

# WMO Core Metadata Profile (WCMP) Version 2

# World Meteorological Organization

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## i. Abstract

Discovery and search are key components of WIS2. Quality discovery metadata that leverages industry standards, best practices, and architecture helps lower the barrier to and extend the reach of weather/climate/water data.

This document defines the content, structure, and encoding for the WMO Core Metadata Profile (WCMP). This standard is a profile and extension of the OGC API - Records standard <sup>[5]</sup>.

WCMP documents provide descriptive information for discovery of WMO resources. WMO resources include, but are not limited to, data (NWP models, observations, forecasts and warnings, etc.), services/APIs, and processes.

WCMP documents shall be encoded in GeoJSON (RFC 7946 <sup>[6]</sup>) as defined in this specification and shall be made available as HTTP crawlable files or via API provisioning as defined by OGC API - Records.

Weather/climate/water data is by nature geospatial and temporal. The W3C Data on the Web Best Practices <sup>[7]</sup> and Spatial Data on the Web Best Practices <sup>[8]</sup> publications provide guidelines on how to best enable spatiotemporal data to lower the barrier for users, search engine optimization, and linked data. This also aligns with the FAIR data principles (Findable, Accessible, Interoperable, Reusable) <sup>[9]</sup>.

## ii. Keywords

The following are keywords to be used by search engines and document catalogues.

wmo, wis, wis2, weather, climate, water, metadata, discovery, search

## iii. Security Considerations

Based on the WMO Unified Data Policy for the International Exchange of Earth System Data (Resolution 1 (Cg-Ext(2021)) <sup>[10]</sup>, exchanged data are classified as **core** or **recommended**. Core data is considered fully open and unrestricted with no security considerations. Recommended data may have access control defined.

No additional security considerations have been made for this standard.

# Chapter 1. Scope

This document defines the content, structure, and encoding of discovery metadata published as part of the WIS2 Global Discovery Catalogue (GDC).

The WMO Core Metadata Profile (WCMP) standard defined herein is an extension of the International Standard *OGC API - Records - Part 1: Core*.

WCMP discovery metadata records shall be encoded as GeoJSON as defined in *OGC API - Records - Part 1: Core*.

The primary purpose of WCMP is to describe **datasets**. While WCMP can describe any resource (datasets, APIs and data reduction services, processes, analytics, etc.), the key component for international data exchange is data. Services and APIs operating on resources may be represented as part of their own metadata or associated through WCMP links.

WCMP discovery metadata record provides descriptions at the granularity level of a dataset. Station, instrument and observation metadata are supported by the *WIGOS Metadata Standard (WMO-No. 1192)* <sup>[11]</sup>.

This specification defines the conformance requirements for the WMO Core Metadata Profile. Annex A defines the abstract test suite. Annex B provides normative information on schemas. Annex C provides informative examples. Annex D provides informative codelists.

[1] <https://community.wmo.int/governance/commission-membership/commission-observation-infrastructures-and-information-systems-infcom/commission-infrastructure-officers/infcom-management-group/standing-committee-information-management-and-technology-sc-int/expert-team-metadata-0>

[2] <https://community.wmo.int/governance/commission-membership/commission-observation-infrastructures-and-information-systems-infcom/commission-infrastructure-national-representatives/infcom-management-group/standing-committee-information-management-and-technology-sc-int/et-metadata>

[3] <https://community.wmo.int/governance/commission-membership/commission-observation-infrastructures-and-information-systems-infcom/commission-infrastructure-officers/infcom-management-group/standing-committee-information-management-and-technology-sc-int>

[4] <https://community.wmo.int/governance/commission-membership/infcom>

[5] <https://ogcapi.ogc.org/records>

[6] <https://datatracker.ietf.org/doc/html/rfc7946>

[7] <https://www.w3.org/TR/dwbp>

[8] <https://www.w3.org/TR/sdw-bp>

[9] [https://en.wikipedia.org/wiki/FAIR\\_data](https://en.wikipedia.org/wiki/FAIR_data)

[10] [https://library.wmo.int/doc\\_num.php?explnum\\_id=11113#page=9](https://library.wmo.int/doc_num.php?explnum_id=11113#page=9)

[11] [https://library.wmo.int/doc\\_num.php?explnum\\_id=10109](https://library.wmo.int/doc_num.php?explnum_id=10109)

# Chapter 2. Conformance

Conformance with this standard shall be checked using the tests specified in Annex A (normative) of this document.

*OGC API - Records* (OARec) provides a record metadata model in support of resource discovery. This standard is an extension of *OGC API - Records - Part 1: Core*. Conformance to this standard requires demonstrated conformance to the applicable Conformance Classes of *OGC API - Records - Part 1: Core*.

Authors of discovery metadata records published within the WIS2 Global Discovery Catalogue (GDC) are required to comply with the WMO Core Metadata Profile (WCMP). WCMP discovery metadata shall therefore be compliant with OGC API - Records - Part 1: Core: Requirements Class: Record Core.

WMO shall publish guidance material to assist authors of WCMP discovery metadata for maintaining consistency across multiple metadata records and perform quality assessment and reporting.

This standard identifies one Requirements Class which defines the functional requirements.

The mandatory Requirements Class for WCMP is:

- "WMO Core Metadata Profile Core": This Requirements Class inherits from *OGC API — Records — Part 1: Core: Requirements Class: Record Core* which defines the requirements for a catalogue record. The requirements specified in the Requirements Class "Record Core" are mandatory for all implementations of WMCP. The requirements are specified in Chapter 7 and in Annex A in more detail.

# Chapter 3. References

- OGC: OGC 20-004, OGC API - Records - Part 1: Core 1.0 (2023) <sup>[1]</sup>
- OGC: OGC 17-069r, OGC API - Features - Part 1: Core 1.0 (2022) <sup>[2]</sup>
- IETF: RFC-7946 The GeoJSON Format (2016) <sup>[3]</sup>
- IETF: RFC-8259 The JavaScript Object Notation (JSON) Data Interchange Format the GeoJSON Format (2016) <sup>[4]</sup>
- W3C/OGC: Spatial Data on the Web Best Practices, W3C Working Group Note (2017) <sup>[5]</sup>
- W3C: Data on the Web Best Practices, W3C Recommendation (2017) <sup>[6]</sup>
- W3C: Data Catalog Vocabulary, W3C Recommendation (2014) <sup>[7]</sup>
- IANA: Link Relation Types (2020) <sup>[8]</sup>
- IANA: Media Types (2023) <sup>[9]</sup>
- Linux Foundation: SPDX License List (2021) <sup>[10]</sup>
- IETF: JSON Schema (2022) <sup>[11]</sup>
- WMO: WIS2 Topic Hierarchy (2022) <sup>[12]</sup>
- OpenAPI Specification 3.1.0 (2022) <sup>[13]</sup>
- Draft guidance on technical specifications of WIS2 (2023) <sup>[14]</sup>

[1] <https://docs.ogc.org/DRAFTS/20-004.html>

[2] <https://docs.engeospatial.org/is/17-069r4/17-069r4.html>

[3] <https://datatracker.ietf.org/doc/html/rfc7946>

[4] <https://datatracker.ietf.org/doc/html/rfc8259>

[5] <https://www.w3.org/TR/sdw-bp>

[6] <https://www.w3.org/TR/dwbp>

[7] <https://www.w3.org/TR/vocab-dcat>

[8] <https://www.iana.org/assignments/link-relations/link-relations.xml>

[9] <https://www.iana.org/assignments/media-types/media-types.xhtml>

[10] <https://spdx.org/licenses>

[11] <https://json-schema.org>

[12] <https://github.com/wmo-im/wis2-topic-hierarchy>

[13] <https://github.com/OAI/OpenAPI-Specification/blob/3.1.0/versions/3.1.0.md>

[14] <https://wmo-im.github.io/wis2-guide/guide/wis2-guide-DRAFT.html>



# Chapter 4. Terms and definitions

This document uses the terms defined in [OGC Policy Directive 49](#), which is based on the ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards. In particular, the word “SHALL” (not “must”) is the verb form used to indicate a requirement to be strictly followed to conform to this Standard and OGC documents do not use the equivalent phrases in the ISO/IEC Directives, Part 2.

This document also uses terms defined in the OGC Standard for Modular specifications ([OGC 08-131r3](#)), also known as the 'ModSpec'. The definitions of terms such as standard, specification, requirement, and conformance test are provided in the ModSpec.

The following additional terms and definitions also apply.

## 4.1. Abbreviated terms

*Table 1. Symbols and abbreviated terms*

Abbreviation	Term
API	Application Programming Interface
ARK	Archival Resource Key
DCAT	Data Catalog Vocabulary
DCPC	Data Collection and Production Centres
DOI	Digital Object Identifier
GDC	Global Discovery Catalogue
GIS	Geographic Information System
GISC	Global Information System Centre
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
IANA	Internet Assigned Numbers Authority
IETF	Internet Engineering Task Force
ISO	International Organization for Standardization
JSON	JavaScript Object Notation
MIME	Multipurpose Internet Mail Extensions
MQTT	Message Queuing Telemetry Transport
NC	National Centre
NWP	Numerical Weather Prediction
OARec	OGC API - Records
OGC	Open Geospatial Consortium

Abbreviation	Term
REST	Representational State Transfer
ROA	Resource-oriented architecture
S3	Simple Storage Service
SEO	Search engine optimization
SOA	Service-oriented architecture
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
W3C	World Wide Web Consortium
WCMP	WMO Core Metadata Profile
WIS	WMO Information System
WMO	World Meteorological Organization
XML	eXtensible Markup Language

# Chapter 5. Conventions

This section provides details and examples for any conventions used in the document. Examples of conventions are symbols, abbreviations, use of JSON schema, or special notes regarding how to read the document.

## 5.1. Identifiers

The normative provisions in this Standard are denoted by the URI:

<http://wis.wmo.int/spec/wcmp/2>

All requirements and conformance tests that appear in this document are denoted by partial URIs which are relative to this base.

## 5.2. Examples

Examples provided in this specification are encoded as GeoJSON.

Complete examples can be found at <https://schemas.wmo.int/wcmp/2.0.0/examples>

## 5.3. Schemas

The WCMP schema can be found at <https://schemas.wmo.int/wcmp/2.0.0/schemas/wcmp2-bundled.json>

## 5.4. Schema representation

JSON Schema <sup>[1]</sup> objects are used throughout this standard to define the structure of metadata records. These schema objects are also typically represented using YAML <sup>[2]</sup>. YAML is a superset of JSON, and in this standard are regarded as equivalent.

Metadata record instances are always represented as JSON.

### 5.4.1. Properties

A JSON **property** represents a key-value pair, where the key is the name of the property and the value is a standard JSON data type.

```
"myPropertyName": "test123"
```

## 5.5. Use of HTTPS

For simplicity, this document only refers to the HTTP protocol. This is not meant to exclude the use of HTTPS and simply is a shorthand notation for "HTTP or HTTPS." In fact, most servers are

expected to use HTTPS, not HTTP.

[1] <https://json-schema.org>

[2] <https://en.wikipedia.org/wiki/YAML>

# Chapter 6. Introduction

## 6.1. Overview

The initial WIS technical specifications were developed using service-oriented architecture (SOA) principles. It featured complex ISO 19115/19139-based XML for metadata. Since then, international standards development organizations such as W3C and OGC have moved to adopt a more resource-oriented architecture (ROA), leveraging RESTful design patterns, and mass market encodings such as JSON and HTML.

Aligning with the WIS2 Principles, in order to support the WIS2 Technical Specifications for discovery and search, discovery metadata will be published to a global discovery catalogue, which will provide an OGC API - Records searchable functionality. Users will be able to search from a web browser, whereas machines will interact with an API.

### 6.1.1. WIS2

WIS2 puts forth the following principles (those focused on discovery metadata are in **bold**):

- (1) **WIS 2.0 adopts Web technology and leverages industry best practices and open standards.**
- (2) **WIS 2.0 uses Uniform Resource Locators (URL) to identify resources (i.e., Web pages, data, metadata, APIs) use.**
- (3) **WIS 2.0 prioritizes the use of public telecommunications networks (i.e. Internet) when publishing digital resources.**
- (4) **WIS 2.0 requires provision of Web service(s) to access or interact with digital resources (e.g. data, information, products) published using WIS.**
- (5) WIS 2.0 encourages NCs and DCPCs to provide 'data reduction' services via WIS that process 'big data' to create results or products that are small enough to be conveniently downloaded and used by those with minimal technical infrastructure.
- (6) **WIS 2.0 adds open standard messaging protocols that use the publish-subscribe message pattern to the list of data exchange mechanisms approved for use within WIS and GTS.**
- (7) WIS 2.0 requires all services that provide real-time distribution of messages (containing data or notifications about data availability) to cache/store the messages for a minimum of 24 hours and allow users to request cached messages for download.
- (8) WIS 2.0 adopts direct data-exchange between provider and consumer and phases out the use of routing tables and bulletin headers.
- (9) **WIS 2.0 provides a catalogue containing metadata that describes both data and the service(s) provided to access that data.**
- (10) **WIS 2.0 encourages data providers to publish metadata describing their data and Web services in a way that can be indexed by commercial search engines.**

### 6.1.2. Discovery metadata design considerations

The following describes envisioned workflows of WIS2 in the context of metadata search and harvesting.

- Flexible metadata publishing mechanisms so providers can publish discovery metadata in the easiest and most efficient way possible.
- Basic, HTTP crawlable metadata files (filesystem, object storage). For example, publishing discovery metadata as JSON files to an S3 bucket, and then making that bucket available for harvesting and traversal to search engines and metadata harvesters.
- The browser as the catalogue. Browsers utilize mass market search engines as the gateway to low barrier discovery. This pattern may work by way of the Global Discovery Catalogue and the Global Cache, with the idea that search engines can index from the authoritative source.

### 6.1.3. Granularity

In order to provide discovery metadata of value, it is important to clarify the granularity levels of which providers are to provide describing their data and associated services. Articulating the level of granularity will reduce catalogue "pollution" and bring the user closer to the data via their search criteria.

For data, A WCMP record provides a description at the primary granularity of a **dataset**, which facilitates clear cataloguing and discovery workflow, in combination with data services or APIs, which provide access, queries, and filters at a lower level of granularity (parameter, variable, spatiotemporal extents).

The [Discovery metadata workflow](#) figure below illustrates example metadata publication and discovery workflows against common meteorological data types:

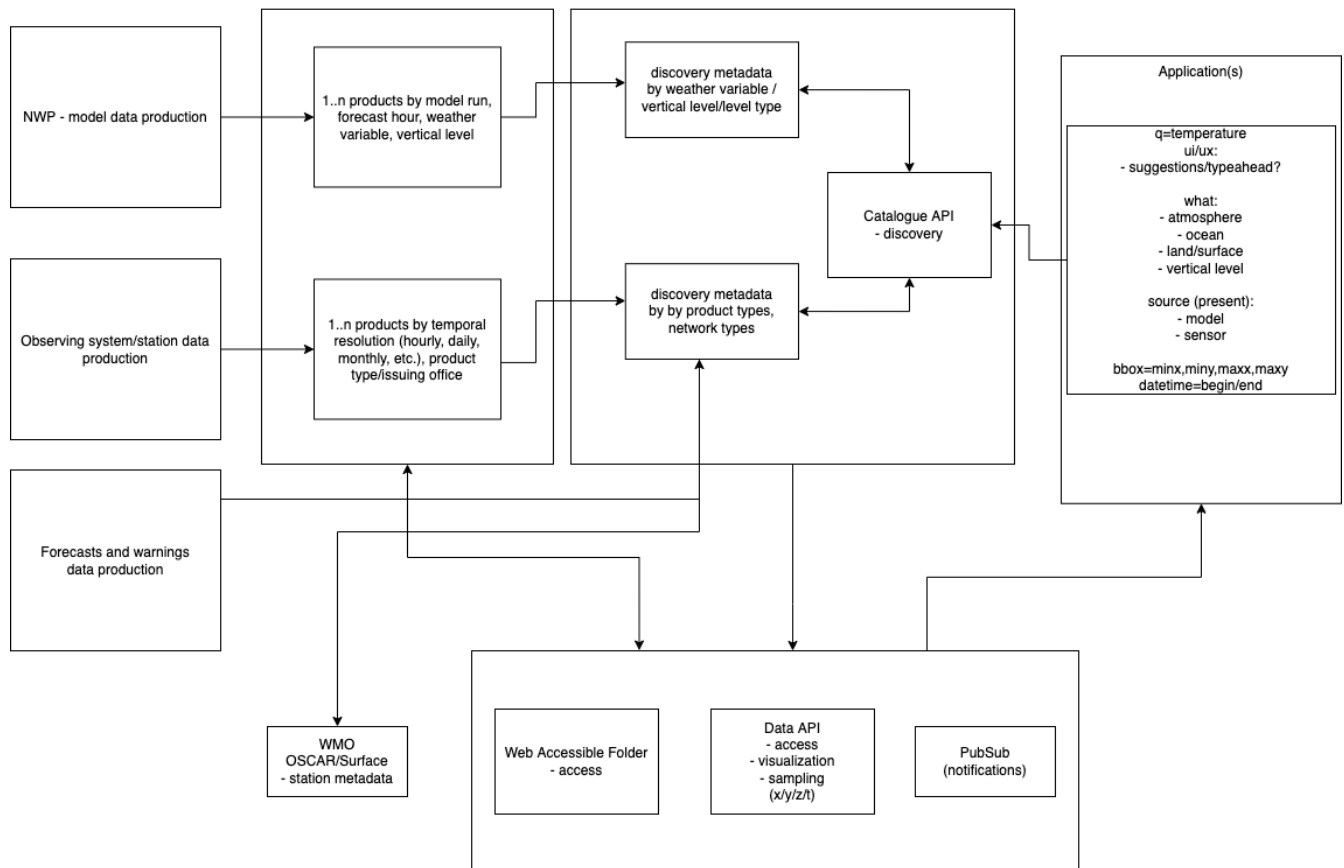


Figure 1. Discovery metadata workflow

Common meteorological data types include:

- collection (model): NWP model (discovery metadata record). Example: Canadian Global Deterministic Prediction System
  - variables are described as themes/concepts (e.g. air temperature)
  - access options:
    - data service or API endpoint to interrogate data/variable/spatiotemporal dimensions
    - x/y/z/t (granule) (STAC Item with link to actual data asset)
- collection (observations): surface weather observations (discovery metadata record)
  - station metadata as WIGOS metadata via WMO OSCAR/Surface
  - access options:
    - data service or API endpoint to interrogate data/variable/spatiotemporal dimensions
    - x/y/z/t (granule) (STAC Item, with link to actual data asset)
- collection (climate archive): climate daily station data (discovery metadata record)
  - access options:
    - API endpoint to interrogate data/variable/spatiotemporal dimensions
    - single observation (granule) (STAC Item with link to actual data asset)

Section "Why are datasets so important?" in the WIS2 Guide [\[wis2-guide\]](#) provides further

explanation and rationale for datasets as part of WIS2.

## 6.2. User stories

As part of requirements gathering <sup>[1]</sup>, the following user stories provide a description of features that are relevant to WIS2 metadata and search, and are cast from a user perspective:

### 6.2.1. Domain specialist

- As an NWP centre operator, I want to quickly and easily publish information about the data that my centre provides and update it as needed in a (semi)automated way using the information that I already have in my databases, so that I can concentrate on my core business.
- As the leader of a forecasting team of a national meteorological institution, I would like to be able to find more sources of data that might be relevant or useful for the work of my team, notably NWP and satellite imagery so that we could further improve our predictions.
- As a GIS professional, I would like to search for weather, climate and water data from my GIS desktop support tool so that I can integrate forecast data into my workflow.

### 6.2.2. Mass market

- As an entrepreneur (start-up) that provides (wants to provide) tailored weather information, I want to find services (free or commercial) that provide meteorological data in the cloud, or even better, a service that provides customizable processing of such data to build my own service on top of it. I also want to be able to find out if a new service becomes available or if an existing one changes its abilities so that my company can keep on advancing.
- As a user, I would like to search for real-time observations for a given time and geographical area of interest, so that I can have up-to-date information on weather for my city.

### 6.2.3. Developers

- As a software developer (working for a national meteorological centre or a private company), I would like to find a relevant technical description of the service (API) that my boss wants me to integrate with, so that the declared interoperability becomes a reality.
- As a web developer, I would like to access a search API that provides easy-to-read documentation, examples, and a simple, intuitive RESTful API with JSON so that I can integrate into my web application quickly.

The following WIS2 marketing video <sup>[2]</sup> adds the following user stories:

- As an everyday user, I would like to find easy-to-understand and precise weather data so that I can plan to have people over for an outdoor BBQ on a nice day.
- As a smart home owner, I would like access to frequently updated data so that I can keep my smart home monitoring up to date.
- As a weather specialist, I would like to access weather data in native data formats and subscribe to data updates, so that I can provide tailor-made weather services to my users.



Given the above, we see a variety of users/actors to which WIS2, driving the need for a low barrier, ubiquitous and efficient discovery, visualization, and access of weather, climate, water (real-time, near real-time, archive, etc.) data.

## 6.3. OGC API - Records - Part 1: Core

The OGC Records - API - Part 1: Core specification:

- lowers the discovery barrier to finding the existence of geospatial resources on the Web
- provides the ability for discovery metadata to be published via API machinery (searchable catalogue) or static records (crawlable catalogue)
- provides a core record model for information communities to extend
- provides a subset of core queryables (e.g. by resource type, by external identifier) which enables federation and cross catalogue discovery functionality

## 6.4. The WIS2 Global Discovery Catalogue

The GDC will provide a central search endpoint, enabling users to traverse, browse and search data holdings in WIS2. Key search predicate capabilities include:

- geospatial (**bbox=**)
- temporal (time instant or time period) (**datetime=**)
- equality predicates (i.e. **property=value**) for any defined discovery metadata property
- full-text (**q=**)

Given the WIS2 principles, use cases, OGC API - Records - Part 1: Core, and the WIS2 Global Discovery Catalogue, WCMP provides a standards-based, clear and well-defined information model to facilitate the management and discovery of data within WIS2.

## 6.5. Mass market considerations

Given WIS2 principle 10 (publishing metadata in a way that commercial search engines can index), WCMP discovery metadata enables annotations that can facilitate Search Engine Optimization (SEO) and structured data discovery, search, and relevant results.

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[1] <https://github.com/wmo-im/wcmp/issues/107>

[2] [https://gisc.dwd.de/wis2.0/WIS\\_2.0\\_final.mp4](https://gisc.dwd.de/wis2.0/WIS_2.0_final.mp4)

# Chapter 7. WMO Core Metadata Profile (Version 2)

Note: This section of working draft document is the same as Appendix F in the [Manual on the WMO Information System](#) (WMO-No. 1060), Volume II.

WMO Core Metadata Profile (WCMP) is an extension of the OGC API – Features standard and shall be encoded in GeoJSON. The normative provisions in this standard are denoted by the base URI (<http://wis.wmo.int/spec/wcmp/2>) and requirements are denoted by partial URIs relative to this base. Property names, values and examples are represented with **shaded text** in this document.

## 1. Requirements Class "Core"

URI	<a href="http://wis.wmo.int/spec/wcmp/2/req/core">http://wis.wmo.int/spec/wcmp/2/req/core</a>
Target type	Discovery metadata
Dependency	The JavaScript Object Notation (JSON) Data Interchange Format ( <a href="#">IETF RFC8259 (2017)</a> )
Dependency	<a href="#">JSON Schema</a> (2022)
Dependency	The GeoJSON Format ( <a href="#">IETF: RFC-7946 (2016)</a> )
Dependency	OGC API - Features - Part 1: Core corrigendum ( <a href="#">OGC: OGC 17-069r</a> )
Pre-conditions	The record conforms to OGC API - Records - Core: Part 1: Requirements Class: Record Core

### 1.1 Overview

The table below provides an overview of the set of properties that may be included in a WCMP record.

Table 2. Table. WCMP record core properties

Property	Requirement	Description
<b>id</b>	<b>Required</b>	A unique identifier of the dataset (see <a href="#">1.4 Identifier</a> )
<b>type</b>	<b>Required</b>	A fixed value denoting the WCMP record as a GeoJSON <b>Feature</b> (see <a href="#">1.3 Validation</a> )
<b>conformsTo</b>	<b>Required</b>	The version of WCMP associated that the record conforms to (see <a href="#">1.5 Conformance</a> )
<b>properties.type</b>	<b>Required</b>	The resource type described by the WCMP record (see <a href="#">1.6 Properties / Type</a> )

Property	Requirement	Description
<code>properties.title</code>	<b>Required</b>	A human-readable name of the dataset (see <a href="#">1.7 Properties / Title</a> )
<code>properties.description</code>	<b>Required</b>	A free-text summary description of the dataset (see <a href="#">1.8 Properties / Description</a> )
<code>properties.keywords</code>	Optional	Keywords, tags or key phrases (see <a href="#">1.9 Properties / Keywords</a> )
<code>properties.themes</code>	<b>Required</b>	Classifiers, categories and controlled vocabularies (see <a href="#">1.10 Properties / Themes</a> )
<code>geometry</code>	<b>Required</b>	Geospatial location associated with the dataset, in a geographic coordinate reference system (see <a href="#">1.11.1 Geospatial extent</a> )
<code>time</code>	<b>Required</b>	Temporal extent associated with the dataset (see <a href="#">1.11.3 Temporal extent</a> )
<code>additionalExtents.spatial</code>	Optional	Additional geospatial extents in other coordinate reference systems (see <a href="#">1.11.2 Additional geospatial extents</a> )
<code>additionalExtents.temporal</code>	Optional	Additional time instants or periods (see <a href="#">1.11.4 Additional temporal extents</a> )
<code>properties.contacts</code>	<b>Required</b>	Contact information for the dataset (see <a href="#">1.12 Properties / Contacts</a> )
<code>properties.version</code>	Optional	Version or edition of the dataset (see <a href="#">1.13 Properties / Version</a> )
<code>properties.externalIds</code>	Optional	Persistent identifiers or handles for the dataset (see <a href="#">1.14 Properties / Persistent identifiers</a> )
<code>properties.created</code>	<b>Required</b>	The date that the WCMP record was created (see <a href="#">1.15 Properties / Record creation date</a> )
<code>properties.updated</code>	Optional	The date that the WCMP record was updated (see <a href="#">1.16 Properties / Record update date</a> )

Property	Requirement	Description
<code>properties.status</code>	Optional	The operational status of the dataset (see <a href="#">1.17 Properties / Status</a> )
<code>properties.wmo:dataPolicy</code>	<b>Conditional</b>	Classification code of <b>core</b> or <b>recommended</b> based on the WMO Data Policy (Resolution 1 (Cg-Ext(2021))) <sup>[1]</sup> . <b>Required</b> for datasets (see <a href="#">1.18 Properties / WMO data policy</a> )
<code>properties.rights</code>	Optional	A statement that concerns all rights not addressed by the license such as a copyright statement (see <a href="#">1.18 Properties / WMO data policy</a> )
<code>links</code>	<b>Required</b>	Online linkages to data retrieval or additional resources associated with the dataset (see <a href="#">1.19 Links and distribution information</a> )
<code>linkTemplates</code>	Optional	Online link templates for dynamic / API access (see <a href="#">1.19.2 Templated links</a> )
<code>properties.*</code>	Optional	Additional properties as needed (see <a href="#">1.20 Additional properties</a> )

## 1.2. WCMP record representation

WCMP record can be represented in various ways internally, in WIS systems and software tools, but its external representation is GeoJSON.

Recommendation 1	/rec/core/media_type
A	The media type assigned to a WCMP record, when transported through a protocol that supports it, SHOULD be <b>application/geo+json</b> .

## 1.3 Validation

The WCMP record schema is based on *OGC API - Records - Part 1: Core: Requirements Class: Record Core* schema and the associated information model. WCMP records compliant with WCMP schema are therefore compliant with the *OGC API - Records* record schema.

Requirement 1	/req/core/validation
---------------	----------------------

A	Each WCMP record SHALL validate without error against the WCMP schema.
B	Each WCMP record SHALL provide <b>id</b> , <b>type</b> , <b>geometry</b> and <b>properties</b> properties for GeoJSON compliance.
C	The <b>type</b> property SHALL be set to a fixed value of <b>Feature</b> for GeoJSON compliance.

## 1.4 Identifier

The **id** property is a unique identifier of the dataset. A record identifier is essential for querying and identifying records within the GDC.

*Example*

```
"id": "urn:wmo:md:ca-eccc-msc:observations.swob"
```

Requirement 2	/req/core/identifier
A	A WCMP record SHALL provide an identifier via the <b>id</b> property.
B	The <b>id</b> property SHALL have the following notation: <b>urn:wmo:md:{centre_id}:{local_identifier}</b> .
C	The <b>centre_id</b> SHALL be based on the associated vocabulary specified in Appendix D: WIS2 Topic Hierarchy.
D	The <b>id</b> property SHALL include a local identifier as defined by the data publisher. The local identifier SHALL NOT have spaces or accented characters.

Permission 1	/rec/core/identifier
A	The local identifier MAY also have colons (:) as required by the data publisher.

## 1.5 Conformance

The **conformsTo** property identifies the version of the WCMP standard that the metadata record conforms to. Conformance identification is valuable for version detection and handling of content.

*Example*

```
"conformsTo": [
  "http://wis.wmo.int/spec/wcmp/2/conf/core"
]
```

Requirement 3	/req/core/conformance
---------------	-----------------------

A	A WCMP record SHALL provide information on conformance via the OARec record <b>conformsTo</b> property.
B	The <b>conformsTo</b> property SHALL advertise conformance to WCMP.

## 1.6 Properties / Type

The **type** property identifies the type of resource that the metadata record describes using values from the resource type codelist. While most metadata records will be set to **dataset**, WCMP can also describe additional resources, such as services and processes.

A **dataset** is the primary granularity of a WCMP record describing a collection of data granules.

A **service** is an API or web service providing a discovery, visualization, or access mechanism that operates on data.

A **process** is a workflow or execution to provide custom functionality to calculate a given output or product.

*Example:*

```
"properties": {
  ...
  "type": "dataset"
  ...
}
```

Requirement 4	/req/core/type
A	A WCMP record SHALL provide a <b>properties.type</b> property.
B	The <b>properties.type</b> property SHALL be a valid code from the <a href="#">WIS resource type</a> codelist.

## 1.7 Properties / Title

The **title** property is a human-readable name of the dataset.

*Example*

```
"properties": {
  ...
  "title": "Surface weather observations"
  ...
}
```

Requirement 5	/req/core/title
A	A WCMP record SHALL provide a <b>properties.title</b> property.

## 1.8 Properties / Description

The **description** property is a free-text summary of the dataset.

*Example*

```
"properties": {  
  ...  
  "description": "Surface observations measured at the automatic and manual stations  
of the Environment and Climate Change Canada and partners networks, either for a  
single station or for the stations of specific provinces and territories (last 30  
days)."  
  ...  
}
```

Requirement 6	/req/core/description
A	A WCMP record SHALL provide a <b>properties.description</b> property.

## 1.9 Properties / Keywords

The **keywords** property is a list of keywords, tags or specific phrases associated with the resource, but are not referenced to a particular vocabulary or knowledge organization system.

*Example*

```
"properties": {  
  ...  
  "keywords": [  
    "surface",  
    "observations",  
    "weather",  
    "real-time"  
  ]  
  ...  
}
```

Recommendation 2	/rec/core/keywords
A	A WCMP record SHOULD provide a <b>properties.keywords</b> property, as a list of freeform text or tags that are not based on a controlled vocabulary.

## 1.10 Properties / Themes

The **themes** property is a list of concepts that are referenced to a vocabulary or knowledge organization system used to classify the resource.

A theme's **scheme** property provides a remote reference to a controlled vocabulary, codelist or

knowledge organization system.

A concept's `id` provides an identifier for the given concept, as well as optional `title`, `description` and `url` properties to further describe the concept as desired.

A concept's optional `url` property can provide a remote reference to a given concept (for example, to an online ontology or code registry).

A WCMP metadata record can have one or more themes.

*Example: Themes object with GRIB2 codes*

```
"properties": {
  ...
  "themes": [
    {
      "concepts": [
        {
          "id": "0-0-0",
          "title": "Temperature",
          "url": "http://codes.wmo.int/grib2/codeflag/4.2/0-0-0"
        },
        {
          "id": "0-1-1",
          "title": "Relative humidity",
          "url": "http://codes.wmo.int/grib2/codeflag/4.2/0-1-1"
        },
        {
          "id": "0-2-2",
          "title": "u-component of Wind",
          "url": "http://codes.wmo.int/grib2/codeflag/4.2/0-2-2"
        },
        {
          "id": "0-2-3",
          "title": "v-component of Wind",
          "url": "http://codes.wmo.int/grib2/codeflag/4.2/0-2-3"
        }
      ],
      "scheme": "http://codes.wmo.int/grib2/codeflag/4.2"
    }
  ]
  ...
}
```

*Example: Themes object with BUFR4 codes*

```
"properties": {
  ...
  "themes": [
    {
      "concepts": [
```



```

    {
      "id": "001",
      "title": "Temperature/air temperature",
      "url": "http://codes.wmo.int/bufr4/b/12/001"
    },
    {
      "id": "003",
      "title": "Dewpoint temperature",
      "url": "http://codes.wmo.int/bufr4/b/12/003"
    }
  ],
  "scheme": "http://codes.wmo.int/bufr4/b"
}
]
...
}

```

*Example: Themes object with of the earth-system-discipline from the WMO Topic Hierarchy*

```

"properties": {
  ...
  "themes": [
    {
      "concepts": [{
        "id": "weather",
        "title": "Weather",
        "url": "http://codes.wmo.int/wis/topic-hierarchy/earth-system-
discipline/weather"
      }],
      "scheme": "http://codes.wmo.int/wis/topic-hierarchy/earth-system-discipline"
    }
  ]
  ...
}

```

Requirement 7	/req/core/themes
A	A WCMP record SHALL provide at least one <b>themes</b> property.
B	Each <b>themes</b> property SHALL provide at least one <b>concept</b> property.
C	Each <b>themes</b> property SHALL provide a <b>scheme</b> property that refers to a controlled vocabulary or thesaurus.
D	A WCMP record describing a dataset SHALL provide a <b>themes</b> property identifying all applicable Earth system disciplines as defined in the WIS2 Topic Hierarchy.

Requirement 8	/req/core/themes_wis2_global_service
---------------	--------------------------------------

A	A WCMP record describing a WIS2 Global Service SHALL provide a <b>themes</b> property identifying all Earth system disciplines as defined in the WIS2 Topic Hierarchy.
B	A WCMP record describing a WIS2 Global Service SHALL provide a <b>themes</b> property identifying the service type provided.

<b>Recommendation 3</b>	<b>/rec/core/granularity</b>
A	A WCMP record SHOULD describe dataset parameters and variables as themes/concepts with an associated controlled vocabulary.

<b>Permission 2</b>	<b>/per/core/themes</b>
A	A WCMP record MAY provide as many themes/concepts as applicable to describe the themes of a given dataset.

## 1.11 Geospatial and temporal extents

### 1.11.1 Geospatial extent

The **geometry** property is the general bounding spatial extent of the dataset in the geographic coordinate system. Geospatial bounding extents provide a useful indicator of the location of the dataset to facilitate search and map displays in the GDC.

#### Examples

```
"geometry": {
  "type": "Polygon",
  "coordinates": [[
    [-142.23, 28.03],
    [-142.23, 82.56],
    [-52.16, 82.56],
    [-52.16, 28.03],
    [-142.23, 28.03]
  ]]
}
```

```
"geometry": {
  "type": "Point",
  "coordinates": [-79.38, 43.65]
}
```

```
"geometry": null
```

<b>Requirement 9</b>	<b>/req/core/extent_geospatial</b>
----------------------	------------------------------------

A	A WCMP record SHALL provide one <b>geometry</b> property to convey the geospatial properties of a dataset using a geographic coordinate reference system (World Geodetic System 1984 [WGS 84]) and longitude and latitude decimal degree units.
B	The <b>geometry</b> coordinates SHALL be integer or float data types.
C	The <b>geometry</b> property SHALL provide the value of <b>null</b> when geometry cannot be derived.

<b>Recommendation 4</b>	<b>/rec/core/extent_geospatial_point</b>
A	For datasets based on a geometry without a calculated area (for example, a single station point), a WCMP record SHOULD provide the GeoJSON geometry as a <b>Point</b> type.

<b>Recommendation 5</b>	<b>/rec/core/extent_geospatial_precision</b>
A	Geometry coordinates SHOULD have a level of precision of at least two or more decimal places.

<b>Recommendation 6</b>	<b>/rec/core/extent_geospatial_wis_2_global_service</b>
A	For a WIS2 Global Service, a WCMP record SHOULD provide the GeoJSON geometry as a <b>Polygon</b> type with a WGS84 bounding geometry of <b>-180</b> (west longitude), <b>-90</b> (south latitude), <b>180</b> (east longitude), <b>90</b> (north latitude).

### 1.11.2 Additional geospatial extents

The **additionalExtents.spatial** property is for other geospatial extents associated with the dataset. For example, it may be useful for non-geographic data or for describing multiple sub-areas of a dataset. The **additionalExtents.spatial.bbox** property provides the ability to list one to many minimum bounding geometries for a given dataset, where:

- The minimum longitude is the westernmost coordinate of the limit of the dataset extent, expressed in longitude decimal degrees as a signed number between -180 and 180, less than or equal to the maximum longitude.
- The minimum latitude is the southernmost coordinate of the limit of the dataset extent, expressed in latitude decimal degrees as a signed number between -90 and 90, less than or equal to the maximum latitude.
- The maximum longitude is the easternmost coordinate of the limit of the dataset extent, expressed in longitude decimal degrees as a signed number between -180 and 180, greater than or equal to the minimum longitude.
- The maximum latitude is the northernmost coordinate of the limit of the dataset extent, expressed in latitude decimal degrees as a signed number between -90 and 90, greater than or equal to the minimum latitude.

This property also facilitates catalogue searches with geospatial predicate (such as, within extent).

### Example

```
"additionalExtents": {
  "spatial": {
    "bbox": [
      [-142, 42, -52, 84]
    ],
    "crs": "http://www.opengis.net/def/crs/OGC/1.3/CRS84"
  }
}
```

Permission 3	/per/core/extent_geospatial
A	A WCMP record MAY provide multiple <b>additionalExtents.spatial.bbox</b> item properties to express additional geospatial extents in other coordinate reference systems.
B	The <b>geometry</b> property MAY provide a third element (height) as per clause 4 of the GeoJSON specification.

### 1.11.3 Temporal extent

The **time** property describes the general bounding extent of the dataset and the temporal resolution.

Temporal extents provide a useful indicator of the date and time period of the dataset and facilitates temporal searching in the GDC.

In addition, the temporal resolution provides a useful indicator of the data update frequency (for example, for real-time datasets). If only times are given for the interval, it is implicitly assumed that those are recurring every day. In cases where no time indication can be derived, it is applicable to state the value of **null**.

### Examples

```
"time": {
  "date": "2021-10-30"
}
```

```
"time": {
  "timestamp": "2021-10-30T11:11:11Z"
}
```

```
"time": {
  "interval" : ["2020-10-30", "2021-10-30"],
  "resolution": "P1D"
}
```

```
"time": {
  "interval" : ["T00Z", "T23Z"],
  "resolution": "PT1H"
}
```

```
"time": {
  "interval": ["2018-04-22", ".."],
}
```

```
"time": null
```

To ensure clarity, an additional human-readable explanation is given in the `properties.description`. Further time-related characteristics (for example, frequency of modifications, available data, etc.) should be added in `properties.themes`.

Some cases might be more complex due to the product's characteristics. If necessary, further granularity can be indicated by the `additionalExtents.temporal` property (see [1.11.4 Additional temporal extents](#)).

*Example: Complex time indication*

```
"time": {
  "interval" : ["2018-04-22", ".."]
},
"additionalExtents": {
  "temporal": {
    "interval": [
      [
        "T00Z",
        "PT180H"
      ],
      [
        "T12Z",
        "PT180H"
      ]
    ],
    "resolution": "PT6H",
    "trs": "http://www.opengis.net/def/trs/ISO-8601"
  }
}
```

*Example: Complex time indication further described with themes property*

```
"properties": {
  ...
  "description": "ICON-EPS 0.5 deg x 0.5 deg regular lat/lon grid, up to +180h every
```

```

6h, runs 00/12 UTC, various parameter, various level, various threshold",
  "themes": [
    {
      "concepts": [
        {"id": "continual"}
      ],
      "scheme":
"https://standards.iso.org/iso/19139/resources/gmxCodelists.xml#MD_FrequencyCode"
    }
  ]
}

```

Requirement 10	/req/core/extent_temporal
A	A WCMP record SHALL provide one <b>time</b> property using the Gregorian calendar.
B	The <b>time</b> property SHALL provide either one <b>date</b> , <b>timestamp</b> , <b>interval</b> , or the value of <b>'null'</b> when a conformant time cannot be derived.
C	All non-null <b>time</b> values SHALL be valid ISO8601 representations or <b>..</b> for an open-ended extent.

Recommendation 7	/rec/core/extent_temporal
A	For datasets with known or discrete intervals, a WCMP record SHOULD provide the temporal resolution ( <b>time.resolution</b> ) as a valid ISO 8601 duration (for example, <b>P1D</b> ).
B	For complex temporal extents, a WCMP record SHOULD also provide a human-readable explanation in <b>properties.description</b> to promote clarification and unambiguity.
C	To distinguish maintenance or update frequency, those SHOULD be included in <b>properties.themes</b> .

Permission 4	/per/core/extent_service
A	For WCMP records describing a service or API, a <b>time</b> value of <b>null</b> MAY be provided.

#### 1.11.4 Additional temporal extents

The **additionalExtents.temporal** property is for describing other temporal extents associated with the dataset. For example, it may be useful to represent multiple time instances or to identify other temporal reference systems. Temporal extents can be fully bound or open in either direction. An **additionalExtents.temporal.resolution** property is able express the temporal granularity at which a given dataset's data is measured, generated, or reported.

### Example

```
"additionalExtents": {
  "temporal": {
    "interval": [
      [
        "T00Z",
        "PT180H"
      ],
      [
        "T12Z",
        "PT180H"
      ]
    ],
    "resolution": "PT6H",
    "trs": "http://www.opengis.net/def/trs/ISO-8601"
  }
}
```

Permission 5	/per/core/extent_temporal
A	A WCMP record MAY provide multiple <b>additionalExtents.temporal</b> item properties to express additional temporal extents in other temporal reference systems.

## 1.12 Properties / Contacts

The **contacts** property is the information associated with one or more responsible parties of the resource.

*Example: Contacts object with all contact details*

```
"properties": {
  ...
  "contacts": [{
    "identifier": "ECCC",
    "organization": "Government of Canada; Environment and Climate Change Canada;
Meteorological Service of Canada",
    "name": "National Inquiry Response Team",
    "phones": [{
      "value": "+18199972800"
    }],
    "emails": [{
      "value": "enviroinfo@ec.gc.ca"
    }],
    "addresses": [{
      "deliveryPoint": [ "77 Westmorland Street, suite 260" ],
      "city": "Fredericton",
      "administrativeArea": "NB",
      "postalCode": "E3B 6Z4",

```

```

    "country": "Canada"
  }],
  "links": [{
    "href": "https://example.org/about",
    "rel": "about",
    "type": "text/html"
  }],
  "contactInstructions": "email",
  "roles": ["producer", "host"]
}]
...
}

```

*Example: Contacts object with URL to the relevant homepage*

```

"properties": {
  ...
  "contacts": [{
    "organization": "Government of Canada; Environment and Climate Change Canada;
Meteorological Service of Canada",
    "links": [{
      "href": "https://example.org/about",
      "rel": "about",
      "type": "text/html"
    }],
    "roles": ["producer"]
  }]
}

```

Requirement 11	/req/core/contacts
A	A WCMP record SHALL provide at least one contact via the <b>properties.contacts</b> property.
B	The <b>properties.contacts</b> SHALL provide an <b>organization</b> property.
C	The <b>roles</b> property, when specified, SHALL provide a role type from the WCMP role type codelist.

Permission 6	/per/core/contacts
A	The <b>properties.contacts</b> property MAY provide more than one contact via multiple objects or a single contact object with multiple roles.

## 1.13 Properties / Version

The **version** property is the version or edition of the dataset. Datasets may be versioned by an organization, for example, the version of an NWP model or a processing chain/workflow, and data providers can make this information available when there are multiple versions of a dataset over



time.

#### Example

```
"properties": {  
  ...  
  "version": "0.1.0"  
  ...  
}
```

Permission 7	/per/core/version
A	A WCMP record MAY provide a <b>properties.version</b> property to describe the version of a given dataset.

## 1.14 Properties / Persistent identifiers

The **externalIds** property is a persistent (or handle) identifier used to provide a long lasting reference to a digital resource. Persistent identifiers are commonly used for scientific publications and datasets.

Examples of persistent identifiers include, but are not limited to:

- Digital Object Identifier ([DOI](#))
- Archival Resource Key ([ARK](#))
- [Handle](#)

#### Example: Persistent identifiers

```
"properties": {  
  ...  
  "externalIds": [{  
    "scheme": "https://doi.org",  
    "value": "10.14287/10000001"  
  }, {  
    "scheme": "https://handle.net",  
    "value": "2381/12775"  
  }, {  
    "scheme": "https://arks.org",  
    "value": "ark:/13030/tf5p30086k"  
  }]  
  ...  
}
```

#### Example: Online citation

```
"links": [  
  {  
    "rel": "cite-as",
```

```

    "title": "Cite as: WMO/GAW Ozone Monitoring Community, World Meteorological
Organization-Global Atmosphere Watch Programme (WMO-GAW)/World Ozone and Ultraviolet
Radiation Data Centre (WOUDC) [Data]. Retrieved [YYYY-MM-DD], from https://woudc.org.
A list of all contributors is available on the website. doi:10.14287/10000004",
    "type": "text/html",
    "href": "https://dx.doi.org/10.14287/10000004"
  }
]

```

Recommendation 8	/rec/core/pids
A	A WCMP record SHOULD provide persistent identifier references via items in the <code>properties.externalIds</code> array property, where the value of <code>scheme</code> is based on an established persistent identifier scheme (such as <a href="https://doi.org">https://doi.org</a> , <a href="https://arks.org">https://arks.org</a> or <a href="https://handle.net">https://handle.net</a> ), and the <code>value</code> property is the persistent identifier (for example, <a href="https://dx.doi.org/10.14287/10000001">https://dx.doi.org/10.14287/10000001</a> ).

Permission 8	/per/core/pids
A	A WCMP record MAY provide a persistent identifier to cite research or resource identification using a persistent identifier scheme/framework.
B	A WCMP record MAY provide a persistent identifier as a link object with <code>rel=cite-as</code> if there is an online citation or reference.

## 1.15 Properties / Record creation date

The `created` property is a single date that the WCMP metadata record was created. Note that this date is not the start or end time of a given dataset. See [1.11.3 Temporal extent](#) for more information on defining dataset temporal extents.

### Example

```

"properties": {
  ...
  "created": "2021-06-12T23:45:24Z"
  ...
}

```

Requirement 12	/req/core/record_creation_date
A	A WCMP record SHALL provide a single <code>properties.created</code> property.
B	The <code>properties.created</code> property SHALL NOT be repeated or used to document change history.

## 1.16 Properties / Record update date

The **updated** property is the date that the WCMP metadata record was last updated. Note, that this date is not the start or end time of a given dataset. See [1.11.3 Temporal extent](#) for more information on defining dataset temporal extents.

*Example*

```
"properties": {  
  ...  
  "updated": "2022-06-12T18:52:39Z"  
  ...  
}
```

Recommendation 9	/rec/core/record_update_date
A	A WCMP record SHOULD provide a <b>properties.updated</b> property when a record has been updated since its initial creation.

## 1.17 Properties / Status

The **status** property identifies the lifecycle of a given dataset.

```
"properties": {  
  "status": {  
    "id": "operational",  
    "title": "dataset is in 24/7 operation",  
    "url": "https://example.org/my-vocab"  
  }  
}
```

Recommendation 10	/rec/core/status
A	A WCMP record SHOULD provide a <b>properties.status</b> property to identify the operational status of a given dataset.
B	A WCMP record SHOULD provide a <b>properties.status.id</b> property to identify the concept of the status (see Annex D for possible codelists to use).
C	A WCMP record SHOULD provide a <b>properties.status.title</b> property to provide a human readable title for the concept.
D	A WCMP record SHOULD provide a <b>properties.status.description</b> property to provide a human readable description for the concept.
E	A WCMP record SHOULD provide a <b>properties.status.url</b> property to provide further description of the concept via the given URI.

## 1.18 Properties / WMO data policy

The `wmo:dataPolicy` property is a codelist that identifies the classification of the dataset exchange as described by the WMO Data Policy (Resolution 1 (Cg-Ext(2021)))<sup>[2]</sup> for the international exchange of Earth system data. The codelist values are `core` or `recommended`. The `wmo:dataPolicy` property is required if the metadata record describes a dataset.

Licensing and copyright are expressed via the `links` property (see [1.19 Links and distribution information](#)), providing access, license and attribution details as required. Conditions on use of the data should be indicated for transparency and clarification.

*Example: Core data*

```
"properties": {  
  ...  
  "wmo:dataPolicy": "core"  
  ...  
}
```

*Example: Recommended data*

```
"properties": {  
  ...  
  "wmo:dataPolicy": "recommended"  
  ...  
}
```

It is useful to add provider-specific details to have the most detailed information about data policy and additional conditions.

*Example: Recommended data with additional conditions and provider-specific details*

```
"properties": {  
  ...  
  "wmo:dataPolicy": "recommended"  
  ...  
},  
"links": [{  
  "rel": "license",  
  "href": "https://example.org/license",  
  "type": "text/html",  
  "title": "EUMETSAT DATA LICENSING"  
}]
```

*Example: License for recommended data in the public domain*

```
"properties": {  
  ...  
  "wmo:dataPolicy": "recommended"
```

```

...
},
"links": [{
  "rel": "license",
  "href": "https://creativecommons.org/publicdomain/zero/1.0/",
  "type": "text/html",
  "title": "CC0 1.0 Deed | CC0 1.0 Universal | Creative Commons"
}]

```

To express rights not addressed by a license, the **rights** property can be used as follows:

*Example: Rights*

```

"properties": {
  ...
  "rights": "Users are granted free and unrestricted access to this data, without
charge and with no conditions on use. Users are requested to attribute the producer of
this data. WMO Unified Data Policy (Resolution 1 (Cg-Ext 2021))."
  ...
}

```

Requirement 13	/req/core/data_policy
A	When the <b>properties.type</b> property is <b>dataset</b> , the record SHALL provide exactly one <b>properties.wmo:dataPolicy</b> property.
B	The <b>properties.wmo:dataPolicy</b> property SHALL be <b>core</b> or <b>recommended</b> .
C	When the <b>properties.wmo:dataPolicy</b> property is <b>recommended</b> , data licensing SHALL be provided by at least one <b>links</b> item with link relations ( <b>rel</b> ) of <b>license</b> .

Recommendation 11	/rec/core/data_policy_conditions
A	Additional conditions represented by a <b>links</b> item SHOULD also provide a <b>title</b> property to include human-readable information about the link.
B	To express any conditions on use of a given dataset, the <b>properties.rights</b> property SHOULD be used.

C	For core data or recommended data compatible with free and unrestricted principles, <code>properties.rights</code> SHOULD be declared with exactly the following statement: <div> Users are granted free and unrestricted access to this data, without charge and with no conditions on use. Users are requested to attribute the producer of this data. WMO Unified Data Policy (Resolution 1 (Cg-Ext 2021)) </div>
D	For core or recommended data not in the public domain, a copyright statement SHOULD be expressed as either a <code>properties.rights</code> statement or a link object with <code>rel=copyright</code> .

<b>Permission 9</b>	<b>/per/core/data_policy</b>
A	For core data (when <code>properties.wmo:dataPolicy</code> property is <code>core</code> ), attribution licensing MAY be provided as needed.
B	For core data (when <code>properties.wmo:dataPolicy</code> is <code>core</code> ) or recommended data (when <code>properties.wmo:dataPolicy</code> is <code>recommended</code> , and the data is compatible with free and unrestricted principles), a license or public domain statement that is compatible with free and unrestricted principles (such as, <a href="#">Creative Commons CC0</a> ) MAY be expressed as a link object with the <code>license</code> link relation.
C	For core data (when <code>properties.wmo:dataPolicy</code> is <code>core</code> ) or recommended data (when <code>properties.wmo:dataPolicy</code> is <code>recommended</code> ), a copyright statement MAY be expressed in <code>properties.rights</code>
D	For core data (when <code>properties.wmo:dataPolicy</code> is <code>core</code> ) or recommended data (when <code>properties.wmo:dataPolicy</code> is <code>recommended</code> ), a link object MAY be expressed with <code>rel=copyright</code> .

## 1.19 Links and distribution information

### 1.19.1 Overview

The `links` property describes URLs and APIs for accessing the dataset or for subscribing to dataset notifications. Links are the primary mechanism for interacting with the data and provide an "actionable" workflow to enhance and improve the user experience with "less clicks" for subscriptions and downloads.

The `links` property may also describe URLs for related documentation, related data, or visual images of the dataset.

The table below provides an overview of the properties of a link object.

Table 3. Table. Link properties

Property	Requirement	Description
<b>href</b>	<b>Required</b>	The link destination or target, or URL.
<b>rel</b>	Optional	The relationship that the link bears in the context of the WCMP record. This is a controlled vocabulary defined by <a href="#">IANA link relations</a> or <a href="#">WIS link type</a> extensions. (see table <a href="#">1.19.5 Link relation selection</a> )
<b>type</b>	Optional	The media (or MIME) type of the format of the link
<b>hreflang</b>	Optional	The language of the content in the link
<b>title</b>	Optional	A human-readable name for the link (can be used for display on search / discovery web portals)
<b>channel</b>	<b>Conditional</b>	For data made available via MQTT, the topic to which a user may subscribe to for notifications and access
<b>security</b>	Optional	For access controlled data, a description of the access control mechanism applied (see <a href="#">1.19.4 Access control</a> )
<b>distribution</b>	Optional	Value added information about the link to further assist the user (additional document, typical file size, etc.) (see <a href="#">1.19 Links and distribution information</a> )

For recommended data, the **links** property may also provide links to services that implement access control in support of authentication and authorization. In secure data use cases, a user needs to be able to detect access-controlled data as part of data discovery and evaluation.

*Example: Access controlled link*

```
"links": [{
  "rel": "data",
  "type": "application/json",
  "title": "link to WAF endpoint",
  "href": "https://example.org/data/secure-data",
  "security": {
    "default": {
```

```

    "type": "http",
    "scheme": "basic",
    "description": "Please contact the data provider for accessing this secured
resource."
  }
}
}]

```

*Example: Two link objects providing both search and MQTT subscription information*

```

"links": [
  {
    "rel": "search",
    "type": "text/html",
    "title": "WOUDC - Data - Station List",
    "href": "https://example.org/data/stations"
  },
  {
    "rel" : "items",
    "type" : "application/geo+json",
    "title": "WIS2 notification service",
    "href" : "mqtts://example.org",
    "channel": "cache/a/wis2/ca-eccc-msc/data/core/weather/surface-based-observations"
  }
]

```

*Example: A link object providing an API capability*

```

"links": [
  {
    "rel": "service",
    "type": "application/json",
    "title": "OGC API - Features service",
    "href": "https://example.org/api"
  }
]

```

*Example: A link object providing a browse graphic*

```

"links": [
  {
    "rel": "preview",
    "type": "image/png",
    "title": "Browse graphic",
    "href": "https://example.org/path/to/browse.png"
  }
]

```



### 1.19.2 Templated links

Templated links allow for specifying a pattern of a link in support API interaction (where parameter values are variable).

*Example: A templated link object of a WMS service providing API access to images*

```
"linkTemplates": [{
  "rel": "item",
  "type": "image/png",
  "title": "Eumetview",
  "uriTemplate":
  "https://example.org/geoserver/ows?service=WMS&request=GetMap&version=1.3.0&layers=msg
  _fes:ir108&styles=&format={format}&crs={crs}&bbox={bbox}&width={width}&height={height}
  ",
  "variables": {
    "crs": {
      "description": "...",
      "type": "string",
      "enum": [
        "EPSG:4326",
        "EPSG:3857"
      ]
    },
    "bbox": {
      "description": "...",
      "type": "array",
      "items": {
        "type": "number",
        "format": "double"
      },
      "minItems": 4,
      "maxItems": 4
    },
    "width": {
      "description": "...",
      "type": "number",
      "format": "integer",
      "minimum": 600,
      "maximum": 5000
    },
    "height": {
      "description": "...",
      "type": "number",
      "format": "integer",
      "minimum": 600,
      "maximum": 5000
    },
    "format": {
      "description": "...",
      "type": "string",
```

```

    "enum": [
      "image/geotiff",
      "image/geotiff8",
      "image/gif",
      "image/jpeg",
      "image/png; mode=8bit"
    ]
  },
  "sampleRequest":
    "https://example.org/geoserver/ows?service=WMS&request=GetMap&version=1.3.0&layers=msg_
    _fes:ir108&styles=&format=image/jpeg&crs=EPSG:4326&bbox=-77,-
    77,77,77&width=800&height=800"
  }
}]

```

Requirement 14	/req/core/links
A	A WCMP record SHALL provide a <b>links</b> property.
B	The <b>links</b> property SHALL contain at least one link to the data access service allowing users to download the data.
C	The <b>links</b> property SHALL contain a Web Accessible Folder (WAF) or an API link for non-real-time data (such as climate records or hydrometric data archives).
D	The <b>links</b> property SHALL contain access control information for data, products, and services that require authentication or authorization.
E	For representing MQTT links, the URI scheme SHALL be <b>mqtt</b> (default port 1883) or <b>mqtt</b> s (default port 8883) for secure transport layer security (TLS) encrypted connections.
F	The <b>links</b> property SHALL provide the <b>channel</b> property of the MQTT topic for real-time data under which the data publication notifications will be accessible from the WIS2 Global Broker, following the WIS2 Topic Hierarchy.
G	The <b>links</b> property SHALL include a valid <b>IANA</b> link relation or a <b>WIS link type</b> code.

Recommendation 12	/rec/core/links
A	A WCMP record's links SHOULD be provided using secure protocols (such as, HTTPS or MQTTS).
B	The <b>links</b> property SHOULD provide a <b>type</b> property with a valid media type from IANA or as designated by WMO.

Permission 10	/per/core/links
---------------	-----------------

A	The <b>links</b> property MAY contain a Web Accessible Folder (WAF) or an API link for real-time data.
---	--

### 1.19.3 Distribution information

The **distribution** property provides information about the format of the dataset, associated documentation and representative examples of the dataset.

Additional distribution information is added to allow more comprehensive discovery services.

*Example: Links object with the complete distribution information*

```
"links": [{
  "rel": "search",
  "type": "text/html",
  "title": "EUMETSAT Datastore",
  "href": "https://example.org/data/map/E0:EUM:DAT:MSG:MSG15-RSS",
  "distribution": {
    "availableFormats": [{
      "name": "native",
      "description": "This is sent in a compressed Submission Information Package (SIP) by default.",
      "numberOfFiles": "288 per day",
      "typicalFileSize": "60 MB",
      "typicalFilename": "MSG3-SEVI-MSG15-0100-NA-20130208102743.243000000Z-1051616.zip",
      "samples": {
        "href": "https://example.org/data/access/MSG3-SEVI-MSG15-0100-NA-20130208102743.243000000Z-1051616.zip"
      },
      "documentation": [{
        "rel": "alternate",
        "type": "text/html",
        "title": "SIP documentation and tools",
        "href": "https://www.eumetsat.int/formats#SIP"
      }]
    }]
  }
}]
```

Recommendation 13	/rec/core/distribution
A	A WCMP record SHOULD describe additional distribution information with the <b>links.distribution</b> property to qualify a given service link. This information SHOULD be used to build the discovery information and allow the user to find and choose the appropriate service for accessing the data.

B	The <code>links.distribution.availableFormats</code> property SHOULD describe the different formats that can be retrieved using the service link.
C	The <code>links.distribution.availableFormats.name</code> property SHOULD describe the available format short name.
D	The <code>links.distribution.availableFormats.description</code> SHOULD describe the associated format.
E	The <code>links.distribution.availableFormats.typicalFilename</code> SHOULD describe the filenames that are available from the service link.
F	The <code>links.distribution.availableFormats.typicalFileSize</code> SHOULD describe the typical filesize available from the service link.
G	The <code>links.distribution.availableFormats.numberOfFile</code> SHOULD describe the typical number of files received during a given period (day, month, ...) when using the service link. It SHOULD follow the pattern X per day, X per month.
H	The <code>links.distribution.availableFormats.documentation</code> SHOULD be a <a href="#">link</a> for accessing the documentation associated with the format.
I	The <code>links.distribution.availableFormats.samples</code> SHOULD be an array of direct links to representative samples of the data.

#### 1.19.4 Access control

WCMP record links may also provide links to services that implement access control in support of authentication and authorization. In secure data use cases, a user needs to be able to detect access-controlled data as part of data discovery and evaluation. The example demonstrates how to express access control using HTTP basic authentication for a given data access service.

##### Example

```
"links": [{
  "rel": "data",
  "type": "application/json",
  "title": "link to WAF endpoint",
  "href": "https://example.org/data/secure-data",
  "security": {
    "default": {
      "type": "http",
      "scheme": "basic",
      "description": "Please contact the data provider for accessing this secured resource."
    }
  }
}]
```

### 1.19.5 Link relation selection

Link relations are very important and provide valuable context to help clarify the semantics of a given link or URL.

The table below provides guidance on which link relation to use to identify common types of links to data and services.

Table 4. Table. Link relation selection

Link type	Link relation ( <b>rel=</b> )
Online data archive	<b>archives</b>
Online documentation	<b>about</b>
OpenAPI endpoint (such as, JSON or YAML)	<b>service-desc</b>
OpenAPI endpoint in HTML (such as, Swagger, ReDoc)	<b>service-doc</b>
OGC WMS, WFS, WCS, CSW, WPS Capabilities	<b>service-desc</b>
A single link providing numerous data granules	<b>items</b>
A link providing a single data granule	<b>item</b>
A link to numerous stations that the dataset is based on	<b>stations</b>
A link to a single station that the dataset is based on	<b>station</b>
citation	<b>cite-as</b>
A search portal or web application	<b>search</b>
A zipfile of data, or bulk download	<b>enclosure</b>
A browse graphic of a dataset	<b>preview</b>
An OGC API endpoint providing a collection description	<b>collection</b>

### 1.20 Additional properties

A WCMP record can be extended as required for organizational purposes by adding properties (of any type) in the record. Additional properties do not break compliance to WCMP.

*Example:*

```
"properties": {
  ...
  "approvalStatus": "approved"
  "_comment": {
    "validationErrors": [
```

```

    "error 1",
    "error 2"
  ]
}
...
}

```

Permission 11	/per/core/additional_properties
A	A WCMP record MAY provide additional properties of any type in any part of the document as needed.

## 2. WMO Core Metadata Profile resources

### 2.1 WMO Codes Registry

- <http://codes.wmo.int/wis/contact-role>
- <http://codes.wmo.int/wis/global-service-type>
- <http://codes.wmo.int/wis/link-type>
- <http://codes.wmo.int/wis/resource-type>
- <http://codes.wmo.int/wis/topic-hierarchy/centre-id>
- <http://codes.wmo.int/wis/topic-hierarchy/data-policy>
- <http://codes.wmo.int/wis/topic-hierarchy/earth-system-discipline>
- <http://codes.wmo.int/wis/topic-hierarchy/notification-type>

### 2.2 WMO schemas server

Validation, examples and other resources are published at <https://schemas.wmo.int/wcmp>.

[1] Resolution 1 (Cg-Ext(2021)) – WMO Unified Policy for the International Exchange of Earth System Data (World Meteorological Congress: Abridged Final Report of the Extraordinary Session (WMO-No. 1281))

[2] Resolution 1 (Cg-Ext(2021)) – WMO Unified Policy for the International Exchange of Earth System Data (World Meteorological Congress: Abridged Final Report of the Extraordinary Session (WMO-No. 1281))

# Chapter 8. Cataloguing considerations

In addition to documenting and describing WIS2 data holdings, WCMP discovery metadata will be searchable via the [The WIS2 Global Discovery Catalogue](#) (GDC). As part of discovery and search workflow, a GDC may choose to apply filters to help narrow search results. This is realized by the API of the GDC, as well as applying facets in the catalogue.

## 8.1. Faceting

The API of the GDC, in addition to allowing for spatial/temporal/attribute queries and filters, may choose to apply facets to WCMP records. Facets are effective when applied against controlled vocabularies and classifications. The following WCMP required properties would be subject to faceting by a GDC:

- `centre-id` as defined in [1.4 Identifier](#)
- [1.6 Properties / Type](#)
- [1.18 Properties / WMO data policy](#)

# Annex A: Conformance Class Abstract Test Suite (Normative)

## A.1. Conformance Class: Core

**label**

<http://wis.wmo.int/spec/wcmp/2/conf/core>

**subject**

Requirements Class "core"

**classification**

Target Type:Discovery Metadata

### A.1.1. Validation

**label**

/conf/core/validation

**subject**

/req/core/validation

**test-purpose**

Validate that a WCMP record is valid to the authoritative WCMP schema.

Run JSON Schema validation on the WCMP record against the WCMP authoritative schema.

### A.1.2. Identifier

**label**

/conf/core/identifier

**subject**

/req/core/identifier

**test-purpose**

Validate that a WCMP record has a valid identifier.

Check for the existence of an **id** property in the WCMP record.



In the WCMP record's **id** property, check that there are at least **five** tokens, delimited by **:**.

In the WCMP record's **id** property, delimiting the value on **:**, check that the first three tokens are equal to [**'urn'**, **'wmo'**, **'md'**].

In the WCMP record's **id** property, delimiting the value on **:**, check that the fourth token is a centre id based on the WIS2 Topic Hierarchy and controlled vocabulary.

In the WCMP record's **id** property, delimiting the value on **:**, check that the fifth token (the local identifier) has no spaces or accented characters.

### A.1.3. Conformance

#### label

/conf/core/conformance

#### subject

/req/core/conformance

#### test-purpose

Validate that a WCMP record provides valid conformance information.

Check for the existence of a **conformsTo** property in the WCMP record.

In the WCMP record's **conformsTo** array property, check that ONE of the values is equal to **http://wis.wmo.int/spec/wcmp/2/conf/core**.

### A.1.4. Type

#### label

/conf/core/type

#### subject

/req/core/type

#### test-purpose

Validate that a WCMP record provides valid resource type information.

Check for the existence of a **properties.type** property in the WCMP record.

Check that the value of **properties.type** is part of the WCMP resource type codelist.

### A.1.5. Geospatial Extent

**label**

/conf/core/extent\_geospatial

**subject**

/req/core/extent\_geospatial

**test-purpose**

Validate that a WCMP record provides a valid geometry property.

Check for the existence of one **geometry** property in the WCMP record.

Check that all **geometry** coordinate value data types are integers or floats.

Check that **geometry** coordinate longitudinal values are between -180 and 180.

Check that **geometry** coordinate latitudinal values are between -90 and 90.

Check that **geometry** property is a valid GeoJSON geometry.

### A.1.6. Temporal Extent

**label**

/conf/core/extent\_temporal

**subject**

/req/core/extent\_temporal

**test-purpose**

Validate that a WCMP record provides a valid temporal extent property.

Check for the existence of one **time** item property in the WCMP record.

Check that the **time** object is one of **date** string, **timestamp** string, **interval** array, or **null**.

Check that all non-null **time** values are valid ISO8601 representations, intervals or durations, or **..** for an open-ended extent.

### A.1.7. Title

**label**

/conf/core/title

**subject**

/req/core/title

**test-purpose**

Validate that a WCMP record provides a title property.

Check for the existence of a `properties.title` property in the WCMP record.

### A.1.8. Description

**label**

/conf/core/description

**subject**

/req/core/description

**test-purpose**

Validate that a WCMP record provides a description property.

Check for the existence of a `properties.description` property in the WCMP record.

### A.1.9. Themes

**label**

/conf/core/themes

**subject**

/req/core/themes

**test-purpose**

Validate that a WCMP record provides a themes property.

Check for the existence of a single `properties.themes` array property in the WCMP record.

Check that the `properties.themes` property provides a minimum of one theme object.

Check that each theme object provides a minimum of one `concepts` property.

Check that each theme object provides one `scheme` property.

Check that each concept object provides a minimum of one `id` property.

Check that the `properties.themes` property provides a theme object with the `scheme` of `https://codes.wmo.int/wis/topic-hierarchy/earth-system-discipline`.

Check that all concepts identified are part of the `scheme` provided.

#### **label**

`/conf/core/themes_wis2_global_service`

#### **subject**

`/req/core/themes_wis2_global_service`

#### **test-purpose**

Validate that a WCMP record provides a themes property from a WIS2 global service.

Check for the existence of a `properties.type` element with a value of `service`.

Check that the `properties.themes` property provides a theme object with the `scheme` of `https://codes.wmo.int/wis/topic-hierarchy/earth-system-discipline`.

Check that each value from the `scheme` is provided as a concept.

Check that the `properties.themes` property provides a theme object with the `scheme` of `https://codes.wmo.int/wis/global-service-type`.

Check that one concept from the `scheme` is provided.

### **A.1.10. Contacts**

#### **label**

`/conf/core/contacts`

#### **subject**

`/req/core/contacts`

#### **test-purpose**

Validate that a WCMP record provides contact information for the metadata point of contact and originator of the data.

Check for the existence of a `properties.contacts` property in the WCMP record.

Check that the `contact` property provides a minimum of one contact object.

Check for the existence of a **roles** property in the contact object.

Check for the existence of an **organization** property in the contact object.

If **roles** exists, check that the value is part of the WCMP contact role codelist.

### A.1.11. Record Creation Date

**label**

/conf/core/record\_creation\_date

**subject**

/req/core/record\_creation\_date

**test-purpose**

Validate that a WCMP record provides a record creation date.

Check for the existence of one and only one **properties.created** property in the WCMP record.

### A.1.12. WMO Data Policy

**label**

/conf/core/data\_policy

**subject**

/req/core/data\_policy

**test-purpose**

Validate that a WCMP record provides information about data policy and, if applicable additional information about licensing and/or copyright.

Check for the type of WCMP record (**properties.type**).

If **properties.type** is found, and **properties.type** is equal to **dataset** check that **properties.wmo:dataPolicy** exists.

Check for the existence of a **properties.wmo:dataPolicy** property in the WCMP record.

If **properties.wmo:dataPolicy** is found, check that **properties.wmo:dataPolicy** has a value equal to **core** or **recommended**.

If `properties.wmo:dataPolicy` is equal to `recommended`, check for the existence of at least one `links` item containing a `license` link relation (`rel`).

### A.1.13. Links

**label**

/conf/core/links

**subject**

/req/core/links

**test-purpose**

Validate that a WCMP record provides a link property.

Check for the existence of a single `links` array property in the WCMP record.

Check that the `links` property provides a minimum of one link object.

Check that a link's `rel` property is a valid IANA, OGC, or WCMP link relation.

For a link object describing real-time data, check that the `href` property starts with the `mqtt` or `mqtt`s protocol, AND that `channel` is additionally defined.

For a link object describing archived (NOT real-time) data made available via API, check that the `rel` property is a recognized API service type as defined by IANA or OGC.

For a link object describing archived (NOT real-time) data made available via Web Accessible Folder, check that the `rel` property is a recognized API service type as defined by IANA or OGC.

For a link object with access control (defined by the `security` object), check that the `security` property contains a `description` property with instructions on how to obtain access.

# Annex B: Schemas (Normative)

## NOTE

The schema document will be published on <http://schemas.wmo.int/wcmp/2.0.0> once the standard has been approved.

## B.1. WMO Core Metadata Profile Schema

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://schemas.wmo.int/wcmp/2.0.0/schemas/wcmp2-bundled.json",
  "title": "WCMP discovery metadata record definition",
  "description": "WCMP discovery metadata record definition",
  "required": [
    "id",
    "conformsTo",
    "type",
    "time",
    "geometry",
    "properties",
    "links"
  ],
  "properties": {
    "id": {
      "type": "string",
      "description": "A unique identifier of the catalog record.",
      "format": "uri"
    },
    "conformsTo": {
      "type": "array",
      "contains": {
        "const": "http://wis.wmo.int/spec/wcmp/2/conf/core"
      }
    },
    "type": {
      "type": "string",
      "enum": [
        "Feature"
      ]
    },
    "time": {
      "oneOf": [
        {
          "enum": [
            null
          ]
        },
        {
          "type": "object",
```

```

"properties": {
  "date": {
    "type": "string",
    "pattern": "^\\d{4}-\\d{2}-\\d{2}$"
  },
  "timestamp": {
    "type": "string",
    "pattern": "^\\d{4}-\\d{2}-\\d{2}T\\d{2}:\\d{2}:\\d{2}(?:\\.\\d+)?Z$"
  },
  "interval": {
    "type": "array",
    "minItems": 2,
    "maxItems": 2,
    "items": {
      "oneOf": [
        {
          "type": "string",
          "pattern": "^\\d{4}-\\d{2}-\\d{2}$"
        },
        {
          "type": "string",
          "pattern": "^\\d{4}-\\d{2}$"
        },
        {
          "type": "string",
          "pattern": "^\\d{4}$"
        },
        {
          "type": "string",
          "pattern": "^\\d{4}-\\d{2}-\\d{2}T\\d{2}:\\d{2}:\\d{2}(?:\\.\\d+)?Z$"
        },
        {
          "type": "string",
          "pattern": "^T\\d{2}(:\\d{2})?(?:\\d{2})?(?:\\.\\d+)?Z$"
        },
        {
          "type": "string",
          "enum": [
            ".."
          ]
        }
      ]
    }
  },
  "resolution": {
    "type": "string",
    "description": "Minimum time period resolvable in the dataset, as an ISO 8601 duration",
    "example": [
      "P1D"
    ]
  }
}

```



```

    ]
  }
}
]
},
"geometry": {
  "oneOf": [
    {
      "enum": [
        null
      ]
    },
    {
      "oneOf": [
        {
          "type": "object",
          "required": [
            "type",
            "coordinates"
          ],
          "properties": {
            "type": {
              "type": "string",
              "enum": [
                "Point"
              ]
            },
            "coordinates": {
              "type": "array",
              "minItems": 2,
              "items": {
                "type": "number"
              }
            }
          }
        },
        {
          "type": "object",
          "required": [
            "type",
            "coordinates"
          ],
          "properties": {
            "type": {
              "type": "string",
              "enum": [
                "MultiPoint"
              ]
            },
            "coordinates": {

```

```

        "type": "array",
        "items": {
            "type": "array",
            "minItems": 2,
            "items": {
                "type": "number"
            }
        }
    }
},
{
    "type": "object",
    "required": [
        "type",
        "coordinates"
    ],
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "LineString"
            ]
        },
        "coordinates": {
            "type": "array",
            "minItems": 2,
            "items": {
                "type": "array",
                "minItems": 2,
                "items": {
                    "type": "number"
                }
            }
        }
    }
},
{
    "type": "object",
    "required": [
        "type",
        "coordinates"
    ],
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "MultiLineString"
            ]
        },
        "coordinates": {

```

```

        "type": "array",
        "items": {
            "type": "array",
            "minItems": 2,
            "items": {
                "type": "array",
                "minItems": 2,
                "items": {
                    "type": "number"
                }
            }
        }
    },
    {
        "type": "object",
        "required": [
            "type",
            "coordinates"
        ],
        "properties": {
            "type": {
                "type": "string",
                "enum": [
                    "Polygon"
                ]
            },
            "coordinates": {
                "type": "array",
                "items": {
                    "type": "array",
                    "minItems": 4,
                    "items": {
                        "type": "array",
                        "minItems": 2,
                        "items": {
                            "type": "number"
                        }
                    }
                }
            }
        }
    },
    {
        "type": "object",
        "required": [
            "type",
            "coordinates"
        ],
        "properties": {

```

```

        "type": {
            "type": "string",
            "enum": [
                "MultiPolygon"
            ]
        },
        "coordinates": {
            "type": "array",
            "items": {
                "type": "array",
                "items": {
                    "type": "array",
                    "minItems": 4,
                    "items": {
                        "type": "array",
                        "minItems": 2,
                        "items": {
                            "type": "number"
                        }
                    }
                }
            }
        }
    },
    {
        "type": "object",
        "required": [
            "type",
            "geometries"
        ],
        "properties": {
            "type": {
                "type": "string",
                "enum": [
                    "GeometryCollection"
                ]
            },
            "geometries": {
                "type": "array",
                "items": {
                    "$ref": "#/properties/geometry/oneOf/1"
                }
            }
        }
    }
]
},
"additionalExtents": {

```

```

    "description": "The extent of the information in the collection. In the Core
only spatial and temporal\nextents are specified. Extensions may add additional
members to represent other\nextents, for example, thermal or pressure ranges.",
    "type": "object",
    "properties": {
        "spatial": {
            "description": "The spatial extent of the information in the collection.",
            "type": "object",
            "required": [
                "bbox",
                "crs"
            ],
            "properties": {
                "bbox": {
                    "description": "One or more bounding boxes that describe the spatial
extent of the dataset.\nIn the Core only a single bounding box is supported.
Extensions may support\nadditional areas. If multiple areas are provided, the union of
the bounding\nboxes describes the spatial extent.",
                    "type": "array",
                    "minItems": 1,
                    "items": {
                        "description": "Each bounding box is provided as four or six numbers,
depending on\nwhether the coordinate reference system includes a vertical
axis\n(height or depth):\n\n* Lower left corner, coordinate axis 1\n* Lower left
corner, coordinate axis 2\n* Minimum value, coordinate axis 3 (optional)\n* Upper
right corner, coordinate axis 1\n* Upper right corner, coordinate axis 2\n* Maximum
value, coordinate axis 3 (optional)\n\nThe coordinate reference system of the values
is WGS 84 longitude/latitude\n(http://www.opengis.net/def/crs/OGC/1.3/CRS84) unless a
different coordinate\nreference system is specified in `crs`.\n\nFor WGS 84
longitude/latitude the values are in most cases the sequence of\nminimum longitude,
minimum latitude, maximum longitude and maximum latitude.\nHowever, in cases where the
box spans the antimeridian the first value\n(west-most box edge) is larger than the
third value (east-most box edge).\n\nIf the vertical axis is included, the third and
the sixth number are\nthe bottom and the top of the 3-dimensional bounding box.\n\nIf
a feature has multiple spatial geometry properties, it is the decision of the\nserver
whether only a single spatial geometry property is used to determine\nthe extent or
all relevant geometries.",
                        "oneOf": [
                            {
                                "items": {
                                    "type": "number"
                                },
                                "minItems": 4,
                                "maxItems": 4,
                                "type": "array"
                            },
                            {
                                "items": {
                                    "type": "number"
                                },
                                "minItems": 6,

```

```

        "maxItems": 6,
        "type": "array"
    }
]
},
"example": [
    -180,
    -90,
    180,
    90
]
},
"crs": {
    "description": "Coordinate reference system of the coordinates in the
spatial extent\n(property `bbox`). The default reference system is WGS 84
longitude/latitude.\nIn the Core this is the only supported coordinate reference
system.\nExtensions may support additional coordinate reference systems ",
    "type": "string",
    "default": "GEOGCS[\"WGS 84\",DATUM[\"WGS_1984\",SPHEROID[\"WGS
84\",6378137,298.257223563,AUTHORITY[\"EPSG\", \"7030\"]],AUTHORITY[\"EPSG\", \"6326\"]],PRIMEM[\"Greenwich\",0,AUTHORITY[\"EPSG\", \"8901\"]],UNIT[\"degree\",0.01745329251994
328,AUTHORITY[\"EPSG\", \"9122\"]],AUTHORITY[\"EPSG\", \"4326\"]]"
    },
    "name": {
        "description": "Name of the vertical coordinate reference system",
        "type": "string"
    }
}
},
"temporal": {
    "description": "The temporal extent of the information in the collection.",
    "type": "object",
    "required": [
        "interval",
        "trs"
    ],
},
"properties": {
    "interval": {
        "description": "RFC3339 compliant Date and Time",
        "type": "array",
        "minItems": 1,
        "items": {
            "description": "Begin and end times of the time interval. The
timestamps are in the\ntemporal coordinate reference system specified in `trs`. By
default\nthis is the Gregorian calendar.",
            "type": "array",
            "minItems": 2,
            "maxItems": 2,
            "items": {
                "type": "string",
                "nullable": true
            }
        }
    }
}

```

```

    },
    "example": [
      [
        "2020-11-12T12:15Z",
        "2020-11-12T12:15Z"
      ],
      [
        "2020-11-12T12:15Z",
        "2020-11-12T12:45Z"
      ],
      [
        "2022-01-14T09:00Z",
        "2022-01-15T09:00Z"
      ],
      [
        "2022-01-14T09:00Z",
        "2022-01-14T21:00Z"
      ],
      [
        "2022-01-14T09:00Z",
        "2022-01-16T09:00Z"
      ]
    ]
  },
  "values": {
    "description": "Provides information about the time intervals available in the collection \nas ISO8601 compliant dates, either as a time range specified \nas start time / end time (e.g. 2017-11-14T09:00Z/2017-11-14T21:00Z) or\ nas number of repetitions / start time / interval (e.g. R4/2017-11-14T21:00Z/PT3H) \nor a list of time values (e.g.\n2017-11-14T09:00Z,2017-11-14T12:00Z,2017-11-14T15:00Z,2017-11-14T18:00Z,2017-11-14T21:00Z)",
    "type": "array",
    "minItems": 1,
    "items": {
      "type": "string",
      "minItems": 1,
      "nullable": true,
      "example": [
        [
          "2020-11-12T12:15Z"
        ],
        [
          "2020-11-12T12:15Z",
          "2020-11-12T12:30Z",
          "2020-11-12T12:45Z"
        ],
        [
          "R12/2022-01-14T09:00Z/2022-01-15T09:00Z"
        ]
      ]
    }
  }
}

```

```

        "R12/2022-01-14T09:00Z/PT1H"
      ],
      [
        "R12/2022-01-14T09:00Z/PT1H",
        "R4/2022-01-14T21:00Z/PT3H",
        "R4/2022-01-15T09:00Z/PT6H"
      ]
    ]
  },
  "trs": {
    "description": "Coordinate reference system of the coordinates in the temporal extent\n(property `interval`). The default reference system is the Gregorian calendar.\nIn the Core this is the only supported temporal coordinate reference system.\nExtensions may support additional temporal coordinate reference systems ",
    "type": "string",
    "example": "TIMECRS[\"DateTime\",TDATUM[\"Gregorian Calendar\"],CS[TemporalDateTime,1],AXIS[\"Time (T)\",future]]",
    "default": "http://www.opengis.net/def/uom/ISO-8601/0/Gregorian"
  },
  "name": {
    "description": "Name of the temporal coordinate reference system",
    "type": "string"
  }
},
"vertical": {
  "description": "The vertical extent of the information in the collection.",
  "type": "object",
  "required": [
    "interval",
    "vrs"
  ],
  "properties": {
    "interval": {
      "description": "In the Core only a single time interval is supported. Extensions may support\nmultiple intervals. If multiple intervals are provided, the union of the\nintervals describes the vertical extent.",
      "type": "array",
      "minItems": 1,
      "items": {
        "description": "minimum and maximum heights of the vertical interval. The values are in the\nvertical coordinate reference system specified in `vrs`. By default\nthis is the vertical coordinate reference system of the source information.",
        "type": "array",
        "minItems": 1,
        "items": {
          "type": "string",
          "nullable": true
        }
      },
      "example": [

```



```

        [
            "2",
            "100"
        ]
    ]
}
},
"values": {
    "description": "Vertical level intervals that data in the collection is
available at \nthese can be defined as follows:\nmin level / max level (e.g.
\"2/100\") or \nas number of repetitions / start level / interval (e.g.\"R5/100/50\")
\nor a list of vertical levels (e.g. \"2\",10,\"80\", \"100\")\n\nThe value 'null' is
supported and indicates an open vertical interval.",
    "type": "array",
    "minItems": 1,
    "items": {
        "type": "string",
        "nullable": true,
        "example": [
            [
                "2/100"
            ],
            [
                "R20/1000/-50"
            ],
            [
                "2",
                "10",
                "80",
                "100"
            ]
        ]
    }
},
"vrs": {
    "description": "Coordinate reference system of the coordinates in the
vertical extent\n(property 'interval'). ",
    "type": "string",
    "example":
"VERTCS[\"WGS_1984\",DATUM[\"D_WGS_1984\",SPHEROID[\"WGS_1984\",6378137.0,298.25722356
3]],PARAMETER[\"Vertical_Shift\",0.0],PARAMETER[\"Direction\",1.0],UNIT[\"Meter\",1.0]
],AXIS[\"Up\",UP]",
    "default":
"VERTCS[\"WGS_1984\",DATUM[\"D_WGS_1984\",SPHEROID[\"WGS_1984\",6378137.0,298.25722356
3]],PARAMETER[\"Vertical_Shift\",0.0],PARAMETER[\"Direction\",1.0],UNIT[\"Meter\",1.0]
],AXIS[\"Up\",UP]"
},
"name": {
    "description": "Name of the vertical coordinate reference system",
    "type": "string"
}
}

```

```

    }
  }
},
"properties": {
  "type": "object",
  "required": [
    "type",
    "title",
    "description",
    "contacts",
    "created"
  ],
  "properties": {
    "type": {
      "type": "string",
      "description": "The nature or genre of the resource. The value should be a code, convenient for filtering records. Where available, a link to the canonical URI of the record type resource will be added to the 'links' property.",
      "maxLength": 64
    },
    "title": {
      "type": "string",
      "description": "A human-readable name given to the resource."
    },
    "description": {
      "type": "string",
      "description": "A free-text account of the resource."
    },
    "keywords": {
      "type": "array",
      "description": "The topic or topics of the resource. Typically represented using free-form keywords, tags, key phrases, or classification codes.",
      "items": {
        "type": "string"
      }
    },
    "themes": {
      "type": "array",
      "minItems": 1,
      "items": {
        "type": "object",
        "required": [
          "concepts",
          "scheme"
        ],
        "properties": {
          "concepts": {
            "type": "array",
            "description": "One or more entity/concept identifiers from this knowledge system. it is recommended that a resolvable URI be used for each

```

```

entity/concept identifier.",
    "minItems": 1,
    "items": {
        "type": "object",
        "required": [
            "id"
        ],
        "properties": {
            "id": {
                "type": "string",
                "description": "An identifier for the concept."
            },
            "title": {
                "type": "string",
                "description": "A human readable title for the concept."
            },
            "description": {
                "type": "string",
                "description": "A human readable description for the concept."
            },
            "url": {
                "type": "string",
                "format": "uri",
                "description": "A URI providing further description of the
concept."
            }
        }
    }
},
"scheme": {
    "type": "string",
    "description": "An identifier for the knowledge organization system
used to classify the resource. It is recommended that the identifier be a resolvable
URI. The list of schemes used in a searchable catalog can be determined by inspecting
the server's OpenAPI document or, if the server implements CQL2, by exposing a
queryable (e.g. named `scheme`) and enumerating the list of schemes in the queryable's
schema definition."
}
},
"contacts": {
    "type": "array",
    "minItems": 1,
    "items": {
        "allOf": [
            {
                "required": [
                    "organization"
                ],
                "additionalProperties": false,

```

```

    "type": "object",
    "description": "Identification of, and means of communication with,
person responsible\nfor the resource.",
    "anyOf": [
      {
        "required": [
          "name"
        ]
      },
      {
        "required": [
          "organization"
        ]
      }
    ],
    "properties": {
      "identifier": {
        "type": "string",
        "description": "A value uniquely identifying a contact."
      },
      "name": {
        "type": "string",
        "description": "The name of the responsible person."
      },
      "position": {
        "type": "string",
        "description": "The name of the role or position of the
responsible person taken from the organization's formal organizational hierarchy or
chart."
      },
      "organization": {
        "type": "string",
        "description": "Organization/affiliation of the contact."
      },
      "logo": {
        "description": "Graphic identifying a contact. The link relation
should be `icon` and the media type should be an image media type.",
        "allOf": [
          {
            "type": "object",
            "required": [
              "href",
              "rel"
            ],
            "properties": {
              "href": {
                "type": "string",
                "example": "http://data.example.com/buildings/123"
              },
              "rel": {
                "type": "string",

```

```

        "example": "alternate"
    },
    "type": {
        "type": "string",
        "example": "application/geo+json"
    },
    "hreflang": {
        "type": "string",
        "example": "en"
    },
    "title": {
        "type": "string",
        "example": "Trierer Strasse 70, 53115 Bonn"
    },
    "length": {
        "type": "integer"
    }
}
},
{
    "type": "object",
    "required": [
        "rel",
        "type"
    ],
    "properties": {
        "rel": {
            "enum": [
                "icon"
            ]
        }
    }
}
]
},
"phones": {
    "type": "array",
    "description": "Telephone numbers at which contact can be made.",
    "items": {
        "type": "object",
        "required": [
            "value"
        ],
        "properties": {
            "value": {
                "type": "string",
                "description": "The value is the phone number itself.",
                "pattern": "^\\+[1-9]{1}[0-9]{3,14}$",
                "example": "+14165550142"
            }
        }
    },
    "roles": {

```

```

        "description": "The type of phone number (e.g. home, work,
fax, etc.).",
        "$ref":
"#/properties/properties/properties/contacts/items/allOf/0/properties/roles"
    }
}
},
"emails": {
    "type": "array",
    "description": "Email addresses at which contact can be made.",
    "items": {
        "type": "object",
        "required": [
            "value"
        ],
        "properties": {
            "value": {
                "type": "string",
                "description": "The value is the email number itself.",
                "format": "email"
            },
            "roles": {
                "description": "The type of email (e.g. home, work, etc.).",
                "$ref":
"#/properties/properties/properties/contacts/items/allOf/0/properties/roles"
            }
        }
    },
    "addresses": {
        "type": "array",
        "description": "Physical location at which contact can be made.",
        "items": {
            "type": "object",
            "properties": {
                "deliveryPoint": {
                    "type": "array",
                    "description": "Address lines for the location.",
                    "items": {
                        "type": "string"
                    }
                },
                "city": {
                    "type": "string",
                    "description": "City for the location."
                },
                "administrativeArea": {
                    "type": "string",
                    "description": "State or province of the location."
                }
            }
        }
    }
}

```

```

        "postalCode": {
            "type": "string",
            "description": "ZIP or other postal code."
        },
        "country": {
            "type": "string",
            "description": "Country of the physical address. ISO 3166-1
is recommended."
        },
        "roles": {
            "description": "The type of address (e.g. office, home,
etc.).",
            "$ref":
"#/properties/properties/properties/contacts/items/allOf/0/properties/roles"
        }
    },
    "links": {
        "type": "array",
        "description": "On-line information about the contact.",
        "items": {
            "allOf": [
                {
                    "$ref":
"#/properties/properties/properties/contacts/items/allOf/0/properties/logo/allOf/0"
                },
                {
                    "type": "object",
                    "required": [
                        "type"
                    ]
                }
            ]
        }
    },
    "hoursOfService": {
        "type": "string",
        "description": "Time period when the contact can be contacted.",
        "example": "Hours: Mo-Fr 10am-7pm Sa 10am-22pm Su 10am-21pm"
    },
    "contactInstructions": {
        "type": "string",
        "description": "Supplemental instructions on how or when to
contact the\nresponsible party."
    },
    "roles": {
        "description": "The set of named duties, job functions and/or
permissions associated with this contact. (e.g. developer, administrator, etc.).",
        "type": "array",
        "minItems": 1,

```

```

        "items": {
            "type": "string"
        }
    }
}
]
}
},
"version": {
    "type": "string",
    "description": "The version or edition of a given dataset."
},
"externalIds": {
    "type": "array",
    "description": "An identifier for the resource assigned by an external (to
the catalog) entity.",
    "items": {
        "type": "object",
        "properties": {
            "scheme": {
                "type": "string",
                "description": "A reference to an authority or identifier for a
knowledge organization system from which the external identifier was obtained. It is
recommended that the identifier be a resolvable URI."
            },
            "value": {
                "type": "string",
                "description": "The value of the identifier."
            }
        },
        "required": [
            "value"
        ]
    },
    "value": {
        "type": "string",
        "description": "Date of creation of this record.",
        "format": "date-time"
    },
    "updated": {
        "type": "string",
        "description": "The most recent date on which the record was changed.",
        "format": "date-time"
    },
    "wmo:dataPolicy": {
        "type": "string",
        "description": "The data policy definition as per the WMO Unified Data
Policy Resolution (Res.1) [23].",
        "enum": [

```



```

        "core",
        "recommended"
    ]
},
"rights": {
    "type": "string",
    "description": "A statement that concerns all rights not addressed by the
license such as a copyright statement."
},
"wmo:status": {
    "description": "The operational status of a given dataset.",
    "$ref":
"#/properties/properties/properties/themes/items/properties/concepts/items"
}
},
"links": {
    "type": "array",
    "minItems": 1,
    "items": {
        "$ref": "#/definitions/Link"
    }
},
"linkTemplates": {
    "type": "array",
    "items": {
        "allOf": [
            {
                "type": "object",
                "properties": {
                    "rel": {
                        "type": "string",
                        "description": "The type or semantics of the relation.",
                        "example": "alternate"
                    },
                    "type": {
                        "type": "string",
                        "description": "A hint indicating what the media type of the result of
dereferencing the link should be.",
                        "example": "application/geo+json"
                    },
                    "hreflang": {
                        "type": "string",
                        "description": "A hint indicating what the language of the result of
dereferencing the link should be.",
                        "example": "en"
                    },
                    "title": {
                        "type": "string",
                        "description": "Used to label the destination of a link such that it
can be used as a human-readable identifier.",

```

```

        "example": "Trierer Strasse 70, 53115 Bonn"
    },
    "length": {
        "type": "integer"
    },
    "created": {
        "type": "string",
        "description": "Date of creation of the resource pointed to by the
link.",
        "format": "date-time"
    },
    "updated": {
        "type": "string",
        "description": "Most recent date on which the resource pointed to by
the link was changed.",
        "format": "date-time"
    }
},
{
    "type": "object",
    "required": [
        "uriTemplate"
    ],
    "properties": {
        "uriTemplate": {
            "type": "string",
            "description": "Supplies a resolvable URI to a remote resource (or
resource fragment).",
            "example": "http://data.example.com/buildings/(building-id)"
        },
        "varBase": {
            "type": "string",
            "description": "The base URI to which the variable name can be
appended to retrieve the definition of the variable as a JSON Schema fragment.",
            "format": "url"
        },
        "variables": {
            "type": "object",
            "description": "This object contains one key per substitution variable
in the templated URL. Each key defines the schema of one substitution variable using
a JSON Schema fragment and can thus include things like the data type of the variable,
enumerations, minimum values, maximum values, etc."
        }
    }
}
]
}
},
"definitions": {

```

```

"Link": {
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://raw.githubusercontent.com/wmo-im/wcmp2/main/schema/link.yaml",
  "title": "WCMP link object definition",
  "description": "WCMP link object definition",
  "type": "object",
  "required": [
    "href",
    "rel"
  ],
  "properties": {
    "rel": {
      "type": "string",
      "description": "The type or semantics of the relation.",
      "example": "alternate"
    },
    "type": {
      "type": "string",
      "description": "A hint indicating what the media type of the result of
dereferencing the link should be.",
      "example": "application/geo+json"
    },
    "hreflang": {
      "type": "string",
      "description": "A hint indicating what the language of the result of
dereferencing the link should be.",
      "example": "en"
    },
    "title": {
      "type": "string",
      "description": "Used to label the destination of a link such that it can be
used as a human-readable identifier.",
      "example": "Trierer Strasse 70, 53115 Bonn"
    },
    "length": {
      "type": "integer"
    },
    "channel": {
      "type": "string",
      "description": "topic to subscribe to for broker workflow"
    },
    "security": {
      "type": "object",
      "patternProperties": {
        "^[a-zA-Z0-9\\.\\-\\_]+$": {
          "oneOf": [
            {
              "$ref": "#/definitions/Schema_Reference"
            },
            {
              "$ref": "#/definitions/Schema_SecurityScheme"
            }
          ]
        }
      }
    }
  }
}

```

```

    }
  ]
}
},
"distribution": {
  "type": "object",
  "description": "the additional information qualifying the service and
allowing to build and display the \"access\" information in a portal",
  "properties": {
    "availableFormats": {
      "type": "array",
      "items": {
        "type": "object",
        "properties": {
          "name": {
            "type": "string",
            "description": "available format short name."
          },
          "description": {
            "type": "string",
            "description": "the individual format description to allow
building the portal information"
          },
          "numberOfFiles": {
            "type": "string",
            "description": "typical number of files disseminated by the
distribution mechanism over a period of time"
          },
          "typicalFileSize": {
            "type": "string",
            "description": "size of a typical individual file (e.g. KB, MB,
GB)"
          },
          "typicalFilename": {
            "type": "string",
            "description": "example filename"
          },
          "samples": {
            "description": "links of samples that can be openly accessed by
users to provide a better understanding of the data",
            "items": {
              "type": "object",
              "$ref":
"#/properties/links/items/properties/distribution/properties/availableFormats/items/pr
operties/documentation/items"
            }
          },
          "documentation": {
            "type": "array",
            "description": "links to the associated documentation available

```

```

for this format when applicable",
    "items": {
        "allOf": [
            {
                "type": "object",
                "required": [
                    "rel"
                ],
                "properties": {
                    "rel": {
                        "type": "string",
                        "description": "The type or semantics of the relation.",
                        "example": "alternate"
                    },
                    "type": {
                        "type": "string",
                        "description": "A hint indicating what the media type of
the result of dereferencing the link should be.",
                        "example": "application/geo+json"
                    },
                    "hreflang": {
                        "type": "string",
                        "description": "A hint indicating what the language of
the result of dereferencing the link should be.",
                        "example": "en"
                    },
                    "title": {
                        "type": "string",
                        "description": "Used to label the destination of a link
such that it can be used as a human-readable identifier.",
                        "example": "Trierer Strasse 70, 53115 Bonn"
                    },
                    "length": {
                        "type": "integer"
                    }
                }
            },
            {
                "type": "object",
                "required": [
                    "href"
                ],
                "properties": {
                    "href": {
                        "type": "string",
                        "description": "The URI of the link target.",
                        "example": "http://data.example.com/buildings/123"
                    }
                }
            }
        ]
    }
}

```

```

    }
  }
}
}
}
}
},
"Schema_APIKeySecurityScheme": {
  "type": "object",
  "required": [
    "type",
    "name",
    "in"
  ],
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "apiKey"
      ]
    },
    "name": {
      "type": "string"
    },
    "in": {
      "type": "string",
      "enum": [
        "header",
        "query",
        "cookie"
      ]
    },
    "description": {
      "type": "string"
    }
  },
  "patternProperties": {
    "^x-": {}
  },
  "additionalProperties": false
},
"Schema_AuthorizationCodeOAuthFlow": {
  "type": "object",
  "required": [
    "authorizationUrl",
    "tokenUrl"
  ],
  "properties": {
    "authorizationUrl": {

```

```

        "type": "string",
        "format": "uri-reference"
    },
    "tokenUrl": {
        "type": "string",
        "format": "uri-reference"
    },
    "refreshUrl": {
        "type": "string",
        "format": "uri-reference"
    },
    "scopes": {
        "type": "object",
        "additionalProperties": {
            "type": "string"
        }
    }
},
"patternProperties": {
    "^x-": {}
},
"additionalProperties": false
},
"Schema_ClientCredentialsFlow": {
    "type": "object",
    "required": [
        "tokenUrl"
    ],
    "properties": {
        "tokenUrl": {
            "type": "string",
            "format": "uri-reference"
        },
        "refreshUrl": {
            "type": "string",
            "format": "uri-reference"
        },
        "scopes": {
            "type": "object",
            "additionalProperties": {
                "type": "string"
            }
        }
    }
},
"patternProperties": {
    "^x-": {}
},
"additionalProperties": false
},
"Schema_HTTPSecurityScheme": {
    "type": "object",

```

```

"required": [
  "scheme",
  "type"
],
"properties": {
  "scheme": {
    "type": "string"
  },
  "bearerFormat": {
    "type": "string"
  },
  "description": {
    "type": "string"
  },
  "type": {
    "type": "string",
    "enum": [
      "http"
    ]
  }
},
"patternProperties": {
  "^X-": {}
},
"additionalProperties": false,
"oneOf": [
  {
    "description": "Bearer",
    "properties": {
      "scheme": {
        "enum": [
          "bearer"
        ]
      }
    }
  },
  {
    "description": "Non Bearer",
    "not": {
      "required": [
        "bearerFormat"
      ]
    },
    "properties": {
      "scheme": {
        "not": {
          "enum": [
            "bearer"
          ]
        }
      }
    }
  }
]

```



```

    }
  }
]
},
"Schema_ImplicitOAuthFlow": {
  "type": "object",
  "required": [
    "authorizationUrl",
    "scopes"
  ],
  "properties": {
    "authorizationUrl": {
      "type": "string",
      "format": "uri-reference"
    },
    "refreshUrl": {
      "type": "string",
      "format": "uri-reference"
    },
    "scopes": {
      "type": "object",
      "additionalProperties": {
        "type": "string"
      }
    }
  },
  "patternProperties": {
    "^x-": {}
  },
  "additionalProperties": false
},
"Schema_OAuth2SecurityScheme": {
  "type": "object",
  "required": [
    "type",
    "flows"
  ],
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "oauth2"
      ]
    },
    "flows": {
      "$ref": "#/definitions/Schema_OAuthFlows"
    },
    "description": {
      "type": "string"
    }
  }
},

```

```

    "patternProperties": {
      "^x-": {}
    },
    "additionalProperties": false
  },
  "Schema_OAuthFlows": {
    "type": "object",
    "properties": {
      "implicit": {
        "$ref": "#/definitions/Schema_ImplicitOAuthFlow"
      },
      "password": {
        "$ref": "#/definitions/Schema_PasswordOAuthFlow"
      },
      "clientCredentials": {
        "$ref": "#/definitions/Schema_ClientCredentialsFlow"
      },
      "authorizationCode": {
        "$ref": "#/definitions/Schema_AuthorizationCodeOAuthFlow"
      }
    },
    "patternProperties": {
      "^x-": {}
    },
    "additionalProperties": false
  },
  "Schema_OpenIdConnectSecurityScheme": {
    "type": "object",
    "required": [
      "type",
      "openIdConnectUrl"
    ],
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "openIdConnect"
        ]
      },
      "openIdConnectUrl": {
        "type": "string",
        "format": "uri-reference"
      },
      "description": {
        "type": "string"
      }
    },
    "patternProperties": {
      "^x-": {}
    },
    "additionalProperties": false
  }
}

```

```

},
"Schema_PasswordOAuthFlow": {
  "type": "object",
  "required": [
    "tokenUrl"
  ],
  "properties": {
    "tokenUrl": {
      "type": "string",
      "format": "uri-reference"
    },
    "refreshUrl": {
      "type": "string",
      "format": "uri-reference"
    },
    "scopes": {
      "type": "object",
      "additionalProperties": {
        "type": "string"
      }
    }
  },
  "patternProperties": {
    "^x-": {}
  },
  "additionalProperties": false
},
"Schema_Reference": {
  "type": "object",
  "required": [
    "$ref"
  ],
  "patternProperties": {
    "^\\$ref$": {
      "type": "string",
      "format": "uri-reference"
    }
  }
},
"Schema_SecurityScheme": {
  "oneOf": [
    {
      "$ref": "#/definitions/Schema_APIKeySecurityScheme"
    },
    {
      "$ref": "#/definitions/Schema_HTTPSecurityScheme"
    },
    {
      "$ref": "#/definitions/Schema_OAuth2SecurityScheme"
    }
  ]
}

```

```
    "$ref": "#/definitions/Schema_OpenIdConnectSecurityScheme"  
  }  
]  
}  
}
```

# Annex C: Examples (Informative)

## C.1. WMO Core Metadata Profile Examples

*Example: Canadian Hourly Surface Weather Observations (dataset)*

```
{
  "id": "urn:wmo:md:ca-eccc-msc:weather.observations.swob-realtime",
  "conformsTo": [
    "http://wis.wmo.int/spec/wcmp/2/conf/core"
  ],
  "time": {
    "interval": [
      "2010-11-11T11:11:11Z",
      ".."
    ]
  },
  "type": "Feature",
  "geometry": {
    "type": "Polygon",
    "coordinates": [
      [
        [
          -142,
          28
        ],
        [
          -142,
          82
        ],
        [
          -52,
          82
        ],
        [
          -52,
          28
        ],
        [
          -142,
          28
        ]
      ]
    ]
  },
  "properties": {
    "title": "Surface Weather Observations",
    "description": "Surface Observations measured at the automatic and manual stations of the Environment and Climate Change Canada and partners networks, either
```

for a single station, or for the stations of specific provinces and territories (last 30 days)",

```
    "themes": [
      {
        "concepts": [
          {
            "id": "Weather"
          },
          {
            "id": "Archives"
          },
          {
            "id": "Precipitation"
          },
          {
            "id": "Air temperature"
          },
          {
            "id": "Humidity"
          },
          {
            "id": "Snow"
          },
          {
            "id": "Wind"
          },
          {
            "id": "Meteorological data"
          }
        ],
        "scheme": "https://canada.multites.net/cst"
      },
      {
        "concepts": [
          {
            "id": "weather",
            "title": "Weather",
            "url": "https://codes.wmo.int/wis/topic-hierarchy/earth-system-discipline/weather"
          }
        ],
        "scheme": "https://codes.wmo.int/wis/topic-hierarchy/earth-system-discipline"
      }
    ],
    "contacts": [
      {
        "name": "National Inquiry Response Team",
        "organization": "Government of Canada; Environment and Climate Change Canada; Meteorological Service of Canada",
        "phones": [
```

```

        {
            "value": "+18199972800"
        }
    ],
    "emails": [
        {
            "value": "enviroinfo@ec.gc.ca"
        }
    ],
    "addresses": [
        {
            "deliveryPoint": [
                "77 Westmorland Street, suite 260"
            ],
            "city": "Fredericton",
            "administrativeArea": "NB",
            "postalCode": "E3B 6Z4",
            "country": "Canada"
        }
    ],
    "links": [
        {
            "rel": "about",
            "type": "text/html",
            "href": "https://www.canada.ca/en/environment-climate-
change.html"
        }
    ],
    "roles": [
        "host",
        "producer"
    ]
},
"type": "dataset",
"created": "2018-01-01T00:11:32Z",
"updated": "2022-06-22T08:23:42Z",
"wmo:dataPolicy": "core"
},
"links": [
    {
        "rel": "stations",
        "href": "https://dd.weather.gc.ca/observations/doc/swob-
xml_station_list.csv",
        "type": "text/csv",
        "title": "Stations associated with this dataset"
    },
    {
        "rel": "data",
        "href": "https://dd.weather.gc.ca/observations/swob-ml",
        "type": "text/html",

```

```

    "hreflang": "en",
    "title": "Raw data download (XML files)",
    "distribution": {
      "availableFormats": [
        {
          "name": "XML"
        }
      ]
    }
  },
  {
    "rel": "items",
    "href": "https://api.weather.gc.ca/collections/swob-realtime/items",
    "type": "application/geo+json",
    "title": "Data access API interface"
  },
  {
    "rel": "about",
    "href": "https://eccc-msc.github.io/open-data/msc-
data/obs_station/readme_obs_insitu_swobdatamart_en",
    "type": "text/html",
    "title": "Documentation"
  },
  {
    "rel": "items",
    "href": "mqtt://everyone:everyone@globalbroker.meteo.fr:8883",
    "channel": "origin/a/wis2/ca-eccc-msc/data/core/weather/surface-based-
observations/synop",
    "type": "application/geo+json",
    "title": "Data notifications"
  }
]
}

```

*Example: ICON-EPS GRIB data (dataset)*

```

{
  "id": "urn:wmo:md:de-dwd:icon-eps.ALL",
  "type": "Feature",
  "conformsTo": [
    "http://wis.wmo.int/spec/wcmp/2/conf/core"
  ],
  "time": {
    "interval": [
      "2018-04-22",
      ".."
    ]
  },
  "geometry": {
    "type": "Polygon",

```



```

    "coordinates": [
      [
        [
          -180,
          -90
        ],
        [
          -180,
          90
        ],
        [
          180,
          90
        ],
        [
          180,
          -90
        ],
        [
          -180,
          -90
        ]
      ]
    ],
    "additionalExtents": {
      "spatial": {
        "bbox": [
          [
            -180,
            -90,
            180,
            90
          ]
        ],
        "resolution": "13km",
        "crs": "http://www.opengis.net/def/crs/OGC/1.3/CRS84"
      },
      "temporal": {
        "interval": [
          [
            "T00Z",
            "PT180H"
          ],
          [
            "T12Z",
            "PT180H"
          ]
        ],
        "resolution": "PT6H",
        "trs": "http://www.opengis.net/def/trs/ISO-8601"
      }
    }
  }
}

```

```

    }
  },
  "properties": {
    "type": "dataset",
    "title": "Global Ensemble Prediction Model",
    "description": "ICON-EPS 0.5 deg x 0.5 deg regular lat/lon grid, up to +180h  
every 6h, runs 00/12 UTC, various parameter, various level, various threshold",
    "themes": [
      {
        "concepts": [
          {
            "id": "meteorology"
          }
        ],
        "scheme":
"http://wis.wmo.int/2012/codelists/WMOCodeLists#WMO_CategoryCode"
      },
      {
        "concepts": [
          {
            "id": "Meteorological geographical features"
          }
        ],
        "scheme": "https://inspire.ec.europa.eu/theme/mf"
      },
      {
        "concepts": [
          {
            "id": "FM 92 GRIB edition 2"
          }
        ],
        "scheme": "https://codes.wmo.int/grib2"
      },
      {
        "concepts": [
          {
            "id": "continual"
          }
        ],
        "scheme":
"http://standards.iso.org/iso/19139/resources/gmxCodelists.xml#MD_FrequencyCode"
      },
      {
        "concepts": [
          {
            "id": "weather",
            "title": "Weather",
            "url": "https://codes.wmo.int/wis/topic-hierarchy/earth-  
system-discipline/weather"
          }
        ],
      },
    ]
  },

```

```

        "scheme": "https://codes.wmo.int/wis/topic-hierarchy/earth-system-
discipline"
    },
    ],
    "contacts": [
        {
            "identifier": "DWD",
            "organization": "Deutscher Wetterdienst",
            "name": "Michael Denhard",
            "emails": [
                {
                    "value": "wis@dwd.de"
                }
            ],
            "addresses": [
                {
                    "deliveryPoint": [
                        "Frankfurter Strasse 135"
                    ],
                    "city": "Offenbach",
                    "postalCode": "63067",
                    "country": "Germany"
                }
            ],
            "links": [
                {
                    "rel": "about",
                    "type": "text/html",
                    "href": "https://www.dwd.de/wmc"
                },
                {
                    "rel": "about",
                    "type": "text/html",
                    "href": "https://gisc.dwd.de"
                }
            ],
            "contactInstructions": "email",
            "roles": [
                "host",
                "producer"
            ]
        }
    ],
    "created": "2018-08-19T08:10:00Z",
    "updated": "2023-12-01T00:00:00Z",
    "wmo:dataPolicy": "core",
    "keywords": [
        "CLCH",
        "CLCL",
        "CLCM",
        "CLCT",

```

```

        "cloud",
        "MSLP",
        "Probability of temperature anomalies",
        "cape",
        "dew point",
        "geopotential height",
        "maximum temperature 2m",
        "minimum temperature 2m",
        "precipitation",
        "snow",
        "snowfall",
        "soil temperature",
        "temperature",
        "wind gusts 10m",
        "wind speed",
        "wind speed 10m"
    ],
    "externalIds": [
        {
            "scheme": "DWD",
            "value": "de.dwd.icon-eps.ALL"
        }
    ],
    "language": "eng",
    "formats": [
        "GRIB2"
    ],
    "rights": "Users are granted free and unrestricted access to this data,
without charge and with no conditions on use. Users are requested to attribute the
producer of this data."
},
"links": [
    {
        "rel": "data",
        "type": "text/html",
        "title": "Open Data Server DWD",
        "href": "https://opendata.dwd.de/weather/wmc/icon-eps/data/grib"
    },
    {
        "rel": "about",
        "href":
"https://www.dwd.de/EN/ourservices/nwp_forecast_data/nwp_forecast_data.html",
        "type": "text/html",
        "title": "NWP Forecast Data"
    },
    {
        "rel": "copyright",
        "type": "text/html",
        "title": "copyright readme",
        "href": "https://opendata.dwd.de/README.txt"
    }
],

```

```

    {
      "rel": "items",
      "channel": "origin/a/wis2/de-
dwd/data/core/weather/prediction/forecast/medium-range",
      "href": "mqtt://everyone:everyone@example.org:8883",
      "type": "application/geo+json",
      "title": "Data notifications"
    }
  ]
}

```

*Example: WIS2 Global Broker (service)*

```

{
  "id": "urn:wmo:md:fr-meteofrance-global-broker:gb",
  "type": "Feature",
  "conformsTo": [
    "http://wis.wmo.int/spec/wcmp/2/conf/core"
  ],
  "time": null,
  "geometry": {
    "type": "Polygon",
    "coordinates": [
      [
        [
          -180,
          -90
        ],
        [
          -180,
          90
        ],
        [
          180,
          90
        ],
        [
          180,
          -90
        ],
        [
          -180,
          -90
        ]
      ]
    ]
  },
  "properties": {
    "type": "service",
    "title": "WIS2 Broker - M\u00e9t\u00e9o-France",
  }
}

```

```

    "description": "TODO",
    "themes": [
      {
        "concepts": [
          {
            "id": "weather",
            "title": "Weather",
            "url": "https://codes.wmo.int/wis/topic-hierarchy/earth-
system-discipline/weather"
          },
          {
            "id": "climate",
            "title": "Climate",
            "url": "https://codes.wmo.int/wis/topic-hierarchy/earth-
system-discipline/climate"
          },
          {
            "id": "hydrology",
            "title": "Hydrology",
            "url": "https://codes.wmo.int/wis/topic-hierarchy/earth-
system-discipline/hydrology"
          },
          {
            "id": "atmospheric-composition",
            "title": "Atmospheric Composition",
            "url": "https://codes.wmo.int/wis/topic-hierarchy/earth-
system-discipline/atmospheric-composition"
          },
          {
            "id": "cryosphere",
            "title": "Cryosphere",
            "url": "https://codes.wmo.int/wis/topic-hierarchy/earth-
system-discipline/cryosphere"
          },
          {
            "id": "ocean",
            "title": "Ocean",
            "url": "https://codes.wmo.int/wis/topic-hierarchy/earth-
system-discipline/ocean"
          },
          {
            "id": "space-weather",
            "title": "Space Weather",
            "url": "https://codes.wmo.int/wis/topic-hierarchy/earth-
system-discipline/space-weather"
          }
        ],
        "scheme": "https://codes.wmo.int/wis/topic-hierarchy/earth-system-
discipline"
      },
      {

```

```

        "concepts": [
            {
                "id": "global-broker",
                "title": "Global Broker",
                "url": "https://codes.wmo.int/wis/service-types/global-broker"
            }
        ],
        "scheme": "https://codes.wmo.int/wis/service-types"
    },
    ],
    "contacts": [
        {
            "identifiant": "meteo-france",
            "organization": "M\u00e9t\u00e9o-France",
            "name": "David Podeur",
            "emails": [
                {
                    "value": "gisc_support@meteo.fr"
                }
            ],
            "addresses": [
                {
                    "deliveryPoint": [
                        "42 Avenue Coriolis"
                    ],
                    "city": "Toulouse",
                    "postalCode": "31057",
                    "country": "France"
                }
            ],
            "links": [
                {
                    "rel": "about",
                    "type": "text/html",
                    "href": "https://donneespubliques.meteofrance.fr"
                }
            ],
            "contactInstructions": "email",
            "roles": [
                "host"
            ]
        }
    ],
    "created": "2022-11-11T11:00:00Z",
    "keywords": [
        "wis2",
        "global discovery catalogue",
        "metadata"
    ]
},
"links": [

```

```

{
  "rel": "items",
  "type": "application/geo+json",
  "title": "WMO WIS2 Global Broker - M\u00e9t\u00e9o-France",
  "href": "mqtt://everyone:everyone@example.org:8883",
  "channel": "cache/a/wis2/#",
  "distribution": {
    "maxMSGsize": 4096,
    "unit": "bytes"
  }
},
{
  "rel": "related",
  "type": "application/json",
  "title": "WMO WIS Global Broker - China Meteorological Administration",
  "href": "mqtt://everyone:everyone@example.org:8883",
  "channel": "cache/a/wis2/#",
  "distribution": {
    "maxMSGsize": 4096,
    "unit": "bytes"
  }
}
]
}

```



# Annex D: Codelists (Informative)

## D.1. Dataset status

The links below provide some controlled vocabularies in support of dataset status, and may be of use when encoding the `properties.status` property..

- <https://www.w3.org/TR/vocab-dcat-3/#life-cycle>
- [https://vocab.met.no/mmd/en/page/?uri=https%3A%2F%2Fvocab.met.no%2Fmmd%2FOperational\\_Status](https://vocab.met.no/mmd/en/page/?uri=https%3A%2F%2Fvocab.met.no%2Fmmd%2FOperational_Status)
- [https://wiki.esipfed.org/ISO\\_19115\\_and\\_19115-2\\_CodeList\\_Dictionaries#MD\\_ProgressCode](https://wiki.esipfed.org/ISO_19115_and_19115-2_CodeList_Dictionaries#MD_ProgressCode)

# Annex E: Bibliography

- W3C/OGC: Spatial Data on the Web Best Practices, W3C Working Group Note 28 September 2017, <https://www.w3.org/TR/sdw-bp>
- W3C: Data on the Web Best Practices, W3C Recommendation 31 January 2017, <https://www.w3.org/TR/dwbp>
- W3C: Data Catalog Vocabulary, W3C Recommendation 16 January 2014, <https://www.w3.org/TR/vocab-dcat>
- IANA: Link Relation Types, <https://www.iana.org/assignments/link-relations/link-relations.xml>
- Linux Foundation: SPDX License List, <https://spdx.org/licenses>

## Annex F: Revision History

Date	Release	Editor	Primary clauses modified	Description
2021-11-06	Template	Tom Kralidis	all	initial template