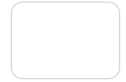




Open-Meteo



Weather Forecast API

Seamless integration of high-resolution weather models with up 16 days forecast

Available APIs ▾

Location and Time

Location: **Coordinates** [List](#)

Latitude
52.52



Longitude
13.41



Timezone
America/Los_Angeles

🔍 Search

+

Time: [🕒 Forecast Length](#) **📅 Time Interval**

Start Date
2025-01-23

End Date
2025-01-24

The **Start Date** and **End Date** options help you choose a range of dates more easily. Archived forecasts come from a series of weather model runs over time. You can access forecasts for up to 3 months and continuously archived in the [Historical Forecast API](#). You can also check out our [Historical Weather API](#), which provides data going all the way back to 1940.

Hourly Weather Variables

- ☐ Temperature (2 m)
- ☐ Relative Humidity (2 m)
- ☐ Dewpoint (2 m)
- ☐ Apparent Temperature
- ☐ Precipitation Probability
- ☐ Precipitation (rain + showers + snow)
- ☐ Rain
- ☐ Showers
- ☐ Snowfall
- ☐ Snow Depth
- ☐ Weather code
- ☐ Sealevel Pressure
- ☐ Surface Pressure
- ☐ Cloud cover Total
- ☐ Cloud cover Low
- ☐ Cloud cover Mid
- ☐ Cloud cover High
- ☐ Visibility

- ☐ Evapotranspiration
- ☐ Reference Evapotranspiration (ET_0)
- ☐ Vapour Pressure Deficit
- ☐ Wind Speed (10 m)
- ☐ Wind Speed (80 m)
- ☐ Wind Speed (120 m)
- ☐ Wind Speed (180 m)
- ☐ Wind Direction (10 m)
- ☐ Wind Direction (80 m)
- ☐ Wind Direction (120 m)
- ☐ Wind Direction (180 m)
- ☐ Wind Gusts (10 m)
- ☐ Temperature (80 m)
- ☐ Temperature (120 m)
- ☐ Temperature (180 m)
- ☐ Soil Temperature (0 cm)
- ☐ Soil Temperature (6 cm)
- ☐ Soil Temperature (18 cm)
- ☐ Soil Temperature (54 cm)
- ☐ Soil Moisture (0-1 cm)
- ☐ Soil Moisture (1-3 cm)
- ☐ Soil Moisture (3-9 cm)
- ☐ Soil Moisture (9-27 cm)
- ☐ Soil Moisture (27-81 cm)

Additional Variables And Options

- ☐ UV Index
- ☐ UV Index Clear Sky
- ☐ Is Day or Night
- ☐ Sunshine Duration
- ☐ Wet Bulb Temperature (2 m)
- ☐ Total Column Integrated Water Vapour
- ☐ CAPE
- ☐ Lifted Index
- ☐ Convective Inhibition
- ☐ Freezing Level Height

☐ Boundary Layer Height PBL

Note: You can further adjust the forecast time range for hourly weather variables using `&forecast_hours=` and `&past_hours=` as shown below.

Forecast Hours
- (default)

Past Hours
- (default)

Temporal Resolution For Hourly Data
1 Hourly

Grid Cell Selection
Terrain Optimized, Prefers Land

Solar Radiation Variables

- ☐ Shortwave Solar Radiation GHI
- ☐ Direct Solar Radiation
- ☐ Diffuse Solar Radiation DHI
- ☐ Direct Normal Irradiance DNI
- ☐ Global Tilted Radiation GTI
- ☐ Terrestrial Solar Radiation
- ☐ Shortwave Solar Radiation GHI (Instant)
- ☐ Direct Solar Radiation (Instant)
- ☐ Diffuse Solar Radiation DHI (Instant)
- ☐ Direct Normal Irradiance DNI (Instant)
- ☐ Global Tilted Radiation GTI
- ☐ Terrestrial Solar Radiation (Instant)

Note: Solar radiation is averaged over the past hour. Use `instant` for radiation at the indicated time. For global tilted irradiance GTI please specify Tilt and Azimuth below.

Panel Tilt (0° horizontal)
0



Panel Azimuth (0° S, -90° E, 90° W)
0



Pressure Level Variables

Temperature

☐ 1000 hPa (110 m)☐ 975 hPa (320 m)

Relative Humidity

☐ 950 hPa (500 m)

Cloud cover

☐ 925 hPa (800 m)☐ 900 hPa (1000 m)

Wind Speed

☐ 850 hPa (1500 m)

Wind Direction

☐ 800 hPa (1900 m)☐ 700 hPa (3 km)

Geopotential Height

☐ 600 hPa (4.2 km)☐ 500 hPa (5.6 km)☐ 400 hPa (7.2 km)☐ 300 hPa (9.2 km)☐ 250 hPa (10.4 km)☐ 200 hPa (11.8 km)☐ 150 hPa (13.5 km)☐ 100 hPa (15.8 km)☐ 70 hPa (17.7 km)☐ 50 hPa (19.3 km)☐ 30 hPa (22 km)

Note: Altitudes are approximate and in meters **above sea level** (not above ground). Use `geopotential_height` to get precise altitudes above sea level.

Weather models 1 / 40

☒ Best match☐ ECMWF IFS 0.4°☐ ECMWF IFS 0.25°☐ ECMWF AIFS 0.25°☐ CMA GRAPES Global☐ BOM ACCESS Global☐ NCEP GFS Seamless☐ NCEP GFS Global 0.11°/0.25°☐ NCEP HRRR U.S. Conus☐ NCEP NBM U.S. Conus☐ GFS GraphCast

- ☐ JMA Seamless
- ☐ JMA MSM
- ☐ JMA GSM

- ☐ DWD ICON Seamless
- ☐ DWD ICON Global
- ☐ DWD ICON EU
- ☐ DWD ICON D2

- ☐ GEM Seamless
- ☐ GEM Global
- ☐ GEM Regional
- ☐ GEM HRDPS Continental

- ☐ Météo-France Seamless
- ☐ Météo-France ARPEGE World
- ☐ Météo-France ARPEGE Europe
- ☐ Météo-France AROME France
- ☐ Météo-France AROME France HD

- ☐ ARPAE Seamless
- ☐ ARPAE COSMO 2I
- ☐ ARPAE COSMO 5M

- ☐ MET Norway Nordic Seamless (with ECMWF)
- ☐ MET Norway Nordic

- ☐ KNMI Seamless (with ECMWF)
- ☐ KNMI Harmonie Arome Europe
- ☐ KNMI Harmonie Arome Netherlands
- ☐ DMI Seamless (with ECMWF)
- ☐ DMI Harmonie Arome Europe

- ☐ UK Met Office Seamless
- ☐ UK Met Office Global 10km
- ☐ UK Met Office UK 2km

Note: The default **Best Match** provides the best forecast for any given location worldwide. **Seamless** combines all models from a given provider into a seamless prediction.

15-Minutely Weather Variables

- ☐ Temperature (2 m)
- ☐ Relative Humidity (2 m)
- ☐ Dewpoint (2 m)
- ☐ Apparent Temperature
- ☐ Precipitation (rain + showers + snow)
- ☐ Rain
- ☐ Snowfall
- ☐ Snowfall Height
- ☐ Freezing Level Height
- ☐ Sunshine Duration

- ☐ Weather code
- ☐ Wind Speed (10 m)
- ☐ Wind Speed (80 m)
- ☐ Wind Direction (10 m)
- ☐ Wind Direction (80 m)
- ☐ Wind Gusts (10 m)
- ☐ Visibility
- ☐ CAPE
- ☐ Lightning Potential Index LPI
- ☐ Is Day or Night

- ☐ Shortwave Solar Radiation GHI
- ☐ Direct Solar Radiation
- ☐ Diffuse Solar Radiation DHI
- ☐ Direct Normal Irradiance DNI
- ☐ Global Tilted Radiation GTI
- ☐ Terrestrial Solar Radiation
- ☐ Shortwave Solar Radiation GHI (Instant)
- ☐ Direct Solar Radiation (Instant)
- ☐ Diffuse Solar Radiation DHI (Instant)
- ☐ Direct Normal Irradiance DNI (Instant)
- ☐ Global Tilted Radiation GTI
- ☐ Terrestrial Solar Radiation (Instant)

Note: Only available in Central Europe and North America. Other regions use interpolated hourly data. Solar radiation is averaged over the 15 minutes. Use `instant` for radiation at the indicated time.

Note: You can further adjust the forecast time range for 15-minutely weather variables using `&forecast_minutely_15=` and `&past_minutely_15=` as shown below.

Forecast Minutely 15
- (default)

Past Minutely 15
- (default)

Daily Weather Variables

- ☐ Weather code
- ☐ Maximum Temperature (2 m)
- ☐ Minimum Temperature (2 m)
- ☐ Maximum Apparent Temperature (2 m)
- ☐ Minimum Apparent Temperature (2 m)
- ☐ Sunrise
- ☐ Sunset
- ☐ Daylight Duration
- ☐ Sunshine Duration
- ☐ UV Index
- ☐ UV Index Clear Sky
- ☐ Precipitation Sum
- ☐ Rain Sum
- ☐ Showers Sum
- ☐ Snowfall Sum
- ☐ Precipitation Hours
- ☐ Precipitation Probability Max
- ☐ Maximum Wind Speed (10 m)
- ☐ Maximum Wind Gusts (10 m)
- ☐ Dominant Wind Direction (10 m)
- ☐ Shortwave Radiation Sum
- ☐ Reference Evapotranspiration (ET₀)

Current Weather

- ☒ Temperature (2 m)
- ☒ Relative Humidity (2 m)
- ☐ Apparent Temperature
- ☐ Is Day or Night
- ☒ Precipitation
 - ☐ Rain
 - ☐ Showers
 - ☐ Snowfall
- ☐ Weather code
- ☐ Cloud cover Total
- ☐ Sealevel Pressure
- ☐ Surface Pressure
- ☒ Wind Speed (10 m)
- ☐ Wind Direction (10 m)
- ☐ Wind Gusts (10 m)

Note: Current conditions are based on 15-minutely weather model data. Every weather variable available in hourly data, is available as current condition as well.

Settings

Temperature Unit
Celsius °C

Wind Speed Unit
Km/h

Precipitation Unit
Millimeter

Timeformat
ISO 8601 (e.g. 2022-12-31)

Usage License: **Non-Commercial** [Commercial](#) [Self-Hosted](#)

Only for **non-commercial use** and less than 10.000 daily API calls. See [Terms](#) for more details.

API Response

Preview: [Chart And URL](#) **[Python](#)** [Typescript](#) [Swift](#) [Other](#)

The sample code automatically applies all the parameters selected above. It includes caching and the conversion to Pandas DataFrames. The use of DataFrames is entirely optional. You can find further details and examples in the [Python API client](#) documentation.

Install

```
pip install openmeteo-requests
pip install requests-cache retry-requests numpy pandas
```

Usage

```
import openmeteo_requests

import requests_cache
import pandas as pd
from retry_requests import retry

# Setup the Open-Meteo API client with cache and retry on error
cache_session = requests_cache.CachedSession('.cache', expire_after = 3600)
retry_session = retry(cache_session, retries = 5, backoff_factor = 0.2)
openmeteo = openmeteo_requests.Client(session = retry_session)

# Make sure all required weather variables are listed here
# The order of variables in hourly or daily is important to assign them correctly below
url = "https://api.open-meteo.com/v1/forecast"
params = {
    "latitude": 52.52,
    "longitude": 13.41,
    "current": ["temperature_2m", "relative_humidity_2m", "precipitation", "wind_speed_10m"],
    "timezone": "America/Los_Angeles",
    "start_date": "2025-01-23",
    "end_date": "2025-01-24",
    "models": "best_match"
}
```

```

responses = openmeteo.weather_api(url, params=params)

# Process first location. Add a for-loop for multiple locations or weather models
response = responses[0]
print(f"Coordinates {response.Latitude()}°N {response.Longitude()}°E")
print(f"Elevation {response.Elevation()} m asl")
print(f"Timezone {response.Timezone()} {response.TimezoneAbbreviation()}")
print(f"Timezone difference to GMT+0 {response.UtcOffsetSeconds()} s")

# Current values. The order of variables needs to be the same as requested.
current = response.Current()

current_temperature_2m = current.Variables(0).Value()

current_relative_humidity_2m = current.Variables(1).Value()

current_precipitation = current.Variables(2).Value()

current_wind_speed_10m = current.Variables(3).Value()

print(f"Current time {current.Time()}")

print(f"Current temperature_2m {current_temperature_2m}")
print(f"Current relative_humidity_2m {current_relative_humidity_2m}")
print(f"Current precipitation {current_precipitation}")
print(f"Current wind_speed_10m {current_wind_speed_10m}")

```

Data Source

Open-Meteo weather forecast APIs use weather models from multiple national weather providers. For each location worldwide, the best models will be combined to provide the best possible forecast.

Weather models cover different geographic areas at different resolutions and provide different weather variables. Depending on the model, data have been interpolated to hourly values or not all weather variables are available. With the drop down **Weather models** (just below the hourly variables), you can select and compare individual weather models.

Weather	National Weather	Origin	Resolution	Forecast	Update
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You can find the update timings in the [model updates documentation](#).

Model	Provider	Country		Length	frequency
ICON	Deutscher Wetterdienst (DWD)	Germany	2 - 11 km	7.5 days	Every 3 hours
GFS & HRRR	NOAA	United States	3 - 25 km	16 days	Every hour
ARPEGE & AROME	Météo-France	France	1 - 25 km	4 days	Every hour
IFS & AIFS	ECMWF	European Union	25 km	15 days	Every 6 hours
UKMO	UK Met Office	United Kingdom	2 - 10 km	7 days	Every hour
MSM & GSM	JMA	Japan	5 - 55 km	11 days	Every 3 hours
MET Nordic	MET Norway	Norway	1 km	2.5 days	Every hour
HARMONIE	KNMI	Netherlands	2 km	2.5 days	Every hour
HARMONIE	DMI	Denmark	2 km	2.5 days	Every 3 hours
GEM	Canadian Weather Service	Canada	2.5 km	10 days	Every 6 hours
GFS GRAPES	China Meteorological Administration (CMA)	China	15 km	10 days	Every 6 hours
ACCESS-G	Australian Bureau of Meteorology (BOM)	Australia	15 km	10 days	Every 6 hours
COSMO 2I & 5M	AM ARPAE ARPAP	Italy	2 km	3 days	Every 3 hours

API Documentation

The API endpoint `/v1/forecast` accepts a geographical coordinate, a list of weather variables and responds with a JSON hourly weather forecast for 7 days. Time always starts at 0:00 today and

contains 168 hours. If `&forecast_days=16` is set, up to 16 days of forecast can be returned. All URL parameters are listed below:

Parameter	Format	Required	Default	Description
latitude, longitude	Floating point	Yes		Geographical WGS84 coordinates of the location. Multiple coordinates can be comma separated. E.g. <code>&latitude=52.52,48.85&longitude=13.41</code> To return data for multiple locations the output changes to a list of structures. CSV and XLSX formats add a column <code>location</code> to the output.
elevation	Floating point	No		The elevation used for statistical downsampling. Per default, a 90 meter digital elevation is used . You can manually set the elevation to match mountain peaks. If <code>&elevation=nan</code> is specified, downsampling can be disabled and the API uses the average grid-cell height. For multiple locations, elevation can also be comma separated.
hourly	String array	No		A list of weather variables which should be returned. Values can be comma separated. Multiple <code>&hourly=</code> parameter in the URL can be used.
daily	String array	No		A list of daily weather variable aggregations which should be returned. Values can be comma separated, or multiple <code>&daily=</code> parameter in the URL can be used. If daily weather variables are specified, parameter <code>timezone</code> is required.
current	String array	No		A list of weather variables to get current conditions.
temperature_unit	String	No	celsius	If <code>fahrenheit</code> is set, all temperature values are converted to Fahrenheit.
wind_speed_unit	String	No	kmh	Other wind speed units: <code>ms</code> , <code>mph</code> , <code>kn</code>

Parameter	Format	Required	Default	Description
precipitation_unit	String	No	mm	Other precipitation amount units: inch
timeformat	String	No	iso8601	If format <code>unixtime</code> is selected, all time are returned in UNIX epoch time in sec. Please note that all timestamp are in GMT. For daily values with unix timestamps, you have to apply <code>utc_offset_seconds</code> again to get correct date.
timezone	String	No	GMT	If <code>timezone</code> is set, all timestamps are returned as local-time and data is returned starting at 00:00 local-time. Any time zone name from the time zone database is supported. If <code>auto</code> is set as a time zone, coordinates will be automatically resolved to the local time zone. For multiple coordinates, a comma separated list of timezones can be specified.
past_days	Integer (0-92)	No	0	If <code>past_days</code> is set, yesterday or the day before yesterday data are also returned.
forecast_days	Integer (0-16)	No	7	Per default, only 7 days are returned. Up to 16 days of forecast are possible.
forecast_hours forecast_minutely_15 past_hours past_minutely_15	Integer (>0)	No		Similar to <code>forecast_days</code> , the number of timesteps of hourly and 15-minutely data is controlled. Instead of using the current time as a reference, the current hour or the current 15-minute time-step is used.
start_date end_date	String (yyyy-mm-dd)	No		The time interval to get weather data. Both must be specified as an ISO8601 date (e.g. <code>2022-06-30</code>).
start_hour end_hour start_minutely_15 end_minutely_15	String (yyyy-mm-ddThh:mm)	No		The time interval to get weather data for hourly or 15 minutely data. Time must be specified as an ISO8601 date (e.g. <code>2022-06-30T12:00</code>).

Parameter	Format	Required	Default	Description
models	String array	No	auto	Manually select one or more weather models. Per default, the best suitable weather model will be combined.
cell_selection	String	No	land	Set a preference how grid-cells are selected. The default 'land' finds a suitable grid-cell on land with similar elevation to the requested coordinates using a 90-meter digital elevation model . 'sea' prefers grid-cells on sea. 'nearest' selects the nearest possible grid-cell.
apikey	String	No		Only required to commercial use to access reserved API resources for customers. The server URL requires the prefix 'customer=' and pricing for more information.

Additional optional URL parameters will be added. For API stability, no required parameters will be added in the future!

Hourly Parameter Definition

The parameter '&hourly=' accepts the following values. Most weather variables are given as an instantaneous value for the indicated hour. Some variables like precipitation are calculated from the preceding hour as an average or sum.

Variable	Valid time	Unit	Description
temperature_2m	Instant	°C (°F)	Air temperature at 2 meters above ground
relative_humidity_2m	Instant	%	Relative humidity at 2 meters above ground
dew_point_2m	Instant	°C (°F)	Dew point temperature at 2 meters above ground
apparent_temperature	Instant	°C (°F)	Apparent temperature is the perceived feels-like temperature combining wind chill factor, relative

Variable	Valid time	Unit	Description
			humidity and solar radiation
pressure_msl surface_pressure	Instant	hPa	Atmospheric air pressure reduced to mean sea level (msl) or pressure at surface. Typically pressure on mean sea level is used in meteorology. Surface pressure gets lower with increasing elevation.
cloud_cover	Instant	%	Total cloud cover as an area fraction
cloud_cover_low	Instant	%	Low level clouds and fog up to 3 km altitude
cloud_cover_mid	Instant	%	Mid level clouds from 3 to 8 km altitude
cloud_cover_high	Instant	%	High level clouds from 8 km altitude
wind_speed_10m wind_speed_80m wind_speed_120m wind_speed_180m	Instant	km/h (mph, m/s, knots)	Wind speed at 10, 80, 120 or 180 meters above ground. Wind speed on 10 meters is the standard level.
wind_direction_10m wind_direction_80m wind_direction_120m wind_direction_180m	Instant	°	Wind direction at 10, 80, 120 or 180 meters above ground
wind_gusts_10m	Preceding hour max	km/h (mph, m/s, knots)	Gusts at 10 meters above ground as a maximum of the preceding hour
shortwave_radiation	Preceding hour mean	W/m ²	Shortwave solar radiation as average of the preceding hour. This is equal to the total global horizontal irradiation
direct_radiation direct_normal_irradiance	Preceding hour mean	W/m ²	Direct solar radiation as average of the preceding hour on the horizontal plane and the normal plane (perpendicular to the sun)

Variable	Valid time	Unit	Description
diffuse_radiation	Preceding hour mean	W/m ²	Diffuse solar radiation as average of the preceding hour
global_tilted_irradiance	Preceding hour mean	W/m ²	Total radiation received on a tilted pane as average of the preceding hour. The calculation is assuming a fixed albedo of 20% and in isotropic sky. Please specify tilt and azimuth parameter. Tilt ranges from 0° to 90° and is typically around 45°. Azimuth should be close to 0° (0° south, -90° east, 90° west). If azimuth is set to "nan", the calculation assumes a horizontal tracker. If tilt is set to "nan", it is assumed that the panel has a vertical tracker. If both are set to "nan", a bi-axial tracker is assumed.
vapour_pressure_deficit	Instant	kPa	Vapour Pressure Deficit (VPD) in kilopascal (kPa). For high VPD (>1.6), water transpiration of plants increases. For low VPD (<0.4), transpiration decreases
cape	Instant	J/kg	Convective available potential energy. See Wikipedia .
evapotranspiration	Preceding hour sum	mm (inch)	Evapotranspration from land surface and plants that weather models assumes for this location. Available soil water is considered. 1 mm evapotranspiration per hour equals 1 liter of water per spare meter.
et0_fao_evapotranspiration	Preceding hour sum	mm (inch)	ET ₀ Reference Evapotranspiration of a well watered grass field. Based on FAO-56 Penman-Monteith equations ET ₀ is calculated from

Variable	Valid time	Unit	Description
			temperature, wind speed, humidity and solar radiation. Unlimited soil water is assumed. ET_0 is commonly used to estimate the required irrigation for plants.
precipitation	Preceding hour sum	mm (inch)	Total precipitation (rain, showers, snow) sum of the preceding hour
snowfall	Preceding hour sum	cm (inch)	Snowfall amount of the preceding hour in centimeters. For the water equivalent in millimeter, divide by 7. E.g. 7 cm snow = 10 mm precipitation water equivalent
precipitation_probability	Preceding hour probability	%	Probability of precipitation with more than 0.1 mm of the preceding hour. Probability is based on ensemble weather models with 0.25° (~27 km) resolution. 30 different simulations are computed to better represent future weather conditions.
rain	Preceding hour sum	mm (inch)	Rain from large scale weather systems of the preceding hour in millimeter
showers	Preceding hour sum	mm (inch)	Showers from convective precipitation in millimeters from the preceding hour
weather_code	Instant	WMO code	Weather condition as a numeric code. Follow WMO weather interpretation codes. See table below for details.
snow_depth	Instant	meters	Snow depth on the ground

Variable	Valid time	Unit	Description
freezing_level_height	Instant	meters	Altitude above sea level of the 0°C level
visibility	Instant	meters	Viewing distance in meters. Influenced by low clouds, humidity and aerosols.
soil_temperature_0cm soil_temperature_6cm soil_temperature_18cm soil_temperature_54cm	Instant	°C (°F)	Temperature in the soil at 0, 6, 18 and 54 cm depths. 0 cm is the surface temperature on land or water surface temperature on water.
soil_moisture_0_to_1cm soil_moisture_1_to_3cm soil_moisture_3_to_9cm soil_moisture_9_to_27cm soil_moisture_27_to_81cm	Instant	m³/m³	Average soil water content as volumetric mixing ratio at 0-1, 1-3, 3-9, 9-27 and 27-81 cm depths.
is_day	Instant	Dimensionless	1 if the current time step has daylight, 0 at night.

15-Minutely Parameter Definition

The parameter `&minutely_15=` can be used to get 15-minutely data. This data is based on NOAA HRRR model for North America and DWD ICON-D2 and Météo-France AROME model for Central Europe. If 15-minutely data is requested for other regions data is interpolated from 1-hourly to 15-minutely.

15-minutely data can be requested for other weather variables that are available for hourly data, but will use interpolation.

Variable	Valid time	Unit	ICON-		
			HRRR	D2	AROME
temperature_2m	Instant	°C (°F)	x		x
relative_humidity_2m	Instant	%	x		x

Variable	Valid time	Unit	ICON-		
			HRRR	D2	AROME
dew_point_2m	Instant	°C (°F)	x		x
apparent_temperature	Instant	°C (°F)	x		x
shortwave_radiation	Preceding 15 minutes mean	W/m²	x	x	
direct_radiation direct_normal_irradiance	Preceding 15 minutes mean	W/m²	x	x	
global_tilted_irradiance global_tilted_irradiance_instant	Preceding 15 minutes mean	W/m²	x	x	
diffuse_radiation	Preceding 15 minutes mean	W/m²	x	x	
sunshine_duration	Preceding 15 minutes sum	seconds	x	x	
lightning_potential	Instant	J/kg		x	
precipitation	Preceding 15 minutes sum	mm (inch)	x	x	x
snowfall	Preceding 15 minutes sum	cm (inch)	x	x	x
rain	Preceding 15 minutes sum	mm (inch)	x	x	x
showers	Preceding 15 minutes sum	mm (inch)		x	
snowfall_height	Instant	meters		x	
freezing_level_height	Instant	meters		x	
cape	Instant	J/kg	x	x	x
wind_speed_10m wind_speed_80m	Instant	km/h (mph, m/s, knots)	x		x

Variable	Valid time	Unit	ICON-		
			HRRR	D2	AROME
wind_direction_10m wind_direction_80m	Instant	°	x		x
wind_gusts_10m	Preceding 15 min max	km/h (mph, m/s, knots)	x		
visibility	Instant	meters	x		x
weather_code	Instant	WMO code	x	x	

Pressure Level Variables

Pressure level variables do not have fixed altitudes. Altitude varies with atmospheric pressure. 1000 hPa is roughly between 60 and 160 meters above sea level. Estimated altitudes are given below. Altitudes are in meters above sea level (not above ground). For precise altitudes, `geopotential_height` can be used.

Level (hPa)	1000	975	950	925	900	850	800	700	600	500	400	300	250	200
Altitude	110 m	320 m	500 m	800 m	1000 m	1500 m	1900 m	3 km	4.2 km	5.6 km	7.2 km	9.2 km	10.4 km	11.8 km

All pressure level have valid times of the indicated hour (instant).

Variable	Unit	Description
temperature_1000hPa temperature_975hPa, ...	°C (°F)	Air temperature at the specified pressure level. Air temperatures decrease linearly with pressure.
relative_humidity_1000hPa relative_humidity_975hPa, ...	%	Relative humidity at the specified pressure level.
dew_point_1000hPa dew_point_975hPa, ...	°C (°F)	Dew point temperature at the specified pressure level.

Variable	Unit	Description
cloud_cover_1000hPa cloud_cover_975hPa, ...	%	Cloud cover at the specified pressure level. Cloud cover is approximated based on relative humidity using Sundqvist et al. (1989) . It may not match perfectly with low, mid and high cloud cover variables.
wind_speed_1000hPa wind_speed_975hPa, ...	km/h (mph, m/s, knots)	Wind speed at the specified pressure level.
wind_direction_1000hPa wind_direction_975hPa, ...	°	Wind direction at the specified pressure level.
geopotential_height_1000hPa geopotential_height_975hPa, ...	meter	Geopotential height at the specified pressure level. This can be used to get the correct altitude in meter above sea level of each pressure level. Be carefull not to mistake it with altitude above ground.

Daily Parameter Definition

Aggregations are a simple 24 hour aggregation from hourly values. The parameter `&daily=` accepts the following values:

Variable	Unit	Description
temperature_2m_max temperature_2m_min	°C (°F)	Maximum and minimum daily air temperature at 2 meters above ground
apparent_temperature_max apparent_temperature_min	°C (°F)	Maximum and minimum daily apparent temperature
precipitation_sum	mm	Sum of daily precipitation (including rain, showers and snowfall)
rain_sum	mm	Sum of daily rain
showers_sum	mm	Sum of daily showers
snowfall_sum	cm	Sum of daily snowfall

Variable	Unit	Description
precipitation_hours	hours	The number of hours with rain
precipitation_probability_max precipitation_probability_min precipitation_probability_mean	%	Probability of precipitation
weather_code	WMO code	The most severe weather condition on a given day
sunrise sunset	iso8601	Sun rise and set times
sunshine_duration	seconds	The number of seconds of sunshine per day is determined by calculating direct normalized irradiance exceeding 120 W/m ² , following the WMO definition. Sunshine duration will consistently be less than daylight duration due to dawn and dusk.
daylight_duration	seconds	Number of seconds of daylight per day
wind_speed_10m_max wind_gusts_10m_max	km/h (mph, m/s, knots)	Maximum wind speed and gusts on a day
wind_direction_10m_dominant	°	Dominant wind direction
shortwave_radiation_sum	MJ/m ²	The sum of solar radiation on a given day in Megajoules
et0_fao_evapotranspiration	mm	Daily sum of ET ₀ Reference Evapotranspiration of a well watered grass field
uv_index_max uv_index_clear_sky_max	Index	Daily maximum in UV Index starting from 0. uv_index_clear_sky_max assumes cloud free conditions. Please follow the official WMO guidelines for ultraviolet index.

JSON Return Object

On success a JSON object will be returned.

```
"latitude": 52.52,
"longitude": 13.419,
"elevation": 44.812,
"generationtime_ms": 2.2119,
"utc_offset_seconds": 0,
"timezone": "Europe/Berlin",
"timezone_abbreviation": "CEST",
"hourly": {
  "time": ["2022-07-01T00:00", "2022-07-01T01:00", "2022-07-01T02:00", ...],
  "temperature_2m": [13, 12.7, 12.7, 12.5, 12.5, 12.8, 13, 12.9, 13.3, ...]
},
"hourly_units": {
  "temperature_2m": "°C"
}
```

Parameter	Format	Description
latitude, longitude	Floating point	WGS84 of the center of the weather grid-cell which was used to generate this forecast. This coordinate might be a few kilometers away from the requested coordinate.
elevation	Floating point	The elevation from a 90 meter digital elevation model. This effects which grid-cell is selected (see parameter cell_selection). Statistical downscaling is used to adapt weather conditions for this elevation. This elevation can also be controlled with the query parameter elevation . If &elevation=nan is specified, all downscaling is disabled and the averge grid-cell elevation is used.
generationtime_ms	Floating point	Generation time of the weather forecast in milliseconds. This is mainly used for performance monitoring and improvements.
utc_offset_seconds	Integer	Applied timezone offset from the &timezone= parameter.
timezone timezone_abbreviation	String	Timezone identifier (e.g. Europe/Berlin) and abbreviation (e.g. CEST)

Parameter	Format	Description
hourly	Object	For each selected weather variable, data will be returned as a floating point array. Additionally a time array will be returned with ISO8601 timestamps.
hourly_units	Object	For each selected weather variable, the unit will be listed here.
daily	Object	For each selected daily weather variable, data will be returned as a floating point array. Additionally a time array will be returned with ISO8601 timestamps.
daily_units	Object	For each selected daily weather variable, the unit will be listed here.

Errors

In case an error occurs, for example a URL parameter is not correctly specified, a JSON error object is returned with a HTTP 400 status code.

```
"error": true,  
"reason": "Cannot initialize WeatherVariable from invalid String value tempeture_2m for key
```

Weather variable documentation

WMO Weather interpretation codes (WW)

Code	Description
------	-------------

Code	Description
0	Clear sky
1, 2, 3	Mainly clear, partly cloudy, and overcast
45, 48	Fog and depositing rime fog
51, 53, 55	Drizzle: Light, moderate, and dense intensity
56, 57	Freezing Drizzle: Light and dense intensity
61, 63, 65	Rain: Slight, moderate and heavy intensity
66, 67	Freezing Rain: Light and heavy intensity
71, 73, 75	Snow fall: Slight, moderate, and heavy intensity
77	Snow grains
80, 81, 82	Rain showers: Slight, moderate, and violent
85, 86	Snow showers slight and heavy
95 *	Thunderstorm: Slight or moderate
96, 99 *	Thunderstorm with slight and heavy hail

(*) Thunderstorm forecast with hail is only available in Central Europe

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