



国家气象信息中心  
National Meteorological Information Centre

# GB functions and MQTT messages

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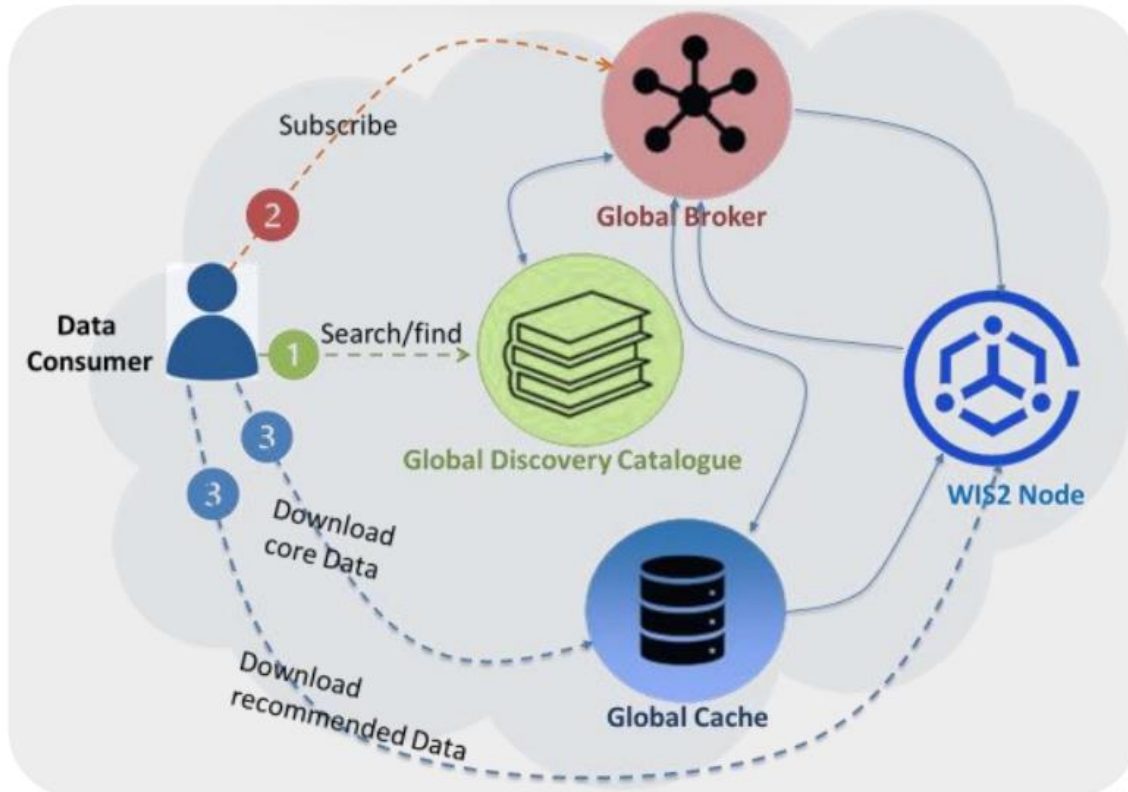
**1. Global Broker**

**2. MQTT messages**



# 1. Global Broker in WIS 2.0

## WIS 2.0



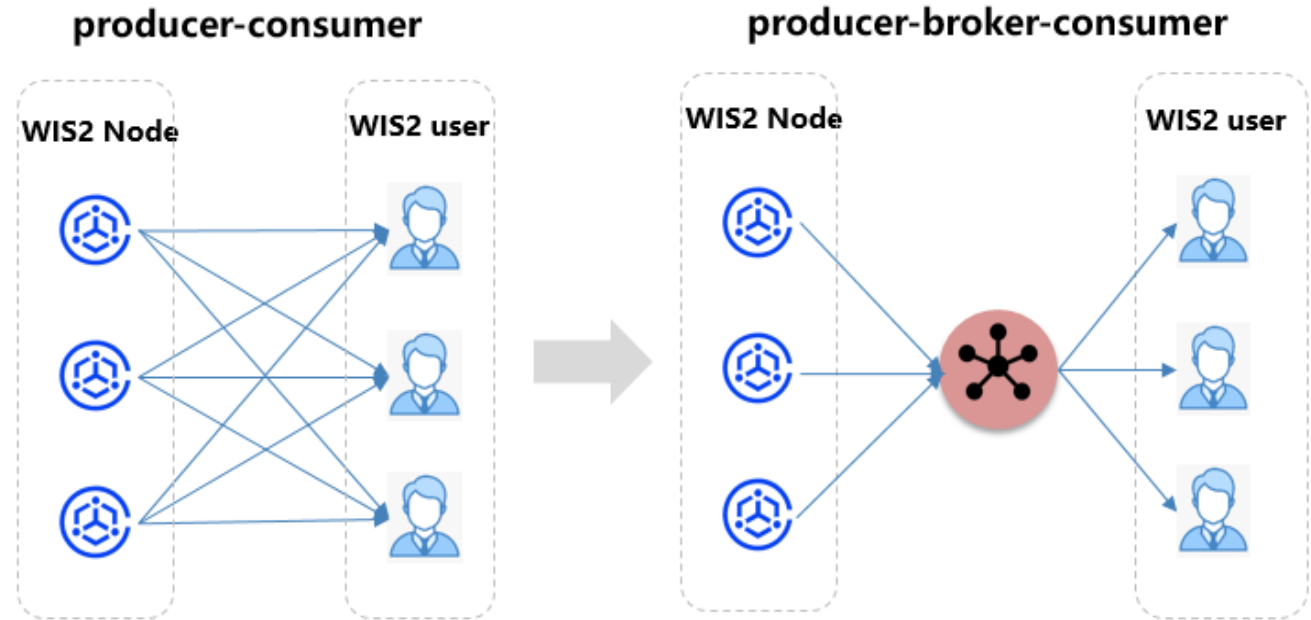
**Global Broker:** Provides MQTT(S) Broker that re-publishes data notifications of all WIS2 Nodes. Users of WIS 2.0 will be able to access data in real-time by subscribing to a Global Broker and receiving notifications when new data is available for download from a Global Cache or the data provider WIS2 Node.

Global Broker is the core function of WIS 2.0. It serves as a connecting link, integrating all Global Services, WIS2 nodes, and gateways.



## 2. Why we need Global Broker?

- Decouple the supply-demand relationship between producers and consumers, eliminating the need for direct dependence between the two parties.
- Reduce the synchronous communication pressure on producers, allowing them to return immediately after sending messages.
- Alleviate the real-time processing burden on consumers, supporting message caching and batch forwarding.
- Ensure reliable message transmission by several distributed brokers.
- Prevent data loss caused by network fluctuations or asynchronous startup/shutdown of both parties.
- Centrally handle message routing, access control, and traffic control.
- Simplify system scalability; new producers/consumers can be added without modifying the original architecture.





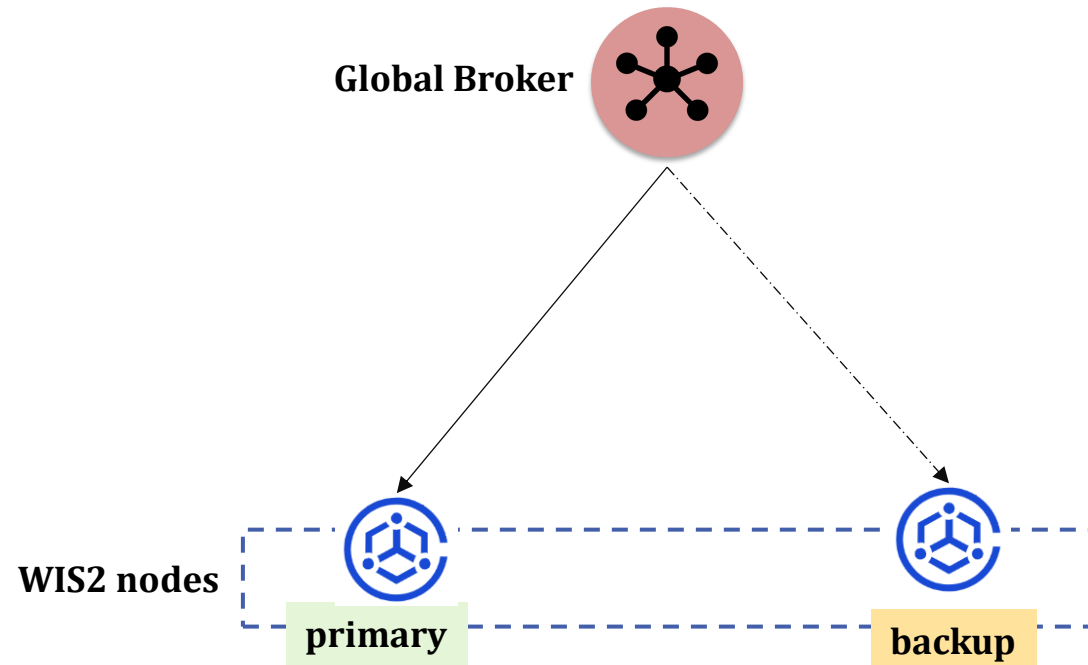
## 3. Functional Requirements of Global Broker

- **High-Availability Message Broker:** Operate a highly available Message Broker for near real-time notification distribution to subscribers
- **Notification Subscription:** Subscribe to notifications from WIS centres and Global Services
- **Message Republication:** Republish notifications from WIS nodes and Global Caches
- **Redundant Transmission:** Subscribe to notifications from other Global Brokers to ensure redundant and reliable transmission
- **Duplicate Detection:** Detect and suppress duplicate notifications to ensure each notification is republished only once
- **Topic Validation:** Validate that published topics comply with WIS2 Topic Hierarchy specification
- **Message Format Compliance:** Verify notification messages against WIS2 Notification Message standard
- **Metadata Verification:** Ensure topics have corresponding discovery metadata records
- **Anti-loop Mechanism:** Implement anti-loop detection using message identifiers



### 3. Functional Requirements of Global Broker

It is recommended to consider a primary-standby node design in the construction of wis2node to avoid single-node failures affecting message publication in this node.





## 4. Performance Requirements of Global Broker

- **Scalability:** Support minimum 200 WIS2 Nodes or Global Services
- **Subscriber Capacity:** Support minimum 1,000 subscribers
- **Processing Speed:** Process minimum 10,000 messages per second
- **Availability:** Achieve at least 99.5% service availability
- **Connection Standards:** Use MQTT v3.1.1 and v5.0 (preferred) with QoS level 1
- **Security:** Implement TLS encryption on ports 8883 (MQTTS) and 443 (WSS)



## 5. Global Broker Instances

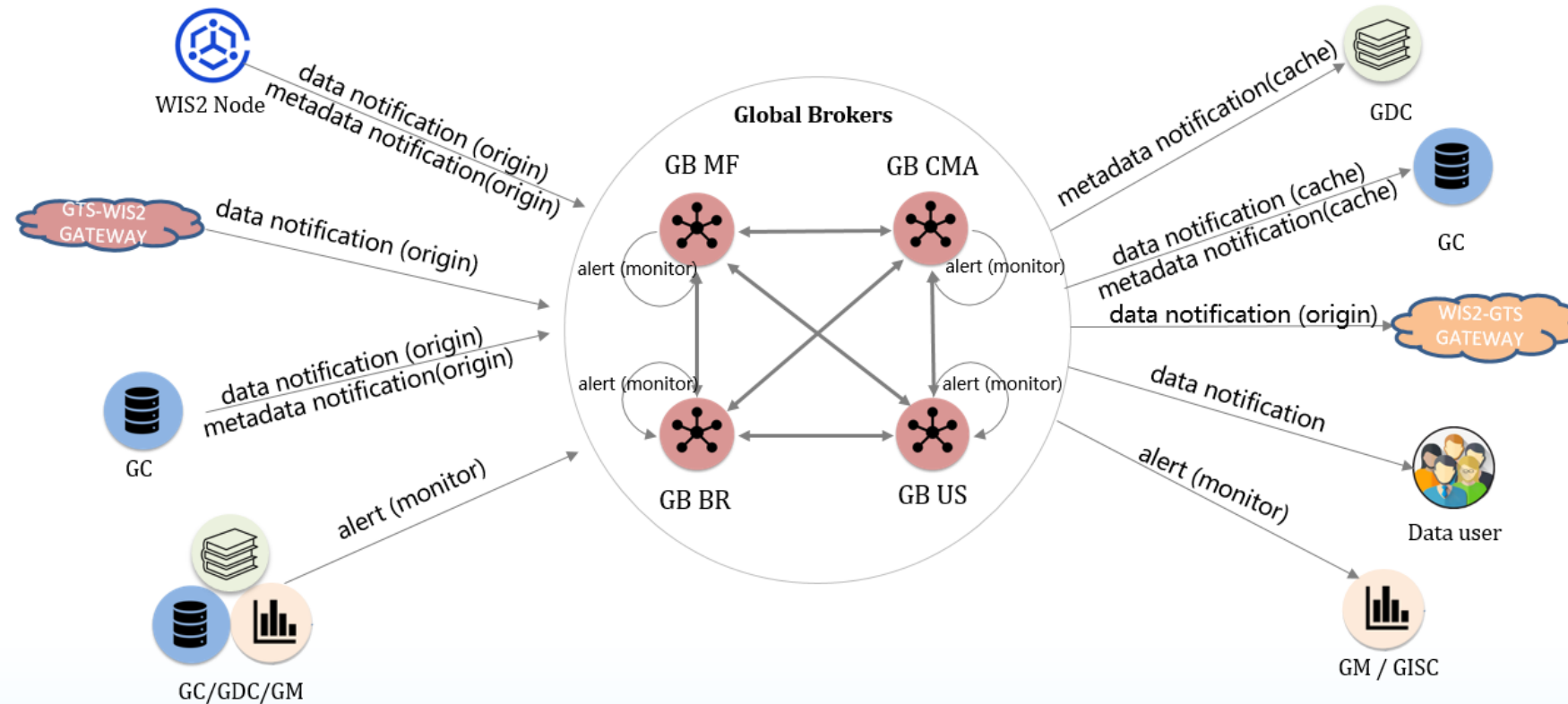
There are four Global Broker instances to ensure that messages within WIS2 are highly available and delivered globally with low latency, and each Global Broker subscribes the other three ones; Data consumers should subscribe to notifications from a Global Broker, not to notifications directly from the Message Brokers operated by WIS2 Nodes.

Instance	Centre-id	Broker Connection Info	IP(s) of the Global Broker
GB Brazil	br-inmet-global-broker	mqtt://everyone:everyone@globalbroker.inmet.gov.br:8883 wss://everyone:everyone@globalbroker.inmet.gov.br:443	191.217.186.152/200.130.106.52
GB China	cn-cma-global-broker	mqtt://everyone:everyone@gb.wis.cma.cn:8883 wss://everyone:everyone@gb.wis.cma.cn:443	210.73.54.34/210.73.54.113/210.73.54.114/ 210.73.54.115
GB France	fr-meteofrance-global-broker	mqtt://everyone:everyone@globalbroker.meteo.fr:8883 wss://everyone:everyone@globalbroker.meteo.fr:443	136.156.128.207
GB US	us-noaa-global-broker	mqtt://everyone:everyone@wis2broker.globaldata.nws.noaa.gov:8883 wss://everyone:everyone@wis2broker.globaldata.nws.noaa.gov:443	137.75.108.151/137.75.108.138 <i>(New IP from 19 November)</i>



## 4. Connections among Global Brokers, other GSs and Users

There are four Global Brokers that form a distributed cluster. Each Global Broker subscribes to data and metadata notification messages from WIS2 nodes and the GC, as well as alert messages from the Global Services. Additionally, they subscribe to each other to ensure reliability. After undergoing processes such as deduplication and verification, these messages are republished: metadata messages are subscribed to by the GC and the GDC; data messages are subscribed to by the GC and users; and alert messages are subscribed to by the GM.





# 5.WIS2 nodes connected by Global Brokers

- Global Brokers subscribe **90 WIS2 Nodes** in total until Oct.20<sup>th</sup>, 2025.
- Each Global Broker subscribes **3 GBs, 6 GCs and 3GDCs**.

No	centre_id	GB-CMA	GB-FR	GB-BR	GB-US
1	ag-antiguamet	OK	OK	OK	OK
2	ai-metservice	OK	OK	OK	OK
3	ar-smn	OK	OK	OK	OK
4	bb-barbadosmetservices	OK	OK	OK	OK
5	bf-anam	OK	OK	OK	OK
6	bg-nimh	OK	OK	OK	fail
7	bi-igebu	OK	OK	OK	OK
8	bn-bdmd	OK	OK	OK	OK
9	br-inmet	OK	OK	OK	OK
10	bs-metservice	OK	OK	OK	OK
11	by-belgidromet	OK	OK	OK	OK
12	bz-nms	OK	OK	OK	OK
13	ca-eccc-msc	OK	OK	OK	OK
14	cg-met	OK	OK	OK	OK
15	cl-meteochile	fail	OK	OK	OK
16	cm-meteocameroun	fail	fail	fail	fail
17	cn-cma	OK	OK	OK	OK
18	co-ideam	OK	OK	OK	OK
19	cr-irmn	OK	OK	OK	OK
20	cu-insmet	OK	OK	OK	OK
21	cy-dom	OK	OK	OK	OK
22	de-dwd	OK	OK	OK	OK
23	de-dwd-gts-to-wis2	OK	OK	OK	OK
24	dk-dmi-opendata	OK	OK	OK	OK
25	dm-dms	OK	OK	OK	OK
26	dz-meteoalgerie	OK	OK	OK	OK
27	eu-eumetnet-femdi	OK	Not subscribed	Not subscribed	Not subscribed
28	fr-meteofrance	OK	OK	OK	OK
29	gd-metservice	OK	OK	OK	OK
30	gn-anm	OK	OK	OK	OK

No	centre_id	GB-CMA	GB-FR	GB-BR	GB-US
31	gy-hydromet	OK	OK	OK	OK
32	hk-hko	OK	OK	OK	OK
33	hk-hko-swic	OK	OK	OK	OK
34	hn-cenaos	OK	OK	OK	Not subscribed
35	id-bmkg	OK	OK	OK	OK
36	il-ims	OK	OK	OK	OK
37	in-imd	OK	OK	OK	OK
38	int-ecmwf	OK	OK	OK	OK
39	int-eumetsat	OK	OK	OK	fail
40	ir-irimo	OK	OK	OK	OK
41	it-meteoam	OK	OK	OK	OK
42	jm-msj	OK	OK	OK	OK
43	jp-jma	OK	OK	OK	OK
44	jp-jma-gts-to-wis2	OK	OK	OK	OK
45	ke-meteo	OK	OK	OK	OK
46	kg-kyrgyzhydromet	OK	OK	OK	OK
47	kn-metservice	OK	OK	OK	OK
48	kr-kma	OK	OK	OK	OK
49	ky-cinws	OK	OK	OK	OK
50	kz-kazhydromet	OK	OK	OK	OK
51	lc-metservice	OK	OK	OK	OK
52	ly-lnmc	OK	OK	OK	OK
53	ma-marocmeteo	OK	OK	OK	OK
54	ml-malimeteo	fail	OK	OK	OK
55	ms-metservice	OK	OK	OK	OK
56	mw-dccms	OK	OK	OK	OK
57	my-metmalaysia	OK	OK	OK	OK
58	na-meteona	OK	OK	OK	OK
59	ng-nimet	fail	fail	fail	fail
60	nz-metservice	OK	OK	OK	OK

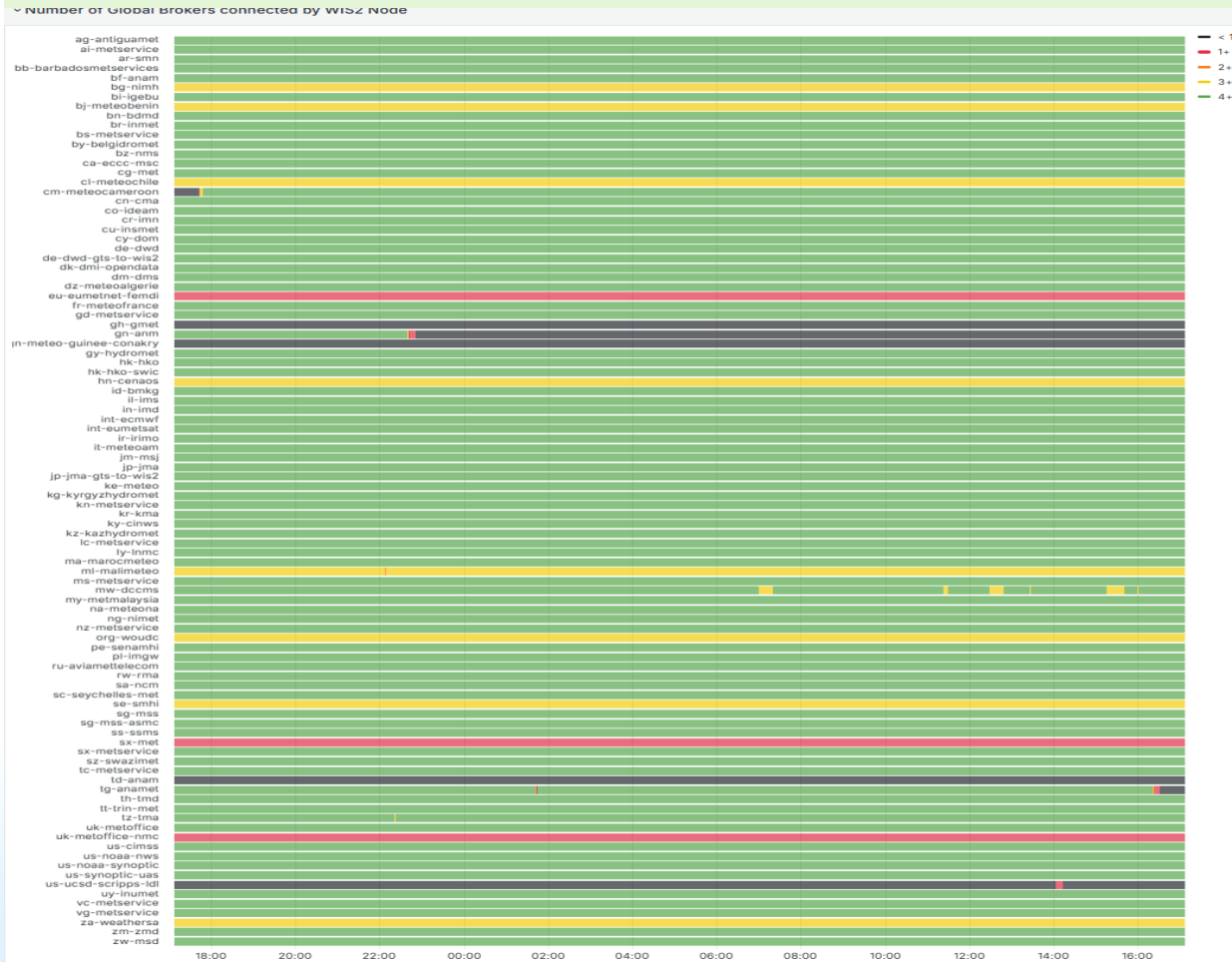
No	centre_id	GB-CMA	GB-FR	GB-BR	GB-US
61	pe-senamhi	OK	OK	OK	OK
62	pl-imgw	OK	OK	OK	OK
63	ru-aviamettelecom	OK	OK	OK	OK
64	rw-rma	OK	OK	OK	OK
65	sa-ncm	OK	OK	OK	OK
66	sc-seychelles-met	OK	OK	OK	OK
67	se-smhi	OK	OK	OK	fail
68	sg-mss	OK	OK	OK	OK
69	sg-mss-asmc	OK	OK	OK	OK
70	ss-ssms	OK	OK	OK	OK
71	sx-metservice	OK	OK	OK	OK
72	sz-swazimet	OK	OK	OK	OK
73	tc-metservice	OK	OK	OK	OK
74	td-anam	OK	OK	OK	OK
75	tg-anamet	OK	OK	OK	OK
76	th-tmd	OK	OK	OK	OK
77	tt-trin-met	OK	OK	OK	OK
78	tz-tma	OK	OK	OK	OK
79	uk-metoffice	OK	OK	OK	OK
80	us-cimss	OK	OK	OK	OK
81	us-noaa-nws	OK	OK	OK	OK
82	us-noaa-synoptic	fail	OK	OK	OK
83	us-synoptic-uas	OK	OK	OK	OK
84	us-ucsd-scripps-ldl	OK	OK	OK	OK
85	uy-inumet	OK	OK	OK	OK
86	vc-metservice	OK	OK	OK	OK
87	vg-metservice	OK	OK	OK	OK
88	za-weatheresa	fail	OK	OK	OK
89	zm-zmd	OK	OK	OK	OK
90	zw-msd	OK	OK	OK	OK



# 6. Global Broker Connections

Global Monitor dashboards display the connections among GB and other WIS centers.

## Connectivity between GBs and WIS2 Nodes



## Connectivity between GBs and other WIS centers

### US-NOAA-GLOBAL-BROKER

WIS2 Nodes	Global Brokers	Global Caches	GDCs
Connected <b>83</b>	Connected <b>3</b>	Connected <b>6</b>	Connected <b>3</b>
Disconnected <b>8</b>	Disconnected <b>0</b>	Disconnected <b>0</b>	Disconnected <b>0</b>

### FR-METEOFRANCE-GLOBAL-BROKER

WIS2 Nodes	Global Brokers	Global Caches	GDCs
Connected <b>87</b>	Connected <b>3</b>	Connected <b>6</b>	Connected <b>3</b>
Disconnected <b>5</b>	Disconnected <b>0</b>	Disconnected <b>0</b>	Disconnected <b>0</b>

### CN-CMA-GLOBAL-BROKER

WIS2 Nodes	Global Brokers	Global Caches	GDCs
Connected <b>85</b>	Connected <b>3</b>	Connected <b>6</b>	Connected <b>3</b>
Disconnected <b>8</b>	Disconnected <b>0</b>	Disconnected <b>0</b>	Disconnected <b>0</b>

### BR-INMET-GLOBAL-BROKER

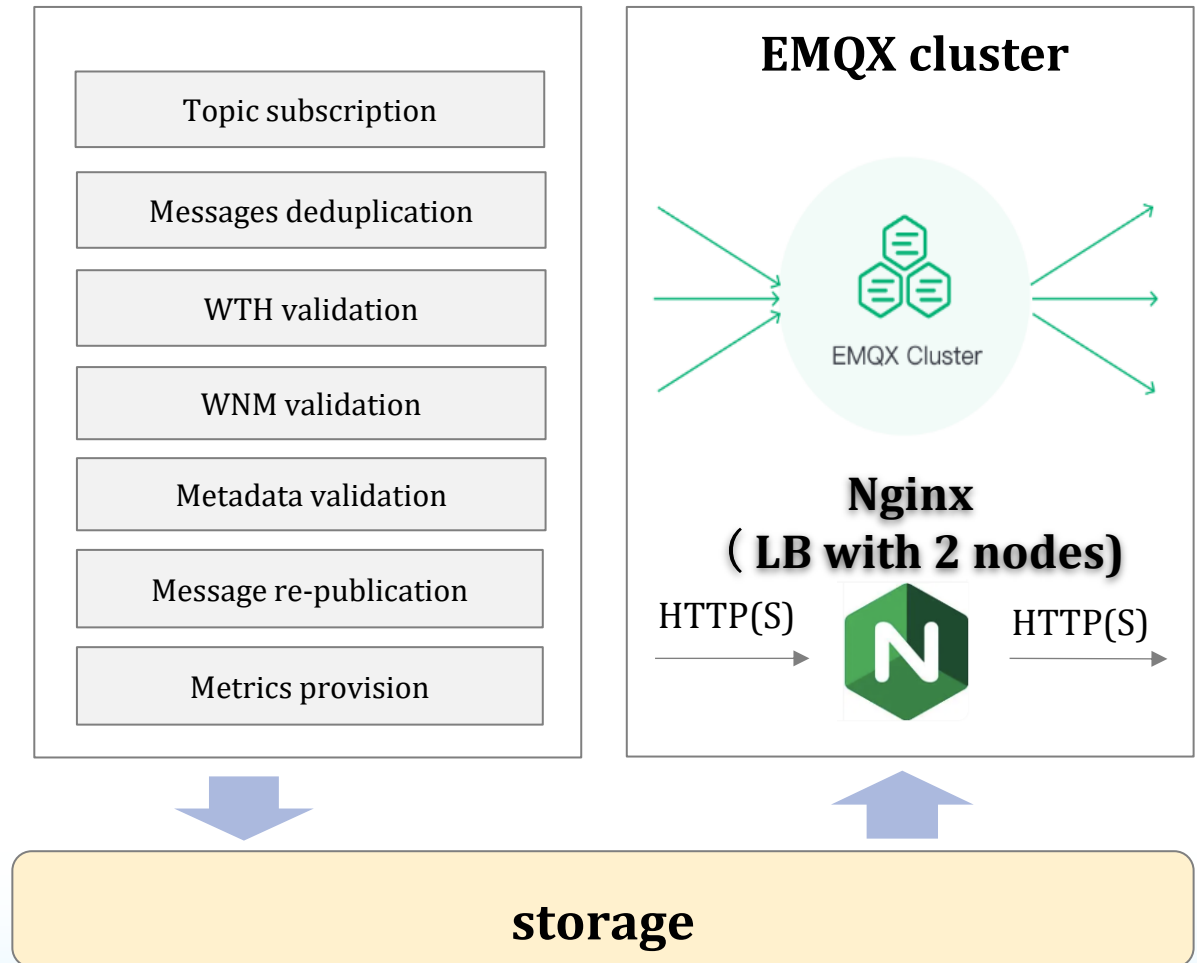
WIS2 Nodes	Global Brokers	Global Caches	GDCs
Connected <b>88</b>	Connected <b>3</b>	Connected <b>6</b>	Connected <b>3</b>
Disconnected <b>6</b>	Disconnected <b>0</b>	Disconnected <b>0</b>	Disconnected <b>0</b>



## 6. Components of Global Broker

Global Broker is built around two software components:

- [An off-the-shelf broker](#) implementing both MQTT 3.1.1 and MQTT 5.0, in a cluster mode. Tools such as EMQX, HiveMQ, VerneMQ, RabbitMQ (in its latest versions) are compliant with these requirements. The open-source version of Mosquitto cannot be clustered and therefore should not be used as part of a Global Broker;
- [Additional features](#), including anti-loop detection, notification message format compliance, validation of the published topic, and metrics provision.



# CONTENTS



**1. Global Broker**

**2. MQTT messages**



# 1. WIS2 Topic Hierarchy (WTH)

The WIS2 Topic Hierarchy (WTH) provides a mechanism for users to subscribe to and receive data or metadata notification. It is documented in discovery metadata records and leveraged by WIS2 brokers. The primary topics apply to all data and resources in WIS. The sub-discipline topics are proposed by domain experts and user communities. These levels are a hierarchical representation of the dataset, and the number of levels in this part may vary according to the requirements of various domains.

Table 1. WTH primary topic levels

Level	Name	Description
1	channel	Location at which the data originates (data providers are <code>origin</code> and Global Services are <code>cache</code> )
2	version	Alphabetical version of the topic hierarchy, currently: <code>a</code>
3	system	Fixed value of <code>wis2</code> for WIS2
4	centre-id	Acronym proposed by Member and endorsed by WMO Secretariat
5	notification-type	WIS2 notification types ( <code>data</code> or <code>metadata</code> )
6	data-policy	Data policy as defined by the WMO Unified Data Policy (Resolution 1 (Cg-Ext(2021))) ( <code>core</code> or <code>recommended</code> )
7	earth-system-discipline	Seven high-level categories as defined by the WMO Unified Data Policy (Resolution 1 (Cg-Ext(2021))) - Annex 1 ( <code>atmospheric-composition</code> , <code>climate</code> , <code>cryosphere</code> , <code>hydrology</code> , <code>ocean</code> , <code>space-weather</code> or <code>weather</code> )

No.	Earth-system-discipline	number
1	atmospheric-composition	1
2	climate	5
3	cryosphere	1
4	hydrology	1
5	ocean	15
6	space-weather	429
7	weather	749

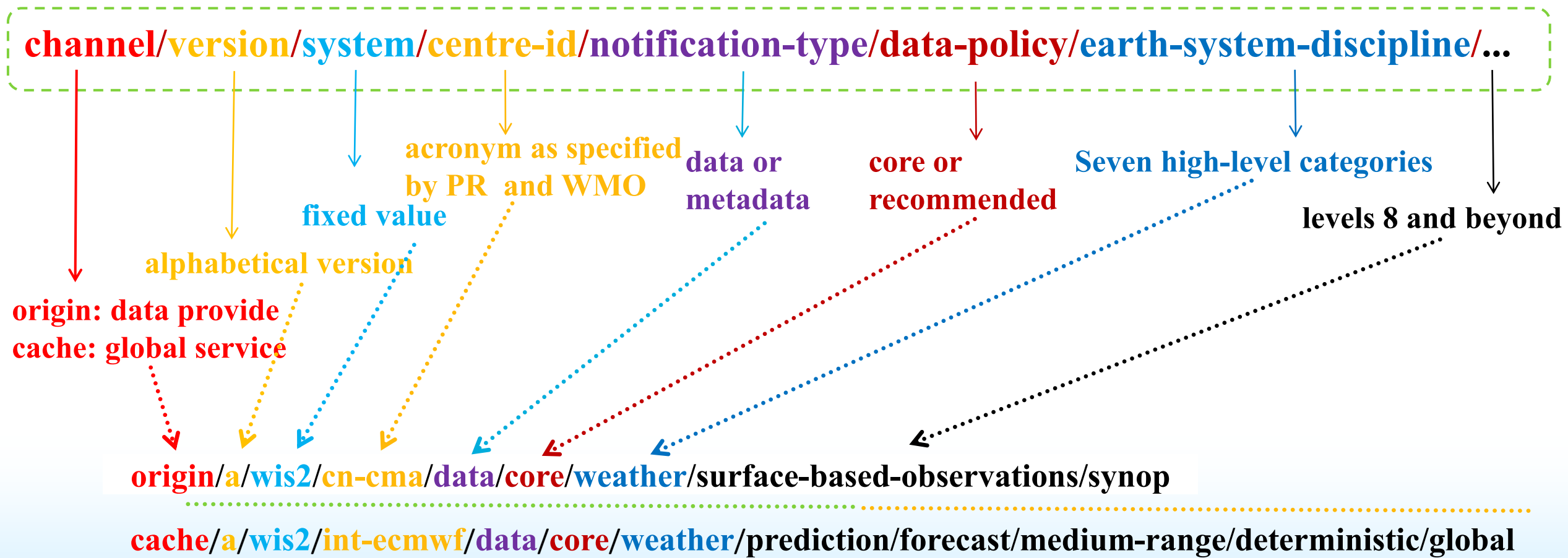
<https://github.com/wmo-im/wis2-topic-hierarchy/tree/main/topic-hierarchy>

<https://wmo-im.github.io/wis2-topic-hierarchy/wth-bundle.zip>



# 1. WIS2 Topic Hierarchy (WTH)

The WIS2 Topic Hierarchy (WTH) is composed of primary topics (levels 1–7) and sub-discipline specific topics (levels 8 and beyond)





# 1. WIS2 Topic Hierarchy (WTH)

The GB handles three message types (data, metadata, and alerts) for both subscription and publication

Message types	Topic instances
data	origin/a/wis2/cn-cma/data/core/weather/surface-based-observations/synop
	cache/a/wis2/ca-eccc-msc/data/core/weather/experimental
metadata	origin/a/wis2/de-dwd-global-discovery-catalogue/metadata
	origin/a/wis2/cn-cma-global-discovery-catalogue/metadata
event	monitor/a/wis2/ca-eccc-msc
	monitor/a/wis2/fr-meteofrance

## Example of invalid topics

- origin/a/wis2/sg-mss/data/core/weather/prediction/forecast/medium-range/deterministic/limited-area/**FPSR01WSSS130934.txt**
- origin/a/wis2/sg-mss/data/core/weather/surface-based-observations/amdar



## 2. WIS2 Notification Message(WNM)

The WIS2 Notification Message (WNM) is an extension of the Open Geospatial Consortium OGC API - Features standard and shall be encoded in GeoJSON.

GB shall verify notification messages against WNM standard.

### WNM core properties

No.	Property	Requirement
1	id	Required
2	type	Required
3	version	Required
4	geometry	Required
5	properties.pubtime	Required
6	properties.data_id	Required
7	properties.metadata_id	Optional
8	properties.producer	Optional
9	properties.datetime	Optional
10	properties.start_datetime	Optional
11	properties.end_datetime	Optional
12	properties.cache	Optional
13	properties.integrity	Optional
14	properties.content	Optional
15	links	Required

```
{
  "id": "59f9b013-c4b3-410a-a52d-fff18f3f1b47",
  "type": "Feature",
  "version": "v04",
  "geometry": {
    "coordinates": [
      -38.69389,
      -17.96472,
      60
    ],
    "type": "Point"
  },
  "properties": {
    "data_id": "br-inmet:synop-obs/WIGOS_0-20000-0-82022_20251114T180000",
    "datetime": "2025-11-14T18:00:00Z",
    "pubtime": "2025-11-14T20:49:31Z",
    "metadata_id": "urn:wmo:md:br-inmet:synop-obs",
    "integrity": {
      "method": "sha512",
      "value": "TBuWycx/G01IiTo47eFPBViGutxcIyk7eikppAKPc4aHg0mTIS5Wb9+0v3awM0yCgw"
    },
    "content": {
      "encoding": "base64",
      "value": "QlVGUGAA+gQAABYAACsAAAAAIAHAAH6AgPBgAAAAALAAABgMGWx1AAAM0AB0IAAA"
      "size": 250
    },
    "wigos_station_identifier": "0-20000-0-82022"
  },
  "links": [
    {
      "rel": "canonical",
      "type": "application/bufr",
      "href": "http://wis2bra.inmet.gov.br/data/2025-11-14/wis/urn:wmo:md:br-inmet"
      "length": 250
    }
  ]
}
```



## 2. WIS2 Notification Message(WNM) – recommended data

Recommended data in WIS2 may be open or access controlled. For data publication with access control implications, WNM provides a security object as part a link object. The security object is defined using OpenAPI Security Scheme definitions.

*Access control using HTTP Basic authentication*

```
{
  "rel": "canonical",
  "type": "application/grib2",
  "href": "https://example.org/my/protected/data/nwp/12/003/20240805120000-air-temp-500.grib2",
  "security": {
    "default": {
      "type": "http",
      "scheme": "basic",
      "description": "Please contact us for access information"
    }
  }
}
```

*Access control using an API key*

```
{
  "rel": "canonical",
  "type": "application/geo+json",
  "href": "https://example.org/my/protected/data/nwp/12/003/20240805120000-air-temp-500.grib2",
  "security": {
    "default": {
      "type": "apiKey",
      "name": "api-key",
      "in": "query",
      "description": "Please see https://example.org/contact-us for more information"
    }
  }
}
```

```
"gts": {
  "ttaaii": "IUAG01",
  "cccc": "VHHH"
},
"pubtime": "2025-11-19T01:20:57Z",
"integrity": {
  "method": "sha512",
  "value": "oIDeuDJjWX+Wlt5zjetdpbrByiqhnOcwHg+I9NuMhIt1rieHyFfVHKfq+KmbCbFxcUwLuEZfIG/Ues2n7WfiJw=="
},
"datetime": "2025-11-19T01:21:41+00:00"
},
"links": [
  {
    "href": "https://wisdev.kishou.go.jp/data/wis2/jp-jma-gts-to-wis2/data/recommended/I/U/A/G/01/VHHH/IUAG01",
    "rel": "canonical",
    "type": "application/octet-stream",
    "length": 269,
    "security": {
      "default": {
        "type": "http",
        "scheme": "basic",
        "description": "Please contact JMA Team for WIS2 Global Cache via wis-jma@met.kishou.go.jp for access"
      }
    }
  }
]
}
```



## 2. WIS2 Notification Message(WNM) – embedded data

The WIS2 Notification Message allows for the transmission of messages in a compact manner and includes the ability to embed content inline as required. For data whose resulting size (after possible compression) is less than 4 096 bytes, notifications **MAY** provide the data inline via `properties.content.value`.

- use `properties.content` object to provide the data
- use `properties.cache=false` to instruct WIS2 Global Cache Services to not cache the data
- provide a link object whose `href` results in **HTTP 204** (No Content)

Embedded data example:

```
{
  "id": "31e9d66a-cd83-4174-9429-b932f1abe1be",
  "conformsTo": [
    "http://wis.wmo.int/spec/wnm/1/conf/core"
  ],
  "type": "Feature",
  "geometry": {
    "type": "Point",
    "coordinates": [
      6.146255135536194,
      46.223296618227444
    ]
  },
  "properties": {
    "pubtime": "2022-03-20T04:50:18Z",
    "datetime": "2022-03-20T04:45:00Z",
    "integrity": {
      "method": "sha512",
      "value": "A2KNxvks...S8qfSCw=="
    },
    "cache": false,
    "data_id": "dataset/123/data-granule/UANT01_CWAO_200445___15103.bufr4",
    "metadata_id": "urn:wmo:md:ca-eccc-msc:observations.swob",
    "content": {
      "encoding": "utf-8",
      "value": "encoded bytes from the file",
      "size": 457
    }
  },
  "links": [
    {
      "href": "https://http.codes/204",
      "rel": "canonical"
    }
  ]
}
```



## 2. WIS2 Notification Message(WNM) – deleted data

- A WIS2 Notification Message provides the ability to publish notifications for new, updated or **deleted data and metadata**. For data or metadata deletions (core or recommended data), a data publisher may not wish to manage or publish the data or metadata link to infrastructure to an HTTP or FTP server.
- In this case, a similar strategy can be used to provide an HTTP 204 No Content link, along with setting rel=deletion in the link object.

*Resource deletion example:*

```
{
  "id": "31e9d66a-cd83-4174-9429-b932f1abe1be",
  "conformsTo": [
    "http://wis.wmo.int/spec/wnm/1/conf/core"
  ],
  "type": "Feature",
  "geometry": {
    "type": "Point",
    "coordinates": [
      6.146255135536194,
      46.223296618227444
    ]
  },
  "properties": {
    "pubtime": "2022-03-20T04:50:18Z",
    "datetime": "2022-03-20T04:45:00Z",
    "integrity": {
      "method": "sha512",
      "value": "A2KNxvks...S8qfSCw=="
    },
    "cache": false,
    "data_id": "dataset/123/data-granule/UANT01_CWAO_200445__15103.bufr4",
    "metadata_id": "urn:wmo:md:ca-eccc-msc:observations.swob"
  },
  "links": [
    {
      "href": "https://http.codes/204",
      "rel": "deletion"
    }
  ]
}
```



## 2. WIS2 Notification Message(WNM) – gts data

- A Member planning to stop GTS transmission shall provide its data in conformance with WIS2 Node operations on WIS2. For data that have previously been available on the GTS, and should continue to be available on the GTS, the GTS Abbreviated Heading Line (AHL) of the bulletin in which the data are to be published needs to be indicated. This is done by including **the 'gts' property** in the WIS2 Notification Message

```
{
  "id": "2cfd1da7-b276-4099-a5bc-32a34afea786",
  "conformsTo": [
    "http://wis.wmo.int/spec/wnm/1/conf/core"
  ],
  "type": "Feature",
  "geometry": null,
  "properties": {
    "pubtime": "2025-11-18T23:47:00.975Z",
    "datetime": "2025-11-18T23:47:00.975Z",
    "integrity": {
      "method": "sha3-512",
      "contentEncoding": "base64",
      "value": "\nMGQc104PxSQ8z7dDAswjkh+nkdmbrjLLJ/qH9My4mBocX5I7G9hcAyeGjUk5yE/pCo9vUw01Vj1yb5"
    },
    "data_id": "data/core/weather/surface-based-observations/synop/A_ISAD59LCLK182340_C_LCNC_202511",
    "metadata_id": "urn:wmo:md:cy-dom:surface-based-observations.synop",
    "cache": true,
    "gts": {
      "ttaai": "ISAD59",
      "cccc": "LCLK"
    }
  },
  "links": [
    {
      "href": "https://www.dom.org.cy/wis2/data/core/weather/surface-based-observations/synop/A_ISA",
      "rel": "canonical",
      "type": "application/x-bufr",
      "length": 15991
    }
  ]
}
```



# 4. WIS2 Notification Message(WNM) – examples of invalid WNM

## Invalid datetime

```
{
  "id": "ffed94fa-0e9b-11f0-8f1c-e43d1a214824",
  "conformsTo": [
    "http://wis.wmo.int/spec/wnm/1/conf/core"
  ],
  "type": "Feature",
  "geometry": null,
  "properties": {
    "data_id": "wis2/de-dwd-gts-to-wis2/data/core/L/N/C/X/34/EUMP/INCX34EUMP312238_C_EDZW_202504010",
    "metadata_id": "",
    "gts": {
      "ttaa": "INCX34",
      "cccc": "EUMP"
    },
    "pubtime": "2025-04-01T01:52:42.496853Z",
    "integrity": {
      "method": "sha512",
      "value": "71kCAmJd0561Ax+zKiM3MviZddktQxMES1EtKfPNYTbLZRHvHCo7gi43aeM8YF0tH5/JMxBsHZg7LxcZ6M"
    },
    "datetime": "2025-04-31T22:38:00Z"
  },
  "links": [
    {
      "href": "https://wis2.dwd.de/gts/eump/A_INCX34EUMP312238_C_EDZW_20250401015241_69205219",
      "rel": "canonical",
      "type": "application/octet-stream",
      "length": 57629
    },
    {
      "href": "https://gisc.dwd.de/angular-frontend/xmlProductDetails;pid=urn:x-wmo:md:int.wmo.wis:...",
      "rel": "about",
      "type": "text/html"
    }
  ]
}
```

## Invalid datetime

```
{
  "id": "8edf24d2-8cb0-495d-8569-8d97a5866e2f",
  "type": "Feature",
  "conformsTo": [
    "http://wis.wmo.int/spec/wnm/1/conf/core"
  ],
  "geometry": {
    "coordinates": [43.2858, 68.6532, 48],
    "type": "Point"
  },
  "properties": {
    "data_id": "ru-aviamettelecom:core.surface-based-observations.synop/"
    + "WIGOS_0-20000-0-22165_250331T210000",
    "datetime": "25-03-31T21:00:00Z",
    "pubtime": "2025-04-01T00:04:00Z",
    "integrity": {
      "method": "sha512",
      "value": "Vtco8hc95h45X3ZHFBfneP3Woyee8GVI/GSS0rXhBLmuRXe/aNzY7LzF6ZJ4BNmPiA17h"
      + "88wBY/xU9YaPh5FA=="
    },
    "metadata_id": "urn:wmo:md:ru-aviamettelecom:core.surface-based-observations.synop",
    "content": {
      "encoding": "base64",
      "value": "Q1VGUGAA9wQAABYAAAQAAEAHAAGQMFQAAAAALAAABgMGWx1AAAMoAB0IAAMjIxNjUAAAAAAAAAAAA"
      + "AAACxSpaCnJKcAAAAAAAAAAAAAAAAAAAGMm/UB5CvQlqCBGFCL/PSz8byv////////+AZDTwtC3/AMg+gAZH////"
      + "+QeBSx++AAB//////////H/VKf//+/R/8AyH9P/9///AMh/SAD//39IAP//A+iBP7IIFD/"
      + "//////////ANzc3Nw==",
      "size": 247
    },
    "wigos_station_identifier": "0-20000-0-22165"
  },
  "links": [
    {
      "rel": "canonical",
      "type": "application/bufr",
      "href": "http://wis2box.mecm.ru/data/25-03-31/wis/urn:wmo:md:ru-aviamettelecom:"
      + "core.surface-based-observations.synop/WIGOS_0-20000-0-22165_250331T210000.bufr4",
      "length": 247
    },
    {
      "rel": "via",
      "type": "text/html",
      "href": "https://oscar.wmo.int/surface/#/search/station/stationReportDetails/"
      + "0-20000-0-22165"
    }
  ],
  "generated_by": "wis2box1.0.0rc1"
}
```

## invalid id

```
{
  "id": "urn:wmo:md:sg-mss:recommended.weather.surface-based-observations.wbgt",
  "conformsTo": [
    "http://wis.wmo.int/spec/wcmp/2/conf/core"
  ],
  "type": "Feature",
  "time": {
    "interval": ["2025-10-12", ".."],
    "resolution": "PT15M"
  },
  "geometry": {
    "type": "Polygon",
    "coordinates": [
      [
        [103.605, 1.158],
        [104.085, 1.158],
        [104.085, 1.471],
        [103.605, 1.471],
        [103.605, 1.158]
      ]
    ]
  },
  "properties": {
    "title": "Wet Bulb Globe Temperature (WBGT) Observations",
    "description": "WBGT is a composite measure that takes into account air temperature, humidity,
      + wind and solar radiation, and it is different from air temperature. The reported WBGT "
```



## 2. WIS2 Notification Message(WNM) – how to validate?

A WIS2 Notification Message provides a JSON Schema which can be used by any programming language that supports JSON and JSON Schema validation.

*Using Python and check-jsonschema*

```
# install check-jsonschema Python Package from the Python Package Index (PyPI)
pip3 install check-jsonschema

# download WNM schema
curl -O http://schemas.wmo.int/wnm/1.1.0/schemas/wis2-notification-message-
bundled.json

# run schema validation
check-jsonschema --schemafile wis2-notification-message-bundled.json
/path/to/my/wnm.json
```

<https://schemas.wmo.int/wnm/>



## 2. WIS2 Notification Message(WNM) – how to validate?

The `pywis-pubsub` tool provides a test suite to validate a message against the WNM specification requirements, as well as a Python API for application integration.

### *Using pywis-pubsub*

```
# install pywis-pubsub
pip3 install pywis-pubsub

# sync WIS2 notification schema
pywis-pubsub schema sync

# validate WNM against abstract test suite (file on disk)
pywis-pubsub ets validate /path/to/file.json

# validate WNM against abstract test suite (URL)
pywis-pubsub ets validate https://example.org/path/to/file.json
```



# 3. WIS2 Monitoring Event Message(WMEM)

Once connected to the WIS2 infrastructure, any Global Service will be monitored by the WIS2 Global Monitor. Monitoring of WIS2 Global Services will allow for detection of service anomalies, interruptions or quality assessments of metadata. WMEM is a mechanism to notify on and describe such events is required in support of Global Service communication and corrective action.

Level	Name	Description
1	channel	Location of where the data originates from (fixed value of monitor)
2	version	Alphabetical version of the topic hierarchy
3	system	Fixed value of wis2 for WIS2
4	centre-id	Acronym proposed by Member and endorsed by WMO Secretariat, of the centre identifier of the subject of the event

Table 3. WMEM core properties

Property	Requirement	Description
id	Required	A universally unique identifier (UUID) of the message (see <a href="#">Identifier</a> )
specversion	Required	The CloudEvents specification version (see <a href="#">Version</a> )
source	Required	The centre identifier producing the event (see <a href="#">Source</a> )
type	Required	The event type related to the message (see <a href="#">Type</a> )
subject	Required	The centre identifier of the subject of the event (see <a href="#">Subject</a> )
time	Required	The date and time of when the notification was published, in RFC3339 format, UTC (see <a href="#">Time</a> )
datacontenttype	Required	The media type of the data content encoding in the event message ( application/json ) (see <a href="#">Data content type</a> )
data	Required	The event payload as JSON (see <a href="#">Data</a> )

```

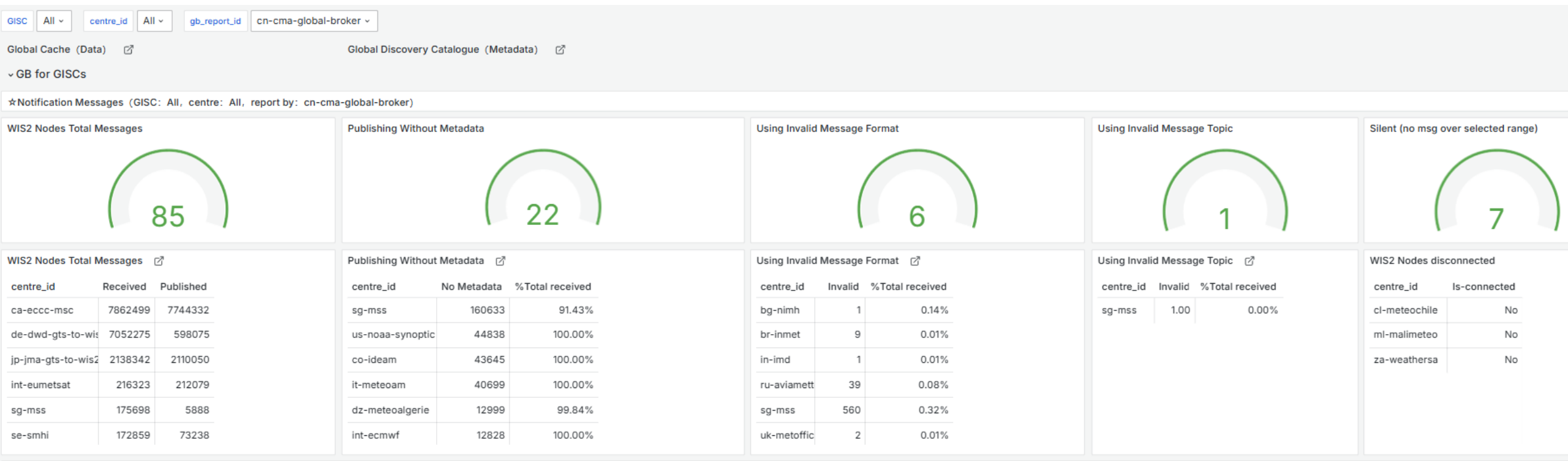
{
  "specversion": "1.0",
  "type": "int.wmo.wis.wme.event.wnm.schema",
  "source": "fr-meteofrance-global-broker",
  "subject": "it-meteoam",
  "id": "3ef98e28-1949-4d91-98f1-55029082f4d2",
  "time": "2025-11-13T00:47:06.734Z",
  "datacontenttype": "application/json",
  "dataschema": "https://raw.githubusercontent.com/wmo-im/wis2-monitoring-events/refs/heads/main/scl
  "data": {
    "topic": "origin/a/wis2/it-meteoam/data/core/weather/surface-based-observations/temp",
    "wnm": {
      "id": "38754bbf-614d-440a-8462-f085cbbabd8b",
      "conformsTo": [
        "http://wis.wmo.int/spec/wnm/1/conf/core"
      ],
      "type": "Feature",
      "geometry": null,
      "properties": {
        "pubtime": "2025-11-13T00:47:05.716Z",
        "datetime": "2025-11-13T00:47:05.716Z",
        "integrity": {
          "method": "sha256",
          "contentEncoding": "base64",
          "value": "FFG5EnLHx9cN7yCVFdm+YE7P98wRo2zcNjM6ciPxiJk="
        },
        "data_id": "it-meteoam/data/core/weather/surface-based-observations/temp/A_IUSD01LIMN130000",
        "metadata_id": "urn:wmo:md:it-meteoam:observations.surface.temp-bufr",
        "cache": true,
        "gts": {
          "ttaaii": "IUSD01",
          "cccc": "LIMN"
        }
      },
      "links": [
        {
          "href": "https://wis.meteoam.it/pilot/it-meteoam/data/core/weather/surface-based-observati
          "rel": "canonical",
          "type": "application/x-bufr",
          "length": 133477
        }
      ]
    },
    "exception": {
      "code": "missing-metadata",
      "description": "Missing Metadata record for data announced in WIS2 Notification Message"
    }
  }
}

```



# 5. Monitor the message compliance via GM

The Global Monitor dashboards display the total number of messages published by each WIS2 Node, as well as messages lacking metadata or containing non-compliant topics or formats. GISCs will monitor the dashboards for their affiliated centers and inform them if there are any non-compliance issues.





## 6.Invalid messages has been discarded or to be discarded

Starting from 2025, the GB gradually discarded messages that do not comply with the topic hierarchy, format, or lack metadata. This means that the data corresponding to these messages can not be shared to WIS2.

Decision 1: Messages not compliant with the schema have been discarded since [January 1, 2025](#)

Decision 2: Messages not using official topic have been discarded since [April 1, 2025](#)

Decision 3: Message without corresponding metadata will be discarded from [January 1, 2026](#)



# 7. How to publish the notification messages?

## ① Create dataset via 'Dataset Editor'

WIS2 in a box

**Dataset Editor Form**

Please choose a dataset

Select existing discovery metadata file or create a new file. Create New...

### Dataset Identification

Title: Hourly synoptic observations from fixed-land :  
Description: This is dataset contains hourly synoptics observations from land stations in country->X

Local ID: synop-dataset-wis2-training

## ③ Create discovery metadata

Centre ID: into-wmo-example  
WMO Data Policy: core  
Discipline topic: weather

Sub-discipline topics (choose one): surface-based-observations/synop  
 experimental (free-text topic)

### Temporal Properties

2024-05-30  
End Date in UTC  
 Dataset ongoing  
Resolution: 1  
Unit: hour(s)

### Spatial Properties

Choose an automatic bounding box (optional)

Your country may not have an automatic bounding box

West Longitude: 165  
North Latitude: -12  
East Longitude: 171  
South Latitude: -21

## New dataset: Initial Information

## ② Input the 'Center-id' and 'Topic'

Centre ID: nl-knmi-test

Template: weather/surface-based-observations/synop

RETURN HOME

CONTINUE TO FORM

## Dataset Mappings Editor

## ④ Transform data format

Plugins in use	File extension	File pattern		
BUFR data converted to BUFR	bin	^*\.bin\$	UPDATE	DELETE
FM-12 data converted to BUFR	txt	^*_(\d{4})(\d{2})\.txt\$	UPDATE	DELETE
BUFR data converted to BUFR	b	^*\.b\$	UPDATE	DELETE
CSV data converted to BUFR	csv	^*\.csv\$	UPDATE	DELETE
BUFR data converted to GeoJSON	buf4	*WIGOS_(\d+\d+\d+)_*.buf4\$	UPDATE	DELETE

## ⑤ Metadata has been published

MQTT Explorer

```

localhost
├── origin
│   └── a
│       └── wis2
│           └── nl-knmi-test
│               └── metadata = {"id": "bae0ab76-bf6d-461a-af5f-8a635a81b365"}
    
```

Value

QoS: 0  
05/30/2024 5:02:26 PM

```

{
  "id": "bae0ab76-bf6d-461a-af5f-8a635a81b365",
  "type": "Feature",
  "version": "v04",
  "geometry": {
    "type": "Polygon",
    "coordinates": [
      [
        [
          165,
          -12
        ],
        [
          171,
          -12
        ],
        [
          171,
          -21
        ],
        [
          165,
          -21
        ],
        [
          165,
          -12
        ]
      ]
    ]
  }
}
    
```

History 1



# 7. How to have a look at the notifications you published?

**MQTT Connection** mqtt://your node's local broker:8883/

Name: your local broker

Validate certificate:

Encryption (tls):

Protocol: mqtt://

Host: your node's local broker

Port: 8883

Username: username

Password: .....

Buttons: DELETE, **ADVANCED**, SAVE, CONNECT

**MQTT Connection** mqtt://your node's local broker:8883/

Topic: origin/a/wis2/#

QoS: 0

Buttons: + ADD

Topic	QoS
origin/a/wis2/#	0

MQTT Client ID: mqtt-explorer-92314ef7

Buttons: CERTIFICATES, **BACK**

**MQTT Explorer** Search... DISCONNECT

localhost

- origin
  - a
    - wis2
      - nl-knmi-test
        - metadata = {"id": "bae0ab76-bf6d-461a-af5f-8a635a81b365", ...}

Value

QoS: 0

05/30/2024 5:02:26 PM

```
{
  "id": "bae0ab76-bf6d-461a-af5f-8a635a81b365",
  "type": "Feature",
  "version": "v04",
  "geometry": {
    "type": "Polygon",
    "coordinates": [
      [
        [
          165,
          -12
        ]
      ]
    ]
  }
}
```

History 1



**Thank you for your attention**