

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 location. Multiple coordinates can be separated. E.g. <code>&latitude=52.52,48.85&longitude=</code> To return data for multiple locations, the output changes to a list of structures. For JSON and XLSX formats add a column <code>location</code> .
elevation	Floating point	No		The elevation used for statistical downscaling. Per default, a 90 meter digital elevation model is used. You can manually set the elevation to correctly match mountain peaks. If <code>&elevation=nan</code> is specified, downscaling will be disabled and the API uses the actual grid-cell height. For multiple locations, the elevation can also be comma separated.
hourly	String array	No		A list of weather variables which should be returned. Values can be comma separated or 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 weather variables are specified, <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>

Parameter	Format	Required	Default	Description
				kn
precipitation_unit	String	No	mm	Other precipitation amount units: i
timeformat	String	No	iso8601	If format <code>unixtime</code> is selected, all ti are returned in UNIX epoch time in Please note that all timestamp are i For daily values with unix timestamp apply <code>utc_offset_seconds</code> again to correct date.
timezone	String	No	GMT	If <code>timezone</code> is set, all timestamps a returned as local-time and data is r starting at 00:00 local-time. Any tir name from the time zone database supported. If <code>auto</code> is set as a time coordinates will be automatically re the local time zone. For multiple co a comma separated list of timezon specified.
past_days	Integer (0- 92)	No	0	If <code>past_days</code> is set, yesterday or th before yesterday data are also retu
forecast_days	Integer (0- 16)	No	7	Per default, only 7 days are returne 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 numb timesteps of hourly and 15-minutel controlled. Instead of using the cur a reference, the current hour or the 15-minute time-step is used.
start_date end_date	String (yyyy-mm- dd)	No		The time interval to get weather da must be specified as an ISO8601 d 2022-06-30).
start_hour end_hour start_minutely_15 end_minutely_15	String (yyyy-mm- ddThh:mm)	No		The time interval to get weather da hourly or 15 minutely data. Time m specified as an ISO8601 date (e.g. 30T12:00).
models	String array	No	auto	Manually select one or more weath Per default, the best suitable weath

Parameter	Format	Required	Default	Description
				will be combined.
cell_selection	String	No	land	Set a preference how grid-cells are selected. The default land finds a suitable grid-cell with similar elevation to the requested coordinates using a 90-meter digital elevation model. sea prefers grid-cells on sea. If not specified, the API selects the nearest possible grid-cell.
apikey	String	No		Only required to commercial use to access reserved API resources for custom server URL requires the prefix custom_server_url. See 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 humidity and solar radiation
pressure_msl surface_pressure	Instant	hPa	Atmospheric air pressure reduced to mean sea level (msl) or pressure at surface. Typically

Variable	Valid time	Unit	Description
			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)
diffuse_radiation	Preceding hour mean	W/m ²	Diffuse solar radiation as average of the preceding hour

Variable	Valid time	Unit	Description
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)	Evapotranspiration 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 temperature, wind speed, humidity and solar radiation. Unlimited soil water is

Variable	Valid time	Unit	Description
			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
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,

Variable	Valid time	Unit	Description
			humidity and aerosols. Maximum visibility is approximately 24 km.
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
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	

Variable	Valid time	Unit	HRRR	ICON-D2	AROME
direct_radiation direct_normal_irradiance	Preceding 15 minutes mean	W/m ²	x	x	
global_tilted_irradiance global_tilted_irradiance_instant	Preceding 15 minutes mean	W/m ²	x	x	
diffuse_radiation	Preceding 15 minutes mean	W/m ²	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
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	150	100	70	50	30
Altitude	110	320	500	800	1000	1500	1900	3	4.2	5.6	7.2	9.2	10.4	11.8	13.5	15.8	17.7	19.3	22
	m	m	m	m	m	m	m	km	km	km	km	km	km	km	km	km	km	km	km

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

Variable	Unit	Description
<code>temperature_1000hPa</code> <code>temperature_975hPa, ...</code>	°C (°F)	Air temperature at the specified pressure level. Air temperatures decrease linearly with pressure.
<code>relative_humidity_1000hPa</code> <code>relative_humidity_975hPa, ...</code>	%	Relative humidity at the specified pressure level.
<code>dew_point_1000hPa</code> <code>dew_point_975hPa, ...</code>	°C (°F)	Dew point temperature at the specified pressure level.
<code>cloud_cover_1000hPa</code> <code>cloud_cover_975hPa, ...</code>	%	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.
<code>wind_speed_1000hPa</code> <code>wind_speed_975hPa, ...</code>	km/h (mph, m/s, knots)	Wind speed at the specified pressure level.
<code>wind_direction_1000hPa</code> <code>wind_direction_975hPa, ...</code>	°	Wind direction at the specified pressure level.
<code>geopotential_height_1000hPa</code> <code>geopotential_height_975hPa, ...</code>	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
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

Variable	Unit	Description
wind_direction_10m_dominant	°	Dominant wind direction
shortwave_radiation_sum	MJ/m²	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.

Parameter	Format	Description
elevation	Floating point	The elevation from a 90 meter digital elevation model. This effects which grid-cell is selected (see parameter <code>cell_selection</code>). Statistical downscaling is used to adapt weather conditions for this elevation. This elevation can also be controlled with the query parameter <code>elevation</code> . If <code>&elevation=nan</code> is specified, all downscaling is disabled and the average 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 <code>&timezone=</code> parameter.
timezone timezone_abbreviation	String	Timezone identifier (e.g. <code>Europe/Berlin</code>) and abbreviation (e.g. <code>CEST</code>)
hourly	Object	For each selected weather variable, data will be returned as a floating point array. Additionally a <code>time</code> 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 <code>time</code> 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 temperture_2"
```

Weather variable documentation

WMO Weather interpretation codes (WW)

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

Code	Description
96, 99 *	Thunderstorm with slight and heavy hail

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

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- Flood API

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- Historical Weather API
- ECMWF API
- GFS & HRRR Forecast API
- Météo-France API
- DWD ICON API
- GEM API
- JMA API
- Met Norway API

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