



Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Infrastructuur en Waterstaat

Unified and uniform access to European *in-situ* climate observations via the MeteoGate platform

15th EUMETNET Data management
workshop
2025-11-05

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Obtaining European climate data

- > From national MetServices
- > Can be quite a hassle
 - Multiple sources
 - Multiple formats



European Climate
Assessment &
Dataset

Time series



E-OBS

Gridded

- > Copy of source data
- > Can be outdated
- > Limited in (meta)data



RODEO

The provision of open access to public meteorological data and development of shared federated data infrastructure for the development of information products and services.



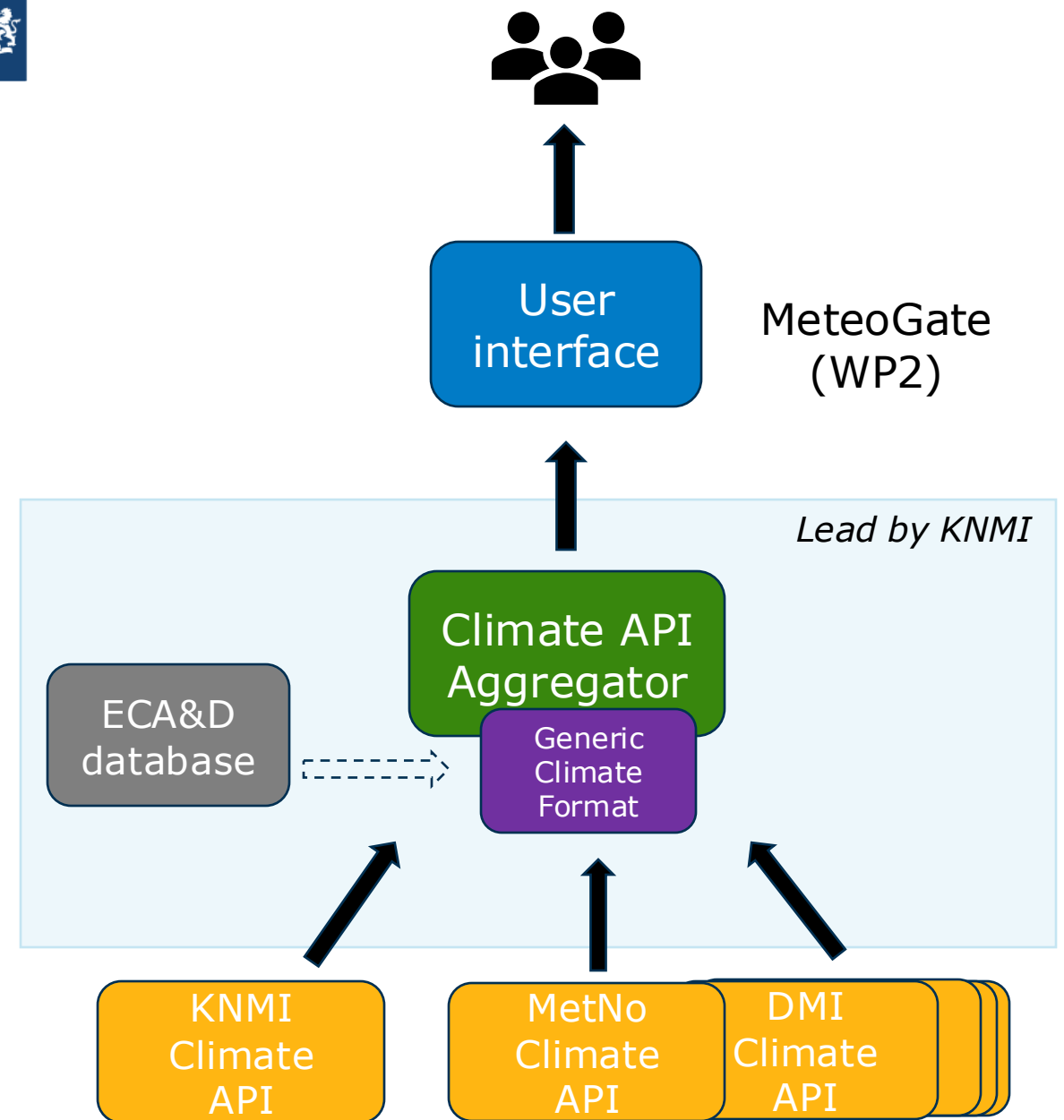
Co-funded by
the European Union

- > High Value Dataset act
 - EU & EUMETNET
- > Work Package 5 (WP5)
 - in-situ meteorological surface observations
 - Climatological timeseries
- > By and for National MetServices
 - 9 front runners
 - KNMI in lead
- > Work in Progress





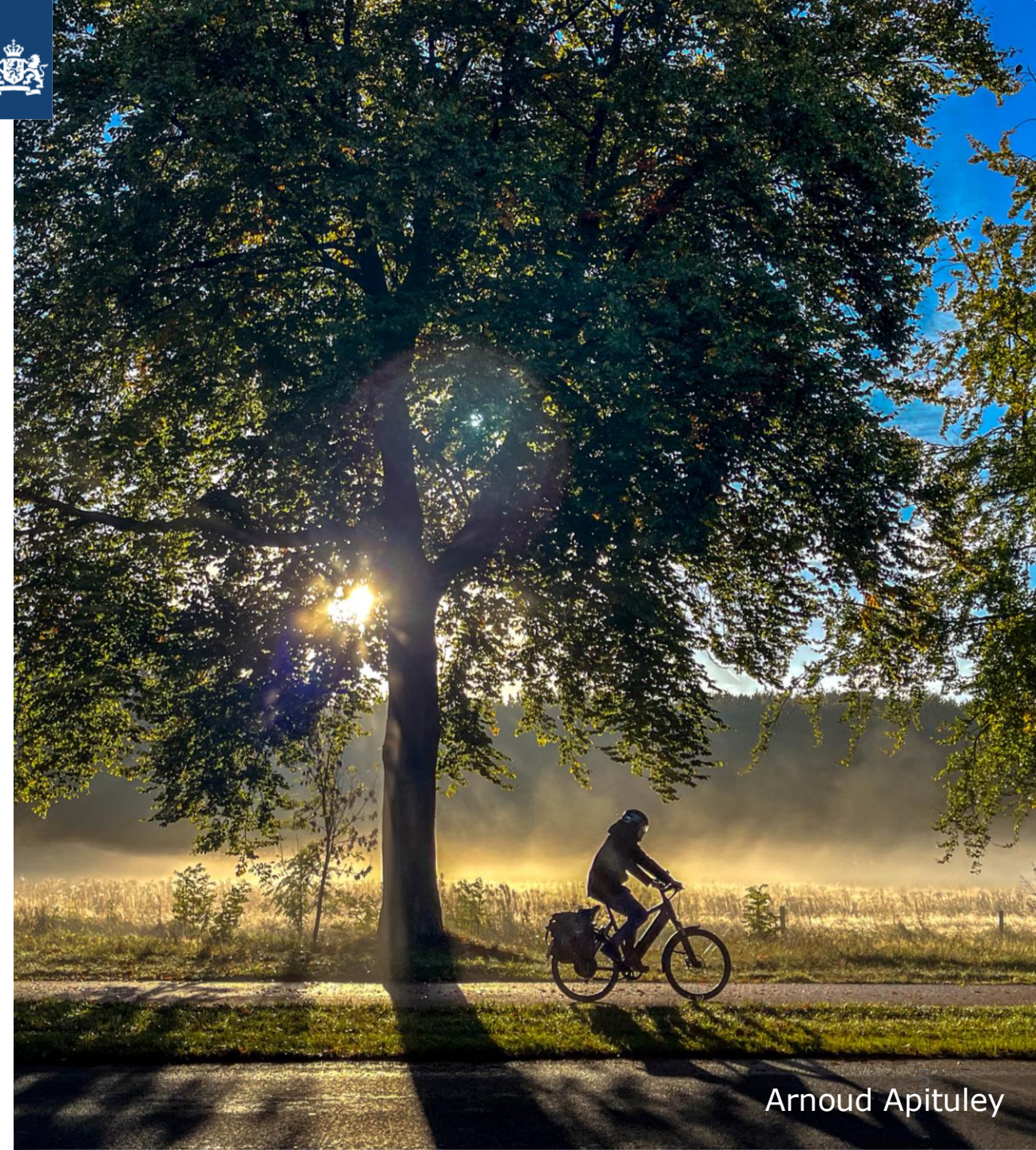
Architecture RODEO WP5





Generic Climate Format

- › **Variables:** Temperature, precipitation, wind pressure, surface radiation (at *minimum*)
- › **Granularity:** Daily station data (at *minimum*)
- › **Derived data:** Climate Indices (icclim)
- › **Metadata:** CF-conventions
- › **Quality flags:** CDM-OBS
- › **Open:** CC-0 or CC-BY-4.0
- › **API:** OGC API EDR
- › **Output:** CoverageJSON or NetCDF





CF conventions



Minimal set of variables

id	label	description	data-type	unit	standard_name	method	duration	level
DDVEC	Mean wind direction	Daily vector mean wind direction, representative for 10 m, in degrees. Wind direction has been weighted with wind speed during aggregation. 0=calm/variable	float	degree	wind_from_direction	mean	-P1D	10
FG	Mean wind speed	Daily mean windspeed, representative for 10 m, in m/s	float	m/s	wind_speed	mean	-P1D	10
TG	Mean temperature	Daily mean air temperature, measured at 1.5 m, in degrees Celsius	float	°C	air_temperature	mean	-P1D	1.5
TN	Minimum temperature	Daily minimum temperature, measured at 1.5 m, in degrees Celsius	float	°C	air_temperature	minimum	-P1D	1.5
TX	Maximum temperature	Daily maximum temperature, measured at 1.5 m, in degrees Celsius	float	°C	air_temperature	maximum	-P1D	1.5
Q	Global solar radiation	Daily global solar radiation, in J/cm ²	float	J/cm ²	integral_wrt_time_of_surface_downwelling_shortwave_flux_in_air	sum	-P1D	
RH	Precipitation amount	Daily precipitation amount, in mm;	float	mm	precipitation_amount	sum	-P1D	
PG	Mean sea level pressure	Daily mean sea level pressure, in hPa	float	hPa	air_pressure_at_mean_sea_level	mean	-P1D	
UG	Mean relative atmospheric humidity	Daily mean relative atmospheric humidity	float	%	relative_humidity	mean	-P1D	

More information: [EUMETNET - Metocean EDR Profile](#)

QUDT

Relative to ground



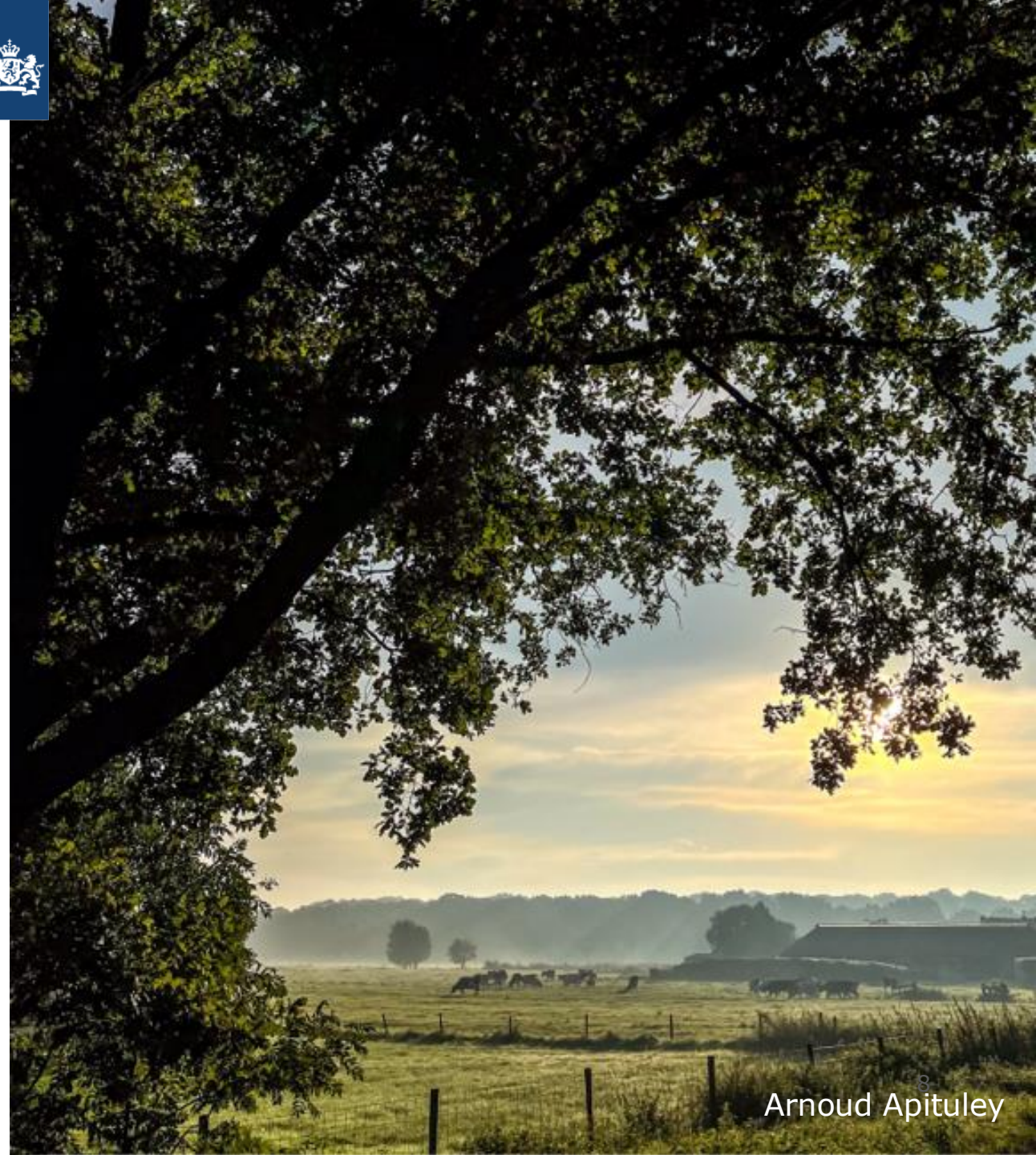
id	label	description	standard_name	level	comment	unit_label	unit_data	unit_sym	unit_sym	unit_symbol_description	observedProperty
DDFHX	Wind direction in hourly interval FHX	Wind direction in hourly interval in which FHX was measured				degree	float	°		https://qudt.org/vocab/unit/DEG	https://vocab.nerc.a
DDVEC	Mean wind direction	Daily vector mean wind direction, representative for 10 meters, in degrees. Wind direction has	wind_from_direction	10		degree	float	°		https://qudt.org/vocab/unit/DEG	https://vocab.nerc.a
DR	Precipitation duration	Daily precipitation duration, in hours				hour	float	h		https://qudt.org/vocab/unit/HR	
EEG	Mean vapor pressure	Daily mean vapor pressure, in hectopascal	water_vapor_partial_pressure_in_air	*1		hectopasc	float	hPa		https://qudt.org/vocab/unit/HectoPA	https://vocab.nerc.a
EV24	Potential evapotranspiration (Makkink)	Potential evapotranspiration (Makkink)	water_potential_evapotranspiration_amount			millimeter	float	mm		https://qudt.org/vocab/unit/MillIM	https://vocab.nerc.a
FG	Mean wind speed	Daily mean wind speed, representative for 10 meters, in meters per second	wind_speed	10		meter per	float	m/s		https://qudt.org/vocab/unit/M-PER-S	https://vocab.nerc.a
FHN	Minimum hourly wind speed	Daily minimum hourly wind speed, representative for 10 meters, in meters per second	wind_speed	10		meter per	float	m/s		https://qudt.org/vocab/unit/M-PER-S	https://vocab.nerc.a
FHNH	Hourly interval in which FHN was measured	Hourly interval in which FHN was measured				unitless	integer	—		https://qudt.org/vocab/unit/UNITLESS	
FHVEC	Vector mean wind speed	Daily vector mean wind speed, representative for 10 meters, in meters per second	wind_speed	10		meter per	float	m/s		https://qudt.org/vocab/unit/M-PER-S	https://vocab.nerc.a
FHX	Maximum hourly wind speed	Daily maximum hourly wind speed, representative for 10 meters, in meters per second	wind_speed	10		meter per	float	m/s		https://qudt.org/vocab/unit/M-PER-S	https://vocab.nerc.a
FHXH	Hourly interval in which FHX was measured	Hourly interval in which FHX was measured				unitless	integer	—		https://qudt.org/vocab/unit/UNITLESS	
FXX	Maximum wind gust	Daily maximum wind gust, representative for 10 meters, in meters per second. Highest 3 seco	wind_speed_of_gust	10		meter per	float	m/s		https://qudt.org/vocab/unit/M-PER-S	https://vocab.nerc.a
FXXH	Hourly interval in which FXX was measured	Hourly interval in which FXX was measured				unitless	integer	—		https://qudt.org/vocab/unit/UNITLESS	
NG	Mean cloud cover	Daily mean cloud cover, in okta. 9=sky invisible	cloud_area_fraction	*2		okta	integer	okta		https://qudt.org/vocab/unit/OKTA	https://vocab.nerc.a
PG	Mean sea level pressure	Daily mean sea level pressure, in hectopascal	air_pressure_at_mean_sea_level	*1		hectopasc	float	hPa		https://qudt.org/vocab/unit/HectoPA	https://vocab.nerc.a
PN	Minimum hourly sea level pressure	Daily minimum mean sea level pressure, in hectopascal	air_pressure_at_mean_sea_level	*1		hectopasc	float	hPa		https://qudt.org/vocab/unit/HectoPA	https://vocab.nerc.a
PNH	Hourly interval in which PN was measured	Hourly interval in which PN was measured			*1	unitless	integer	—		https://qudt.org/vocab/unit/UNITLESS	
PX	Maximum hourly sea level pressure	Daily maximum hourly mean sea level pressure, in hectopascal	air_pressure_at_mean_sea_level			hectopasc	float	hPa		https://qudt.org/vocab/unit/HectoPA	https://vocab.nerc.a
PXH	Hourly interval in which PX was measured	Hourly interval in which PX was measured				unitless	integer	—		https://qudt.org/vocab/unit/UNITLESS	
Q	Global solar radiation	Daily global solar radiation, in joules per square centimeter	integral_wrt_time_of_surface_downwelling			joule per s	float	J/cm²		https://qudt.org/vocab/unit/J-PER-C	https://vocab.nerc.a
RH	Precipitation amount	Daily precipitation amount, in millimeters; -1 for <0.05 millimeters	precipitation_amount			millimeter	float	mm		https://qudt.org/vocab/unit/MillIM	https://vocab.nerc.a
RHX	Maximum hourly precipitation amount	Daily maximum hourly precipitation amount; -1 for <0.05 millimeters	precipitation_amount			millimeter	float	mm		https://qudt.org/vocab/unit/MillIM	https://vocab.nerc.a
RHXH	Hourly interval in which RHX was measured	Hourly interval in which RHX was measured				unitless	integer	—		https://qudt.org/vocab/unit/UNITLESS	
SP	Percentage of potential sunshine duration	Daily percentage of potential sunshine duration	duration_of_sunshine			percent	float	%		https://qudt.org/vocab/unit/PERCENT	https://vocab.nerc.a
SQ	Sunshine duration	Daily sunshine duration, in hours, calculated from global solar radiation	duration_of_sunshine			hour	float	h		https://qudt.org/vocab/unit/HR	https://vocab.nerc.a
T10N	Minimum air temperature at 10 cm	Daily minimum air temperature at 10 centimeters above surface, in degrees Celsius	air_temperature	0.1		degrees ce	float	°C		https://qudt.org/vocab/unit/DEG_C	https://vocab.nerc.a
T10NH	6-Hourly interval in which T10N was measured	6-hourly interval in which T10N was measured; 6=0-6 UTC; 12=6-12 UTC; 18=12-18 UTC; 24=18-24 UTC				unitless	integer	—		https://qudt.org/vocab/unit/UNITLESS	
TG	Mean temperature	Daily mean air temperature at 1.50 meters, in degrees Celsius	air_temperature	1.5	*1	degrees ce	float	°C		https://qudt.org/vocab/unit/DEG_C	https://vocab.nerc.a
TN	Minimum temperature	Daily minimum air temperature at 1.50 meters, in degrees Celsius	air_temperature	1.5		degrees ce	float	°C		https://qudt.org/vocab/unit/DEG_C	https://vocab.nerc.a
TNH	Hourly interval in which TN was measured	Hourly interval in which TN was measured				unitless	integer	—		https://qudt.org/vocab/unit/UNITLESS	
TX	Maximum temperature	Daily maximum air temperature at 1.50 meters, in degrees Celsius	air_temperature	1.5		degrees ce	float	°C		https://qudt.org/vocab/unit/DEG_C	https://vocab.nerc.a
TXH	Hourly interval in which TX was measured	Hourly interval in which TX was measured				unitless	integer	—		https://qudt.org/vocab/unit/UNITLESS	
TZG	Mean sea temperature	Daily mean sea temperature in degrees Celsius	sea_water_temperature			degrees ce	float	°C		https://qudt.org/vocab/unit/DEG_C	https://vocab.nerc.a
UG	Mean relative atmospheric humidity	Daily mean relative atmospheric humidity	relative_humidity	*1		percent	float	%		https://qudt.org/vocab/unit/PERCENT	https://vocab.nerc.a
UN	Minimum relative atmospheric humidity	Daily minimum relative atmospheric humidity	relative_humidity	*1		percent	float	%		https://qudt.org/vocab/unit/PERCENT	https://vocab.nerc.a
UNH	Hourly interval in which UN was measured	Hourly interval in which UN was measured				unitless	integer	—		https://qudt.org/vocab/unit/UNITLESS	
UX	Maximum relative atmospheric humidity	Daily maximum relative atmospheric humidity	relative_humidity	*1		percent	float	%		https://qudt.org/vocab/unit/PERCENT	https://vocab.nerc.a
UXH	Hourly interval in which UX was measured	Hourly interval in which UX was measured				unitless	integer	—		https://qudt.org/vocab/unit/UNITLESS	

daily variables



Why OGC EDR?

- › HTTPS web API
- › Environmental Data Retrieval
- › OGC standard
 - Open Geospatial Consortium
 - Since 2016
- › Discoverable
- › Filtering in space and time
- › Multiple datasets





How to use an EDR API?

- > Any HTTPS client
 - e.g. from web browsers to Python
- > GUI clients (in development)
 - OpenGeoWeb
 - MeteoGate

Capabilities Essential characteristics of the information available from the API.

GET **/collections** List The Available Collections From The Service

GET **/** Landing Page Of This Api

Collection metadata Description of the information available from the collections

GET **/collections/{collection_id}** List Query Types Supported By The Collection

Collection data queries Data queries available.

GET **/collections/{collection_id}/position** Query End Point For Position Queries O

GET **/collections/{collection_id}/locations** List Available Location Identifiers For

GET **/collections/{collection_id}/locations/{location_id}** Query End Point

GET **/collections/{collection_id}/cube** Query End Point For Cube Queries Of Collecti



CoverageJSON

- > Recommended EDR output
- > A format for publishing geotemporal data (on the web)
 - Time series
 - Gridded
- > Format: JSON
 - Easier than NetCDF?
 - Better than CSV
- > More info:
 - <https://covjson.org/>

```
1▼ {
2  "type": "CoverageCollection",
3  "domainType": "PointSeries",
4▼  "coverages": [
5▼    {
6      "type": "Coverage",
7▼      "domain": {
8          "type": "Domain",
9          "domainType": "PointSeries",
10▼        "axes": {
11▼          "x": {
12▼            "values": [
13              5.1797
14            ]
15          },
16▼          "y": {
17▼            "values": [
18              52.0989
19            ]
20          },
21▼          "t": {
22▼            "values": [
23              "2019-02-22T15:30:00Z"
24            ]
25          }
26        }
27      },
28▼      "ranges": {
29▼        "ta": {
30            "type": "NdArray",
31            "dataType": "float",
32▶            "axisNames": [ ↵ 3 ↵ ],
37▶            "shape": [ ↵ 3 ↵ ],
42▼            "values": [
43              11.2
44            ]
45          }
46        },
```



Servers

<https://api.dataplatform.knmi.nl/edr/v1>

Authorize

Capabilities Essential characteristics of the information available from the API.

10-minute-in-situ-meteorological-observations Near real-time 10-minute automated in-situ ground-based meteorological observations in the Netherlands

daily-in-situ-meteorological-observations-validated Daily, validated and automated in-situ ground-based meteorological observations in the Netherlands

hourly-in-situ-meteorological-observations-validated Hourly, validated and automated in-situ ground-based meteorological observations in the Netherlands

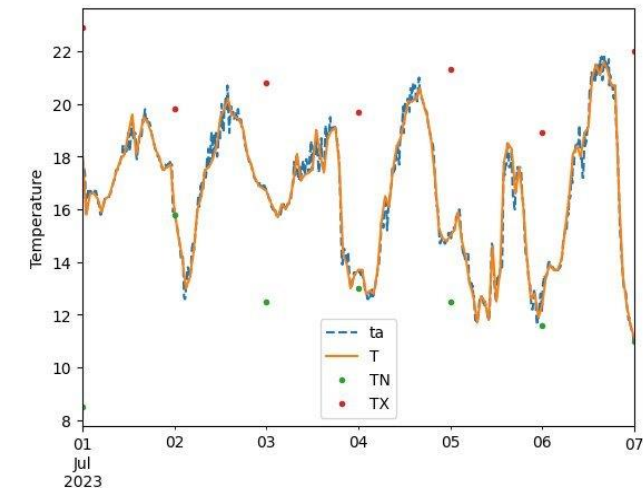
- > 10-minute, hourly and daily collections
 - Updated live
- > Observations since 1901
- > In total 163 variables across 71 stations
- > Fully operational since August
- > <https://developer.dataplatform.knmi.nl/>

```
[38]: ax = ten_minute_df.plot(style='--', y='ta')
      hourly_df.plot(ax=ax, y='T')
      daily_df.plot(style='.', ax=ax, y='TN')
      daily_df.plot(style='.', ax=ax, y='TX')

      ax.set_ylabel("Temperature")

      ax
```

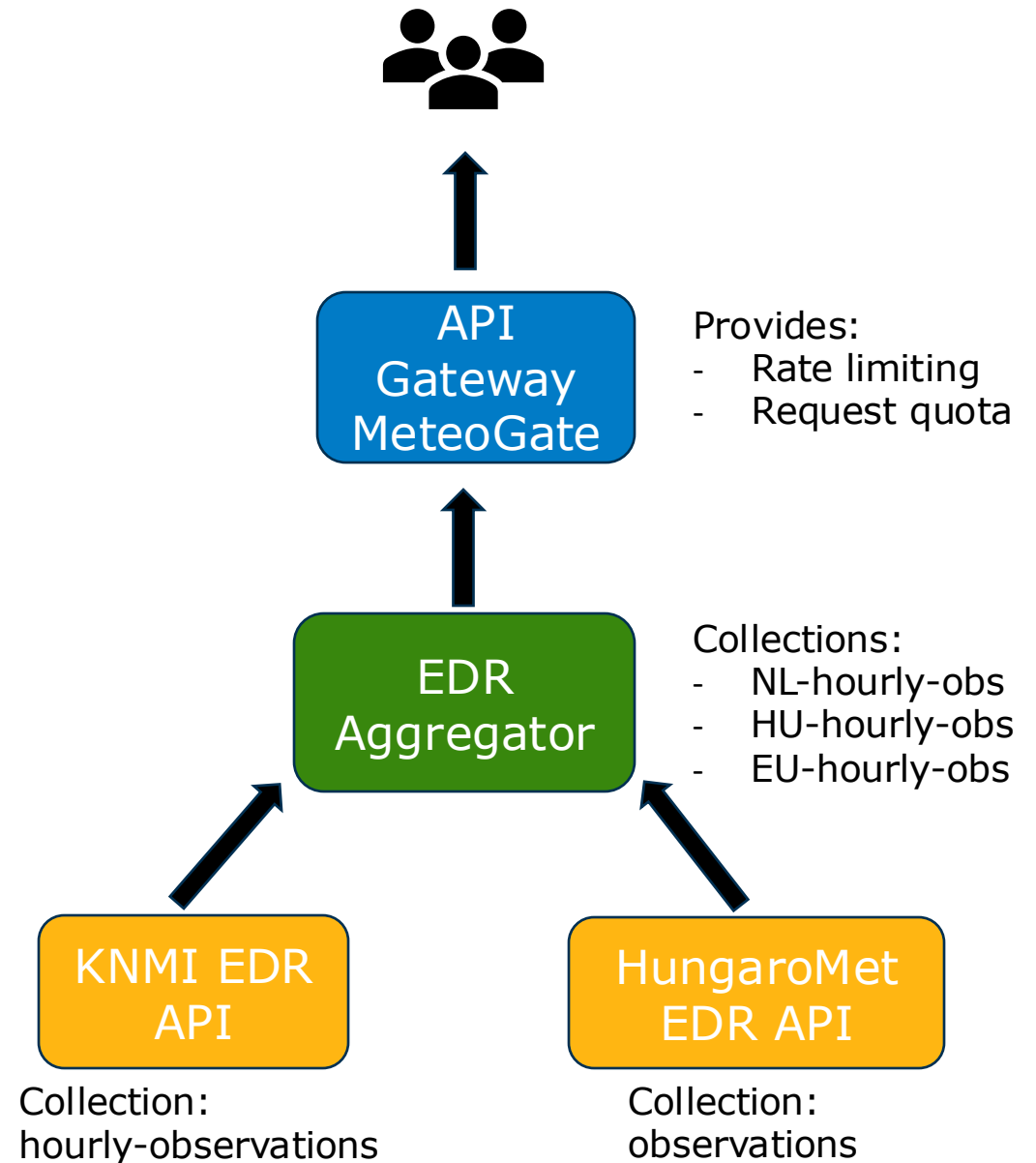
[38]: <Axes: ylabel='Temperature'>





Work in Progress: EDR Aggregator

- > Unify multiple EDRs into one
- > (Proposed) functionality:
 - Output conversion: NetCDF, CSV
 - Caching
 - Merged collections
- > Benefits for MetServices:
 - Simplify EDR implementation and deployment
 - Implementation agnostic
- > Benefits for users:
 - One endpoint and one query
- > Work in progress:
 - In operation internally at KNMI since July 2024
 - To be released as OSS





Challenges for EDR API Aggregator

- › When can we merge a variable from two MetServices? Consider mean air temperature
 - Unit
 - Standard name (CF Conventions)
 - Aggregation period
 - Method (mean, max, min, etc)
 - Level (height above ground)
- › How to handle errors at source EDRs?
 - Permanent, intermittent, timeouts
 - How to communicate to users?
- › Station metadata
 - Or the lack thereof
 - Limited to name, lat/lon, z
 - Strengthen OSCAR?



EDR Aggregator: Work in Progress

Servers



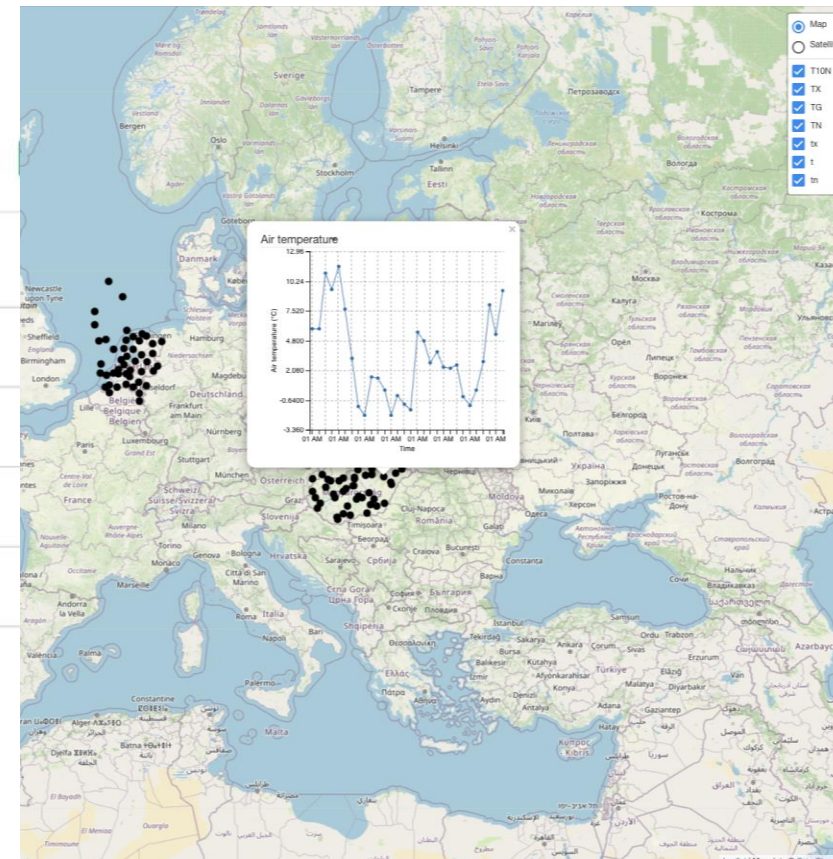
Capabilities Essential characteristics of the information available from the API.

eu-daily-observations Daily, validated and automated in-situ ground-based meteorological observations in the Netherlands

hungary-daily-observations Meteo data - climate observation

poland-daily-observations Metadata & Data queries available for collection observations

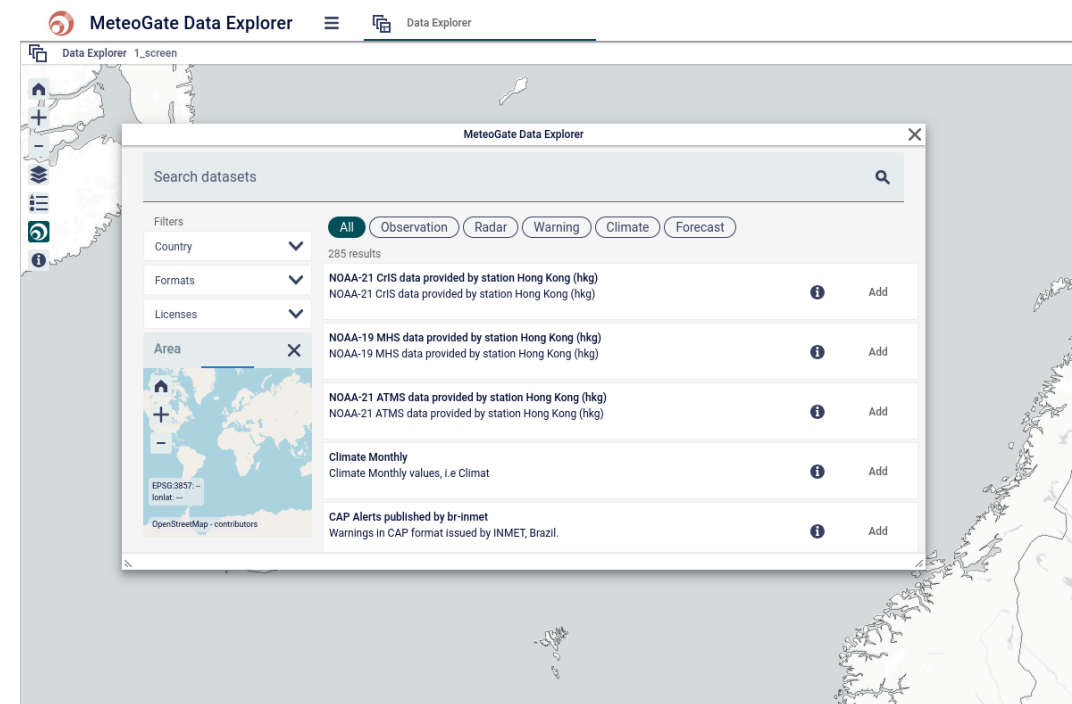
nl-daily-observations Daily, validated and automated in-situ ground-based meteorological observations in the Netherlands





MeteoGate Data Explorer

- > RODEO WP2
- > Goal: One-stop shop for all EUMETNET Open Data
- > Offers: Catalog and API gateway
- > Uses WIS 2.0 (successor GTS)
- > Based on OpenGeoWeb
- > Work in Progress





Summary

- › Retrieve climate data standardised on
 - API
 - Metadata
 - Output
- › Data at the source
 - Updated live
- › EDR Aggregator: Single endpoint for users

Outlook

- › More MetService APIs can become available soon
 - ECA&D via EDR API
- › Release EDR Aggregator and connection to MeteoGate
- › Continuation of project
 - Optional EUMETNET project
 - Interest of support by Copernicus



Build your own EDR API

KNMI / **edr-pydantic** (Public)

<> Code Issues 2 Pull requests 3 Actions Projects Security Insights

main Go to file Code About

About

Pydantic models for Environmental Data Retrieval (EDR) API

python coveragejson pydantic ogc-api ogc-api-edr pydantic-v2

Readme Apache-2.0 license Activity Custom properties 14 stars 5 watching 2 forks Report repository

Releases 9

0.7.0 (Latest) on Mar 5 + 8 releases

Packages

No packages published

Contributors 5

OGC Environmental Data Retrieval (EDR) API Pydantic

CI passing codecov unknown pypi package v0.7.0 downloads 1.8k/month license Apache-2.0

This repository contains the edr-pydantic Python package. It provides

EDR Pydantic package

KNMI / **covjson-pydantic** (Public)

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About

Pydantic models for CoverageJSON

python coveragejson ogc-api ogc-api-edr pydantic-v2

Readme Apache-2.0 license Activity Custom properties 17 stars 3 watching 4 forks Report repository

Releases 7

0.7.0 (Latest) on May 9 + 6 releases

Contributors 4

CoverageJSON Pydantic

CI passing codecov 94% pypi package v0.7.0 downloads 24k/month license Apache-2.0

This repository contains the covjson-pydantic Python package. It provides

CovJSON Pydantic package

EUMETNET / **ogc-edr-workshop** (Public)

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About

No description, website, or topics provided.

Readme Activity Custom properties 5 stars 4 watching 1 fork Report repository

Releases

No releases published

Packages

No packages published

Contributors 4

OGC EDR Workshop

This workshop was given twice as part of the EUMETNET project RODEO, in the context of Work Package 5 (Climate data). The workshop was first given on 2024-06-13 and 2024-06-14 in Helsinki, Finland. The second time took place in Vienna, on 2025-04-08 and 2025-04-09. The third in Zagreb, on 2025-10-07 and 2025-10-08.

Languages

OGC EDR Workshop

3 sessions – participants from in total 21 EUMETNET members



Thank you for your attention!

- › paul.van.schayck@knmi.nl
- › opendata@knmi.nl
- › Want to test out an EDR API?
 - [KNMI Developer Portal](#)
 - [KNMI EDR Documentation](#)
 - [CovJSON playground](#)
- Want to build your own EDR API?
 - [CovJSON Pydantic package](#)
 - [EDR Pydantic package](#)
 - [OGC EDR Workshop](#)
 - [EDR spec](#)
 - [CovJSON spec](#)