/bulk"** retrieves forecasts for a pre-defined group of weather stations, airports, maritime ports, or customer locations from our optimized point forecast system;

Tides API:

- "**/tides**" retrieves Tides data (current, forecast, or historical);

Soil Moisture APIs:

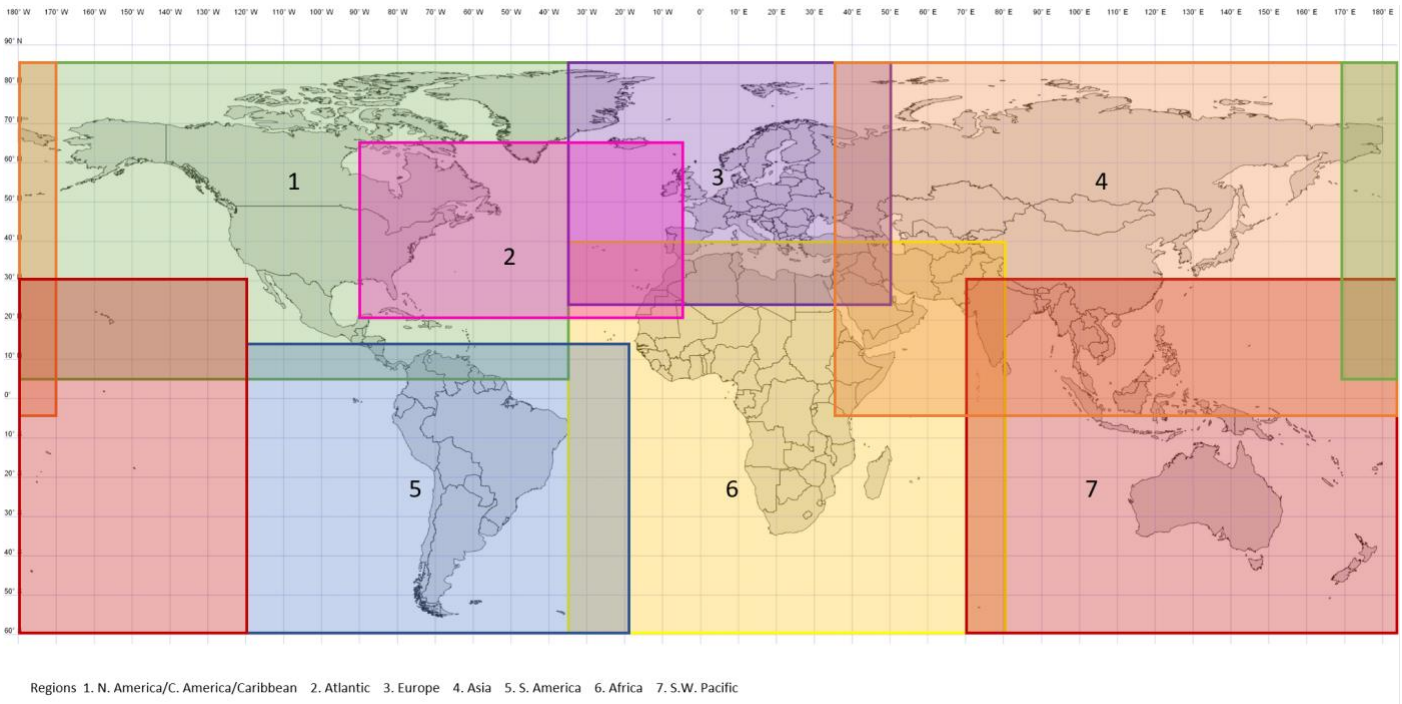
- **"/soil-moisture/region"** retrieves NetCDF or GeoTIFF files containing current soil moisture conditions for an entire region for dates not older than 180 days;
- **"/soil-moisture/point"** retrieves current soil moisture conditions for a lat/long coordinate for dates not older than 180 days in either CSV or JSON format;
- **"/soil-moisture/historical/region"** retrieves historical NetCDF or GeoTIFF files containing soil moisture conditions for an entire region for dates older than 180 days;
- **"/soil-moisture/historical/point"** retrieves historical soil moisture conditions for a lat/long coordinate for dates older than 180 days in either CSV or JSON format;

Note: All date/times at the API use the ISO8601 date format are in Universal Coordinated Time (UTC)

API Concept - Region

Most Spire Weather APIs have the concept of "region", which limits the area you query data for. The region can be global (to access the whole planet) or one of the pre-defined regions listed below. They are particularly helpful for file downloads or WMS, and they also restrict the area for which customers may use point API queries to access data. The available regions are:

Region	Parameter name	Map Legend	Coordinates bounding box (Long, Lat, Long, Lat)	Area in Square Kilometers
Global	global	-	Entire planet	-
Africa	africa	6	35 W, 60 S, 80 E, 39 N	122,096,869
Asia	asia	4	34 E, 5 S, 169 W, 85 N	120,762,938
Atlantic	atlantic	2	90 W, 20 N, 5 W, 65 N	38,061,789
Europe	europe	3	35 W, 23 N, 50 E, 85 N	36,540,290
North America, Central America and Caribbean	north-america_central-america_caribbean	1	170 E, 5 N, 35 W, 85 N	100,041,281
South America	south-america	5	120 W, 60 S, 20 W, 13 N	77,460,524
South West Pacific	south-west_pacific	7	70 E, 60 S, 120 W, 30 N	164,881,812



Note: Some customers have custom regions. If that is the case for you, the API will be configured to use your region as default so you can ignore this option.

API Concept - Data Bundles

Our data for all products are organized in data bundles (or packages). Each bundle groups variables for a specific domain.

For instance, the basic bundle contains the variables that are more commonly used, such as:

- Temperature
- Precipitation
- Wind Speed and Direction (at 10 m)
- Relative Humidity
- Etc.

The Maritime Bundle contains variables that are commonly used at the Maritime or Offshore industries, such as:

- Sea Surface Temperature
- Ocean Currents Speed and Direction
- Significant Wave Height
- Mean Wave Direction
- Mean Wave Period

Your account is likely subscribed to a subset of the bundles, and it will limit the variables you have access to. The data description section of this document has detailed information about all the available data bundles and a description of each variable.

In all APIs, the default unit system (si) used by the API follows the Climate and Forecast Conventions (and most APIs have an option to change the unit system):: http://cfconventions.org/Data/cf-standard-names/47/build/cf-standard-name-table.html

API Concept - Time Bundles

The Spire Weather API has the concept of a time bundle, it is a parameter that helps define the temporal output to retrieve at the forecast/file and forecast/point endpoints. The options for the time bundles are:

- ‘hourly’ - Retrieves the forecast in 1h steps - available for the first 48h (2 days)
- ‘hourly_6day’ – Retrieves the forecast in 1h steps for the entire 6 day time range (high resolution forecast only)
- ‘3_hourly’ - Retrieves the forecast in 3h steps - available for the first 120h (5 days)
- ‘6_hourly’ - Retrieves the forecast in 6h steps - available for the first 168h (7 days)
- ‘6_hourly_10day’ - Retrieves the forecast in 6h steps - available for the first 240h (10 days)
- ‘6_hourly_15day’ - Retrieves the forecast in 6h steps - available for the first 360h (15 days)
- ‘all’ – Retrieves the 15 day hourly forecast output in hourly steps from the Optimized Point Forecast

Time bundles can be combined. For example, using ‘hourly’ and ‘3_hourly’ together will retrieve 5 days of the forecast, with hourly data for the first two days and 3-hourly for the following 3 days.

If no time bundle is specified, the API will return all data your account has access to (for instance, ‘hourly’, ‘3_hourly’, ‘6_hourly_10day).

Some examples of how to retrieve specific information using the time bundle parameter:

Example - Get the list of files of the latest 7 days forecast with hourly (48h) and 6-hourly output

To retrieve the latest full forecast (up to 7 days, with both hourly and six-hour steps):

- Set the time bundle to ‘hourly’ and ‘6_hourly’
- **Important**: *The API will only return the updates done at 8:00 or at 20:00 - You won’t see the short-range only updates done at 00:00 and 14:00 since they don’t have the forecasts for all 7 days.*

```
curl -X GET 'https://api.wx.spire.com/forecast/file?time_bundle=hourly,6_hourly' -H 'spire-api-key: <YOUR API KEY>'
```

Note: For Windows, use double quotation marks

Example - Get the list of files of the latest short-range forecast with hourly output

To retrieve the latest short-range forecast (48h) with hourly output:

- Set the time bundle to ‘hourly’
- **Important:** *The API will return all the forecast updates (4 updates per day), but two of them will only have data for the first 24h*

```
curl -X GET 'https://api.wx.spire.com/forecast/file?time_bundle=hourly' -H 'spire-api-key: <YOUR API KEY>'
```

Note: For Windows, use double quotation marks

Example - Get the list of files of the 7-days forecast

To retrieve the latest medium-range forecast (with 7 days, and output every 6h):

- Set the time bundle to ‘6_hourly’
- **Important**: *The API will only return the updates done at 8:00 or at 20:00 - You won’t see the short-range only updates done at 00:00 and 14:00 since they don’t have the forecasts for all 7 days.*

```
curl -X GET 'https://api.wx.spire.com/forecast/file?time_bundle=6_hourly' -H 'spire-api-key: <YOUR API KEY>'
```

Note: For Windows, use double quotation marks

Example - Get the list of files of the latest 10-days forecast

To retrieve the latest extended-range forecast (all the 10 days, with output every 6h):

- Set the time bundle to ‘6_hourly_10day’
- **Important**: *The API will only return the updates done at 8:00 or at 20:00 - You won’t see the short-range only updates done at 00:00 and 14:00 since they don’t have the forecasts for all 7 days.*

```
curl -X GET 'https://api.wx.spire.com/forecast/file?time_bundle=6_hourly_10day' -H 'spire-api-key: <YOUR API KEY>'
```

Note: For Windows, use double quotation marks

Example - Get the list of files of the latest update, no matter if it is short-range or medium-range

To retrieve the latest update available, no matter if it is short-range or medium-range

- For the latest update, there is a dedicated endpoint called “latest”
- Instead of calling the regular /forecast/file or /forecast/point, use the /latest without the time_bundle parameter.

- **Important**: *The API will return the latest update, no matter how many hours of forecast we have available.*
    - If that is an update of the short-range forecast, the response will only contain the first 24h.
    - If the update is a full one, it will contain the 7 days with all the temporal data available for your account (ie. hourly output for 48h and 6h output up to 7 days).

```
curl -X GET 'https://api.wx.spire.com/forecast/latest/file' -H 'spire-api-key: <YOUR API KEY>'
```

```
curl -X GET 'https://api.wx.spire.com/forecast/latest/point?lat=40.018672&lon=-105.250537' -H 'spire-api-key: <YOUR API KEY>'
```

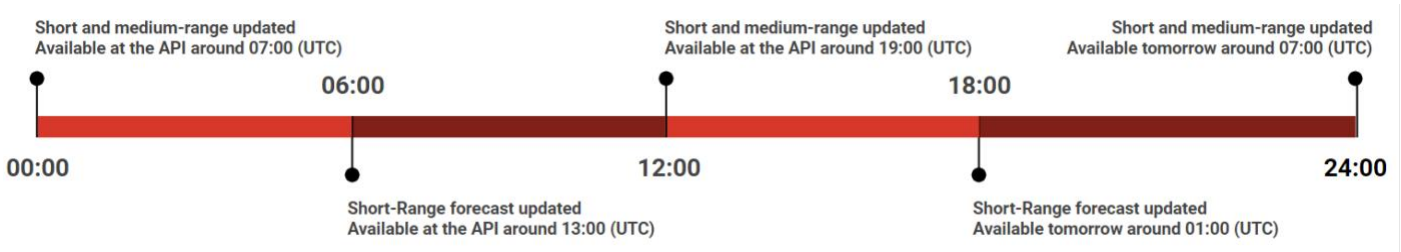
Note: For Windows, use double quotation marks

Concept - Forecast Updates

Spire Weather's forecasts are refreshed four times per day - around 01:00, 7:00, 13:00, 19:00 (UTC)

- The short-range forecast (first 24 hours) is updated every time the forecast is refreshed - four times per day
- All other forecasts are updated two times per day (at 07:00 and 19:00)

The forecast refresh timeline for one day:



More information on forecast updates can be found on our dedicated FAQ page.

Querying the API while the forecast is being updated

While the forecast is being updated, the data arrives at the API incrementally until the full forecast (either 24h, or 15 days depending on what is being updated) is available. While the forecast is being updated, the API will respond with a partial forecast. For instance, it is possible that at 07:05 the file endpoint has only files available for the first 3 days, and then at 07:10, all the files are available again. The files are always made available in chronological order.

Systems integrating to the Spire Forecast API, depending on the use case, can:

- Download the data as it is made available to get the updated forecasts as soon as possible
- Wait until all is published to download them

We have an online FAQ about using the API while the forecast is being updated. In addition, our GitHub has an example of waiting for the forecast to be fully published before starting to download the files.

Spire Weather API - Historical

Asynchronous Route API - /archive/route

The historical route endpoint allows customers to submit requests for an automated route (trajectory) data extraction from Spire's historical archive of weather conditions and to retrieve the generated output. Users can interact with the API using any HTTP client, including command-line utilities such as curl or graphical utilities like Postman.

Workflow

The basic workflow for the historical route endpoint is as follows:

1. Submit a new data retrieval request via the `/route` endpoint
    a. If the request parameters fail a basic validation test, an error will be returned indicating the problem. Modify your parameters accordingly and retry.
    b. If the request passes validation, a retrieval job is created and the API response includes a unique identifier (called `job_uuid`) that can be used to monitor the status of the retrieval job as processing progresses, and eventually to retrieve the generated output. Remember to record the `job_uuid` for your request so that you can retrieve your data when it becomes available.
    c. The total number of waypoints included in your route retrieval request are immediately reserved, but not yet deducted, from your available waypoints quota.
2. Check job status by sending a GET request to `/jobs/<job_uuid>/status`.
    a. The `/jobs/<job_uuid>/status` endpoint returns basic information about the status of your job's data retrieval workflow,
    b. If the returned `job_status` indicates the job has been completed, an `export_uri` is also provided and indicates the location where the generated output file(s) are available for download. If `job_status` indicates failure or otherwise indicates your job has not finished after more than 72 hours, please report the problem and provide your `job_uuid` to the Spire team for assistance.
    c. Once your job has been completed successfully, the previously-reserved waypoints are formally deducted from your waypoints quota. If a job fails to complete for any reason, the reserved waypoints will be returned to your quota.
3. Download the generated output file(s) from the provided Export API endpoint.
    a. Route data output will be zipped into a single file named `<job_uuid>.zip`.

Endpoints

Submit a new route data retrieval request

`https://api.wx.spire.com/archive/route`

This endpoint allows the user to submit requests for historical trajectory/route data retrievals. Requests must provide the desired data fields (or field bundles) to be retrieved, a route name, and a series of waypoints (latitude/longitude/time) describing a historical route along which data will be extracted.

Show job status

`https://api.wx.spire.com/archive/jobs/<job_uuid>/status`

This endpoint shows job creation time, the latest status, and the data export URI (once the job has been completed).

Download generated output

`https://api.wx.spire.com/export/<job_uuid>`

This endpoint provides download access to the output ZIP archive generated for a data retrieval request. This link will also be given by the Job Status endpoint (see above) after the job has been completed

successfully. Accessing the URL indicated above (substituting your job_uuid) will return a JSON response indicating the specific files available for download. For route data retrievals, this will always indicate a single ZIP file that can be downloaded at: https://api.wx.spire.com/export/<job_uuid>/<job_uuid>.zip

Submitting Route Data Retrieval Requests

Retrieval requests are submitted using HTTP POST requests to the `/route` endpoint. Parameters are accepted as part of the request body in the form of a JSON payload.

After the request has been validated and the job has been accepted, the API will respond with a unique job identifier called a `job_uuid`. **Please record this value, as you will need it later to retrieve your data.**

API Input Parameters

The following parameters are accepted when submitting a new route data retrieval request:

- route
  - A JSON object describing a historical route
  - The route definition must include a name and one or more waypoints, each describing a specific point in space and time (i.e., latitude, longitude, and time).
  - The waypoints can be provided at any time. At present, our historical data is available at hourly time intervals, so all the times provided will be “snapped” to the closest top of the hour we have data for. For instance, a request for data at 03:20 will be accepted, but the returning data will be from our 03:00 historical data.
  - Waypoint timestamps must be specified in ISO 8601 format.
  - The provided route name will be used to generate an output file name, so it must only contain alphanumeric characters, underscores, or hyphens (no spaces).
  - At the present time, a **maximum of 10.000 waypoints** may be included in each route data retrieval.
  - Example route definition:

```
{
  “name”: “my_route”,
  “waypoints”: [
    {
      “lat”: 23.25,
      “lon”: -62.10,
      “time”: "2021-07-12T03:00:00"
    },
    {
      “lat”: 23.32,
      “lon”: -62.11,
      “time”: "2021-07-12T04:00:00"
    },
    {
      “lat”: 23.36,
      “lon”: -62.13,
      “time”: "2021-07-12T05:00:00"
    },
    {
      “lat”: 23.42,
      “lon”: -62.16,
      “time”: "2021-07-12T06:00:00"
    }
  ]
}
```

- variables
  - An array of strings identifying specific parameters to be included.
  - Complete list of supported variables is below:

air_pressure_at_mean_sea_level
air_pressure_at_surface
air_temperature
air_temperature_max_in_last_hour
air_temperature_min_in_last_hour
convective_available_potential_energy
convective_inhibition
dew_point_temperature
eastward_sea_water_velocity
eastward_wind
eastward_wind_100m
latent_heat_flux
max_precip_rate
max_wind_gust
mean_snowfall_rate
northward_sea_water_velocity
northward_wind
northward_wind_100m
precipitation_type
relative_humidity
sea_ice_concentration
sea_ice_cover
sea_ice_thickness
sea_surface_first_partition_swell_wave_mean_direction
sea_surface_first_partition_swell_wave_mean_period
sea_surface_first_partition_swell_wave_significant_height
sea_surface_maximum_individual_wave_height
sea_surface_salinity
sea_surface_second_partition_swell_wave_mean_direction
sea_surface_second_partition_swell_wave_mean_period
sea_surface_second_partition_swell_wave_significant_height
sea_surface_temperature
sea_surface_total_swell_wave_mean_direction
sea_surface_total_swell_wave_mean_period
sea_surface_total_swell_wave_significant_height
sea_surface_wave_mean_direction
sea_surface_wave_mean_period
sea_surface_wave_significant_height
sea_surface_wind_wave_mean_direction
sea_surface_wind_wave_mean_period
sea_surface_wind_wave_significant_height
sea_water_direction
sea_water_speed
sensible_heat_flux
snow_depth
soil_moisture_0-7cm
soil_moisture_100-289cm
soil_moisture_28-100cm
soil_moisture_7-28cm
soil_temperature_0-7cm
soil_temperature_100-289cm
soil_temperature_28-100cm
soil_temperature_7-28cm
specific_humidity
surface_net_downward_solar_radiation
surface_net_downward_thermal_radiation
surface_net_solar_radiation
surface_net_thermal_radiation
surface_temperature
% vesseltop_of_atmosphere_net_thermal_radiation
total_cloud_cover
total_precipitation_last_hour
total_snowfall_last_hour
wind_direction
wind_direction_100m
wind_gust
wind_speed
wind_speed_100m

- output_format
    - An optional string value representing the desired output format.
    - Supported values are CSV or JSON.
    - The default value is JSON.
    - The extracted route data will be encoded in a single compressed output file of the specified format.

Below is an example of a route retrieval request using the curl command-line utility:

```
curl --location 'https://api.wx.spire.com/archive/route' \
--header 'Content-Type: application/json' \
--header 'spire-api-key: <YOURAPIKEYGOESHERE>' \
--data '{
   "output_format": "CSV",
   "fields":
["air_pressure_at_mean_sea_level","air_pressure_at_surface","air_temperature","air_temperature_max_in_last_hour","air_temperature_min_in_last_hour","convective_available_potential_energy","convective_inhibition","dew_point_temperature","eastward_sea_water_velocity","eastward_wind","eastward_wind_100m","latent_heat_flux","max_precip_rate","max_wind_gust","mean_snowfall_rate","northward_sea_water_velocity","northward_wind","northward_wind_100m","precipitation_type","relative_humidity","sea_ice_concentration","sea_ice_cover","sea_ice_thickness","sea_surface_first_partition_swell_wave_mean_direction","sea_surface_first_partition_swell_wave_mean_period","sea_surface_first_partition_swell_wave_significant_height","sea_surface_maximum_individual_wave_height","sea_surface_salinity","sea_surface_second_partition_swell_wave_mean_direction","sea_surface_second_partition_swell_wave_mean_period","sea_surface_second_partition_swell_wave_significant_height","sea_surface_temperature","sea_surface_total_swell_wave_mean_direction","sea_surface_total_swell_wave_mean_period","sea_surface_total_swell_wave_significant_height","sea_surface_wave_mean_direction","sea_surface_wave_mean_period","sea_surface_wave_significant_height","sea_surface_wind_wave_mean_direction","sea_surface_wind_wave_mean_period","sea_surface_wind_wave_significant_height","sea_water_direction","sea_water_speed","sensible_heat_flux","snow_depth","soil_moisture_0-7cm","soil_moisture_100-289cm","soil_moisture_28-100cm","soil_moisture_7-28cm","soil_temperature_0-7cm","soil_temperature_100-289cm","soil_temperature_28-100cm","soil_temperature_7-28cm","specific_humidity","surface_net_downward_solar_radiation","surface_net_downward_thermal_radiation","surface_net_solar_radiation","surface_net_thermal_radiation","surface_temperature","top_of_atmosphere_net_thermal_radiation","total_cloud_cover","total_precipitation_last_hour","total_snowfall_last_hour","wind_direction","wind_direction_100m","wind_gust","wind_speed","wind_speed_100m"],
   "route":
      {"name": "ONE_Apus_Route-Shortened",
      "waypoints": [{"lat": "22.57912333", "lon": "114.2778117", "time": "2020-11-19T09:00:00"}, {"lat": "22.579185", "lon": "114.2778967", "time": "2020-11-19T10:00:00"}, {"lat": "22.55125167", "lon": "114.34796", "time": "2020-11-19T11:00:00"}, {"lat": "22.4136", "lon": "114.460965", "time": "2020-11-19T12:00:00"}, {"lat": "22.28233167", "lon": "114.6235383", "time": "2020-11-19T13:00:00"}, {"lat": "22.251065", "lon": "114.8154083", "time": "2020-11-19T14:00:00"}]}
}'
```

Note: For Windows, use double quotation marks

Querying Status of Submitted Retrieval Jobs

After a retrieval request has been successfully submitted and a `job_uuid` has been returned to you, that value can be provided to the `/jobs/<job_uuid>/status` endpoint to monitor the progress of your data request.. The returned `job_status` can be one of the following:

- CREATED
    - The retrieval request was successfully submitted to the API server, job parameters have passed initial validation, and the job definition was created successfully.
- RESTORING_FILES
    - Input datasets required for the job are currently being restored. Processing has not yet begun.
- RESTORE_COMPLETED
    - All input datasets required to fulfill the job have been restored from the archive, and the job will begin processing soon.
- INITIATED

    - A job has been successfully initiated, and the processing task was triggered. Failures at this stage are rare and additional events should follow.
- PROCESSING
    - Processing has begun and the requested data is being generated.
- COMPLETED
    - Processing has been completed successfully and the requested output is now available for download from the Export API.
- FAILED
    - Job processing has failed. Please contact the Spire team for assistance.
- UNKNOWN
    - An unexpected problem has occurred, and the current job status could not be determined. Please contact the Spire team for assistance.

Sample API query to check a submitted job status:

```
curl --location --request GET
'https://api.wx.spire.com/archive/jobs/4e35b50f3eb57683616753a97df482eef6e1b075/status' \
--header 'spire-api-key: <<your api token here>>'
```

And a sample response:

```
{
   "creation_time": "2021-09-25T16:52:12.488856",
   "export_uri": "https://api.wx.spire.com/export/abcdefghijklmnop1234567890",
   "job_status": "COMPLETED",
   "job_uuid": "abcdefghijklmnop1234567890"
}
```

Downloading Data from a Completed Job

By navigating to the `export_uri` you can view the files available for download. In the above example, visiting `https://api.wx.spire.com/export/abcdefghijklmnop1234567890` should return a data structure like this:

```
{
        "meta":  {
                "count":  1
        },
        "files": [
                "abcdefghijklmnop1234567890.zip"
        ]
}
```

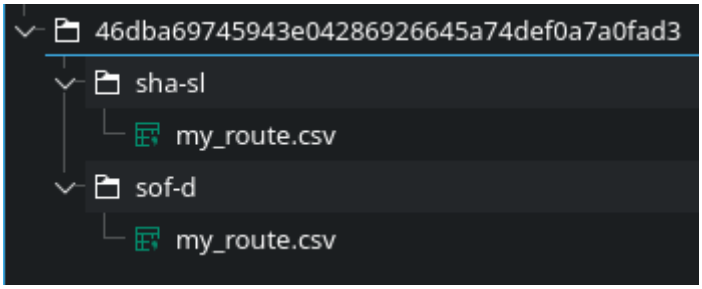
To download the exported ZIP, simply append the filename to the `export_uri`: `https://api.wx.spire.com/export/abcdefghijklmnop1234567890/abcdefghijklmnop1234567890.zip`

Output File Content

The output will generally contain one file (in JSON or CSV format) with the historical weather data requested. The exception is when the request includes data from the previous 6 days. In this case, this data is based on Spire's historical forecast (and not the same historical re-analysis).

In this case, when the request completes, the file will include a file per product in the archive file:

- The sha-sl folder contains the data from Spire's historical re-analysis (anything from 6 days before the time of request or before)
- The sof-d folder contains the data from the time of the request to minus six days, coming from Spire's historical forecast



Example of the file contents when recent history is requested

There are no additional columns within the CSV files themselves indicating which dataset is which. That is currently handled by the folder structure.

If JSON data was requested instead of CSV the same thing occurs - you'll get sha-sl/my_route.json and sof-d/my_route.json files with the usual response structure. An example follows:


```
{
  "data": [
    {
      "location": {
        "coordinates": {
          "lat": 45.08,
          "lon": -23.47
        },
        "time": "2022-03-09T18:00:00"
      },
      "times": {
        "valid_time": "2022-03-09T18:00:00",
        "requested_valid_time": "2022-03-09T18:15:00"
      },
      "values": {
        "land_sea_mask": 0.0,
        "model_bathymetry": 999.0,
        "sea_ice_cover": 0.0,
        "sea_surface_first_partition_swell_wave_mean_direction": 340.0,
        "sea_surface_first_partition_swell_wave_mean_period": 11.5,
        "sea_surface_first_partition_swell_wave_significant_height": 2.0,
        "sea_surface_maximum_individual_wave_height": 9.5,
        "sea_surface_second_partition_swell_wave_mean_direction": 57.5,
        "sea_surface_second_partition_swell_wave_mean_period": 10.25,
        "sea_surface_second_partition_swell_wave_significant_height": 0.25,
        "sea_surface_temperature": 287.0,
        "sea_surface_total_swell_wave_mean_direction": 307.75,
        "sea_surface_total_swell_wave_mean_period": 11.25,
        "sea_surface_total_swell_wave_significant_height": 2.0,
        "sea_surface_wave_mean_direction": 226.0,
        "sea_surface_wave_mean_period": 8.5,
        "sea_surface_wave_significant_height": 5.0,
        "sea_surface_wind_wave_mean_direction": 207.5,
        "sea_surface_wind_wave_mean_period": 7.5,
        "sea_surface_wind_wave_significant_height": 4.5
      }
    },
    {
      "location": {
        "coordinates": {
          "lat": 42.97,
          "lon": -25.5
        },
        "time": "2022-03-10T06:00:00"
      },
      "times": {
        "valid_time": "2022-03-10T06:00:00",
```

```
            "requested_valid_time": "2022-03-10T06:12:00"
          },
          "values": {
            "land_sea_mask": 0.0,
            "model_bathymetry": 999.0,
            "sea_ice_cover": 0.0,
            "sea_surface_first_partition_swell_wave_mean_direction": 184.25,
            "sea_surface_first_partition_swell_wave_mean_period": 19.0,
            "sea_surface_first_partition_swell_wave_significant_height": 2.5,
            "sea_surface_maximum_individual_wave_height": 11.5,
            "sea_surface_second_partition_swell_wave_mean_direction": 179.25,
            "sea_surface_second_partition_swell_wave_mean_period": 27.5,
            "sea_surface_second_partition_swell_wave_significant_height": 0.5,
            "sea_surface_temperature": 287.75,
            "sea_surface_total_swell_wave_mean_direction": 277.5,
            "sea_surface_total_swell_wave_mean_period": 12.5,
            "sea_surface_total_swell_wave_significant_height": 2.75,
            "sea_surface_wave_mean_direction": 269.0,
            "sea_surface_wave_mean_period": 10.25,
            "sea_surface_wave_significant_height": 6.0,
            "sea_surface_wind_wave_mean_direction": 267.75,
            "sea_surface_wind_wave_mean_period": 9.75,
            "sea_surface_wind_wave_significant_height": 5.5
          }
        },
…
```


sha-sl/my_route.json example

Note: The response includes two date fields:

- requested_valid_time: The timestamp the customer requested the data for
- valid_time : The timestamp the data refers to
  - For instance, for a customer requesting data for 01/01/2021 12:20, we will respond:
    - requested_valid_time : 12:20
    - valid_time : 12:00

Limitations

The following are some known limitations of the present system:

- Data Availability
  - The historical data request can contain data from even 1 hour prior to the request.
    - The historical re-analysis is currently produced with a 6 days delay. Any data from 1h to 6 days previous to the time of the request will be provided using Spire's historical forecast output (using the 6-hourly analysis plus the first 5 hours of each forecast).
  - The oldest data that may be requested is January 1, 1990. When submitting a retrieval request, the system will respond with an error if data is requested outside of this data availability window.
- Request Validation
  - The API does significant syntax validation and value-checking before accepting a retrieval request, but can not correct for all typos, so please be sure about your parameters before submitting requests.
- Job Cancellation
  - Presently, the API does not support the cancellation of submitted jobs. If you realize a mistake with a submitted request, please contact the Spire team as soon as possible and we can cancel the job for you.
- Quotas
  - When submitting route data retrieval requests, the total number of included waypoints can not exceed the waypoint quota associated with your account.

- When data requests are submitted, the number of submitted waypoints are reserved, but not subtracted, from your quota. Once the job has been completed successfully, the waypoints are deducted from your quota. If the job fails to complete for any reason, the reserved waypoints will be returned to your quota.

Synchronous Route API - /historical/route

The historical route endpoint allows customers to submit requests for an automated route (trajectory) data extraction from Spire's historical archive of weather conditions. **To use the synchronous route API, the route data range submitted must be within the past 6 months**. Users can interact with the API using any HTTP client, including command-line utilities such as curl or graphical utilities like Postman. Online API documentation can be accessed any time at the following URL:

https://developers.wx.spire.com/swagger_ui/index.html#/Historical%20Data/post_historical_route

Workflow

The basic workflow for the historical route endpoint is as follows:

1. Submit a new data retrieval request via the `/historical/route` endpoint
    a. If the request parameters fail a basic validation test, an error will be returned indicating the problem. Modify your parameters accordingly and retry.
    b. If the request passes validation, the API will begin processing and retrieving your historical data per the request made.
2. The API will respond with your requested .json historical output within ~60 seconds or less

Endpoint

Submit a new route data retrieval request: `https://api.wx.spire.com/historical/route`
This endpoint allows the user to submit requests for historical trajectory/route data retrievals. Requests must provide the desired data fields (or field bundles) to be retrieved and a series of waypoints (latitude/longitude/time) describing a historical route along which data will be extracted.

Submitting Route Data Retrieval Requests

Retrieval requests are submitted using HTTP POST requests to the `/historical/route` endpoint. Parameters are accepted as part of the request body in the form of a JSON payload.

API Input Parameters

The following parameters are accepted when submitting a new route data retrieval request:

- route
    - A JSON object describing a historical route.
    - The route definition includes a name and one or more waypoints, each describing a specific point in space and time (i.e., latitude, longitude, and time).
    - The waypoints can be provided at any time within the past 6 months. At present, our historical data is available at hourly time intervals, so all the times provided will be "snapped" to the closest top of the hour we have data for. For instance, a request for data at 03:20 will be accepted, but the returning data will be from our 03:00 historical data.
    - Waypoint timestamps must be specified in ISO 8601 format.
    - The provided route name must only contain alphanumeric characters, underscores, or hyphens (no spaces).

- ⊄ At the present time, a **maximum of 1,000 waypoints** may be included in each route retrieval request.

∉ Variables (e.g. “fields”)

- ⊄ An array of strings identifying specific weather parameters to be included for each waypoint and timestamp.
- ⊄ A complete list of supported variables is contained within the below example request body:

```
{
  "route": {
    "name": "route_1",
    "waypoints": [
      {"lat": 0,"lon": 0,"time": "2023-10-01T14:00:00"},
      {"lat": 0,"lon": 0,"time": "2023-10-01T15:00:00"},
      {"lat": 0,"lon": 0,"time": "2023-10-01T16:00:00"}
    ]
  },
  "fields":
["100_meter_wind_direction","100_meter_wind_speed","air_pressure_at_mean_sea_level","air_pressure_at_surface","air_temperature","air_temperature_max_in_last_hour","air_temperature_min_in_last_hour","convective_available_potential_energy","convective_inhibition","dew_point_temperature","eastward_sea_water_velocity","eastward_wind","eastward_wind_100m","high_vegetation_cover","land_sea_mask","latent_heat_flux","leaf_area_index_high_vegetation","leaf_area_index_low_vegetation","low_vegetation_cover","max_precip_rate","max_wind_gust","mean_snowfall_rate","model_bathymetry","moisture_flux","northward_sea_water_velocity","northward_wind","northward_wind_100m","orography","precipitation_type","relative_humidity","sea_ice_concentration","sea_ice_cover","sea_ice_thickness","sea_surface_first_partition_swell_wave_mean_direction","sea_surface_first_partition_swell_wave_mean_period","sea_surface_first_partition_swell_wave_significant_height","sea_surface_maximum_individual_wave_height","sea_surface_salinity","sea_surface_second_partition_swell_wave_mean_direction","sea_surface_second_partition_swell_wave_mean_period","sea_surface_second_partition_swell_wave_significant_height","sea_surface_temperature","sea_surface_total_swell_wave_mean_direction","sea_surface_total_swell_wave_mean_period","sea_surface_total_swell_wave_significant_height","sea_surface_wave_mean_direction","sea_surface_wave_mean_period","sea_surface_wave_significant_height","sea_surface_wind_wave_mean_direction","sea_surface_wind_wave_mean_period","sea_surface_wind_wave_significant_height","sea_water_direction","sea_water_speed","sensible_heat_flux","snow_depth","soil_moisture_0-7cm","soil_moisture_100-289cm","soil_moisture_28-100cm","soil_moisture_7-28cm","soil_temperature_0-7cm","soil_temperature_100-289cm","soil_temperature_28-100cm","soil_temperature_7-28cm","soil_type","specific_humidity","surface_net_downward_solar_radiation","surface_net_downward_thermal_radiation","surface_net_solar_radiation","surface_net_thermal_radiation","surface_temperature","top_of_atmosphere_net_thermal_radiation","total_cloud_cover","total_precipitation_last_hour","total_snowfall_last_hour","type_of_high_vegetation","type_of_low_vegetation","wind_direction","wind_gust","wind_speed"
]
}
```

Below is an example of a route retrieval request using the curl command-line utility:

```
curl -X 'POST' \
  'https://api.wx.spire.com/historical/route' \
  -H 'accept: application/json' \
  -H 'spire-api-key: YOURAPITOKENHERE' \
  -H 'Content-Type: application/json' \
  -d '{
  "route": {
    "name": "route_1",
    "waypoints": [
      {
        "lat": 0,
        "lon": 0,
        "time": "2023-10-01T13:00:00"
      }
    ]
  },
  "fields": [
    "air_temperature"
  ]
}'
```

Note: For Windows, use double quotation marks

Output Content

Output from the API will be in .json format, with each coordinate and time having a corresponding list of values. A simple, truncated output follows:


```
{
  "data": [
    {
      "location": {
        "coordinates": {
          "lat": 0,
          "lon": 0,
          "elevation": 0.4080047607421875
        }
      },
      "times": {
        "issuance_time": "2023-10-01T14:00:00+00:00",
        "valid_time": "2023-10-01T14:00:00+00:00"
      },
      "values": {
        "100_meter_wind_direction": 180,
        "100_meter_wind_speed": 7.6,
        "air_pressure_at_mean_sea_level": 101160.1,
        "air_pressure_at_surface": 101155.4,
        "air_temperature": 298.7,
        "air_temperature_max_in_last_hour": 298.7,
        "air_temperature_min_in_last_hour": 298.7,
        "convective_available_potential_energy": 0,
        "convective_inhibition": null,
        "dew_point_temperature": 295.2,
        "eastward_sea_water_velocity": -0.3,
        "eastward_wind": 0,
        "eastward_wind_100m": 0,
        "high_vegetation_cover": 0,
        "land_sea_mask": 0,
        "latent_heat_flux": 142.2,
        "leaf_area_index_high_vegetation": 0,
        "leaf_area_index_low_vegetation": 0,
        "low_vegetation_cover": 0,
        "max_precip_rate": 0,
        "max_wind_gust": 9.9,
        "mean_snowfall_rate": 0,
        "model_bathymetry": 999,
        "moisture_flux": -0.00005688052624464035,
        "northward_sea_water_velocity": -0.1,
        "northward_wind": 6.9,
        "northward_wind_100m": 7.6,
        "precipitation_type": "rain",
        "relative_humidity": 86,
        "sea_ice_concentration": null,
        "sea_ice_cover": 0,
        "sea_ice_thickness": null,
        "sea_surface_first_partition_swell_wave_mean_direction": null,
        "sea_surface_first_partition_swell_wave_mean_period": 9.2,
        "sea_surface_first_partition_swell_wave_significant_height": null,
        "sea_surface_maximum_individual_wave_height": 3.688533429056406,
        "sea_surface_salinity": null,
        "sea_surface_second_partition_swell_wave_mean_direction": 209,
        "sea_surface_second_partition_swell_wave_mean_period": null,
        "sea_surface_second_partition_swell_wave_significant_height": null,
        "sea_surface_temperature": 300.1,
        "sea_surface_total_swell_wave_mean_direction": 172,
        "sea_surface_total_swell_wave_mean_period": null,
        "sea_surface_total_swell_wave_significant_height": null,
        "sea_surface_wave_mean_direction": null,
        "sea_surface_wave_mean_period": null,
```

```
      "sea_surface_wave_significant_height": 1.9,
      "sea_surface_wind_wave_mean_direction": 180,
      "sea_surface_wind_wave_mean_period": 3.8,
      "sea_surface_wind_wave_significant_height": null,
      "sea_water_direction": 76,
      "sea_water_speed": 0.3,
      "sensible_heat_flux": -11.9,
      "snow_depth": 0,
      "soil_moisture_0-7cm": 0.000007539987564086914,
      "soil_moisture_100-289cm": 0,
      "soil_moisture_28-100cm": 0.000002314569428563118,
      "soil_moisture_7-28cm": 0.000004110770532861352,
      "soil_temperature_0-7cm": 300.0782928466797,
      "soil_temperature_100-289cm": 300.0796203613281,
      "soil_temperature_28-100cm": 300.0773468017578,
      "soil_temperature_7-28cm": 300.07789611816406,
      "soil_type": 0,
      "specific_humidity": 17,
      "surface_net_downward_solar_radiation": 2881280,
      "surface_net_downward_thermal_radiation": 1473233.6875,
      "surface_net_solar_radiation": 2761728,
      "surface_net_thermal_radiation": -176654,
      "surface_temperature": 299.9,
      "top_of_atmosphere_net_thermal_radiation": -1028003,
      "total_cloud_cover": 91.0003662109375,
      "total_precipitation_last_hour": 0,
      "total_snowfall_last_hour": 0,
      "type_of_high_vegetation": 0,
      "type_of_low_vegetation": 0,
      "wind_direction": 180,
      "wind_gust": 9.8,
      "wind_speed": 6.9
    }
   },
…….
  ],
  "meta": {
    "unit_system": "si"
  }
}
```


.json example output, truncated

Note: The response includes two “times” fields:

- issuance_time: The timestamp the customer requested the data for
- valid_time : The timestamp the data refers to
  - For requests which include data within the most recent past 6 days of history, it is possible that the issuance_time and valid_time are not the same.
    - issuance_time : 12:00
    - valid_time : 16:00
      - Due to a time gap in the historical observations backfilling of around 6 days, we fill in this time range with recent short term historical forecast data. There will be a maximum mismatch of +5 hours from issuance_time to valid_time as a result of this gap-filling process.
  - For requests older than the past 6 days, the issuance_time and valid_time will match.

Limitations

The following are some known limitations of the present system:

- Concurrent Requests (e.g. multithreading)
  - At this time, the API does not support multi-threaded or simultaneous requests from the same API token.

    - Each API token is limited to a single active request for retrieving historical data at one time. Once the data has been delivered and the query is no longer active, a subsequent query can be made.
- Data Availability
    - The historical data request can contain data from even 1 hour prior to the request.
        - The historical re-analysis is currently produced with a 6 day delay. Any data from 1h to 6 days previous to the time of the request will be provided using Spire's historical forecast output (using the 6-hourly analysis plus the first 5 hours of each forecast).
        - When historical forecast output is provided in the API response, the full set of forecast variables is provided in the output, in order to allow the users to potentially use the "next best" variable fit in the case that there is not an exact historical data to forecast data variable match.
    - The oldest data that may be requested is January 1, 1990. When submitting a retrieval request, the system will respond with an error if data is requested outside of this data availability window.
- Request Validation
    - The API does significant syntax validation and value-checking before accepting a retrieval request, but cannot correct for all typos, so please be sure about your parameters before submitting requests.
- Quotas
    - When submitting route data retrieval requests, the total number of included waypoints cannot exceed the waypoint quota associated with your account.
    - When data requests are submitted, the number of submitted waypoints are subtracted from your quota. If the job fails to complete for any reason, the waypoints will be returned to your quota.

Spire Weather API - Current

File Endpoint - /current/weather/file

The file endpoint is used to retrieve the global current weather conditions product for a whole region, or even globally. The forecast is split in several files, each containing the forecast for one specific time, for one bundle, in an entire region, in GRIB2 format.

Each file contains the current conditions for a given hour for the entire planet (global) or a region (see the regions section).

If you never worked with GRIB2, check our tutorial on how to get started with it. We also have tutorials explaining how to process GRIB2 data for different industry needs.

The basic workflow to work with the files API is:

1. List the available files using the file endpoint
    a. The file API has options to filter the response
2. Select the file you want to download (or loop through the available files) and download it using the file/{file_id} endpoint

List the current conditions files

The current conditions endpoint keeps the last 3 days of conditions available at the live API (after that, the files are archived).

To retrieve a list of currently available files using CURL:

```
curl -X GET ‘https://api.wx.spire.com/current/weather/file’ -H ‘spire-api-key: <YOUR API KEY>'
```

Note: For Windows, use double quotation marks


```
{
  "meta": {
    "count": 135
  },
  "files": [
    "cwc.20211205.t00z.0p027.basic.global.grib2",
    "cwc.20211205.t01z.0p027.basic.global.grib2",
    "cwc.20211205.t02z.0p027.basic.global.grib2",
    "cwc.20211205.t03z.0p027.basic.global.grib2",
    "cwc.20211205.t04z.0p027.basic.global.grib2",
    ...
    "cwc.20211210.t10z.0p027.basic.global.grib2",
    "cwc.20211210.t11z.0p027.basic.global.grib2",
    "cwc.20211210.t12z.0p027.basic.global.grib2",
    "cwc.20211210.t13z.0p027.basic.global.grib2",
    "cwc.20211210.t14z.0p027.basic.global.grib2"
  ]
}
```


Sample response

API Parameters

Here are some of the key API parameters for this endpoint. Please refer to the online API documentation for more details:

- **time**: Allows choosing the specific timestamp to retrieve the file list
  - Optional (default is all of the currently available files)
- **regions**: Allows defining the regions of interest, can be global or a specific region to limit the data in the output
  - Optional (default is all regions you have access to)
  - *Note: Read the section about regions to understand it better*

Understanding the file names

A sample file name: cwc.20211210.t12z.0p027.basic.global.grib2:

File name part	Description
cwc	Spire Operational Current Weather Conditions
20211210	The issuance date of the current conditions (or the day it refers to). In the example, December 10, 2021
t12z	The issuance time of the current conditions (in UTC). In the example, 12:00:00
0p027	The grid resolution in degrees. In the example, 0.027 (1/36th-degree).
basic	The bundle, indicating what variables are available at the file (continue reading to understand bundles and the variables)
global	The region included in the file. In the example, global
grib2	The file format: GRIB2

Download a current condition file

To download a file, use the same /current/weather/file endpoint, but add the file name to the query.

For example, "/current/weather/file/cwc.20211210.t12z.0p027.basic.global.grib2"

Example - Download a forecast file

This example shows how to download one forecast file using CURL:

```
curl -OJL -X GET 'https://api.wx.spire.com/forecast/file/sof.20190304.t00z.0p25.basic.global.f000.grib2' -H 'spire-api-key: <YOUR API KEY>'
```

Note: For Windows, use double quotation marks

```
curl: Saved to filename 'cwc.20211210.t12z.0p027.basic.global.grib2'
```

Sample response

Point Endpoint - /current/weather/point

The point endpoint is used to retrieve the current weather conditions for a single time in one location (defined by a lat/long coordinate). It will return it in JSON format.

A single API call to the point API will return all the supported weather variables you have access to (from all data bundles).

Example - Get the current conditions for one coordinate

This example shows how to retrieve the current weather conditions for Boulder (CO) using CURL:

```
curl -X GET 'https://api.wx.spire.com/current/weather/point?lat=40.018672&lon=-105.250537' -H 'spire-api-key: <YOUR API KEY>'
```

Note: For Windows, use double quotation marks


```
{
  "meta": {
    "unit_system": "si",
    "forecast": "Spire Current Weather Conditions",
    "message": null
  },
  "data": [
    {
      "location": {
        "coordinates": {
          "lat": 40.018672,
          "lon": -105.250537
        }
      },
      "times": {
        "valid_time": "2021-12-10T15:00:00+00:00"
      },
      "values": {
        "air_pressure_at_sea_level": 100512.3359375,
        "air_temperature": 272.8951416015625,
        "dew_point_temperature": 270.6507873535156,
        "eastward_wind": -1.447329044342041,
        "northward_wind": -3.0793211460113525,
        "precipitation_rate": 0,
        "relative_humidity": 84.80000305175781,
        "wind_direction": 25.17425765561137,
        "wind_gust": 3.7142257690429688,
```

```
      "wind_speed": 3.402496154717697
    }
   }
  ]
}
```


Sample response

API Parameters

Here are some of the key API parameters for the point endpoint. Please refer to the online API documentation for more details:

- **Lat/Lon:** The latitude and longitude of the point to retrieve data for.
- **time**: Allows choosing the specific date/time to retrieve the current conditions data
  - Optional (default is the current hour)
- **tz**: The name of a time zone that times will be returned in.
  - Optional (default is the local time zone - at the coordinate location)
- **unit_system:** The unit system that is used in response values.
  - Optional (default is the Standard International System of Units, with the units described in the Data Description section)
- **X-Fields**: A field mask to filter the response and include only selected fields
  - Optional (default is all available data)

Spire Weather API - Forecast

File Endpoint - /forecast/file

The file endpoint is used to retrieve the global weather forecast for a whole region, or even globally, in GRIB2 format.

The forecast is split into several small files, each containing the forecast for one specific time, for one bundle, in one region.

If you never worked with GRIB2, check our tutorial on how to get started with it. We also have tutorials explaining how to process GRIB2 data for different industry needs.

The basic workflow to work with the files API is:

1. List the available files using the file endpoint
   a. The file API has options to filter the response
2. Loop through the available files, downloading each one (per file name) using the file/{file_id} endpoint

List the forecast files from the Global Forecast Model

To retrieve a list of available forecast files using CURL:

```
curl -X GET ‘https://api.wx.spire.com/forecast/file’ -H ‘spire-api-key: <YOUR API KEY>’
```

Note: For Windows, use double quotation marks


```
{
 “meta”: {
  “count”: 9
 },
```

```
  "files": [
    "sof.20190307.t00z.0p25.basic.global.f000.grib2",
    "sof.20190307.t00z.0p25.basic.global.f006.grib2",
    "sof.20190307.t00z.0p25.basic.global.f012.grib2",
    "sof.20190307.t00z.0p25.basic.global.f018.grib2",
    ….
]}
```

Sample response

API Parameters

Here are some of the key API parameters for this endpoint. Please refer to the online API documentation for more details:

- **issuance_time**: Allows retrieving the most recent issuance, or forecasts issued in the last 3 days
  - Optional (default is the most recent)
- **regions**: Allows defining the regions of interest, can be global or a specific region to limit the data in the output
  - Optional (default is all regions you have access to)
  - *Note: Read the section about regions to understand it better*
- **bundles**: Allows choosing a subset of the subscribed data bundles.
  - Optional (default is all bundles you have access to)
  - *Note: Read the section about data bundles to understand it better*
- **time_bundle**: Allows choosing a subset of their subscribed time period (for example, only query for the 5 days forecast, omitting the full 15 days).
  - Optional (default is all available time bundles)
  - *Note: Read the section about time bundles to understand it better*

Understanding the file names

A sample file name: sof-d.20190421.t12z.0p125.basic.africa.f000.grib2:

File name part	Description
sof-d	Spire Operational Forecast
20190421	The issuance date of the forecast. In the example, April 21, 2019
T12z	The issuance time of the forecast. In the example, 12:00:00 UTC
0p125	The grid resolution in degrees. In the example, 0.125 ($^{1}/$8th-degree).
basic	The bundle, indicating what variables are available at the file (continue reading to understand bundles and the variables)
africa	The region included in the file (continue reading for the available regions)
f006	How many hours after the issuance date/time does this forecast refer to. This example indicates the forecast for April 21, 2019 18:00:00 UTC. Will vary from f000 to f240.
grib2	The file format: GRIB2

List the forecast files from the High-Resolution Forecast Model

To retrieve a list of available forecast files using CURL:

```
curl -X G‘T 'https://api.wx.spire.com/forecast/file?product=srfs' -H 'spire-api-key: <YOUR API KEY>'
```

Note: For Windows, use double quotation marks

```
{
   "meta": {
      "count": 145,
      "issuance_time": "2023-11-06T12:00:00+00:00"
   },
   "files": [
      "srfs.20231106.t12z.03km.core.europe.f000m00.grib2",
      "srfs.20231106.t12z.03km.core.europe.f001m00.grib2",
      "srfs.20231106.t12z.03km.core.europe.f002m00.grib2",
      "srfs.20231106.t12z.03km.core.europe.f003m00.grib2",
      "srfs.20231106.t12z.03km.core.europe.f004m00.grib2",
    “  "srfs.20231106.t12z.03km.core.europe.f005m00.gr”b2",
…}
```

Sample response

API Parameters

Here are some of the key API parameters for this endpoint. Please refer to the online API documentation for more details:

- **issuance_time**: Allows retrieving the most recent issuance, or forecasts issued in the last 3 days
  - Optional (default is the most recent)
- **regions**: Allows defining the regions of interest if your token has access to multiple regional forecast model domains
  - Optional (default is all regions you have access to)
  - *Note: Read the section about regions to understand it better*
- **bundles**: Allows choosing a subset of the subscribed data bundles.
  - Optional (default is all bundles you have access to)
  - *Note: Read the section about data bundles to understand it better*
- **time_bundle**: Allows choosing a subset of their subscribed time period (for example, only query for the next 24h forecast, omitting the last 14 days).
  - Optional (default is all available time bundles)
  - *Note: Read the section about time bundles to understand it better*

Understanding the file names

A sample file name: srfs.20231106.t12z.03km.core.europe.f006m00.grib2:

File name part	Description
srfs	Spire Regional Forecast System
20231106	The issuance date of the forecast. In the example: November 6, 2023
t12z	The issuance time of the forecast. In the example: 12:00:00 UTC
03km	The grid resolution in kilometers. In the example: 3 kilometers.
core	The bundle, indicating what variables are available at the file (continue reading to understand bundles and the variables)
europe	The region included in the file (continue reading for the available regions)
f006	How many hours after the issuance date/time does this forecast refer to. This example indicates the forecast for April 21, 2019 18:00:00 UTC.

	Will vary from f000 to fXXX depending on the maximum lead time in the high-resolution model you are using.
m00	How many minutes after the issuance date/time does the forecast refer to. This is in addition to the hours field directly above. If the forecast only has hourly output, then every hour will simply have 'm00' after the hour. If the forecast has sub-hourly output, you will note that minutes will change within the forecast lead hour, resulting in additional forecast grib2 files with a higher temporal resolution in the forecast output.
grib2	The file format: GRIB2

WORKING WITH GRIB2 FILES

The GRIB2 data messages are provided in many smaller files (one file per bundle per lead time) to speed the data download. If you prefer to manipulate just a single file when integrating with your applications, they can be combined by simply concatenating one to the other.

Our website and GitHub have several examples about how to work with GRIB2 which can be accessed through https://spire.com/developers.

Download the forecast files

To download the files you listed (see the example above), use the same /forecast/file endpoint, but add the file name to the query.

For example, "/forecast/file/srfs.20231106.t12z.03km.core.europe.f006m00.grib2"

Example - Download a forecast file

This example shows how to download one forecast file using CURL:

```
curl -OJL -X GET 'https://api.wx.spire.com/forecast/file/srfs.20231106.t12z.03km.core.europe.f006m00.grib2' -H 'spire-api-key: <YOUR API KEY>'
```

Note: For Windows, use double quotation marks

```
curl: Saved to filename srfs.20231106.t12z.03km.core.europe.f006m00.grib2'
```

Sample response

Online example - Download multiple forecast files

Our developers' web page has other examples about how to work with the file API. For instance, read this article to understand how to download multiple forecast files.

At the GRIB2 files, the units of the variables are following the Climate and Forecast Conventions (and also included in the data description):
http://cfconventions.org/Data/cf-standard-names/47/build/cf-standard-name-table.html

Point Endpoint - /forecast/point

Point endpoint is used to retrieve the forecast for the next days in one position (a lat/lon coordinate). It will return the forecast in JSON format.

A single API call to the point API will return all the supported weather variables you have access to (from all data bundles). Please note that some bundles are not available at the point endpoint (for instance, the Aviation bundle).

Example - Get the forecast for one coordinate

This example shows how to retrieve the latest forecast for Boulder (CO) using CURL:

```
curl -X GET 'https://api.wx.spire.com/forecast/point?lat=40.018672&lon=-105.250537' -H 'spire-api-key: <YOUR API KEY>'
```

Note: For Windows, use double quotation marks


```
{
 "meta": {
  "unit_system": "si",
  "forecast": "Spire Operational Forecast"
 },
 "data": [
  {
   "location": {
    "coordinates": {
     "lat": 40.018672,
     "lon": -105.250537
    }
   },
   "times": {
    "issuance_time": "2019-03-14T00:00:00",
    "valid_time": "2019-03-14T00:00:00"
   },
   "values": {
    "relative_humidity": 75.6697006225586,
    "air_temperature": 258.00137329101557,
    "dew_point_temperature": 257.24810791015625,
    "northward_wind": 1.54555904865265,
    "eastward_wind": -1.96840810775757,
   }
  },
  ...
 ]
}
```


Sample response

API Parameters

Here are some of the key API parameters for the point endpoint. Please refer to the online API documentation for more details:

- **Lat/Lon:** The latitude and longitude of the point to retrieve data for.
- **issuance_time**: Allows retrieving the most recent issuance, or forecasts issued in the last 3 days
  - Optional (default is the most recent)
- **regions**: Allows defining the regions of interest, can be global or a specific region to limit the data in the output
  - Optional (default is all regions you have access to)
  - *Note: Read the section about regions to understand it better*
- **bundles**: Allows choosing a subset of the subscribed data bundles.
  - Optional (default is all bundles you have access to)

    - *Note: Read the section about data bundles to understand it better*
- **time_bundle**: Allows choosing a subset of their subscribed time period (for example, only query for the 5 days forecast, omitting the full 10 days).
    - Optional (default is all available time bundles)
    - *Note: Read the section about time bundles to understand it better*
- **valid_time_interval:** Allows filtering for a subset of the total forecast time period
    - Optional (default is all available data)
- **tz**: The name of a time zone that times will be returned in.
    - Optional (default is the local time zone - at the coordinate location*)*
- **unit_system:** The unit system that is used in response values.
    - Optional (default is the Standard International System of Units, with the units described in the Data Description section)
- **X-Fields**: A field mask to filter the response and include only selected fields
    - Optional (default is all available data)

WMS Endpoint - /ogc/wms

The wms endpoint has Spire's implementation of the Open Geospatial Consortium's (OGC) Web Map Service (WMS) standard (https://www.opengeospatial.org/standards/wms) - it provides access to our weather data as map layers.

Authentication

Just as with the other API endpoints, authentication is required in order to access WMS services. But differently from the others, the WMS endpoint supports additional options for authentication to accommodate different client needs. The supported methods are:

HTTP Basic Authentication

- The username is the same as the API key
- If that is your preferred method, ask Spire Weather's Support staff for an additional Password

API Key in Query Params

- Put your API key in a query parameter named 'spire-api-key'

API Key in Header

- Put your API key in a header named 'spire-api-key'

Query Parameters

The following query parameters are **mandatory** in a WMS call:

- 'product': The only option currently allowed is 'sof-d'
- 'bundle': The bundle containing the variable(s) you are looking for
    - See the list of bundles at the data description for the ones that support WMS (for instance, 'basic', 'precipitation', and 'maritime')

GetCapabilities

The GetCapabilities request retrieves metadata about the WMS service, including supported operations and parameters, and a list of the available layers.

GetCapabilities for the basic bundle using the spire-api-key query param:

```
curl -v -X GET 'https://api.wx.spire.com/ows/wms?service=WMS&request=GetCapabilities&product=sof-d&bundle=basic&spire-api-key=xxxxxxxxxxxx'
```

Note: For Windows, use double quotation marks

GetCapabilities for the maritime bundle using the spire-api-key query param:

```
curl -v -X GET 'https://api.wx.spire.com/ows/wms?service=WMS&request=GetCapabilities&product=sof-d&bundle=maritime&spire-api-key=xxxxxxxxxxxx'
```

Note: For Windows, use double quotation marks

GetCapabilities for the basic bundle using the spire-api-key header:

```
curl -v -X GET 'https://api.wx.spire.com/ows/wms?service=WMS&request=GetCapabilities&product=sof-d&bundle=basic' -H 'spire-api-key: xxxxxxxxxxxxxx'
```

Note: For Windows, use double quotation marks

GetCapabilities request for the basic bundle using HTTP basic authentication:

```
curl -v -X GET 'https://api.wx.spire.com/ows/wms?service=WMS&request=GetCapabilities&product=sof-d&bundle=basic' -u 'USERNAME:PASSWORD'
```

Note: For Windows, use double quotation marks

Note: No time information is required when performing GetCapabilities requests.

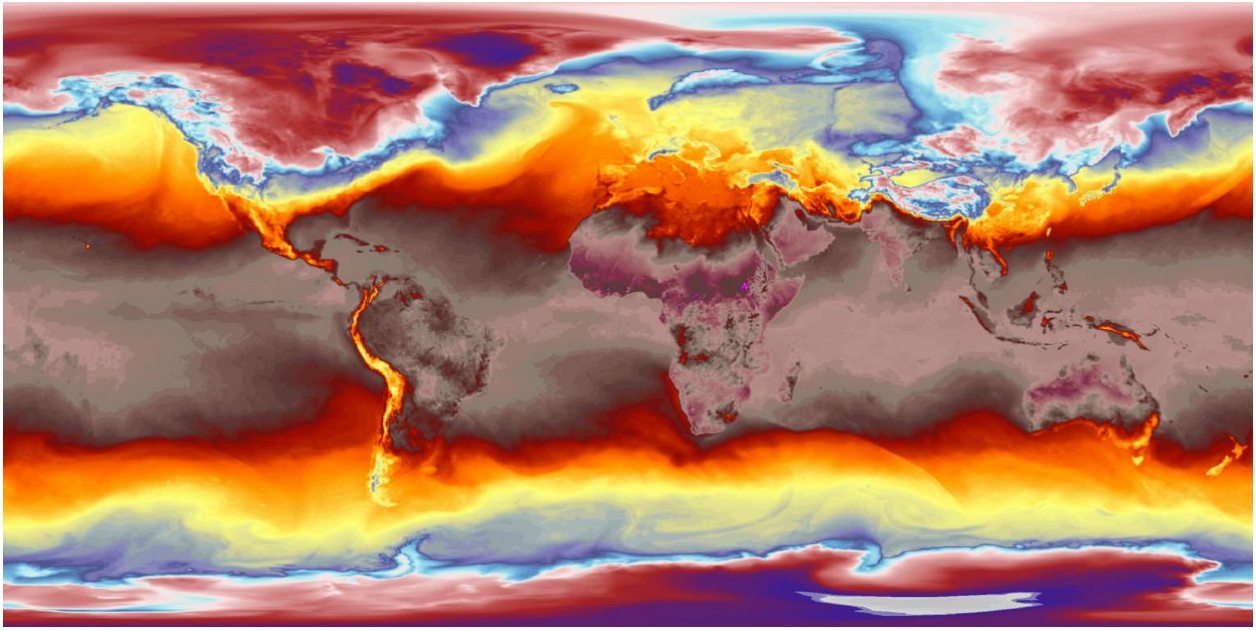
GetMap

GetMap request for a layer (2-m temperature) from the sof-d / basic bundle using the spire-api-key query parameter for authentication:

Note: The time values highlighted in red, will need to be updated depending on when you perform this request.

```
curl -v -X GET 'https://api.wx.spire.com/ows/wms?service=WMS&request=GetMap&bundle=basic&spire-api-key=xxxxxxxxxxxxx&version=1.3.0&width=3072&height=1536&crs=EPSG:4326&bbox=-90,-180,90,180&FORMAT=image/png&TRANSPARENT=true&EXCEPTIONS=application/vnd.ogc.se_inimage&TIME=2020-02-20T12:00:00.000Z&&layers=sof-d/20200220/12/t2m:K&styles=temp:K/nearest' -o get_map_request_image.png
```

Note: For Windows, use double quotation marks



Sample output

Route Endpoint - /forecast/route

The Route endpoint can retrieve weather forecasts over a planned route (trajectory). The difference between a route request and a point request is that, in the route's case, the point is moving through time - at the point API, the location is the same throughout the forecast period.

For instance, the point API can be used to request the 15-days forecast for the city of Paris, while the route API can be used to request the forecast over a planned vessel path - and one day it will be in a port, the other in the ocean, and some days ahead in another port.

A single API call to the route API will return all the supported weather variables you have access to (from all data bundles). Please note that some bundles and/or parameters are not available at the route endpoint (E.g. Aviation or Upper-Air bundles, Accumulated Precipitation variable).

API Parameters

Retrieval requests are submitted using HTTP POST requests to the `/route` endpoint. Parameters are accepted as part of the request body in the form of a JSON payload.

The following parameters are required when submitting a new route data retrieval request:

- **route**: A JSON object describing the future route (trajectory). The route definition must include a name and one or more waypoints, each describing a specific point in space and time (i.e., latitude, longitude, and time).
    - A maximum of 120 waypoints may be included in each route data retrieval.
    - Example route definition:

```
{
      “waypoints”: [
      {
         “lat”: 23.25,
         “lon”: -62.10,
         “time”: "2021-07-12T03:00:00"
      },
      {
         “lat”: 23.32,
         “lon”: -62.11,
         “time”: "2021-07-12T04:00:00"
      },
      {
         “lat”: 23.36,
         “lon”: -62.13,
         “time”: "2021-07-12T05:00:00"
      },
      {
         “lat”: 23.42,
         “lon”: -62.16,
         “time”: "2021-07-12T06:00:00"
      }
   ]
}
```

- **bundles**: A comma-separated list of strings identifying predefined bundles of parameters to be included
    - Example: [“basic,maritime-wave”]

The following optional parameters are allowed when submitting a request:

- **issuance_time**: Allows retrieving the most recent issuance, or forecasts issued in the last 3 days
    - Optional (default is the most recent)
- **tz**: The name of a time zone that times will be returned in.
    - Optional (default is the local time zone - at the coordinate location)
- **unit_system:** The unit system that is used in response values.

- Optional (default is the Standard International System of Units, with the units described at the Data Description section)

Example - Get the forecast for one route

This example shows how to do a route retrieval request using the `curl` command-line utility:

```
curl --location --request POST 'https://api.wx.spire.com/forecast/route' \
--header 'spire-api-key: XXXXXXXXXXXXXXXXXXXXXXXXXXXX' \
--header 'Content-Type: application/json' \
--data-raw '{
  "route": {"name": "my_route", "waypoints": [{"time": "2021-05-01T18:00:00", "lat": 26.71, "lon": -22.41}, {"time": "2021-05-
      01T19:00:00", "lat": 26.542, "lon": -22.484}, {"time": "2021-05-01T20:00:00", "lat": 26.23, "lon": -22.62}, {"time": "2021-05-
      01T21:00:00", "lat": 25.78, "lon": -22.715}, {"time": "2021-05-01T22:00:00", "lat": 25.692, "lon": -22.812}, {"time": "2021-05-
      01T22:00:00", "lat": 25.53, "lon": -22.93}, {"time": "2021-05-01T23:00:00", "lat": 25.563, "lon": -22.99}, {"time": "2021-05-
      02T00:00:00", "lat": 25.44, "lon": -23.075}, {"time": "2021-05-02T00:00:00", "lat": 25.378, "lon": -23.13}, {"time": "2021-05-
      02T01:00:00", "lat": 25.21, "lon": -23.23}]},
  "bundles": “basic,maritime”
}'
```

Additional Information

While no constraints are placed on the time values in requests, situations may arise where the requested times do not align with the times for which forecast data is available. To account for this, the temporal metadata in the response JSON places the original waypoint times into `requested_valid_time` attributes and shows the nearest time for which data is available, and returned for, in the `valid_time` attribute.

In the example below, data was requested for 0110 UTC on 12/24 which happened to not match one of the Spire-produced forecast times from this particular issuance so the closest point in time (12/24 0000 UTC) is returned instead:

```
"times": {
"issuance_time": "2021-12-21T12:00:00+00:00",

"valid_time": "2021-12-24T00:00:00+00:00",

"requested_valid_time": "2021-12-24T01:10:00+00:00"

},
```

Power Production Endpoint - /forecast/power

The Power Production endpoint can retrieve forecasts of generated power from either wind or solar assets over a predetermined geographic region. In this case, instead of forecasting the solar radiation hitting the solar panels, the power endpoint forecasts the actual power generation from the solar panels over an aggregated area. Similarly, instead of forecasting wind speed at hub heights, the forecast is for wind power generation over an aggregated area including all hub heights across all assets.

The current design of the Power endpoint is such that users will be able to retrieve the 6-day forecast for a given country level aggregation of solar or wind energy generation at an hourly granularity. The API parameters below describe how to retrieve the data for a given country and renewable power source.

To retrieve a power forecast for a single location, formulate an API query like the following:

https://api.wx.spire.com/forecast/power?type=solar,wind&region=uk,austria&time_bundle=hourly_6day

API Query Parameters:

- issuance_time: Allows retrieving the most recent issuance, or forecasts issued in the last 3 days
  - Optional (default is the most recent)
- region – can be any of the following predefined regions, including comma separated multiple regions in a single request as per the example above:
  - Austria, France, Germany, Hungary, Netherlands, UK
- time_bundle – can be any supported time bundle which falls within the high-resolution forecast model output time horizon:
  - hourly (2 day hourly forecast)
  - 3_hourly (every 3 hour forecast to day 6)
  - 6_hourly (every 6 hour forecast to day 6)
  - **hourly_6day** (every hour forecast to day 6)
    - this is the preferred time bundle to leverage if a user wants to use the maximum timeseries
- type – either wind or solar, but can retrieve both types if your API token allows for access to both
- source – the background source forecast NWP data source for the request
  - Optional (default is the source that you have access to)
  - srfs

Example output from the API:


```
{
  "data": [
    {
      "region": "france",
      "source": "srfs",
      "type": "wind",
      "times": {
        "issuance_time": "2024-09-05T12:00:00+00:00",
        "valid_time": "2024-09-05T12:00:00+00:00"
      },
      "values": {
        "power": 2336.8286
      }
    },
    {
      "region": "france",
      "source": "srfs",
      "type": "wind",
      "times": {
        "issuance_time": "2024-09-05T12:00:00+00:00",
        "valid_time": "2024-09-05T13:00:00+00:00"
      },
      "values": {
        "power": 2521.2336
      }
    },
…
```


API Output Parameters:

- region – can be any of the following predefined regions:
  - Austria, France, Germany, Hungary, Netherlands, UK
- source – indicates the background source forecast NWP data source; in this case, srfs = spire high resolution forecast
- type – reflects which bundle was requested, either wind power or solar power
- power – the value of predicted power output over the previous hour in Megawatts.

Spire Weather API – Optimized Point Forecast

Optimized Point Endpoint - /forecast/point/optimized

The Optimized point endpoint is used to retrieve the forecast in one optimized location (by the location ID). The location can be an airport, a maritime port, a METAR station, or your own points of interest. It will return the forecast in JSON format.

Data returned by Spire Weather's Point API, File APIs, and OWS/WMS API all come from the same place, Spire's in-house global weather forecast model. Despite the different output formats (JSON, GRIB2, and WMS) each of these APIs convey information from a common source.

On the other hand, data returned by the Optimized Point API is the product of a different process, explained at the "Discovering Spire Weather" section of the user manual.

Example - Get the forecast for one location

This example shows how to retrieve the latest forecast for the Los Angeles International Airport (ICAO: KLAX, WMO: 72295)

```
curl -X GET 'https://api.wx.spire.com/forecast/point/optimized?location=72295' -H 'spire-api-key: <YOUR API KEY>'
```

Note: For Windows, use double quotation marks


```
{
  "meta": {
    "forecast": "Spire Optimized Point Forecast"
  },
  "data": [
    {
      "location": {
        "id": "KLAX",
        "coordinates": {
          "lat": 33.94,
          "lon": -118.39
        }
      },
      "times": {
        "issuance_time": "2020-05-28T07:00:00+00:00",
        "valid_time": "2020-05-28T08:00:00+00:00"
      },
      "values": {
        "ceiling": "60-152 m",
        "visibility": 4.184294400000001,
        "wind_speed": 0.5144444444444445,
        "wind_direction": 260,
        "air_temperature": 288.7055555555556,
        "relative_humidity": 92,
        "total_cloud_cover": 72,
        "probability_of_fog": 5,
        "surface_air_pressure": 100800,
        "dew_point_temperature": 287.59444444444443,
        "eastward_wind_velocity": 1.028888888888889,
        "max_temperature_utc_day": 293.7055555555556,
        "min_temperature_utc_day": 289.81666666666666,
        "northward_wind_velocity": 0,
        "precipitation_amount_1hr": 0,
        "precipitation_amount_3hr": 0,
```

```
      "precipitation_amount_6hr": 0,
      "max_temperature_local_day": 293.7055555555556,
      "min_temperature_local_day": 288.7055555555556,
      "probability_of_thunderstorm": 0,
      "air_pressure_at_mean_sea_level": 101400,
      "conditional_probability_of_ice": 0,
      "precipitation_probability_24hr": 0,
      "conditional_probability_of_rain": 100,
      "conditional_probability_of_snow": 0,
      "probability_of_precipitation_1hr": 0,
      "probability_of_precipitation_3hr": 0,
      "probability_of_precipitation_6hr": 0
    }
...
```


Sample response

API Parameters

Here are some of the key API parameters for the optimized point endpoint. Please refer to the online API documentation for more details:

- **location:** A location identified. For instance, an ICAO airport identifier, a WMO identifier, a maritime port UN/LOCODE
- **location_id**: A location ID in UUID format
- **issuance_time**: Allows retrieving the most recent issuance, or forecasts issued in the last 3 days
  - Optional (default is the most recent)
- **bundles**: Allows choosing a subset of the subscribed data bundles.
  - Optional (default is all bundles you have access to)
  - *Note: Read the section about data bundles to understand them better*
- **time_bundle**: Allows choosing a subset of their subscribed time period (for example, only query for the 5 days forecast, omitting the full 7 days).
  - Optional (default is all available time bundles)
  - *Note: Read the section about time bundles to understand them better*
- **valid_time_interval:** Allows filtering for a subset of the total forecast time period
  - Optional (default is all available data)
- **tz**: The name of a time zone that times will be returned in.
  - Optional (default is the local time zone - at the coordinate location)
- **unit_system:** The unit system that is used in response values.
  - Optional (default is the Standard International System of Units, with the units described in the Data Description section)
- **X-Fields**: A field mask to filter the response and include only selected fields
  - Optional (default is all available data)

Bulk Extraction for Optimized Point Endpoint - /forecast/optimized/bulk

For customers with larger numbers of individually optimized locations, the bulk extraction API offers a convenient way of downloading all the data at once (or grouped by sets of locations).

Once the system is configured for you, every time Spire publishes a new update of the optimized point forecast (once per hour), the new bulk files will be automatically generated and available to download through the bulk API.

Configuring your groups

We don't yet offer an API to configure the group of locations, so they need to be pre-configured before they are available for you to download.

This can be done by contacting our solution engineers, and having the following information available:

- A name for the group of locations you want to enable to be downloaded in bulk;
- The list of locations to be included in the group;
- The preferred data format (CSV or JSON format).

Listing available data

The bulk endpoint has a similar behavior to the file API described above. When calling the API with no parameters, it will list the files that are available to download.

The file name will contain the information needed to identify the file to be downloaded. This is a sample file name: point.20220523.t1200z.groupname.csv:

File name part	Description
point	Datasource for the file: Spire's Point Forecast
20220523	The issuance date of the forecast. In the example, May 23, 2022
T1100z	The issuance time of the forecast. In the example, 11:00:00 UTC
groupname	The name of the location group defined by your company
csv	The file format. Can be CSV or JSON.

Downloading the bulk files

To download a file, the API should be called informing the name of the file to be downloaded. For instance, "forecast/optimized/bulk/{file_name1}"), will download the bulk file called "file-name1"

Spire Weather API - Tides

Tides Endpoint - /tides/point

The Tides point endpoint is used to get hourly tides data (the height of the tides compared to mean sea level) for a 10 days period. Different from other endpoints, Tides allow users to retrieve historical or forecast data at a single API (or even a single query). The data grid resolution is 1/16th-degree (roughly 6 km).

Currently, Spire Tides data is limited to the period between 01/01/1990 and 31/12/2025.

Example - Get the Tides data for a coordinate

This example shows how to retrieve Tides detailed data for a coordinate using CURL:

```
curl -X GET 'https://api.wx.spire.com/tides/point?lat=0&lon=0' -H 'spire-api-key: <YOUR API KEY>'
```

Note: For Windows, use double quotation marks


```
{
  "meta": {
    "unit_system": "si",
    "message": null
  },
  "data": [
```

```
  {
   "location": {
    "coordinates": {
     "lat": 1.244723,
     "lon": 103.810454
    }
   },
   "times": {
    "valid_time": "2021-05-19T00:00:00"
   },
   "values": [
    {
     "tide_height": -0.18442470244519424
    }
   ]
  },
  {
   "location": {
    "coordinates": {
     "lat": 0,
     "lon": 0
    }
   },
   "times": {
    "valid_time": "2021-05-19T01:00:00"
   },
   "values": [
    {
     "tide_height": -0.3205269285806336
    }
   ]
  },
...
```


Sample response

API Parameters

Here are some of the key API parameters for the point endpoint. Please refer to the online API documentation for more details:

- **Lat/Lon:** The latitude and longitude of the point to retrieve data for.
- **forecast_hours**: The number of hours (from the start date) to retrieve tides data
    - Optional (default is 240 hours - 10 days)
- **start_datetime**: The start date and time to retrieve the tides data
    - Optional (default is now)

Tides Extrema Endpoint - /tides/point/extrema

The Tides extrema endpoint is used to get summarized peaks tides data (max and min heights). Different from other endpoints, Tides allow users to retrieve historical or forecast data at a single API (or even a single query).

Example - Get the Tides summary for a coordinate

This example shows how to retrieve Tides detailed data for a coordinate using CURL:

```
curl -X GET 'https://api.wx.spire.com/tides/point/extrema?lat=0&lon=0&start_datetime=2021-11-01T20:00:00&end_datetime=2021-11-02T20:00:00' -H "spire-api-key: <YOUR API KEY>'
```

Note: For Windows, use double quotation marks


```
{
```

```
 "meta": {
  "unit_system": "si",
  "message": null
 },
 "data": [
  {
   "high": {
    "time": "2021-11-01T23:59:00",
    "values": {
     "tide_height": 0.4613368804812777
    }
   },
   "low": {
    "time": "2021-11-01T20:00:00",
    "values": {
     "tide_height": -0.4123371899594915
    }
   },
   "date": "2021-11-01"
  },
  {
   "high": {
    "time": "2021-11-02T01:33:00",
    "values": {
     "tide_height": 0.6110983521052881
    }
   },
   "low": {
    "time": "2021-11-02T19:47:00",
    "values": {
     "tide_height": -0.5305067481760019
    }
   },
   "date": "2021-11-02"
  }
 ]
}
```


Sample response

API Parameters

Here are some of the key API parameters for the point endpoint. Please refer to the online API documentation for more details:

- **Lat/Lon:** The latitude and longitude of the point to retrieve data for.
- **start_datetime**: The start date and time to retrieve the tides extrema data
- **end_datetime**: The end date and time to retrieve the tides extrema data

Spire Weather API – Storm Tracks

The Storm Tracks API is a capability that we have developed to disseminate the majority of relevant information related to current or historical tropical cyclone activity around the globe. Spire has aggregated the data from the NHC, CPHC and JTWC to ensure global coverage.

The product joins together both historical and forecast datasets; such that users can query historical tropical cyclone activity back to 1990 for any tropical basin and retrieve all active tropical storms with many filtering options such as filtering by basin, category, searching for a tropical storm by its exact unique identifier code, and many more options.

Here are the basic specifications of the Storm Tracks API:

1. Coverage: Global, all basins.
2. Spatial Resolution: n/a - the forecasts are issued by government bodies based on their standard procedures around the world, therefore 'resolution' doesn't apply to this product.
3. Temporal Resolution: Forecasts are typically updated for active tropical cyclones every 6 hours, but this can vary by forecasting center. Forecast updates may occur more frequently as tropical cyclones are closer to making landfall.
    a. Historical tropical cyclone track information is available dating back to 1990.
4. API Output: see the Appendix A section "Spire Weather API – Storm Tracks" for a table of the output from this API.
5. API Endpoints: The data are available in two formats; JSON and KMZ.
    a. KMZ data are able to be visualized in an application like Google Earth Pro

API Parameters

Parameter	Description
status {active (default), inactive, all}	• Whether to return all, only the active storms, or only the inactive storms that are part of a particular query • Because the default is "active", when no query params are provided, the default response of this API is to return the set of active storms

id	• The unique ATCF_ID for a single storm
	• ATCF-IDs are formatted like BBXXYYY where:
	  ○ BB is a 2-digit basin character code (that differs from the defined basins below) specific to the ATCF system
	  ▪ Possible values: WP, IO, SH, CP, EP, AL
	  ○ XX is a unique 2-digit number indicating the annual ATCF basin specific cyclone number. Each storm in a given basin is assigned an annual cyclone number (1-99) and these are not reused until the following season
	  ○ YYYY the 4-digit year that the storm formed in
	• EX: AL012023

name	• The anthropomorphic name given to a storm by a national center once it has reached the status of a Tropical Storm or stronger • Note: name does not include any category code. • EX: Isla

region {options enumerated in Description}	• Either the basin
	  ○ NA - North Atlantic
	  ○ EP - Eastern North Pacific
	  ○ WP - Western North Pacific
	  ○ NI - North Indian
	  ○ SI - South Indian
	  ○ SP - Southern Pacific
	  ○ SA - South Atlantic
	• Or the subbasin

	○ CS – Carribean Sea ○ GM – Gulf of Mexico ○ MM – Missing ○ CP – Central Pacific ○ AS – Arabian Sea ○ BB – Bay of Bengal ○ WA – Western Australia ○ EA – Eastern Australia • NOTE: While the behavior around the "basin" options is clear, the way that queries currently work around these "subbasin" options is less so. This is because subbasin is set on a per-position basis and can change as a storm moves in/out of a subbasin. So, when querying on a subbasin the current behavior is: ○ a cyclone is returned for a subbasin if the latest position was within that subbasin ○ For example: AL032023 formed in the middle of the NA basin and therefore it has a value of "MM" for subbasin for a majority of the track. However, the last few positions were within the "CS" subbasin and so this storm is returned if "region=CS" is provided as a query param.
category {options enumerated in Description}	• The development category (will return all storms with categories equal to or greater than provided) • Precedence of categories follows the order of options listed below • Options: 1. XX - Unknown 2. DS – Dissipating (cyclone) 3. IN – Inland (cyclone) 4. PT – Post-Tropical Cyclone 5. LO – Low-pressure center 6. SS – Subtropical Storm 7. TD – Tropical Depression 8. TS – Tropical Storm 9. TC1 – Tropical Cyclone/Hurricane Category 1 or Typhoon 10. TC2 - Tropical Cyclone/Hurricane Category 2 or Typhoon 11. TC3 - Tropical Cyclone/Hurricane Category 3 or Typhoon 12. TC4 - Tropical Cyclone/Hurricane Category 4 or Typhoon 13. TC5 - Tropical Cyclone/Hurricane Category 5 or Super Typhoon • EX: category=TC2 ○ will return all storms that match the rest of the query that reached TC2, TC3, TC4, and TC5 at any point in their observed track • NOTE: As of now, we only show the 2/3 letter category code in the output of both the JSON and KMZ APIs. The mapping to human-readable names is contained solely in documentation like this.
intensity	• Returns any storm that reached a sustained wind speed equal to or greater than the provided value at any point along that storm's track

	• EX: 60
period	• String representing the date range to search for storms • Returns all storms that have any positions within provided date range • Ex: period = 2023-01-01T00:00:00/2023-07-15T00:00:00
data_filter {all (default), analysis, forecast}	• Allows a user to only see the observed, forecast, or the combined parts of each storm's track
limit	• The number of storms that are returned • Min = 0, Max = 100, default = 100
offset	• The number of storms to skip over • Can be used in conjunction with the "Limit" parameter to paginate response

Sample JSON API Output (truncated):


```
[
  {
    "atcf_id": "WP052023",
    "storm_name": "Doksuri",
    "basin": "WP",
    "subbasin": "MM",
    "season": 2023,
    "is_active": true,
    "advisory_number": 18,
    "advisory_issuance_time": "2023-07-25T18:00:00+00:00",
    "max_development_category": "TC4",
    "max_sustained_wind": 128.0,
    "min_mslp": 926.0,
    "dates_active": {
      "start": "2023-07-17",
      "end": "ongoing"
    },
    "observed_track": [
      {
        "lat": 7.1,
        "lon": 136.2,
        "category_code": "XX",
        "basin": "WP",
        "subbasin": "MM",
        "wind_gusts": null,
        "max_sustained_wind": 20.0,
        "min_mslp": 1004.0,
        "movement_direction": null,
        "movement_speed": null,
        "wind_extent_radii": {},
        "time": "2023-07-17T00:00:00+00:00"
      },
.....
      ],
    "forecast_track": [
      {
        "lat": 19.6,
        "lon": 120.6,
        "category_code": "TC3",
        "basin": "WP",
        "subbasin": "MM",
        "wind_gusts": 135.0,
        "max_sustained_wind": 110.0,
        "min_mslp": null,
        "movement_direction": 315.0,
        "movement_speed": 6.0,
```

```
            "wind_extent_radii": {
               "34kts": {
                  "wind_speed": 34.0,
                  "ne": 190.0,
                  "se": 210.0,
                  "nw": 180.0,
                  "sw": 150.0
               },
               "50kts": {
                  "wind_speed": 50.0,
                  "ne": 80.0,
                  "se": 80.0,
                  "nw": 70.0,
                  "sw": 90.0
               },
               "64kts": {
                  "wind_speed": 64.0,
                  "ne": 40.0,
                  "se": 40.0,
                  "nw": 30.0,
                  "sw": 30.0
               }
            },
            "forecast_hour": 12,
            "forecast_time": "2023-07-26T06:00:00+00:00"
         },
         {
            "lat": 20.5,
            "lon": 119.7,
            "category_code": "TC3",
            "basin": "WP",
            "subbasin": "MM",
            "wind_gusts": 130.0,
            "max_sustained_wind": 105.0,
            "min_mslp": null,
            "movement_direction": 325.0,
            "movement_speed": 8.0,
            "wind_extent_radii": {
               "34kts": {
                  "wind_speed": 34.0,
                  "ne": 220.0,
                  "se": 180.0,
                  "nw": 220.0,
                  "sw": 150.0
               },
               "50kts": {
                  "wind_speed": 50.0,
                  "ne": 70.0,
                  "se": 70.0,
                  "nw": 60.0,
                  "sw": 70.0
               },
               "64kts": {
                  "wind_speed": 64.0,
                  "ne": 40.0,
                  "se": 30.0,
                  "nw": 30.0,
                  "sw": 30.0
               }
            },
           .....................
         }
      ]
   }
]
```

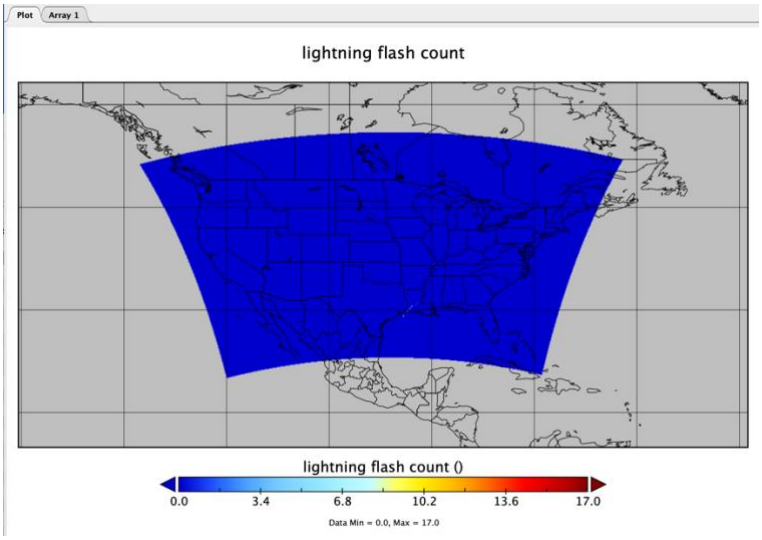
Spire Weather API – Lightning Density

Lightning is an API-based service that relies on point-based real-time lightning strikes to generate a gridded file of lightning strike density. This product is available for CONUS only as of the time of this manual's last update. The API provides access to lightning density files which update every 5 minutes, and each file contains a 5km x 5km equal area grid for which each grid box has a tally of the recent cloud to ground lightning strikes over a rolling 60-minute time window.

The lightning density files utilize the following naming convention, like the Forecast and Current Conditions file APIs. A key difference is the lightning density files are provided in **netCDF format**:

lightning.20250130.t21m15.05km.core.conus-equal-area.f01m00.nc

An example of a lightning density data grid, including the bounding box extent, is shown below:



Spire Weather API - Insights

"Insights" is an API-based service that enables a user to query the outcomes of weather for specific use cases or questions.

Spire creates, extract, fuse and analyze relevant data sources, together with its weather data, domain knowledge, and weather expertise. The results are direct, simple and easy to consume - and target different operational issues that are affected by weather.

The Insights API structure is defined per use case, and each one may have different required inputs, and different output schemas.

The initial Insights are provided for the Maritime industry. The following sections of this document will detail each Insight endpoint.

Maritime Insights

Vessel Risk Endpoint - /insights/maritime/route?type=risk

The Vessel Risk Insight indicates the risk weather is posing during navigation.

As inputs users provide the characteristics of the vessel, the vessel load, and desired route to check. Spire will then calculate the heading of the vessel along the route, and combining with our weather forecast data will provide the expected risk of the voyage. The result will be an array that represents the different parts of the voyage, and for each their weather risk level.

The Risk capability is focused on three different queries, all in the field of risk for the Shipping & Logistics sector:

1. What risk to the **Vessel** does the weather around the vessel pose?
2. What risk to the **Cargo** does the weather around the vessel pose?
3. What risk to the **Crew** does the weather around the vessel pose?

A single route query will result in an answer to all those questions. The output uses a "Traffic-Light" concept. Each part of the queried route is represented by one out of three color options: Red, Amber, or Green, indicating the expected risk levels. It also includes the "reason" for the color, when not green (e.g. this part was painted in RED due to a forecast of strong gust winds).

This API is based on Spire's 15 days weather forecast, so it has the same basic specifications.

API Parameters

Retrieval requests are submitted using HTTP POST requests to the `insights /maritime/route` endpoint. Parameters are accepted as part of the request body in the form of a JSON payload.

The following parameters are required when submitting a new route data retrieval request:

- **Type:** Should be set to "risk" (example: type=risk)
- **Route**: A JSON object describing the future route (trajectory). The route definition must include a name and one or more waypoints, each describing a specific point in space and time (i.e., latitude, longitude, and time).
    - A maximum of 120 waypoints may be included in each route data retrieval.
    - Example route definition:

```
{
    "waypoints": [
    {
      "lat": 23.25,
      "lon": -62.10,
      "time": "2021-07-12T03:00:00"
    },
    {
      "lat": 23.32,
      "lon": -62.11,
      "time": "2021-07-12T04:00:00"
    },
    {
      "lat": 23.36,
      "lon": -62.13,
      "time": "2021-07-12T05:00:00"
    },
    {
      "lat": 23.42,
      "lon": -62.16,
      "time": "2021-07-12T06:00:00"
    }
  ]
}
```

- **Vessel Configuration:** Valid vessel configuration objects in the API include the following vessel_type, vessel_state combinations:

    - container_ship
        - low_gm

        - high_gm
        - medium_gm
    - bulk_carrier
        - in_ballast
        - loaded_small
        - loaded_half
        - loaded_full
    - tanker
        - in_ballast
        - loaded
    - general_cargo
        - low_gm
        - high_gm
        - Medium_gm

Additional Information

While no constraints are placed on the time values in requests, situations may arise where the requested times do not align with the times for which forecast data is available. To account for this, the temporal metadata in the response JSON places the original waypoint times into `requested_valid_time` attributes and shows the nearest time for which data is available, and returned for, in the `valid_time` attribute.

In the example below, data was requested for 0110 UTC on 12/24 which happened to not match one of the Spire-produced forecast times from this particular issuance so the closest point in time (12/24 0000 UTC) is returned instead.

"times": {
"issuance_time": "2021-12-21T12:00:00+00:00",
"valid_time": "2021-12-24T00:00:00+00:00",
"requested_valid_time": "2021-12-24T01:10:00+00:00"

Sample JSON API Output (truncated):


```
{
  "meta": {},
  "data": [
    {
      "start": {
        "time": "2022-02-25T22:39:28.543127",
        "lat": 0.0,
        "lon": 0.0
      },
      "end": {
        "time": "2022-02-26T04:39:28.543182",
        "lat": 0.5,
        "lon": 0.5
      },
      "combined_risk": "red",
      "risk_factors": {
        "vessel": {},
        "cargo": {
          "humidity": {
            "risk": "red",
            "reasons": [
              "relative humidity is greater than 60 %"
            ]
          }
        },
        "crew": {}
      }
    },
    {
```

```
    "start": {
      "time": "2022-02-26T04:39:28.543182",
      "lat": 0.5,
      "lon": 0.5
    },
    "end": {
      "time": "2022-02-26T10:39:28.543237",
      "lat": 1.0,
      "lon": 1.0
    },
    "combined_risk": "red",
    "risk_factors": {
      "vessel": {},
      "cargo": {
        "humidity": {
          "risk": "red",
          "reasons": [
            "relative humidity is greater than 60 %"
          ]
        }
      },
    }
  }
 ]
}
```


Sample response

Risk factors are classified into three categories (vessel, cargo, and crew) that are linked to different meteorological and oceanographic conditions (e.g. wind, waves, humidity, etc.). A description of the factors that caused the risk to be “amber” or “red” are listed under the reasons.

How this API Works

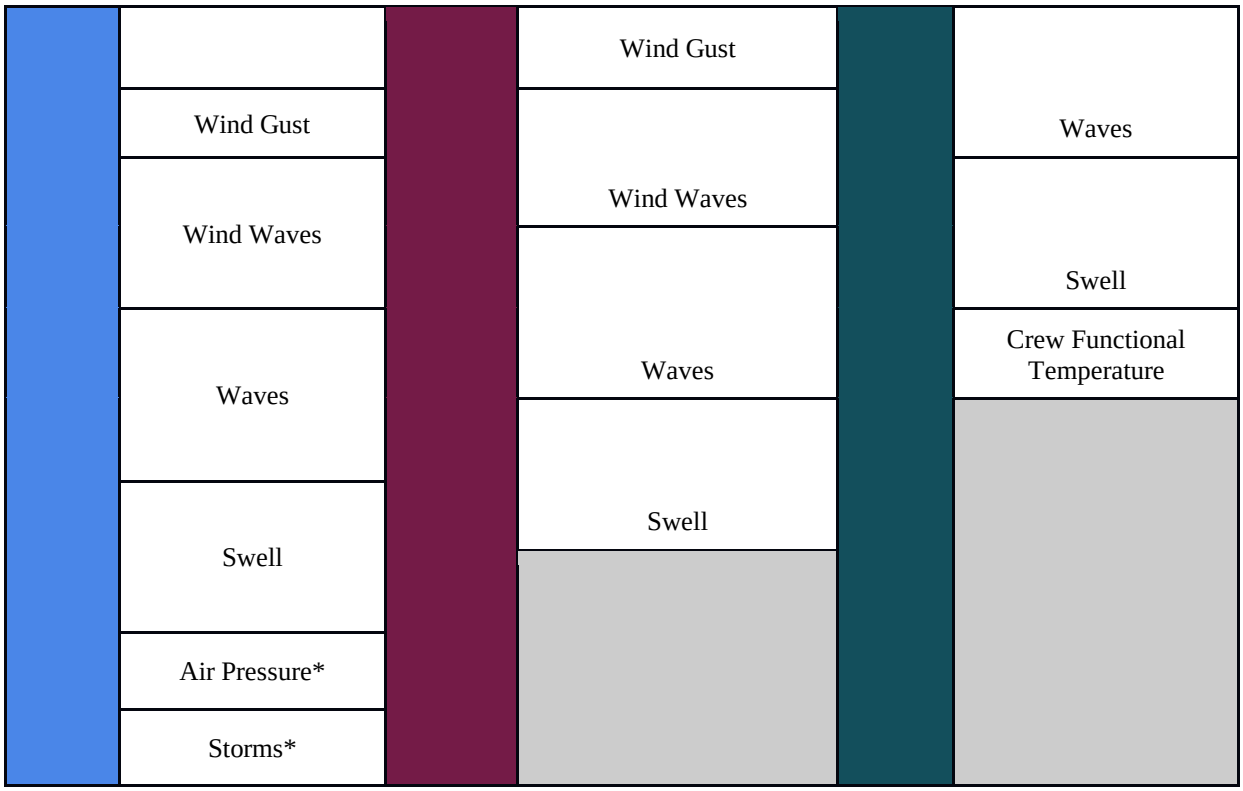
The waypoints provided will indicate the planned vessel movement, and the times the vessel will be in each position. The service will break each leg in smaller steps, and check the weather conditions along the leg (at each step of the way) between two waypoints.

By default, all legs are considered “green” when we start. If, at any location inside the leg - in the time the vessel is expected to cross that part of the leg - we have a potential risky weather condition, the leg will receive either an Amber or a Red result, and an indication of what was the condition that triggered it:

All legs are GREEN, by default	An AMBER value, turn an entire leg into AMBER	A RED value turns an entire leg into RED

Taking the given vessel and commodity characteristics AND Spire’s forecasted weather data, the Insights service will define the risk value for each leg. Here are examples of the weather attributes that affect each of the risk aspects mentioned (Vessel, Cargo, Crew):

Vessel risk	**Hazardous Checklist**	**Cargo risk**	**Hazardous Checklist**	**Crew risk**	**Hazardous Checklist**
	Visibility		Commodity Maintenance - (Dew Point)		Wind (General)
	Ice Accretion (Basic)		Commodity Maintenance - (Temperature)		Wind Gust
			Commodity Maintenance - (Humidity)		
	Wind (General)		Wind (General)		Wind Waves



*Future addition

Customized Thresholds

Spire's unique algorithms come with a set of thresholds that are configured by our specialists for what green, amber, and red means for each of the aforementioned variables. Those are the recommended thresholds.

We also offer the option of customizing these thresholds, to take into account each company's particularities, different market scenarios, or others. A customer can have multiple threshold settings, and at each Insights query specify which one to use.

For instance, a user with a "risk taking" approach, might call configuration file "C1", while one with a more "conservative" approach, would call configuration file "C2".
Since each query calls its own configuration file, a customer can have the option of creating and using as many customized set of thresholds that s.he needs.

Important to emphasize that those values are not being used directly, but fused with all other considerations that were mentioned above (see the additional explanation in the "How this API works" section).

Note: This version requires the user to share the configuration files with Spire, when onboarding the service. Any updates will have to go through Spire's customer service.

The full list of thresholds that can be configured will be shared by demand.

Example - Get risk insights for one route + (Optional) Threshold configuration

This example shows how to do a route retrieval request using the curl command-line utility, and uses the "C1" configuration explained above (the configuration element is in bold):

```
curl -X POST -d @- -H Content-Type:application/json -H spire-api-key:xxxxxx \
https://api.wx.spire.com/insights/maritime/route?type=risk <<BODY
{
  "route": {
```

```
  "waypoints": [
    {
      "lat": 0.0,
      "lon": 0.0,
      "time": "2022-02-25T22:36:30.903764"
    },
    {
      "lat": 0.5,
      "lon": 0.5,
      "time": "2022-02-26T04:36:30.903830"
    },
    {
      "lat": 1.0,
      "lon": 1.0,
      "time": "2022-02-26T10:36:30.903896"
    },
    {
      "lat": 1.5,
      "lon": 1.5,
      "time": "2022-02-26T16:36:30.903962"
    },
    {
      "lat": 2.0,
      "lon": 2.0,
      "time": "2022-02-26T22:36:30.904028"
    }
   ]
  },
  "vessel": {
    "vessel_type": "container_ship",
    "vessel_state": "low_gm"
  }
  "configuration": "C1"
}
BODY
```

Vessel Efficiency Endpoint - /insights/maritime/route?type=efficiency

The Vessel Efficiency Insight indicates the expected efficiency of a future route with regards to the forecasted weather conditions.

As inputs users provide the characteristics of the vessel, the vessel load, and desired route to check. Spire will then calculate the heading of the vessel along the route, and combining with our weather forecast data will provide the expected efficiency of the voyage. The result will be an array that represents the different parts of the voyage, and for each their weather efficiency level.

The output uses a color rank concept. Each part of the queried route is represented by one out of five color options: Red, Orange, Grey, Light Green, or Green, indicating the expected efficiency levels (from worst to best). It also includes the weather parameter-by-parameter classification, indicating which weather conditions are affecting that planned route.

This API is based on Spire's 15 days weather forecast, so it has the same basic specifications.

API Input Parameters

Retrieval requests are submitted using HTTP POST requests to the `insights /maritime/route` endpoint. Parameters are accepted as part of the request body in the form of a JSON payload.

The API uses the exact same parameters as the Risk Insights when submitting a new route data retrieval request:

- **Type:** Should be set to “efficiency” (example: type=efficiency)
- **Route**: A JSON object describing the future route (trajectory). The route definition must include a name and one or more waypoints, each describing a specific point in space and time (i.e., latitude, longitude, and time).
    - A maximum of 120 waypoints may be included in each route data retrieval.
    - Example route definition:


```
{
 "route": {
  "waypoints": [
   {
    "lat": 0.0,
    "lon": 0.0,
    "time": "2022-12-06T22:36:30.903764"
   },
   {
    "lat": 0.5,
    "lon": 0.5,
    "time": "2022-12-07T04:36:30.903830"
   },
   {
    "lat": 1.0,
    "lon": 1.0,
    "time": "2022-12-07T10:36:30.903896"
   },
   {
    "lat": 1.5,
    "lon": 1.5,
    "time": "2022-12-07T16:36:30.903962"
   },
   {
    "lat": 2.0,
    "lon": 2.0,
    "time": "2022-12-07T22:36:30.904028"
   }
  ]
 },
 "vessel": {
  "vessel_type": "container_ship",
  "vessel_state": "low_gm"
 }
}
```


- **Vessel Configuration:** Valid vessel configuration objects in the API include the following vessel_type, vessel_state combinations:

    - container_ship
        - low_gm
        - high_gm
        - medium_gm
    - bulk_carrier
        - in_ballast
        - loaded_small
        - loaded_half
        - loaded_full
    - tanker
        - in_ballast
        - loaded
    - general_cargo
        - low_gm
        - high_gm
        - Medium_gm

How this API Works

The waypoints provided will indicate the planned vessel movement, and the times the vessel will be in each position. The service will break each leg in smaller steps, and check the weather conditions along the leg (at each step of the way) between the two waypoints.

Taking the given vessel and commodity characteristics AND Spire's forecasted weather data, the Insights service will define the efficiency value for each leg. Here are examples of the weather attributes that are currently taken into account when evaluating the potential efficiency:

- 10-m wind speed & direction
- 50-m wind speed & direction
- Ocean currents speed & direction
- Total Waves (combined wind waves and swell) height & direction
- Swell waves height & direction
- Wind waves height & direction

The final recommendation will be a combination of these different weather factors affecting the efficiency of that leg, with some weather conditions having larger weights than others depending on the vessel type, the vessel load, and also the heading of the vessel relative to the direction the weather event is coming from.

The output will be provided in ranks using five colors, from worst to better conditions for the vessel efficiency:

Red	Orange	Grey	Light Green	Green

API Output

The API output will include each leg of the trip, with the total forecasted efficiency levels (combining all weather parameters), plus the parameter-by-parameter classification. For the same example above, here is a sample response:


```
{
  "meta": {},
  "data": [
    {
      "start": {
        "time": "2022-12-06T22:36:30.903764",
        "lat": 0.0,
        "lon": 0.0
      },
      "end": {
        "time": "2022-12-07T04:36:30.903830",
        "lat": 0.5,
        "lon": 0.5
      },
      "combined_efficiency": "orange",
      "efficiency_factors": {
        "ocean_currents": {
          "efficiency": "red"
        },
        "mean_waves": {
          "efficiency": "light green"
        },
        "wind_waves": {
          "efficiency": "orange"
        },
        "swell_waves": {
          "efficiency": "light green"
        },
        "winds_10m": {
```

```
            "efficiency": "orange"
          },
          "winds_50m": {
            "efficiency": "orange"
          }
        }
      }
    ]
}
```


Sample response

Spire Weather API – Soil Moisture Observations

Soil moisture observations, gathered by Spire satellites, are accessible via the Spire Weather API in both gridded and point data formats. The resolution of the soil moisture observations available is either 6km (globally), or down to 500 meters and 100 meters for specific customer requested regions.

Due to the specific characteristics of this data, a dedicated Product User Manual is available upon request, offering detailed insights into its technical background and data formats.

Appendix A - Data Description

Historical Weather Data Packages

Core Bundle

Field Name	Vertical Level	Description	Unit
Temperature	2 meters AGL	Air temperature at standard observation height (2 meters above the surface)	K
Relative humidity	2 meters AGL	The fractional ratio of the partial pressure of water vapor to the equilibrium vapor pressure at a given temperature, expressed as a percentage	%
Dewpoint temperature	2 meters AGL	Temperature at which a parcel of air cooled at constant pressure and specific humidity reaches saturation	K
u-wind component	10 meters AGL	The eastward component of the horizontal wind	m/s
v-wind component	10 meters AGL	The northward component of the horizontal wind	m/s
Wind speed	10 meters AGL	Wind speed	m/s
Wind direction	10 meters AGL	Meteorological wind direction (direction from which the wind is blowing) Ie. 90° is wind from the east, 180° from the south, etc.	degrees
Mean sea-level pressure	Sea level	Air pressure adjusted to mean sea level	Pa
Total precipitation	Surface	The total accumulated (liquid) precipitation that occurred in the last hour	m*
Wind gust	10 meters AGL	Instantaneous wind gust speed	m/s
Max wind gust	10 meters AGL	Maximum wind gust speed that occurred in the last hour	m/s
Maximum temperature	2 meters AGL	Maximum air temperature in the previous hour	K
Minimum temperature	2 meters AGL	Minimum air temperature in the previous hour	K
Cloud Cover	Whole atmosphere	The percentage of the sky covered by clouds	%

* Total precipitation is provided in meters for the File API (GRIB2) data, but centimeters in the Point API

Agricultural Bundle

Field Name	Vertical Level	Description	Unit
Skin (surface) temperature	Surface	Temperature at the interface between the air and the ground	K
Specific humidity	2 meters AGL	The ratio of the mass of water vapor to the total mass of an air parcel in a moist atmosphere taken at screen level	kg/kg
Soil moisture	0-7 cm, 7-28 cm 28-100 cm, 100-289 cm	Volumetric soil moisture content, expressed as a fraction, for a given depth below the surface	m^3/m^3
Soil temperature	0-7 cm,	The temperature of the soil for a given depth below the surface	

	7-28 cm 28-100 cm, 100-289 cm		K
Latent heat flux	Surface	The exchange of heat between the surface and the air owing to evaporation (and sublimation)	W/m^2
Sensible heat flux	Surface	The exchange of heat between the surface and the air due to the turbulent motion of air	W/m^2

Invariants Bundle

Field Name	Vertical Level	Description	Unit
Terrain height	Surface	The elevation of the surface of the earth in the model environment, relative to mean sea level. Also known as orography.	m
Soil Type	Surface	Index from 1 to 7 indicating the following soil types: ● 1 = Coarse ● 2 = Medium ● 3 = Medium fine ● 4 = Fine ● 5 = Very fine ● 6 = Organic ● 7 = Tropical organic Soil types are derived from the FAO/UNESCO Digital Soil Map of the World.	-
Low Vegetation Cover	Surface	Fraction of the grid box (0-1) that is covered with vegetation that is classified as 'low'	%
Type of Low Vegetation	Surface	This parameter indicates the recognised types of low vegetation: ● 1 = Crops, Mixed farming ● 2 = Grass ● 7 = Tall grass ● 9 = Tundra ● 10 = Irrigated crops ● 11 = Semidesert ● 13 = Bogs and marshes ● 16 = Evergreen shrubs ● 17 = Deciduous shrubs ● 20 = Water and land mixtures Other types are high vegetation or indicate no land surface vegetation (8 = Desert, 12=Ice caps and Glaciers, 14 = Inland water, 15 =Ocean)	-
High Vegetation Cover	Surface	Fraction of the grid box (0-1) that is covered with vegetation that is classified as 'high'	%
Type of High Vegetation	Surface	This parameter indicates the recognised types of high vegetation: ● 3 = Evergreen needleleaf trees ● 4 = Deciduous needleleaf trees ● 5 = Deciduous broadleaf trees ● 6 = Evergreen broadleaf trees ● 18 = Mixed forest/woodland ● 19 = Interrupted forest Other types are low vegetation or indicate no land surface vegetation (8 = Desert, 12=Ice caps and Glaciers, 14 = Inland water, 15 =Ocean)	-
Land-Sea Mask	Surface	The proportion of land, as opposed to ocean or inland waters (lakes, reservoirs, rivers, and coastal waters), in a grid box.	%

Ocean Depth	Sea Level	The depth of water from the surface to the bottom of the ocean. Also known as bathymetry.	m

Maritime Bundle

Field Name	Vertical Level	Description	Unit
Sea Surface Temperature	Sea level	The temperature of the ocean surface	K
Significant Wave Height	Sea level	Wave heights of combined swell and wind waves	m
Mean Wave Direction	Sea level	Mean wave direction of combined swell and wind waves	Degrees
Mean Wave Period	Sea level	Mean wave period of combined swell and wind waves	Seconds
Maximum Wave Height	Sea level	The estimated height of the expected highest individual wave.	m
Ocean Currents (eastward component)	Sea level	The eastward component of the ocean current vector	m/s
Ocean Currents (northward component)	Sea level	The northward component of the ocean current vector	m/s
Ocean Salinity	Sea level	The amount of dissolved salts that are present in water.	kg/kg
Sea Ice Fraction	Sea level	Fraction of the grid box (0-1) that is covered by sea ice.	%
Sea Ice Thickness	Sea level	Mean thickness of the sea ice layer in the area of the grid cell covered by ice.	m

Maritime Wave Bundle

Field Name	Vertical Level	Description	Unit
Significant Wind Wave Height	Sea level	Wave heights of waves generated by local winds	m
Mean Wind Wave Direction	Sea level	Mean wave direction of waves generated by local winds	Degrees
Mean Wind Wave Period	Sea level	Mean wave period of waves generated by local winds	Seconds
Significant Total Swell Wave Height	Sea level	Wave heights of combined swell waves	m
Mean Total Swell Wave Direction	Sea level	Mean wave direction of combined swell waves	Degrees
Mean Total Swell Wave Period	Sea level	Mean wave period of combined swell waves	Seconds

Maritime Swell Wave

Field Name	Vertical Level	Description	Unit
Significant Wave Height of 1st Swell Partition	Sea level	Wave heights of the first swell partition	m
Mean Wave Direction of 1st Swell Partition	Sea level	Mean wave direction of the first swell partition	Degrees

Mean Period of 1st Swell Partition	Sea level	Mean wave period of first swell partition	Seconds
Significant Height of 2nd Swell Partition	Sea level	Wave heights of the second swell partition	m
Mean Wave Direction of 2nd Swell Partition	Sea level	Mean wave direction of the second swell partition	Degrees
Mean Wave Period of 2nd Swell Partition	Sea level	Mean wave period of the second swell partition	Seconds

Precipitation Bundle

Field Name	Vertical Level	Description	Unit
Precipitation Type	Surface	The type of precipitation at the surface, at the specified time. Types are the following: ● 0 = No precipitation ● 1 = Rain ● 3 = Freezing rain ● 5 = Snow ● 6 = Wet snow ● 7 = Mixture of rain and snow ● 8 = Ice pellets	-
Total Snowfall	Surface	The total accumulated snow that occurred in the last hour. It represents the depth the water would have if the snow melted and was spread evenly over the whole grid box (liquid equivalent).	m*
Snow depth	Surface	The depth of snow from the snow-covered area of a grid box. Also represents the liquid equivalent.	m*
Maximum precipitation rate	Surface	Maximum total precipitation rate that occurred in the last hour	mm/s**

* Total Snowfall is provided in meters for the File API (GRIB2) data, but centimeters in the Point API
** Maximum precipitation rate is provided in millimeters per second for the File API (GRIB2) data, but millimeters per hour in the Point API

Wind Energy Bundle

Field Name	Vertical Level	Description	Unit
u-wind component	100 meters AGL	The eastward component of the horizontal wind	m/s
v-wind component	100 meters AGL	The northward component of the horizontal wind	m/s
Wind speed	100 meters AGL	Wind speed at 100 meters	m/s
Wind direction	100 meters AGL	The meteorological wind direction at 100 meters (direction from which the wind is blowing) Ie. 90° is wind from the east, 180° from the south, etc.	Degrees

Solar Energy Bundle

Field Name	Vertical Level	Description	Unit

Incoming shortwave radiation	Surface	Hour-accumulated shortwave radiation directed at the surface from above, including direct and diffuse components	J/m^2
Incoming longwave radiation	Surface	Hour-accumulated longwave radiation directed at the surface from above	J/m^2
Outgoing longwave radiation	Surface	Hour-accumulated longwave radiation directed (upwards) away from the surface	J/m^2
Outgoing shortwave radiation	Surface	Hour-accumulated shortwave radiation directed (upwards) away from the surface	J/m^2
Outgoing longwave radiation	Top of atmosphere	Hour-accumulated longwave radiation directed (upwards) away from the top of the atmosphere	J/m^2

Thunderstorm Bundle

Field Name	Vertical Level	Description	Unit
CAPE	Whole atmosphere	Convective Available Potential Energy	J/kg
CIN	Whole atmosphere	Convective Inhibition	J/kg

Current Weather Conditions Data Package

Core Bundle

Field Name	Vertical Level	Description	Unit
Temperature	2 meters AGL	Air temperature at standard observation height (2 meters above the surface)	K
Relative humidity	2 meters AGL	The fractional ratio of the partial pressure of water vapor to the equilibrium vapor pressure at a given temperature, expressed as a percentage	%
Dewpoint temperature	2 meters AGL	Temperature at which a parcel of air cooled at constant pressure and specific humidity reaches saturation	K
u-wind component	10 meters AGL	The eastward component of the horizontal wind	m/s
v-wind component	10 meters AGL	The northward component of the horizontal wind	m/s
Wind speed	10 meters AGL	The wind speed at standard observation height (10 m above the surface). Available only at the point API.	m/s
Wind direction	10 meters AGL	The meteorological wind direction (90° corresponds to wind from east). Available only at the point API.	degrees
Wind gust speed	10 meters AGL	Instantaneous wind gust speed	m/s
Mean sea-level pressure	Sea level	Air pressure adjusted to mean sea level	Pa
Precipitation rate	Surface	The instantaneous rate of liquid equivalent precipitation at the	mm/s

		specified time.	
Visibility	Surface	The horizontal visibility	m
Incoming Shortwave Radiation	Surface	Instantaneous shortwave radiation directed at the surface from above, including direct and diffuse components.	W/m^2
Precipitation Type	Surface	A categorical field where the dominant precipitation type is indicated by either: 1 - rain 3 - freezing rain 5 - snow 8- ice pellets (no hail) 10 - hail 11 - drizzle 12 - freezing drizzle	-
Effective Cloud Cover	Surface	An Effective Cloud Cover [0% - 100%] designed to quantify the effect of clouds on the amount of solar radiation reaching the ground. For instance, a completely overcast sky with thin high clouds can be translucent for solar radiation which could result in an Effective Cloud Cover <<100%.	%

This bundle is available at the current conditions point and file API endpoints.

Global Weather Forecast Data Packages

Basic Bundle (basic)

Field Name	Vertical Level	Description	Units
Temperature	2 meters AGL	Air temperature at standard observation height (2 meters above the surface)	K
Relative humidity	2 meters AGL	The fractional ratio of the partial pressure of water vapor to the equilibrium vapor pressure at a given temperature expressed as a percentage	%
Dewpoint temperature	2 meters AGL	Temperature at which a parcel of air cooled at constant pressure and specific humidity reaches saturation	K
u-wind component	10 meters AGL	The eastward component of the horizontal wind Download a sample of how to convert from u/v components to speed and direction.	m/s
v-wind component	10 meters AGL	The northward component of the horizontal wind	m/s
Mean sea-level pressure	Sea level	Air pressure adjusted to mean sea level	Pa
Accumulated precipitation	Surface	The total **accumulated** (liquid) precipitation occurring since the beginning of the forecast. Read more about working with accumulated fields.	mm* kg/m^2
Precipitation Rate	Surface	The instantaneous rate of precipitation valid at the top of each hour	mm/s**
Wind gust speed	10 meters AGL	Instantaneous wind gust (speed)	m/s

Maximum temperature	2 meters AGL	Maximum air temperature in the previous six hours	K
Minimum temperature	2 meters AGL	Minimum air temperature in the previous six hours	K
Cloud Cover	Whole atmosphere	The percentage of the sky covered by clouds	%
Visibility	Surface	The horizontal visibility	m

* Accumulated precipitation is provided in millimeters for the File API (GRIB2) data, but centimeters in the Point API
** Precipitation rate is provided in millimeters per second for the File API (GRIB2) data, but millimeters per hour in the Point API

*Output via the point API endpoint will show these in units of cm for precipitation amount and mm/hour for precipitation rate
This bundle is available at the file, point, route, and wms API endpoints.

Note: Two additional calculated variables are included in the point API only, 10 meters wind speed (in m/s) and 10 meters wind direction (in degrees).

Basic Accumulation Bundle (basic-accumulation)

The basic accumulation bundle is complementary to the basic bundle, and available for all users that subscribed to the basic bundle). It is opt-in, so if you are interested and doesn't have access to it, please contact our sales engineering team.

Field Name	Vertical Level	Description	Unit
1-h precipitation amount	Surface	Total liquid precipitation accumulated in the previous hour	mm
3-h precipitation amount	Surface	Total liquid precipitation accumulated in the previous 3 hours	mm
6-h precipitation amount	Surface	Total liquid precipitation accumulated in the previous 6 hours	mm

Note: Not all fields are available at all lead times. For instance, 3-h amounts are only included in requests that include the 3-hourly time bundle, and limited to the leat times that it is provided (currently, until day 5)

This bundle is available at the point API endpoint.

Maritime Bundle (maritime)

Field Name	Vertical Level	Description	Units
Sea Surface Temperature	Sea level	The temperature of the ocean surface	K
Ocean Currents (eastward component)	Sea level	The eastward component of the ocean current vector Download a sample of how to convert from u/v components to speed and direction.	m/s
Ocean Currents (northward component)	Sea level	The northward component of the ocean current vector	m/s
Significant Wave Height	Sea level	Wave heights of combined swell and wind waves	m

Mean Wave Direction	Sea level	Mean wave direction of combined swell and wind waves	Degrees
Mean Wave Period	Sea level	Mean wave period of combined swell and wind waves	Seconds
Ocean Salinity	Sea level	The amount of dissolved salts that are present in water.	kg/kg

This bundle is available at the file, point, route, and WMS API endpoints.

Maritime Atmospheric Bundle (maritime-atmos)

Field Name	Vertical Level	Description	Units
u-wind component	50 meters AGL	The eastward component of the horizontal wind Download a sample of how to convert from u/v components to speed and direction.	m/s
v-wind component	50 meters AGL	The northward component of the horizontal wind	m/s
50-m Wind gust speed	50 meters AGL	Instantaneous wind gust (speed) at 50 meters above the ground level.	m/s

This bundle is available at the file, point, route, and WMS API endpoints.

Maritime Waves Bundle (maritime-wave)

Field Name	Vertical Level	Description	Units
Significant Wind Wave Height	Sea level	Wave heights of waves generated by local winds	m
Mean Wind Wave Direction	Sea level	Mean wave direction of waves generated by local winds	Degrees
Mean Wind Wave Period	Sea level	Mean wave period of waves generated by local winds	Seconds
Significant Total Swell Wave Height	Sea level	Wave heights of combined swell waves	m
Mean Total Swell Wave Direction	Sea level	Mean wave direction of combined swell waves	Degrees
Mean Total Swell Wave Period	Sea level	Mean wave period of combined swell waves	Seconds

This bundle is available at the file, point, route, and WMS API endpoints.

Maritime Waves Ext Bundle (maritime-wave-ext)

Field Name	Vertical Level	Description	Units
Maximum individual wave height	Sea level	The height of the highest individual wave within a 20 minute time window. Useful as a guide to the likelihood of extreme or freak waves. Includes both wind and swell waves.	m
Peak Wave Period	Sea level	The period of the most energetic ocean waves associated with both wind and swell waves.	s
Mean Zero Crossing Wave Period	Sea level	The mean length of time between occasions where the sea/ocean surface crosses mean sea level. Combined with wave height information, it can be used to determine the length of time a particular location/structure along the coast may be under water.	s

This bundle is available at the file, point, route, and WMS API endpoints.

Thunderstorm Bundle (thunderstorm)

Field Name	Vertical Level	Description	Units
CAPE	Whole atmosphere	A measure of the amount of energy available for convection. CAPE is directly related to the maximum potential vertical speed within an updraft; thus, higher values indicate greater potential for severe weather.	J/kg
Downdraft CAPE	Whole atmosphere	The maximum energy available to a descending parcel of air. Mainly used to estimate the potential strength of any rain-cooled downdrafts within a thunderstorm.	J/kg
CIN	Whole atmosphere	A measure of the amount of energy needed in order to initiate convection. Values of CIN typically reflect the strength of the cap. They are obtained on a sounding by computing the area enclosed between the environmental temperature profile and the path of a rising air parcel, over the layer within which the latter is cooler than the former.	J/kg
Lifted Index	Whole atmosphere	The temperature difference between the air lifted from the surface to 500 hPa and the environmental temperature at that level.	K
Level of Free Convection	Whole atmosphere	The level at which a parcel of air, lifted dry-adiabatically, becomes warmer than the surrounding air and begins to rise freely (moist-adiabatically). This occurs most readily in a conditionally unstable atmosphere.	m
Lifted Condensation Level	Whole atmosphere	The level at which a parcel of moist air becomes saturated when it is lifted dry adiabatically. Often considered to be the cloud base height when forecasting severe weather potential.	m
Equilibrium Level	Whole atmosphere	The height of the EL is the height at which thunderstorm updrafts no longer accelerate upward. Thus, to a close approximation, it represents the height of expected (or ongoing) thunderstorm tops.	m
Storm-relative helicity	0-3 km	A measure of the transfer of vorticity from the environment to an air parcel in convective motion from a frame of reference moving with a thunderstorm	m^2/s^2
Storm motion (eastward component)	0-6 km	The eastward component of the storm-motion vector	m/s
Storm motion (northward component)	0-6 km	The northward component of the storm-motion vector	m/s
0-6 km shear vector (eastward component)	0-6 km	The eastward component of the deep-layer shear vector	s^{-1}
0-6 km shear vector (northward component)	0-6 km	The northward component of the deep-layer shear vector	s^{-1}
Precipitable Water	Whole atmosphere	The depth of water in a column of the atmosphere, if all the water in that column were precipitated as rain	kg/m^2

This bundle is available at the file, point and WMS API endpoints.

Upper Air Bundle (upper-air)

Field Name	Vertical Level	Description	Units
Geopotential height	Isobaric levels: 1000 to 1 hPa	The approximate height of a given point in the atmosphere above the surface of the earth accounting for variations in gravity	gpm
Temperature	1000 to 1 hPa	Air temperature	K
u-wind component	1000 to 1 hPa	The eastward component of the horizontal wind	m/s
v-wind component	1000 to 1 hPa	The northward component of the horizontal wind	m/s
Relative humidity	1000 to 1 hPa	The fractional ratio of the partial pressure of water vapor to the equilibrium vapor pressure at a given temperature expressed as a percentage	%
Vertical velocity	1000 to 1 hPa	The component of the full velocity vector in the vertical direction	m/s
Absolute vorticity	1000 to 1 hPa	The vertical component of the absolute vorticity vector measuring the local rotation of the atmosphere	s^{-1}
Cloud water mixing ratio	1000 to 50 hPa	The ratio of the mass of non-precipitating liquid water to the mass of dry air in a unit volume of air	kg/kg
Cloud ice mixing ratio	1000 to 50 hPa	The ratio of the mass of non-precipitating frozen water to the mass of dry air in a unit volume of air	kg/kg

This bundle is available at the file and WMS API endpoints. The following isobaric levels are available: 1000, 950, 925, 900, 850, 800, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, 15, 10, 7, 5, 3, 2, 1 hPa.

Note: Not all fields are available for all the isobaric levels. The list above indicates the range each field is displayed.

Aviation Bundle (aviation)

Field Name	Vertical Level	Description	Units
Temperature	Flight levels	Air temperature	K
Relative humidity	Flight levels	The fractional ratio of the partial pressure of water vapor to the equilibrium vapor pressure at a given temperature, expressed as a percentage	%
u-wind component	Flight levels	The eastward-component of the horizontal wind Download a sample of how to convert from u/v components to speed and direction.	m/s
v-wind component	Flight levels	The northward-component of the horizontal wind	m/s
Height	Level of max. winds	The height (above sea level) where the maximum wind speed is found	gpm
u-wind component	Level of max. winds	The eastward component of the horizontal wind	m/s
v-wind component	Level of max. winds	The northward component of the horizontal wind	m/s

Clear-air turbulence	Flight levels	Severity of turbulence associated with wind shear (not due to mountain waves or convection), using the EDR (Eddy Dissipation Rate).	$m^{2/3}/s$
Icing potential	Flight levels	Potential for aircraft icing using temperature, relative humidity, and cloud top temperatures. Provided for FL100 - FL350	0 - 1

This bundle is available at the file API endpoint.

The flight levels currently available range from FL100 to FL450 (10,000 feet to 45,000 feet mean sea level). The altitudes in the files are shown in meters and correspond to the following values:

- 3048, 3352, 3657, 3962, 4267, 4572, 4876, 5181, 5486, 5791, 6096, 6400, 6705, 7010, 7315, 7620, 7924, 8229, 8534, 8839, 9144, 9448, 9753, 10058, 10363, 10668, 10972, 11277, 11582, 11887, 12192, 12496, 12801, 13106, 13411, 13716.

Agricultural Bundle (agricultural)

Field Name	Vertical Level	Description	Units
Skin (surface) temperature	Surface	Temperature at the interface between the air and the ground	K
Specific humidity	2 meters AGL	The ratio of the mass of water vapor to the total mass of an air parcel in a moist atmosphere taken at screen level	kg/kg
Soil moisture	0-10 cm, 10-40 cm, 40-100 cm, 100-200 cm	Volumetric soil moisture content, expressed as a fraction, for a given depth below the surface	Fraction
Soil temperature	0-10 cm, 10-40 cm, 40-100 cm, 100-200 cm	The temperature of the soil for a given depth below the surface	K
Latent heat flux	Surface	The exchange of heat between the surface and the air owing to evaporation (and sublimation)	W/m^2
Sensible heat flux	Surface	The exchange of heat between the surface and the air due to the turbulent motion of air	W/m^2

This bundle is available at the file, point, and route API endpoints.

Clouds Bundle (clouds)

Field Name	Vertical Level	Description	Units
Cloud Ceiling Height	Whole Atmosphere	The height above the surface of the base of the lowest cloud layer when the cloud cover is greater than 50%	m
Low Cloud Cover (fraction)	-	The percent of model grid box covered by a low cloud layer	%
Mid Cloud Cover (fraction)	-	The percent of model grid box covered by a mid cloud layer	%
High Cloud Cover (fraction)	-	The percent of model grid box covered by a high cloud layer	%

This bundle is available at the file, point, route, and WMS API endpoints. Cloud Ceiling is not available as WMS.

Note: The lower cloud layer is defined by a top that is lower than approximately 650hPa. The mid cloud layer has a top higher than approximately 650hPa but below 350hPa. The high cloud has a top that is higher than 350hPa.

Wind Energy Bundle (wind-energy)

Field Name	Vertical Level	Description	Units
u-wind component	80 meters AGL	The eastward component of the horizontal wind Download a sample of how to convert from u/v components to speed and direction.	m/s
v-wind component	80 meters AGL	The northward component of the horizontal wind	m/s
u-wind component	100 meters AGL	The eastward component of the horizontal wind	m/s
v-wind component	100 meters AGL	The northward component of the horizontal wind	m/s
u-wind component	120 meters AGL	The eastward component of the horizontal wind	m/s
v-wind component	120 meters AGL	The northward component of the horizontal wind	m/s
Air Density	80 meters AGL	The air density at 80 m above ground level. Air density is the density of the atmosphere. It is a function of atmospheric pressure, temperature, and humidity and decreases with increasing altitude.	kg/m^3
Air Density	100 meters AGL	The air density at 100 m above ground level. Air density is the density of the atmosphere. It is a function of atmospheric pressure, temperature, and humidity and decreases with increasing altitude.	kg/m^3
Air Density	120 meters AGL	The air density at 120 m above ground level. Air density is the density of the atmosphere. It is a function of atmospheric pressure, temperature, and humidity and decreases with increasing altitude.	kg/m^3

This bundle is available at the file, point, and route API endpoints.

Solar Energy Bundle (solar-energy)

Field Name	Vertical Level	Description	Units
Incoming shortwave radiation (acc.)	Surface	Accumulated shortwave radiation directed at the surface from above, including direct and diffuse components Read more about working with accumulated fields.	J/m^2
Incoming longwave radiation (acc.)	Surface	Accumulated longwave radiation directed at the surface from above	J/m^2
Outgoing longwave radiation (acc.)	Surface	Accumulated longwave radiation directed (upwards) away from the surface	J/m^2
Outgoing shortwave radiation (acc.)	Surface	Accumulated shortwave radiation directed (upwards) away from the surface	J/m^2
Outgoing longwave radiation (acc.)	Top of atmosphere	Accumulated longwave radiation directed (upwards) away from the top of the atmosphere	J/m^2

This bundle is available at the file, point, and route API endpoints.

Solar Energy Accumulation Bundle (solar-energy-accumulation)

The solar energy accumulation bundle is complementary to the solar energy bundle, and available for all users that subscribed to the solar energy one. It is opt-in, so if you are interested and don't yet have access to it, please contact our sales engineering team.

Field Name	Vertical Level	Description	Unit
1-h Incoming shortwave radiation	Surface	Shortwave radiation directed at the surface from above, including direct and diffuse components, accumulated in the previous hour	J/m^2
3-h Incoming shortwave radiation	Surface	Shortwave radiation directed at the surface from above, including direct and diffuse components, accumulated in the previous three hours	J/m^2
6-h Incoming shortwave radiation	Surface	Shortwave radiation directed at the surface from above, including direct and diffuse components, accumulated in the previous six hours	J/m^2
1-h Incoming longwave radiation	Surface	Longwave radiation directed at the surface from above, accumulated in the previous hour	J/m^2
3-h Incoming longwave radiation	Surface	Longwave radiation directed at the surface from above, accumulated in the previous three hours	J/m^2
6-h Incoming longwave radiation	Surface	Longwave radiation directed at the surface from above, accumulated in the previous six hours	J/m^2
1-h Outgoing longwave radiation	Surface	Longwave radiation directed (upwards) away from the surface, accumulated in the previous hour	J/m^2
3-h Outgoing longwave radiation	Surface	Longwave radiation directed (upwards) away from the surface, accumulated in the previous three hours	J/m^2
6-h Outgoing longwave radiation	Surface	Longwave radiation directed (upwards) away from the surface, accumulated in the previous six hours	J/m^2
1-h Outgoing shortwave radiation	Surface	Shortwave radiation directed (upwards) away from the surface, accumulated in the previous hour	J/m^2
3-h Outgoing shortwave radiation	Surface	Shortwave radiation directed (upwards) away from the surface, accumulated in the previous three hours	J/m^2
6-h Outgoing shortwave radiation	Surface	Shortwave radiation directed (upwards) away from the surface, accumulated in the previous six hours	J/m^2
1-h Outgoing longwave radiation	Top of atmosphere	Longwave radiation directed (upwards) away from the top of the atmosphere, accumulated in the previous hour	J/m^2
3-h Outgoing longwave radiation	Top of atmosphere	Longwave radiation directed (upwards) away from the top of the atmosphere, accumulated in the previous three hours	J/m^2
6-h Outgoing longwave radiation	Top of atmosphere	Longwave radiation directed (upwards) away from the top of the atmosphere, accumulated in the previous six hours	J/m^2

Note: Not all fields are available at all lead times. For instance, 3-h amounts are only included in requests that include the 3-hourly time bundle, and limited to the leat times that it is provided (currently, until day 5)

This bundle is available at the point API endpoint.

Precipitation Bundle (precipitation)

Field Name	Vertical Level	Description	Units
Precipitation Type	Surface	The predominant precipitation type. Values are "no_precipitation", "rain", "snow", "freezing_rain", "mixed/ice" *Note: At the file API, available as categorical masks for areas of*	-

		each of the precipitation types	
Snowfall Amount	Surface	The total **accumulated** snowfall occurring since the beginning of the forecast. Read more about working with accumulated fields.	m *
Composite Reflectivity **	Whole atmosphere	The maximum reflectivity in the vertical column above each grid point derived from the model hydrometeor mixing ratios.	dBZ

* Snowfall Amount is provided in Meters for the File API (GRIB2) data, but Centimeters in the Point API
** Composite Reflectivity is available through the file API only

This bundle is available at the file, point, route, and WMS API endpoints.

Precipitation Accumulation Bundle (precipitation-accumulation)

The precipitation accumulation bundle is complementary to the precipitation bundle, and available for all users that subscribed to the precipitation one). It is opt-in, so if you are interested and doesn't have access to it, please contact our sales engineering team.

Field Name	Vertical Level	Description	Unit
1-h snowfall amount	Surface	The total snowfall accumulated in the previous hour	cm
3-h snowfall amount	Surface	The total snowfall accumulated in the previous three hours	cm
6-h snowfall amount	Surface	The total snowfall accumulated in the previous six hours	cm

Note: Not all fields are available at all lead times. For instance, 3-h amounts are only included in requests that include the 3-hourly time bundle, and limited to the lead times that it is provided (currently, until day 5)

This bundle is available at the point API endpoint.

Optimized Point Forecast Data Packages

Core Bundle

Field Name	Vertical Level	Description	Unit
Temperature	2 meters AGL	Air temperature at screen level. *AGL = Above Ground Level*	K
Relative Humidity	2 meters AGL	The fractional ratio of the partial pressure of water vapor to the equilibrium vapor pressure at a given temperature, expressed as a percentage	%
Dewpoint Temperature	2 meters AGL	The screen-level temperature at which a parcel of air cooled at constant pressure and specific humidity reaches saturation	K
24-h Maximum temperature UTC	2 meters AGL	Maximum air temperature for the remainder of the current calendar day (day in UTC time – same across all stations). For example, at 18 UTC, the Maximum Temperature is predicted for the period between 19:00 and 23:59	K
24-h Minimum temperature UTC	2 meters AGL	Minimum air temperature for the remainder of the current calendar day (day in UTC time – same across all stations)	K

24-h Maximum temperature local	2 meters AGL	Maximum air temperature for the remainder of the current calendar day (day in the station local time zone)	K
24-h Minimum temperature local	2 meters AGL	Minimum air temperature for the remainder of the current calendar day (day in the station local time zone)	K
Mean sea-level pressure	Sea level	Air pressure adjusted to mean sea level	Pa
Cloud ceiling	Surface	The height above the Earth's surface of the base of the lowest layer of cloud with a coverage of more than 50%. Data is provided in ranges For example, "0 to 800 m" or "No Ceiling". *Note: Cloud ceiling is only available for locations with weather stations. This parameter may also experience latency populating into the most recent forecast issuance. Lastly, this parameter is only provided to +24h from the forecast issuance time.*	-
Total cloud cover	Surface	The percentage of the sky around the location covered by clouds	%
Visibility	Surface	The horizontal visibility	m
Probability of fog	Surface	The probability of fog	%
Probability of thunderstorm	Surface	The probability of thunderstorm	%
Wind speed	10 meters AGL	The wind speed at standard observation height (10 m above the surface)	m/s
Wind direction	10 meters AGL	The meteorological wind direction (90° corresponds to wind from east)	degree
Eastward wind velocity	10 meters AGL	The eastward component of the horizontal wind. It is the horizontal speed of air moving towards the east	m/s
Northward wind velocity	10 meters AGL	The northward component of the horizontal wind. It is the horizontal speed of air moving towards the north	m/s
Wind Gust Speed	10 meters AGL	Instantaneous wind gust speed	m/s
Precipitation Rate	Surface	The rate of total precipitation at the specified time (e.g., the amount of rain that would fall over a given interval of time if the rainfall intensity were constant over that time period)	mm/s
1-h Probability of precipitation	Surface	The probability of (liquid) precipitation in the next one hour	%
1-h Accumulated precipitation	Surface	The total accumulated (liquid) precipitation occurring in the next one hour	mm kg/m2
3-h Probability of precipitation	Surface	The probability of (liquid) precipitation in the next three hours	%
3-h Accumulated precipitation	Surface	The total accumulated (liquid) precipitation occurring in the next three hours	mm kg/m2
6-h Probability of precipitation	Surface	The probability of (liquid) precipitation in the next six hours	%

6-h Accumulated precipitation	Surface	The total accumulated (liquid) precipitation occurring in the next six hours	mm kg/m2
24-h Probability of precipitation	Surface	The probability of (liquid) precipitation in the next 24 hours	%
24-h Accumulated precipitation	Surface	The total accumulated (liquid) precipitation occurring in the next 24 hours	mm kg/m2
Conditional probability of rain	Surface	Conditional probability of rain. Likelihood of receiving rain if precipitation were actually to occur.	%
Conditional probability of snow	Surface	Conditional probability of snow. Likelihood of receiving snow if precipitation were actually to occur.	%
Conditional probability of ice	Surface	Conditional probability of ice (freezing rain or sleet). Likelihood of receiving ice if precipitation were actually to occur.	%

This bundle is available at the point optimized API endpoint.

Wind Energy Bundle

Field Name	Vertical Level	Description	Unit
Wind speed	80 meters AGL	Wind speed at 80 m above the surface.	m/s
Wind speed	100 meters AGL	Wind speed at 100 m above the surface.	m/s
Wind speed	120 meters AGL	Wind speed at 120 m above the surface.	m/s

This bundle is available at the optimized point API endpoint.

Solar Energy Bundle

Field Name	Vertical Level	Description	Unit
Global Horizontal Irradiance	Surface	Total shortwave radiation received by a surface horizontal to the ground. This field is the combination of both the direct normal irradiance (DNI) and the diffuse horizontal irradiance.	W/m2
Direct Normal Irradiance	Surface	The incoming shortwave radiation per unit area received by a surface which is always normal (perpendicular) to the direction of the sun's incoming rays.	W/m2
Plane of Array Irradiance	Surface	The irradiance received by a sensor attached directly to a solar array. This field incorporates the tilt of the array, the solar zenith angle, as well as the solar azimuth angle to obtain a best estimate for the amount of radiation received by the array directly.	W/m2

This bundle is available at the optimized point API endpoint.

High-Resolution Forecast Bundles

Core-v2 Bundle

Field Name	Vertical Level	Description	Units
Temperature	2 meters AGL	Air temperature at standard observation height (2 meters above the	K

		surface)	
Relative humidity	2 meters AGL	The fractional ratio of the partial pressure of water vapor to the equilibrium vapor pressure at a given temperature expressed as a percentage	%
Dewpoint temperature	2 meters AGL	Temperature at which a parcel of air cooled at constant pressure and specific humidity reaches saturation	K
u-wind component	10 meters AGL	The eastward component of the horizontal wind Download a sample of how to convert from u/v components to speed and direction.	m/s
v-wind component	10 meters AGL	The northward component of the horizontal wind	m/s
u-wind component	80 meters AGL	The eastward component of the horizontal wind	m/s
v-wind component	80 meters AGL	The northward component of the horizontal wind	m/s
u-wind component	100 meters AGL	The eastward component of the horizontal wind	m/s
v-wind component	100 meters AGL	The northward component of the horizontal wind	m/s
Mean sea-level pressure	Sea level	Air pressure adjusted to mean sea level	Pa
Accumulated precipitation	Surface	The total **accumulated** (liquid) precipitation occurring since the beginning of the forecast. **Forecast only Read more about working with accumulated fields.	mm kg/m^2
1-hour Accumulated Precipitation	Surface	The total liquid precipitation equivalent accumulated in the previous hour	mm kg/m^2
3-hour Accumulated Precipitation	Surface	The total liquid precipitation equivalent accumulated in the previous three hours	mm kg/m^2
6-hour Accumulated Precipitation	Surface	The total liquid precipitation equivalent accumulated in the previous six hours	mm kg/m^2
Precipitation type / rain	Surface	Categorical precipitation type field: liquid precipitation	-
Precipitation type / freezing rain	Surface	Categorical precipitation type field: freezing rain	-
Precipitation type / ice pellets	Surface	Categorical precipitation type field: ice pellets or sleet (U.S. definition)	-
Precipitation type / snow	Surface	Categorical precipitation type field: snow	-
Simulated Composite Reflectivity	Whole Atmosphere	The maximum reflectivity in the vertical column above each grid point derived from the model hydrometeor mixing ratios. **Forecast only	dBZ

Wind gust speed	10 meters AGL	Instantaneous wind gust (speed)	m/s
Total Cloud Cover	Whole atmosphere	The percentage of the sky covered by clouds through the full depth of the atmosphere. **Forecast only	%
Effective Cloud Cover	Whole atmosphere	A measure of the amount of sunlight penetrating through clouds or clear air, which will reach the surface. This is often considered a more accurate representation of the 'brightness' at the surface.	%
Low Cloud Cover (fraction)	-	The percent of model grid box covered by a low cloud layer	%
Mid Cloud Cover (fraction)	-	The percent of model grid box covered by a mid cloud layer	%
High Cloud Cover (fraction)	-	The percent of model grid box covered by a high cloud layer	%
Instantaneous Incoming shortwave radiation	Surface	Shortwave radiation flux at the surface, including direct and diffuse components. **Forecast only	W/m2

This bundle is available at the file API endpoint.

**Forecast only – These fields require the model to "spin-up" and so at the 0-hour analysis time for each run the grids will be filled entirely with 0.0 values.

Upper-Air Bundle

Field Name	Vertical Level	Description	Units
Geopotential height	Isobaric levels	The approximate height of a given point in the atmosphere above the surface of the earth accounting for variations in gravity	gpm
Temperature	Isobaric levels	Air temperature	K
u-wind component	Isobaric levels	The eastward component of the horizontal wind	m/s
v-wind component	Isobaric levels	The northward component of the horizontal wind	m/s
Relative humidity	Isobaric levels	The fractional ratio of the partial pressure of water vapor to the equilibrium vapor pressure at a given temperature expressed as a percentage	%
Vertical velocity	Isobaric levels	The component of the full velocity vector in the vertical direction	m/s
Absolute vorticity	Isobaric levels	The vertical component of the absolute vorticity vector measuring the local rotation of the atmosphere	s^{-1}

This bundle is available at the file API endpoint. The following isobaric levels are available: 1000, 925, 850, 700, 500, 300, 200, 100 hPa.

Thunderstorm Bundle

Field Name	Vertical Level	Description	Units
Maximum Hail Size	Surface	A calculated field to estimate the maximum **radius** of individual hail stones which could reach the surface from convective storms within the	mm

		past 1 hour.	
CAPE	Whole atmosphere	A measure of the amount of energy available for convection. CAPE is directly related to the maximum potential vertical speed within an updraft; thus, higher values indicate greater potential for severe weather.	J/kg
Downdraft CAPE	Whole atmosphere	The maximum energy available to a descending parcel of air. Mainly used to estimate the potential strength of any rain-cooled downdrafts within a thunderstorm.	J/kg
CIN	Whole atmosphere	A measure of the amount of energy needed in order to initiate convection. Values of CIN typically reflect the strength of the cap. They are obtained on a sounding by computing the area enclosed between the environmental temperature profile and the path of a rising air parcel, over the layer within which the latter is cooler than the former.	J/kg
Lifted Index	Whole atmosphere	The temperature difference between the air lifted from the surface to 500 hPa and the environmental temperature at that level.	K
Level of Free Convection	Whole atmosphere	The level at which a parcel of air, lifted dry-adiabatically, becomes warmer than the surrounding air and begins to rise freely (moist-adiabatically). This occurs most readily in a conditionally unstable atmosphere.	m
Lifted Condensation Level	Whole atmosphere	The level at which a parcel of moist air becomes saturated when it is lifted dry adiabatically. Often considered to be the cloud base height when forecasting severe weather potential.	m
Equilibrium Level	Whole atmosphere	The height of the EL is the height at which thunderstorm updrafts no longer accelerate upward. Thus, to a close approximation, it represents the height of expected (or ongoing) thunderstorm tops.	m
Storm-relative helicity	0-3 km	A measure of the transfer of vorticity from the environment to an air parcel in convective motion from a frame of reference moving with a thunderstorm	m^2/s^2
Storm motion (eastward component)	0-6 km	The eastward component of the storm-motion vector	m/s
Storm motion (northward component)	0-6 km	The northward component of the storm-motion vector	m/s
0-6 km shear vector (eastward component)	0-6 km	The eastward component of the deep-layer shear vector	s^{-1}
0-6 km shear vector (northward component)	0-6 km	The northward component of the deep-layer shear vector	s^{-1}
Precipitable Water	Whole atmosphere	The depth of water in a column of the atmosphere, if all the water in that column were precipitated as rain	kg/m^2

This bundle is available at the file API endpoint.

Derived Bundle

Field Name	Vertical Level	Description	Units
Geopotential Height Thickness	500 hPa – 1000 hPa	A derived field produced by calculating the difference in geopotential heights from the 500 hPa and the 1000 hPa levels.	M

Air Temperature Departure from Normal – 30yr	850 hPa	The difference in forecast air temperature at 850 hPa as compared to climatological normal values, for the valid calendar day, in the past 30 years	K
Geopotential Height Departure from Normal – 30yr	500 hPa	The difference in geopotential height at 500 hPa as compared to climatological normal values, for the valid calendar day, in the past 30 years	M

This bundle is available at the file API endpoint.

Power Forecast

Field Name	Vertical Level	Description	Unit
Power	n/a	Estimated aggregate output of solar or wind power production in the specified region for each forecast lead time	MW (megawatts)

Tides Data Package

Field Name	Vertical Level	Description	Unit
Tides	Sea Level	The altered height of the sea above its normal level due to effects of the earth's rotation and gravitational pull of the sun and moon.	m

Storm Tracks Data Package

Field Name	Description
Storm Id	The ATCF_ID which follows the format BBXXYYYY Where: <BB> is the 2-character ATCF basin code (WP, IO, SH, CP, EP, AL) <XX> is the 2-digit annual cyclone number (1-99) <YYYY> is the 4-digit year when the storm formed
Storm Name	The storm name without including the storm type (ie. TC ISLA will be just called ISLA). This will be empty until the storm reaches a certain intensity and gets a name.
Annual Number	Unique cyclone number assigned to each storm by NHC/JTWC when it forms and strengthens to at least a tropical depression
Advisory Number	Number indicating the advisory from which data is extracted. This value is NULL when a storm is no longer active and all positions are observed
Issuance Time	Issuance time for the relevant advisory forecast position(s). This value is NULL when a storm is no longer active and all positions are observed
is_active	True or False. True if the storm is active when API is queried
Dates Active	The start and end dates for all storm positions

Max Development Category	The highest category code that was reached by the storm over the full set of observed positions. See Category Code below for ranking of categories
Time	The time at which all data for that position is valid at. Only used for observed-positions
Forecast_Time	The time at which all data for that position is valid at. Only used for forecast-positions.
Forecast Hour	The hours elapsed from the advisory issuance time for that position information. Only used for forecast-positions.
Latitude	Latitude of the storm center
Longitude	Longitude of the storm center
Category Code	The tropical cyclone category, from the following list: XX - Unknown DS – Dissipating (cyclone) IN – Inland (cyclone) PT – Post-Tropical Cyclone LO – Low-pressure center SS – Subtropical Storm TD – Tropical Depression TS – Tropical Storm TC1 – Tropical Cyclone/Hurricane Category 1 or Typhoon TC2 - Tropical Cyclone/Hurricane Category 2 or Typhoon TC3 - Tropical Cyclone/Hurricane Category 3 or Typhoon TC4 - Tropical Cyclone/Hurricane Category 4 or Typhoon TC5 - Tropical Cyclone/Hurricane Category 5 or Super Typhoon Note: categories listed here are ordered according to intensity
Basin	The basin name: NANorth Atlantic EPEastern North Pacific WPWestern North Pacific NINorth Indian SISouth Indian SPSouthern Pacific SASouth Atlantic
Sub-Region	The sub-region name, from this list: CS – Carribean Sea GM – Gulf of Mexico MM – Missing CP – Central Pacific AS – Arabian Sea BB – Bay of Bengal WA – Western Australia EA – Eastern Australia
Wind Gusts	The maximum wind gusts found anywhere in the cyclone in knots
Max Sustained Wind	The maximum sustained wind speed, found anywhere in the cyclone, reported (or forecast for future tracks) at 10-m above ground level in knots.

	Also provided as a storm-summary level field that gives the maximum value of this field over the full set of observed positions.
Min Sea Level Pressure	Lowest Sea-level pressure noted at the center of the storm in hPa. Also provided as a storm-summary level field that gives the maximum value of this field over the full set of observed positions. Note: For data from the JTWC: For observed positions: Min Sea Level Pressure will be available with a delay of a few hours. For forecast positions: N/A
Movement Direction	The degrees from N that the storm is moving towards
Movement Speed	The speed that a storm is moving in the direction of "storm movement direction" in knots
Winds Radii	Winds Radii information for 34, 50, 64kt. For each, it will have four quadrants (NE, SE, SW, NW) with: • Distance (in nautical miles) that the winds extend from the storm center

Basic Weather Bundle

This bundle is an aggregation of many weather forecast and current condition bundles into a single product offering. The Basic Weather Bundle includes the following data elements, which are referenced earlier in the prior tables:

Product	Bundle	Endpoint(s)	Time Bundle(s)	Data Format(s)
Current Global Forecast	Basic	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (10 day)	JSON, GRIB2, WMS
Current Global Forecast	Basic - Accumulation	/forecast/point	Hourly (48h), 3-Hourly (5 day), 6-Hourly (10 day)	JSON
Current Global Forecast	Clouds	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (10 day)	JSON, GRIB2, WMS
Current Global Forecast	Precipitation	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (10 day)	JSON, GRIB2, WMS
Current Global Forecast	Precipitation - Accumulation	/forecast/point	Hourly (48h), 3-Hourly (5 day), 6-Hourly (10 day)	JSON
Current Conditions	Basic	/current/weather/file /current/weather/point	Hourly (past 72 hours)	JSON, GRIB2
Storm Tracks	n/a	/storm	n/a	JSON, KMZ

Enhanced Weather Bundle

This bundle is an aggregation of many weather forecast and current condition bundles into a single product offering. The Enhanced Weather Bundle includes the following data elements, which are referenced earlier in the prior tables:

Product	Bundle	Endpoint(s)	Time Bundle(s)	Data Format(s)
Current Global Forecast	Basic	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON, GRIB2, WMS
Current Global Forecast	Basic - Accumulation	/forecast/point	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON
Current Global Forecast	Clouds	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON, GRIB2, WMS
Current Global Forecast	Precipitation	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON, GRIB2, WMS
Current Global Forecast	Precipitation - Accumulation	/forecast/point	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON
Current Global Forecast	Thunderstorm	/forecast/point /forecast/file	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON, GRIB2
Current Global Forecast	Agricultural	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON, GRIB2
Current Global Forecast	Wind Energy	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON, GRIB2
Current Global Forecast	Solar Energy	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON, GRIB2
Current Global Forecast	Solar Energy – Accumulation	/forecast/point	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON
Current Optimized Point Forecast	Core	/forecast/point/optimized /forecast/optimized/bulk	Hourly (15 day)	JSON, CSV
Current Conditions	Basic	/current/weather/file /current/weather/point	Hourly (past 72 hours)	JSON, GRIB2
Storm Tracks	n/a	/storm	n/a	JSON, KMZ

Premium Weather Bundle

This bundle is an aggregation of many weather forecast and current condition bundles into a single product offering. The Enhanced Weather Bundle includes the following data elements, which are referenced earlier in the prior tables:

Product	Bundle	Endpoint(s)	Time Bundle(s)	Data Format(s)
Current Global Forecast	Basic	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON, GRIB2, WMS
Current Global Forecast	Basic - Accumulation	/forecast/point	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON
Current Global Forecast	Clouds	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON, GRIB2, WMS
Current Global Forecast	Precipitation	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON, GRIB2, WMS
Current Global Forecast	Precipitation - Accumulation	/forecast/point	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON
Current Global Forecast	Thunderstorm	/forecast/point /forecast/file	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON, GRIB2
Current Global Forecast	Agricultural	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON, GRIB2
Current Global Forecast	Wind Energy	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON, GRIB2
Current Global Forecast	Solar Energy	/forecast/point /forecast/file /forecast/route	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON, GRIB2
Current Global Forecast	Solar Energy – Accumulation	/forecast/point	Hourly (48h), 3-Hourly (5 day), 6-Hourly (15 day)	JSON
Current Optimized Point Forecast	Core	/forecast/point/optimized /forecast/optimized/bulk	Hourly (15 day)	JSON, CSV
Current Optimized Point Forecast	Solar Power	/forecast/point/optimized /forecast/optimized/bulk	15-minute (48 hourly)	JSON, CSV
Current Optimized Point Forecast	Wind Power	/forecast/point/optimized /forecast/optimized/bulk	15-minute (48 hourly)	JSON, CSV
Current Conditions	Basic	/current/weather/file /current/weather/point	Hourly (past 72 hours)	JSON, GRIB2
Storm Tracks	n/a	/storm	n/a	JSON, KMZ

Appendix B - Status Page

Spire Weather offers an online web page to monitor the status of the API and the multiple weather datasets we provide.

The status page can be accessed here: Spire Weather Status.

Any issues will be reported using the following status values:

- **Under Maintenance:** When the system is undergoing planned maintenance
- **Degraded Performance**: The system is operational, but the performance (either the API response times or the forecast updates) are slower than normal
- **Major Outage**: The APIs are offline, or the weather data update is severely delayed

The following items explain each monitored product and what it means when a problem is reported.

Spire Weather Forecast - Global Atmospheric Data

This component monitors Spire's proprietary global atmospheric weather forecast model. This is the model that produces all but the maritime and maritime waves global data bundles, and is accessed through the following APIs:

- forecast/file
- forecast/point
- forecast/route

When we run our global model, it produces the weather forecast for the following 15 days. Every 6-hours, the model is run again and updated data is provided.

It is important to note that if the Status Page is showing a problem in this item, there are a few effects for users (described below), but forecast data is still available in our APIs and can be used.

If this dataset is under **degraded performance**, it means that the latest model refresh run is delayed. The effects of this are the following:

- The short-range forecast (first 24 to 36 hours) is outdated, and its accuracy may be lower than normal. This will likely be more visible in the first few hours of the forecast.
- The medium-range forecast (the 15-day forecast) is likely missing the last few hours - since we are using the last global model run that was run over 6 hours ago (so the system may only be able to provide the next 9.5 days for instance)
    - *There may be a small decrease in forecast accuracy beyond the first day of the forecast, but this is likely minor.*

If this dataset is under **major outage**, it means that the next model run is severely delayed. The effects of this are the following:

- The short-range forecast (first 24 to 36 hours) is outdated, and its accuracy may be lower than normal.
- This decrease in forecast accuracy is possibly also observed in the 2nd day of the forecast, and may even extend beyond that (but with minor impact)
- The medium-range forecast (the 15-day forecast) is missing the last several hours. Since we will be using the last or second-to-last global model run that was run over 12 or even 18 hours ago. The system may only be able to provide the next 9 days for instance (instead of the next 15 days)

Spire Weather Forecast - Global Maritime Data

This item is the same as the above (Global Atmospheric Data), but for the oceanographic forecasts (the data that is provided in the maritime and maritime waves bundles).

All the same considerations apply, and the observed effects of the degraded performance or major outage are the same.

Spire Weather Forecast - Custom Global Data

This item is the same as the Global Atmospheric Data, but monitors the post-processing of the data (the statistical optimization of the forecast). This item only affects customers that are subscribed to the post-processed forecasts package. If you subscribe only to a weather model output package this item should be ignored.

All the same considerations apply, and the observed effects of the degraded performance or major outage are the same described above - but should only affect the "core" bundle.

Spire Weather Forecast - Custom Point Data

This item monitors Spire's optimized point forecast system - the one providing the optimized and localized forecasts for airports, ports, or customer's points of interest. This is the model that produces the data accessed through the forecast/optimized endpoint.

The optimized forecast system is updated every hour. If the Status Page is showing a problem in this item, there are a few observed effects for users (described below) but forecast is still available in the API and can be used.

If this dataset is under **degraded performance**, it means that the optimization is delayed and at least the latest update was not yet made available in the API. The effects of this are the following:

- The first few hours of the forecast are outdated, and its accuracy may be lower than normal.

Note: There may be a small decrease in forecast accuracy beyond the first few hours of the forecast, but this is likely minor.

If this dataset is under a **major outage**, it means that the optimization is severely delayed. The visible effects of this are:

- The first day or even 36 hours (depending on how long the system is out) are outdated, and have it's accuracy being lower than normal.
- The latest lead times of the forecast are not available (for instance, the last 12 hours of the 7-day forecast, if that is the system you are subscribing to)

Spire Weather Current Conditions - Global Data

This item monitors Spire's current weather conditions, the model that produces the data accessed through the current/weather endpoint.

The global current conditions are updated every hour. If the Status Page shows a problem in this item, it means the system is not being updated and the API is returning the latest produced issuance (that is at least one hour late).

If this dataset is under **degraded performance**, it means that the model is delayed for at least one hour, and the current conditions APIs are displaying data from a previous time (not the current hour).

If this dataset is under a **major outage**, it means that the model is delayed for several hours, and the current conditions APIs are displaying data from a previous time (not the current hour).

Spire Weather API

This item monitors all Spire Weather APIs except the WMS endpoint (that has its own monitor).

- **Degraded performance** means the API is available, but the response times are slower than normal
- **Major outage** means the API is offline

Spire Weather WMS

This item monitors the WMS API.

- **Degraded performance** means the API is available, but the response times are slower than normal
- **Major outage** means the API is offline

Spire Weather Historical Data Service

This item monitors the historical archive extraction system:

- **Degraded performance** is not a currently tracked condition for this product
- **Major outage** means the data extraction system is offline. If you requested an historical data extraction and are waiting for a response, this state indicates that you can expect a delay.