

Fengyun Satellite Data Exchange Using WIS 2.0 and CMACast

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China Meteorological Administration (CMA)

2025.10.30



国家气象信息中心
National Meteorological Information Centre

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- 01** : Introduction to RTH Beijing & GISC Beijing
- 02** : Introduction to WIS 2.0 & Implementation Plan
- 03** : Fengyun Satellite Data Exchange in WIS 2.0
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- 05** : Fengyun Satellite Data Exchange in CMACast
- 06** : Future Plans



1.1 RTH Beijing

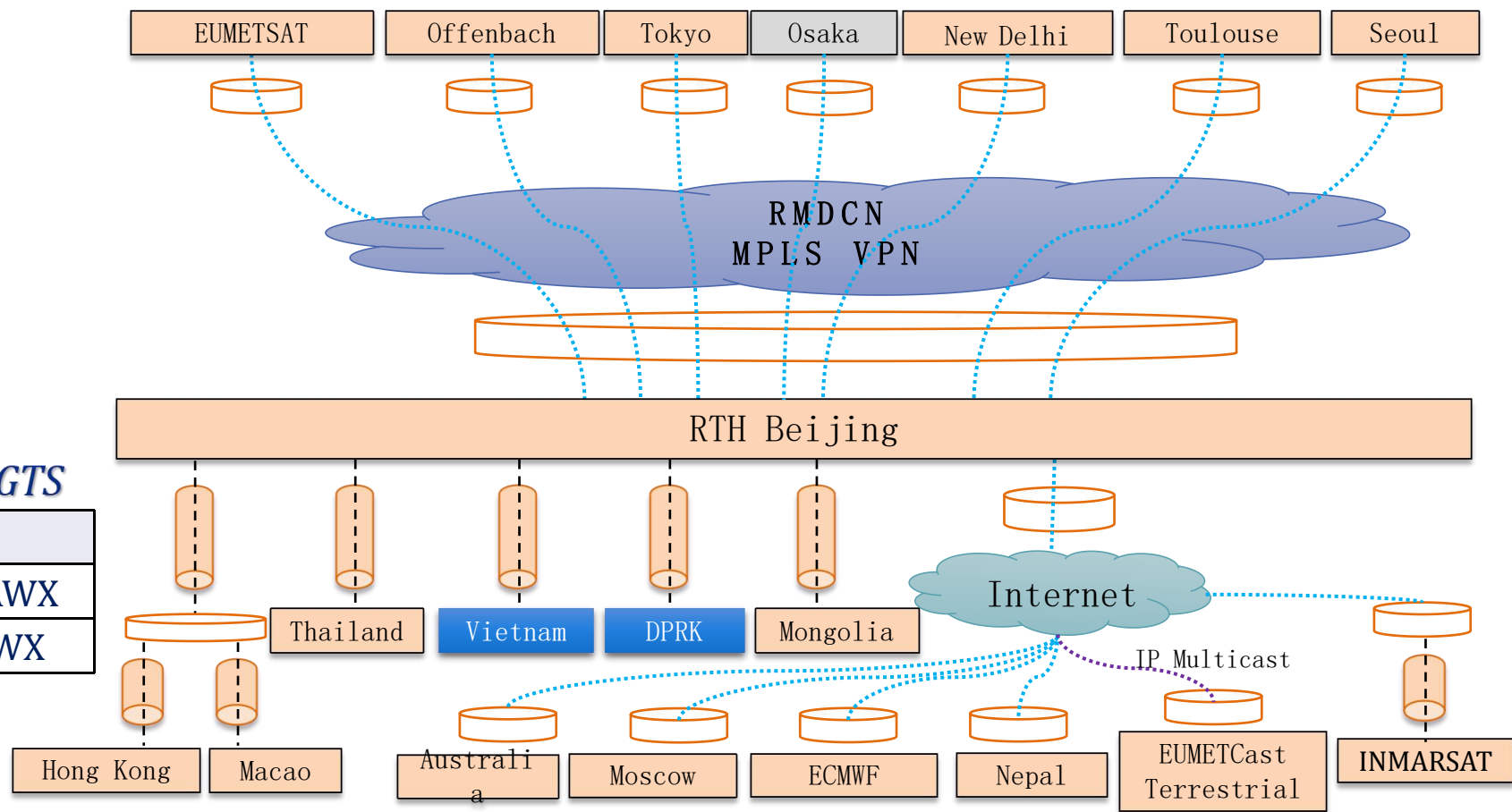
CMA assumes the responsibility of RTH in Region II of WMO, collects and exchanges **GTS data** among CMA, other RTHs and NMCs in Area of Responsibility via GTS main network (RMDCN), bilateral dedicated lines as well as Internet.

GTS data exchange includes:

- surface
- upper-air
- ocean/ship/buoy
- NWP products
- **Satellite**
-

China Global Satellite data exchange in GTS

Dataset	Header
FY-2G/H AMV	IUCX[03,04] BAWX
FY3D/E occultation products	IUT[A-L]14 BAWX





1.2 GISC Beijing

CMA is endorsed by WMO in 2011 as one of the WIS GISCs to collect from and disseminate information to WIS centers in its Area of Responsibility and with the global WMO community, and it provides a portal with the **services of data discovery, data cache and data subscription**.

Area of Responsibility

NCs (7):

- China
- Hong Kong, China
- Macao, China
- Democratic People's Republic of Korea
- Mongolia
- Nepal
- Pakistan

DCPCs (6):

- WWIS (Hong Kong, China)
- WMC (CMA)
- RSMC (CMA)
- BCC/NCC (CMA)
- NSMC (CMA)
- RTH (CMA)



Content

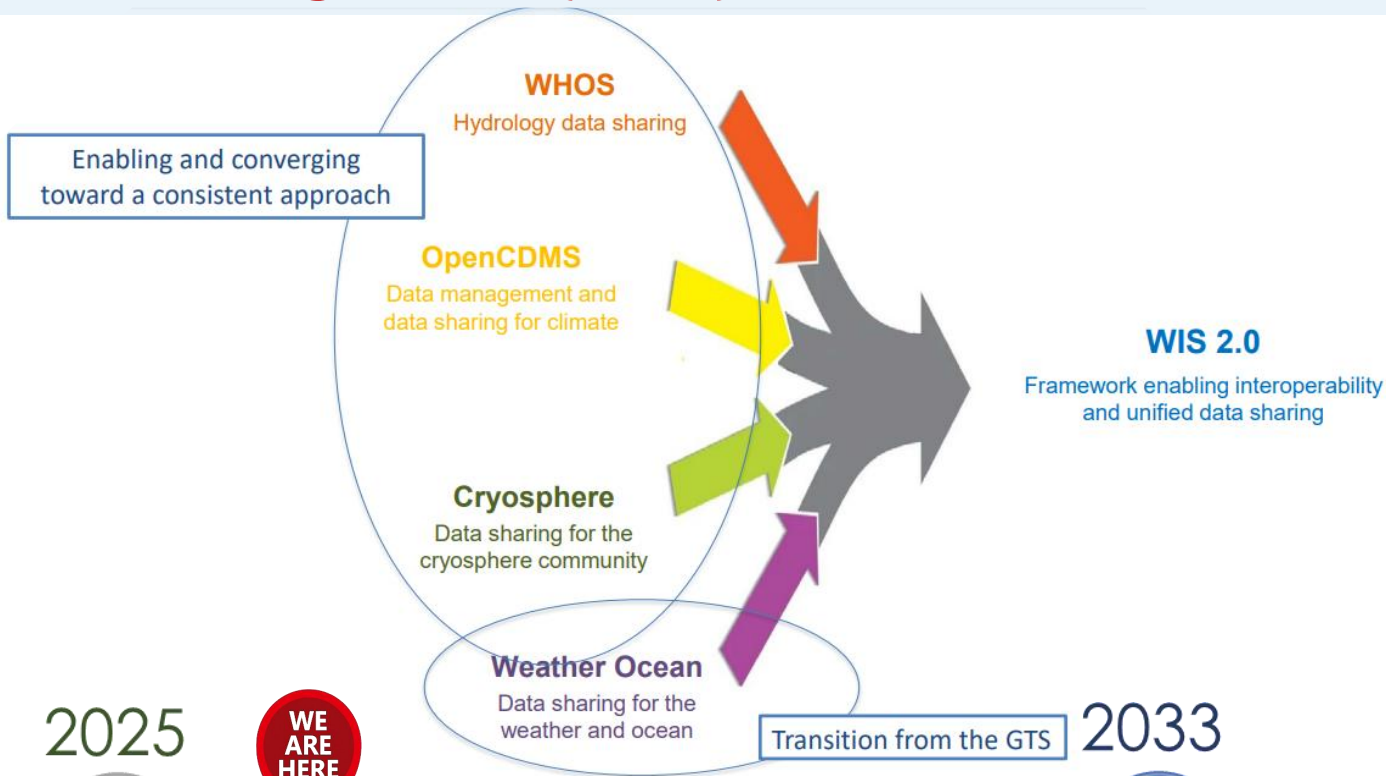
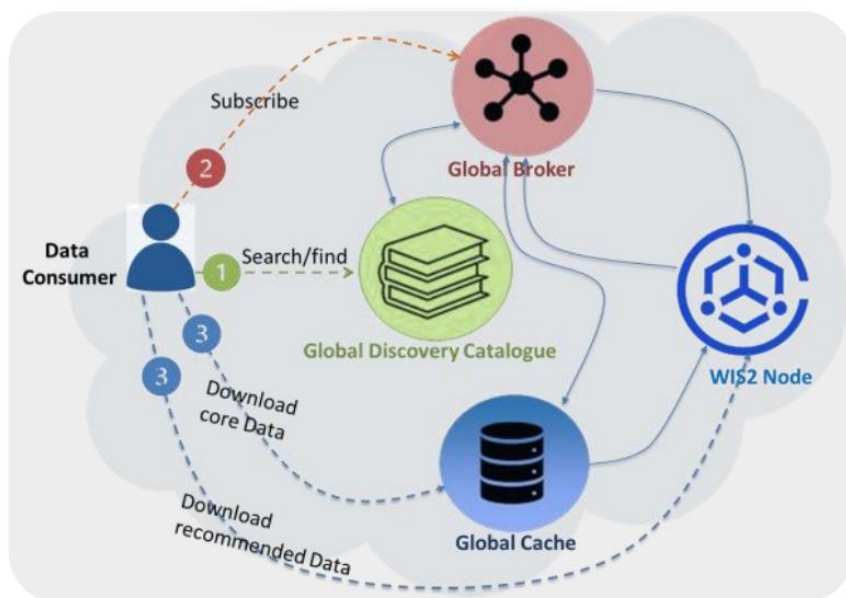
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Vision and Transition of WIS2.0

WIS 2.0 provides a framework for WMO data sharing in the 21st century, for **all WMO members** and **all the WMO disciplines in domains** to embrace the Earth system approach, enable the **WMO unified data policy**, and support the **WMO global basic observing network(GBON)**.

WIS 2.0



2023

2024

2025

WE ARE HERE

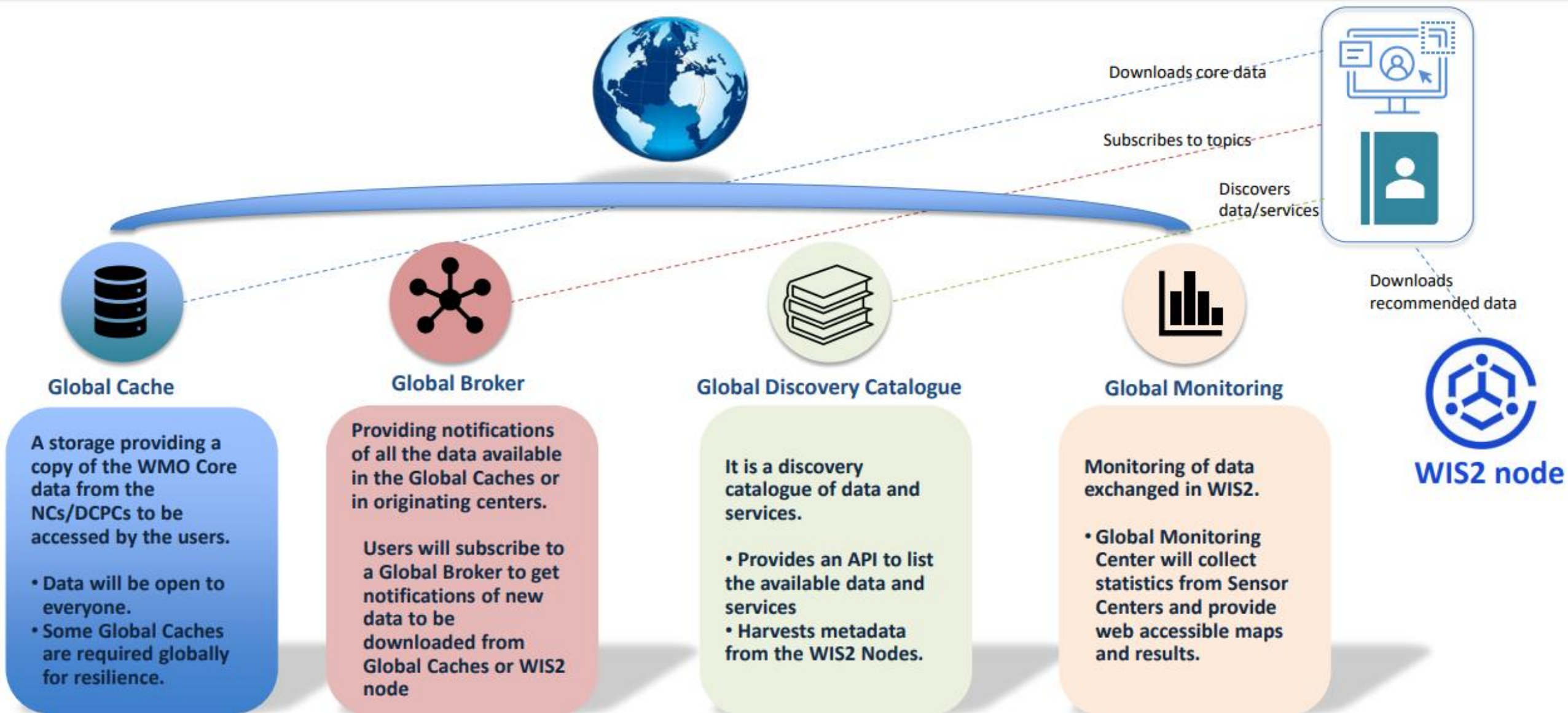
2033

WIS 2.0 Pilot phase

Pre-operational phase

Transition period: the WIS2-to-GTS and GTS-to-WIS2 gateways ensure data is available in both GTS and WIS2
Transition

Stop GTS





WIS2 Global Service instances

**Global
Broker**



Brazil
France
China
USA

**Global
Discovery
Catalogue**



Canada
China
Germany

**Global
Cache**



China
Germany
Japan
Republic of Korea
Saudia Arabia
USA/UK

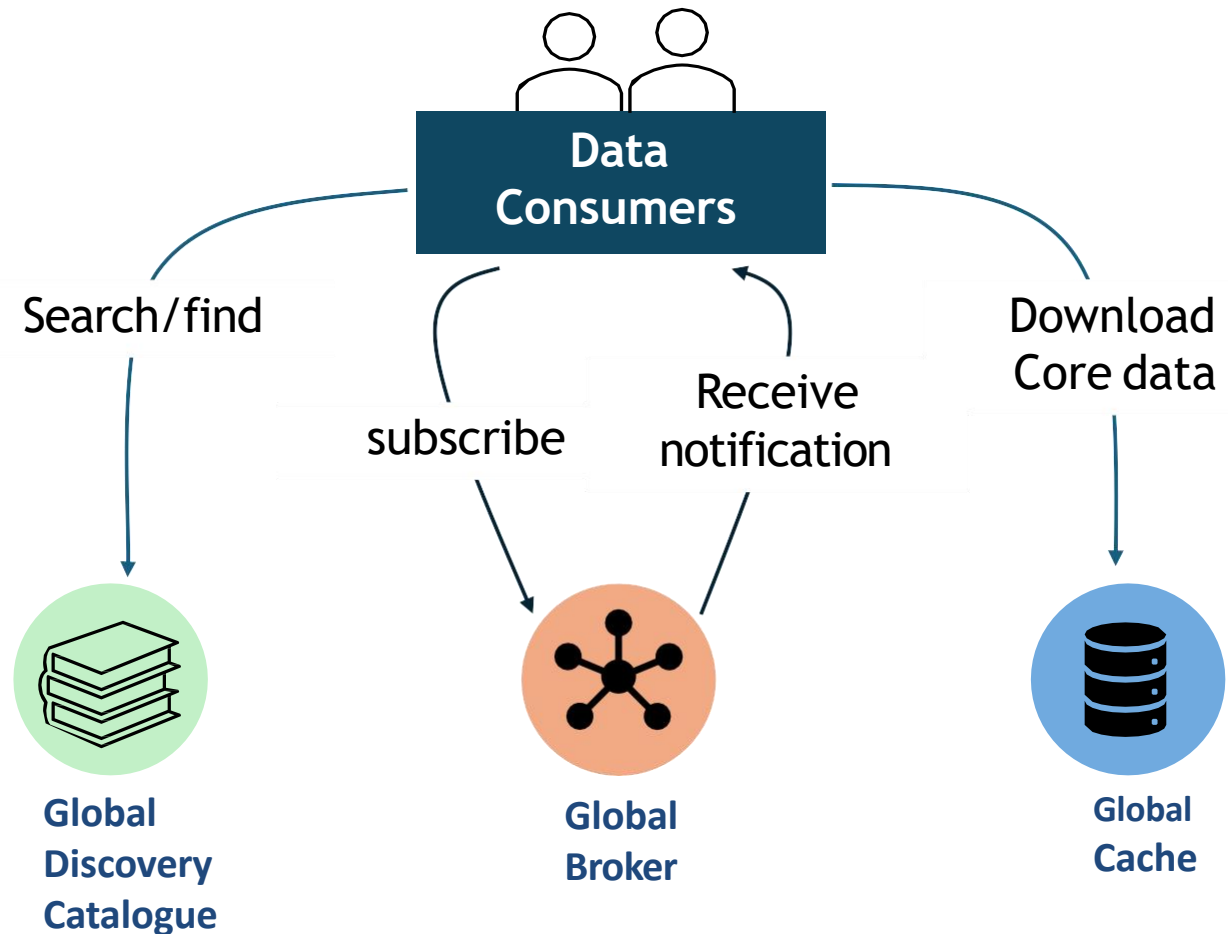
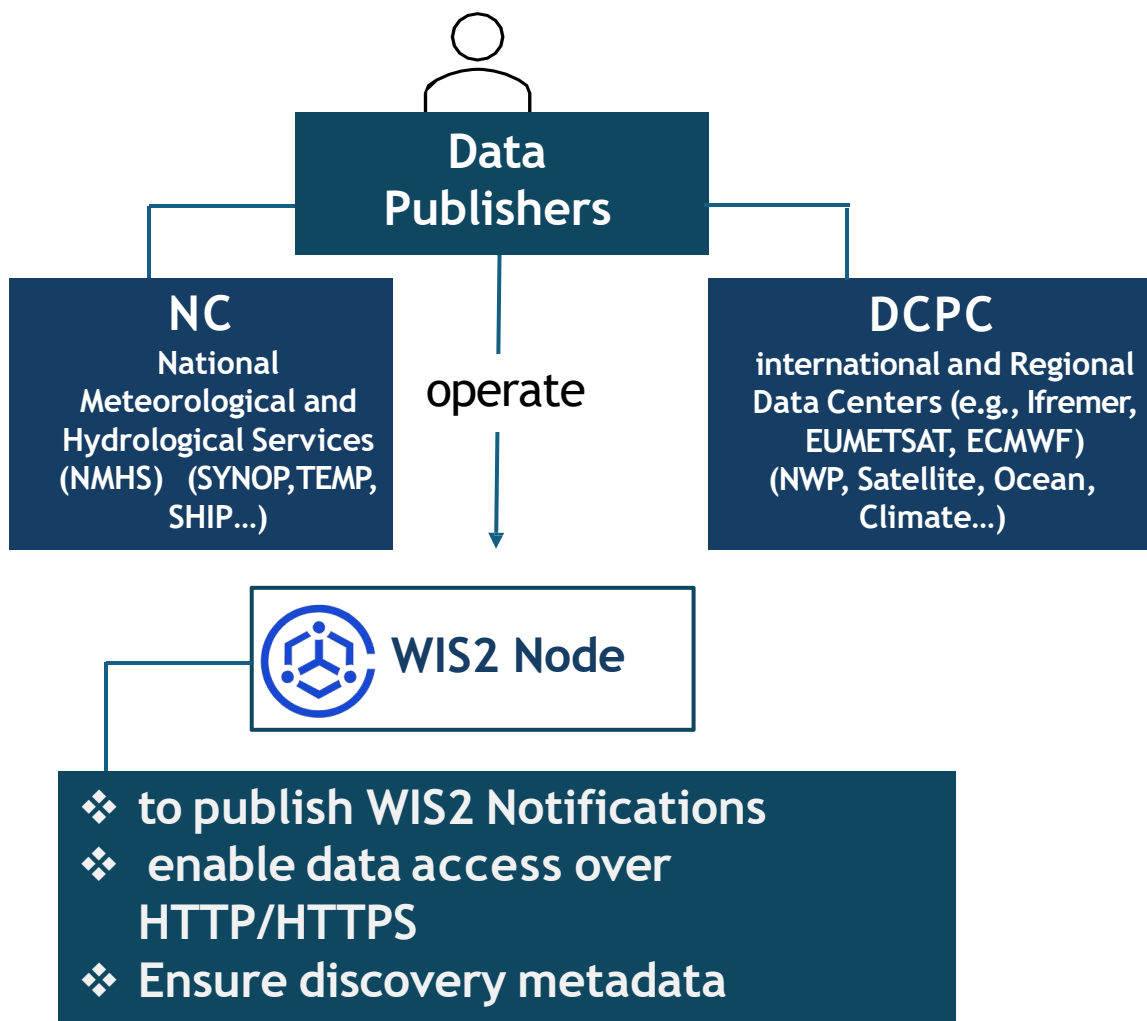
**Global
Monitoring**



China
Morocco



Data flow of WIS 2.0 – Sharing data on WIS 2.0





Architecture of WIS 2.0 – What is WIS2 in a box?

- WIS2 in a box (wis2box) is a Reference Implementation of a WIS2 Node
- Developed as Docker Compose stack using existing **Free and Open Source** implementations and wis2box-specific components
- Free Open-Source Software (FOSS) github.com/World-Meteorological-Organization/wis2box
- Designed to be cost-effective and low-barrier to operate
- **Currently over 80 WMO-Members** are using wis2box to share data on WIS2

Free and Open Source Software



Open Standards



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WMO Unified data policy

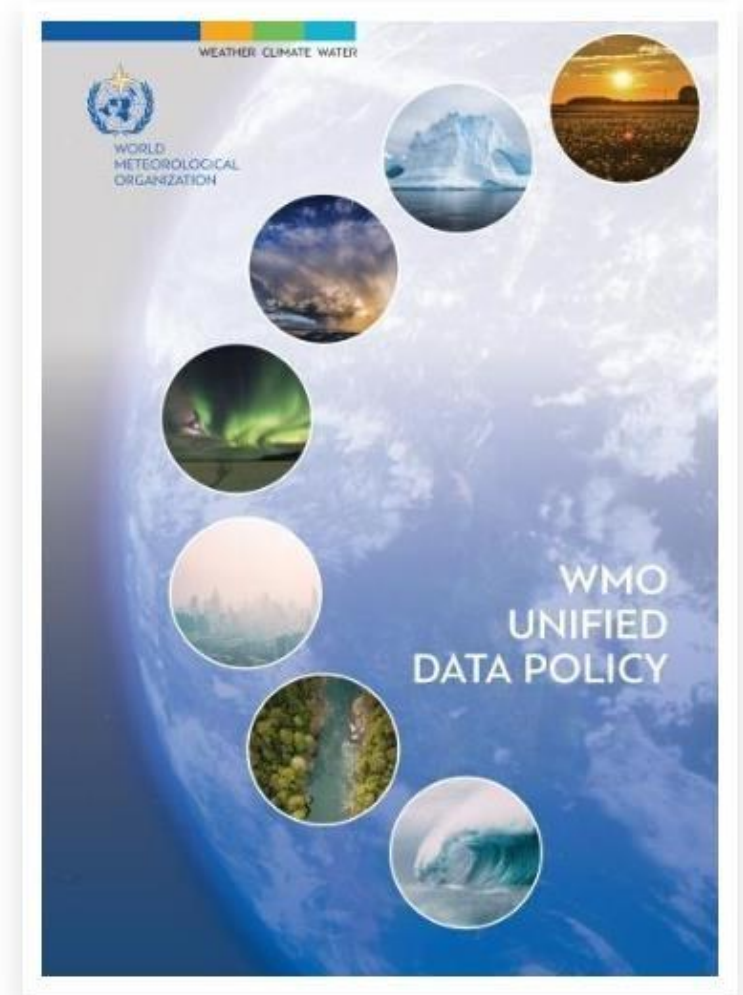
WMO Unified Data Policy, Resolution 1 (Cg-Ext(2021))

International provision and exchange of Earth system data shall follow a 2-tier approach:

- ① Members **shall** provide on a free and unrestricted basis **Core** data that is necessary for provision of safety critical services
- ② Members **should** provide the **Recommended** data that are required to support Earth system monitoring and prediction

Lists core and recommended data for the following Earth system disciplines/domains:

1. **Weather**
2. Climate
3. Hydrology
4. Atmospheric Composition
5. Cryosphere
6. Oceans
7. **Space Weather**



7 types of data are currently exchanged via WIS 2.0, including:

Surface, Upper-air, Oceanographic information, Warnings, Numerical Forecasts, **Satellite**, and Climate data.



Topic Hierarchy of Satellite dataset in WIS 2.0

WIS2 uses Topic Hierarchy to replace GTS headers for defining data types.

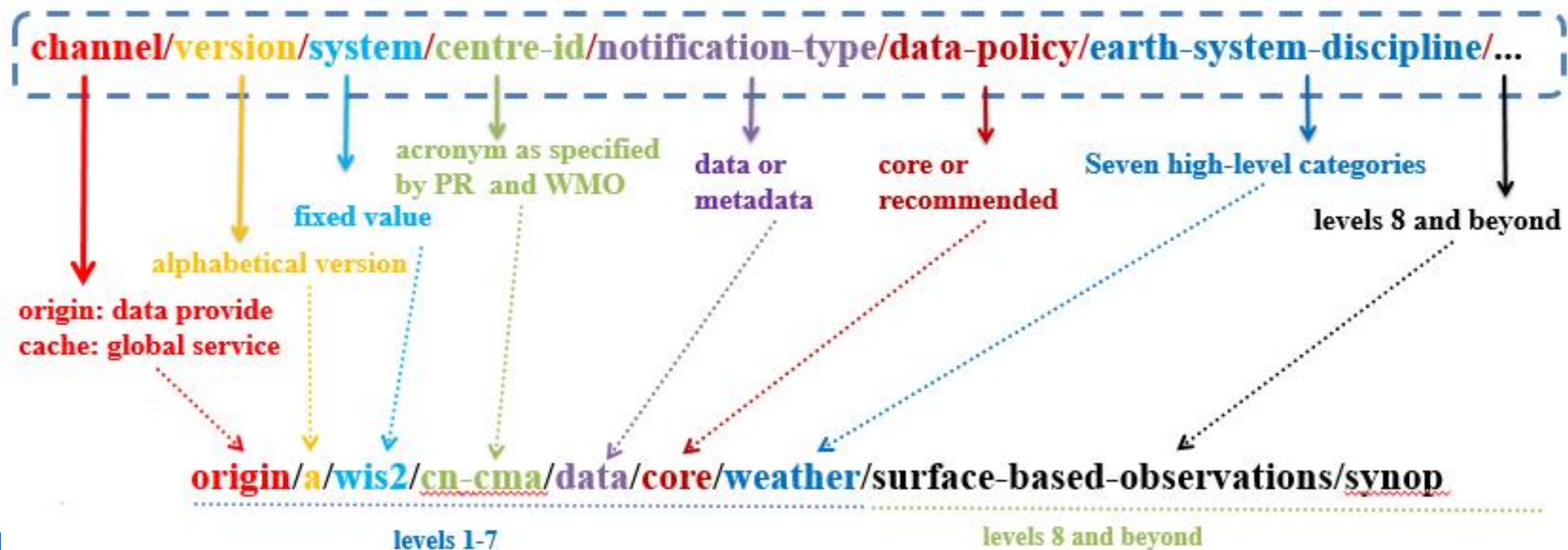
WMO has reserved **over 1,200 topics**, including **more than 1000 topics of satellite data**.

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

Eg.

origin/a/wis2/cn-cma/data/core/weather/space-based-observations/fy-3e/gnos-2

origin/a/wis2/kr-kma/data/core/weather/space-based-observations/geo-kompsat-2a/ami





Satellite Data Collection from WIS 2.0

Currently, **37 types of** satellite data have been shared from **7 WMO Members** or contributing organizations through WIS 2.0. *(by October 21st, 2025)*

No.	Member	centreId_id	data-policy	Number of types	Satellite Name
1	China	cn-cma	core	1	fy-3e/gnos-2
2	India	in-imd	core	1	insat-3dr/imager
3	South Korea	kr-kma	core	1	geo-kompsat-2a/ami
4	Singapore	sg-mss-asmc	recommended	1	noaa-20/viirs
5	America	us-cimss	core	4	noaa-20/cris ...
6	Hong Kong, China	hk-hko	core	3	metop-c/mhs ...
7	France	fr-meteofrance	core	8	metop-b/amsu-a ...
8	EUMETSAT	int-eumetsat	core	18	meteosat-10/seviri ...
Total Number of Satellite data types				37	

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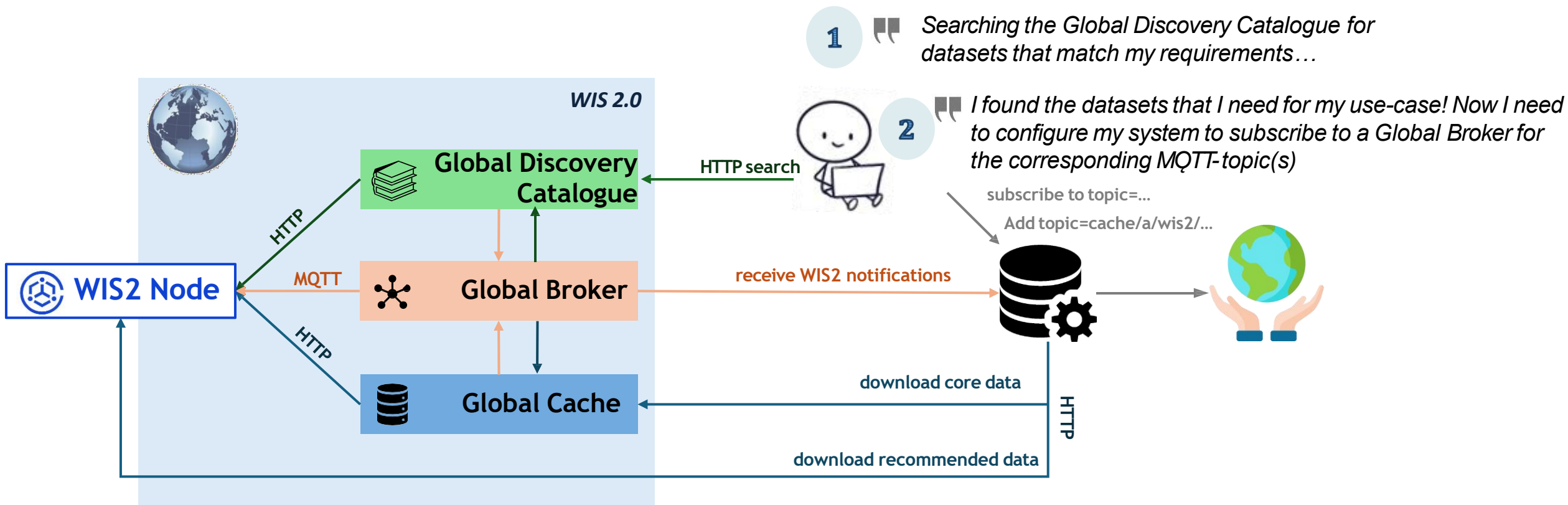
Discovering and downloading data from WIS 2.0

Find new data by searching one of the Global Discovery Catalogue

- Query the OGC API endpoint over HTTP

Setup an MQTT subscription and use the URL in the WIS2 notification to download the data

- Develop custom code using MQTT client libraries or use tools like 'wis2downloader'





Discovering datasets from the WIS2 Global Discovery Catalogue

The Global Discovery Catalogue (GDC) provides cataloguing and discovery capability for WIS2 datasets.

GDC subscribes to and get metadata messages from GBs, and then downloads metadata from the corresponding GC.

GDC ECCC

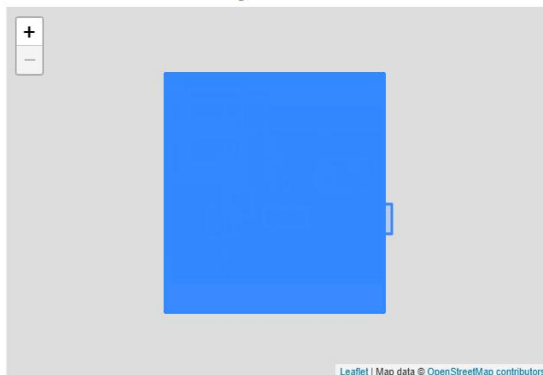


Environment and
Climate Change Canada

Environnement et
Changement climatique Canada

Home / Collections / WIS2 discovery metadata / Items

WIS2 discovery metadata



title	description
Global Deterministic Storm...	The Global Deterministic storm...
Regional Deterministic Wave...	The Regional Deterministic Wave...
Wildfire hotspots ingested by RAQDPS	Hotspots represent active wild...
Operational Hydrodynamic...	The Operational Hydrodynamic...

GDC CMA



CHINA
METEOROLOGICAL
ADMINISTRATION

Home / Discovery Metadata / Collections

Current Location: Home > collections > wis2-discovery-metadata > items

wis2-discovery-metadata

WMO WIS2 discovery metadata (experimental)

Leaflet | Map data © OpenStreetMap contributors

Id	Title	Type	Keywords	Format	Links
urn:wmomd:br-inmet:cap	CAP bulletins Brazil	dataset	CAPAlertWarning.xmlavi so		Notifications: mqt Notifications from I r: mdtts://evapor Notifications from I ne@globalbroker.r Notifications from I

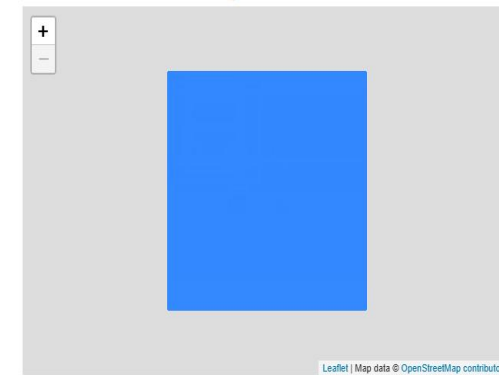
GDC DWD



Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Home / Collections / WIS2 discovery metadata / Items

WIS2 discovery metadata



title	type	identifier
Automatic Weather Stations...	dataset	urn:wmomd:kr-kma:surface-based-...
Hourly synoptic observations...	dataset	urn:wmomd:za-weather:saxoeh2t
Upper-level...	dataset	urn:wmomd:hk-hko:core.surface-b...
Hourly synoptic observations...	dataset	urn:wmomd:cg-met:core.surface-b...

Each Global Discovery Catalogue provides an OGC API endpoint to query records

- Environment and Climate Change Canada, Meteorological Service of Canada: <https://wis2-gdc.weather.gc.ca>
- China Meteorological Administration: <https://gdc.wis.cma.cn>
- Deutscher Wetterdienst: <https://wis2.dwd.de/gdc>



Discovering datasets from the WIS2 Global Discovery Catalogue

Enter “**space-based-observations**” into the textbox, then can check the metadata through the portal. There are currently **32** metadata records for satellite data. *(by October 21st, 2025)*

<https://gdc.wis.cma.cn/collections/wis2-discovery-metadata/items>

Id

▼

space-based-observations

Search

Id	Title	Type	Keywords	Format	Links
Check the metadata through the portal.					
urn:wmo:md:hk-hko:http:core.weather.space-based-observations.noaa-18.am-su-a	NOAA-18 AMSU-A data provided by station Hong Kong (hkg)	dataset	DBNet,NOAA-18,AMSU-A	--	The landing page of this series The landing page of this series ml This document as RDF (JSON-LD): wis2-discovery-metadata/items/space-based-observations.noaa-18.am-su-a This document as HTML: https://gdc.wis.cma.cn/collections/wis2-discovery-metadata/items/space-based-observations.noaa-18.am-su-a WIS2 discovery metadata: wis2-discovery-metadata
urn:wmo:md:kr-kma:core.weather.space-based-observations.geo-kompsat-2a	GK2A Satellite Observation Data (AMV / CSR)	dataset	geo-kompsat-2a,space-based-observations,AMV(Atmospheric Motion Vectors),CSR(Clear Sky R	--	Notifications: mqtt://ever
urn:wmo:md:hk-hko:core.weather.space-based-observations.metop-c.mhs	METOP-C MHS data provided by station Hong Kong (hkg)	dataset	DBNet,METOP-C,MHS	--	Notifications: mqtt://every



Discovering datasets from the WIS2 Global Discovery Catalogue

View the metadata information online and also access the metadata in **JSON** format.

[Home](#) | [Discovery Metadata](#) | [Collections](#)

Current Location: Home > collections > wis2-discovery-metadata > items > Item Fy-3e radio occultation

Item Fy-3e radio occultation



Leaflet | Map Word © GS(2022)3124

Property	Value
id	urn:wmo:md:cn-cma:data.core.weather.space-based-observations.fy-3e.gnos-2
identifier	urn:wmo:md:cn-cma:data.core.weather.space-based-observations.fy-3e.gnos-2
title	Fy-3e radio occultation
description	Radio occultation data, up to about 500 events every day from one navigation system, globally distribution, various parameter, various level.
themes	concepts: [object Object] scheme: https://github.com/wmo-im/wis2-topic-hierarchy/blob/main/topic-hierarchy/earth-system-discipline/index.csv
	href: mqttss://everyone:everyone@wis2node.wis.cma.cn:8883 type: application/json name: origin/a/wis2/cn-cma/data/core/weather/space-based-observations/fy-3e/gnos-2

JSON

```
{
  "id": "urn:wmo:md:cn-cma:data.core.weather.space-based-observations.fy-3e.gnos-2",
  "conformsTo": [
    "http://wis.wmo.int/spec/wcamp/2/conf/core",
    "http://www.opengis.net/spec/ogcapi-records-1/1.0/req/record-core"
  ],
  "type": "Feature",
  "geometry": {
    "type": "Polygon",
    "coordinates": [
      [
        [-180, -90],
        [-180, 90],
        [180, 90],
        [180, -90],
        [-180, -90]
      ]
    ]
  },
  "properties": {
    "identifier": "urn:wmo:md:cn-cma:data.core.weather.space-based-observations.fy-3e.gnos-2",
    "title": "Fy-3e radio occultation",
    "description": "Radio occultation data, up to about 500 events every day from one navigation system, globally distribution, various parameter, various level.",
    "themes": [
      {
        "concepts": [
          {
            "id": "satelliteObservation"
          }
        ],
        "scheme": "https://github.com/wmo-im/wis2-topic-hierarchy/blob/main/topic-hierarchy/earth-system-discipline/index.csv"
      }
    ],
    "type": "dataset",
    "created": "2024-05-06T00:00:00Z",
    "updated": "2025-08-18T01:00:07Z",
    "contacts": [
      {
        "addresses": [
          {
            "deliveryPoint": [
              "46 Zhongguancun Nandajie"
            ]
          }
        ]
      }
    ]
  }
}
```

Get the metadata through the OGC API ([urn:wmo:md:cn-cma:data.core.weather.space-based-observations.fy-3e.gnos-2](https://wis2node.wis.cma.cn:8883/origin/a/wis2/cn-cma/data/core/weather/space-based-observations/fy-3e/gnos-2))

Get “urn:wmo:md:cn-cma:data.core.weather.space-based-observations.fy-3e.gnos-2” from GDC CMA:

<https://gdc.wis.cma.cn/collections/wis2-discovery-metadata/items/urn:wmo:md:cn-cma:data.core.weather.space-based-observations.fy-3e.gnos-2?f=json>



Subscribe Message from Global Broker

Use MQTT TOOL(MQTT-Explorer) to subscribe Global Broker
Broker of GB CMA: `mqtt://*****.*****@gb.wis.cma.cn:1883`
Topic Hierachy: `origin/a/wis2/#`

The screenshot displays the MQTT Explorer application interface. On the left, a tree view shows the topic hierarchy under the broker `gb.wis.cma.cn`. The selected topic is `cache/a/wis2/de-dwd-gts-to-wis2/ca-eccc-msc/data/core/weather/experimental`. A pink box highlights the `amsu-a` sub-topic under `space-based-observations`. The main panel shows the selected topic's value as a JSON object. A green callout box with the text "Check the messages that need attention" points to the `amsu-a` sub-topic in the tree view.

MQTT Connection `mqtt://gb.wis.cma.cn:1883/`

MQTT Explorer

Topic

Value

Check the messages that need attention

```
{
  "id": "24dd518b-e63e-475b-b935-387eb032587c",
  "type": "Feature",
  "conformsTo": [
    "http://wis.wmo.int/spec/wnm/1/conf/core"
  ],
  "geometry": null,
  "properties": {
    "data_id": "hk-hko:core.weather.space-based-observations.metop-c.amsu-a/W_cn-HKO-hkg,AMSUA,RARS+METOP03+hkg_C_VHHH_20250907144714_amsua11c_metop03_20250907_1425_35468_bufn",
    "datetime": "2025-09-07T00:00:00Z",
    "pubtime": "2025-09-07T14:50:33Z",
    "integrity": {
```

History 1



Downloading datasets from the WIS2 – wis2downloader



wis2downloader:

- Flask-based Python application including MQTT-client
- API to manage subscriptions on MQTT-topics
- Multiple download workers for more efficient data downloading
- Provides statistics via /metrics endpoint for Prometheus



Flask



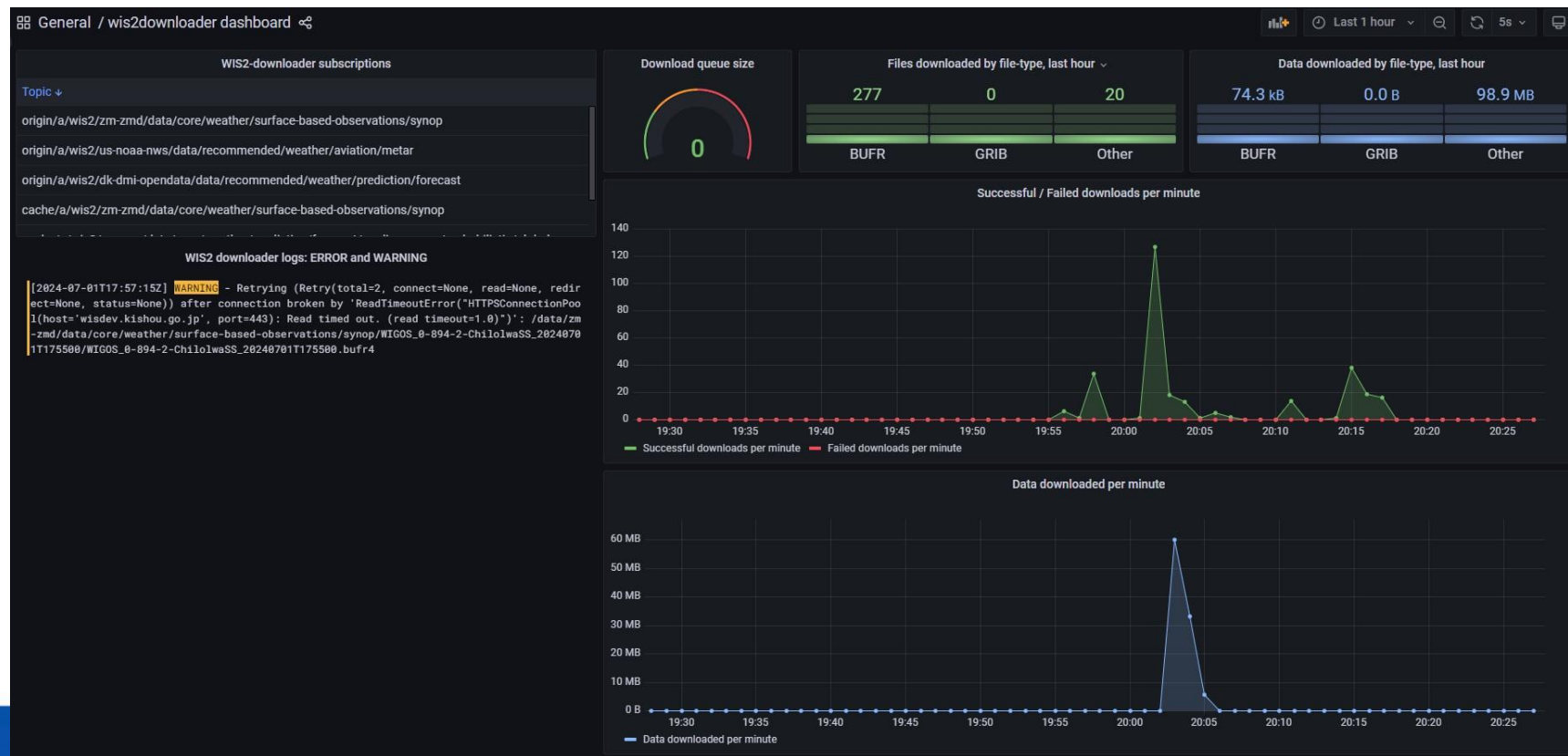
pypi.org/project/wis2downloader

Source code:

github.com/wmo-im/wis2downloader

Included in wis2box, can also be installed independently: `pip3 install wis2downloader`

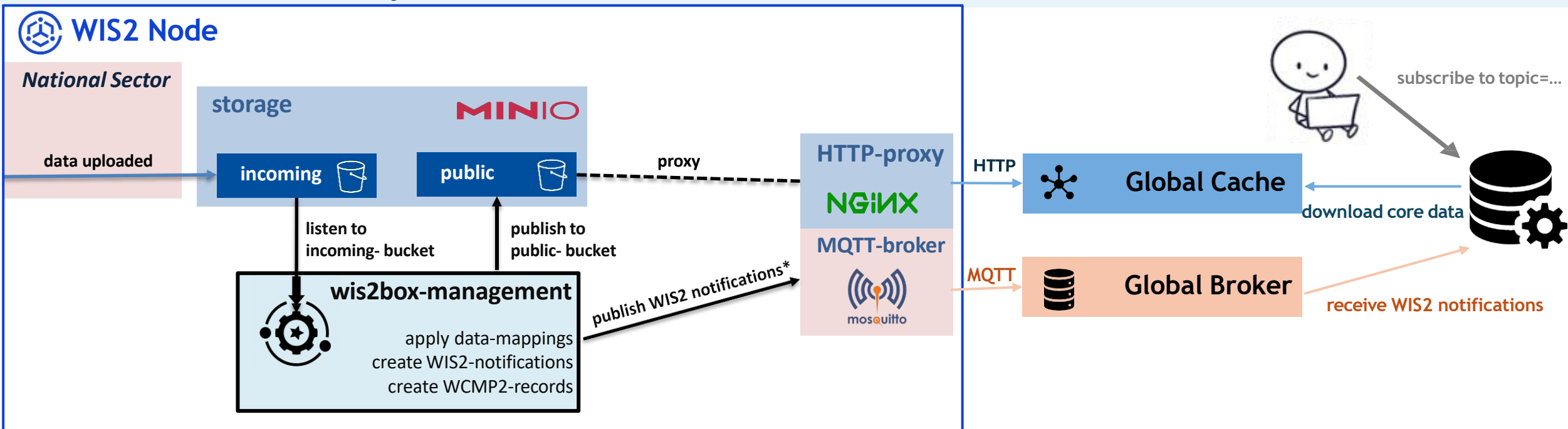
The monitoring stack in wis2box collects and stores wis2downloader metrics in **Prometheus** and provides a dashboard for viewing information about the data downloaded:





Publishing datasets from the WIS2

- Data can be uploaded to wis2box-incoming in different ways. Optimal solution will depend on systems used in national sector.
- Output-file in public bucket results in **WIS2-notification** on MQTT. Use MQTT explorer to see the WIS2-notifications for your data.



Options for ingesting data in wis2box:

- **Manual upload using MinIO UI:** manually create path and upload data, useful for testing data-workflow
- **Interfaces in wis2box-webapp:** manual submission using FM-12 form or manual file upload interface
- **Scripts:** write code to upload data using MinIO client software
- **Using SFTP protocol:** forward data to MinIO SFTP-endpoint

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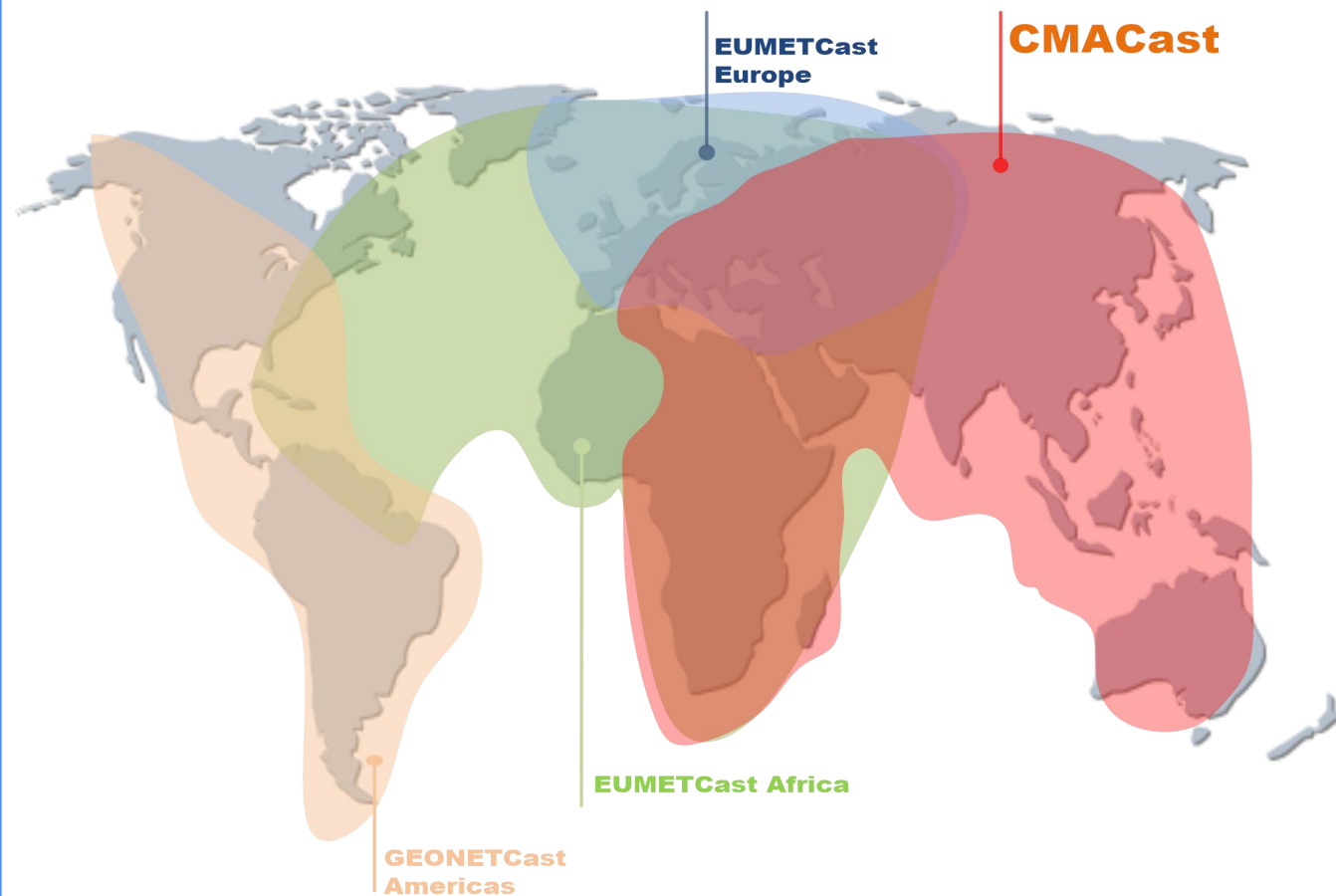


CMACast - One of the three pillars of GEONETCast

“

As one of the main distribution way of GISC Beijing, **CMACast**, together with **GEONETCast Americas** and **EUMETCast**, contributes together in **GEONETCast**, is responsible for providing local data distribution to Asia and Oceania, as well as broadcasting and forwarding data from the Americas and Europe.

”





CMACast - System updates and upgrades

Since **1998**, the system has gradually developed and a total of 4 generations of systems have been upgraded. At present, its coverage has expanded to **Central Asia, West Asia, the Middle East, and most parts of Africa.**



(1998-2006)

● First generation

- Frequency band: Ku
- Technology: **HDLC**
- Data : 3GB/day

(2006-2012)

● Second generation

- Frequency band: Ku & C
- Technology: **DVB-S**
- Data: 30GB/day

(2012-2022)

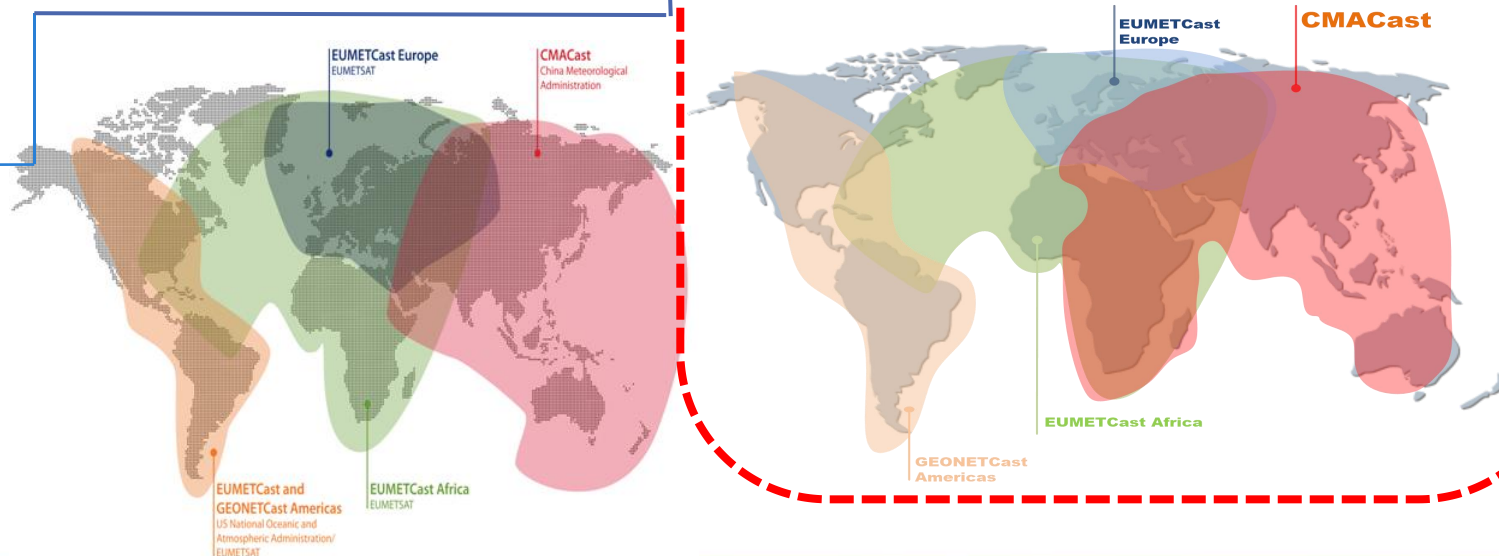
● Third generation

- Frequency band: C
- Technology: **DVB-S2**
- Data : 400GB/day

(2022-now)

● Fourth generation

- Frequency band: C
- Technology: **DVB-S2X**
- Data: 550GB/day

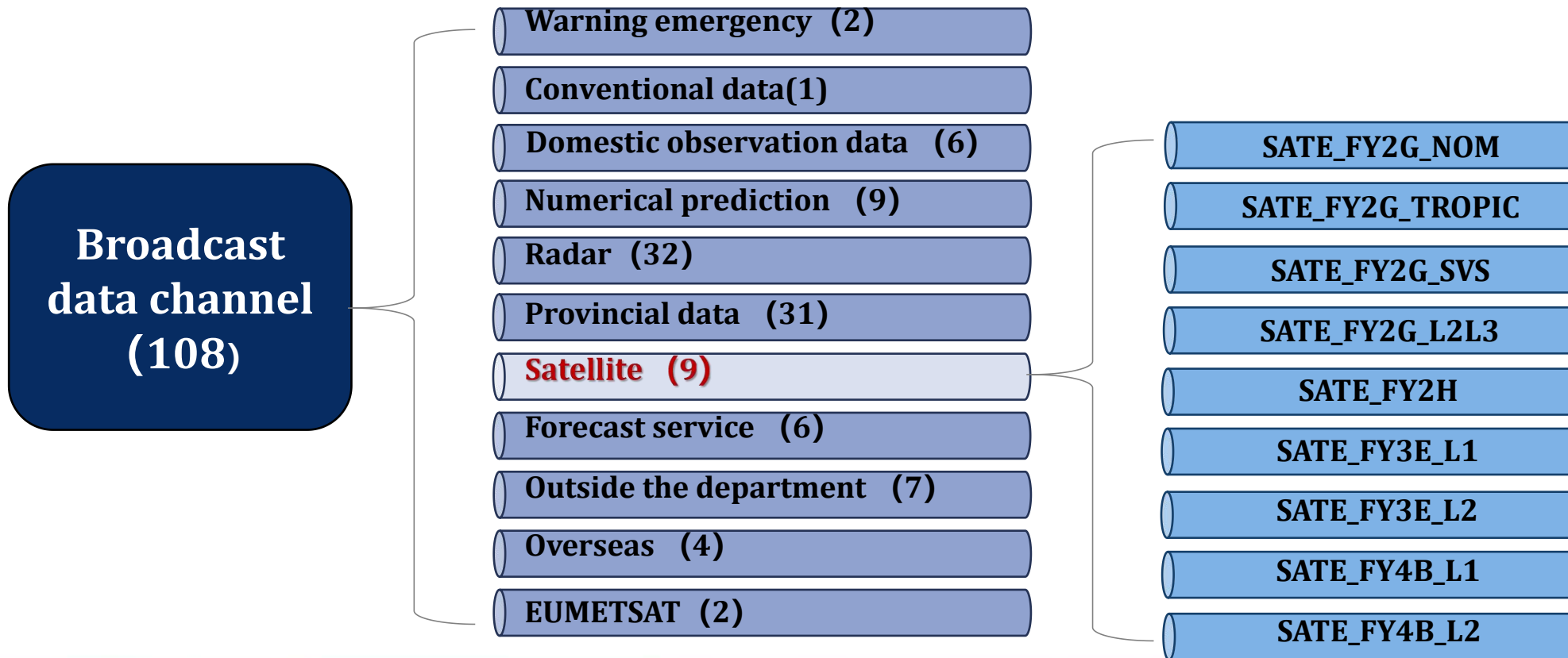




CMACast - High quality data products

Data broadcasted by CMACast up to **560GB/day**, satellite products account for **54%**. CMACast provides international users with **FY2G/H, FY3E, FY4B images and products**, broadcasting **over 220GB** of China FY series satellite products daily.

12 categories, over 300 real-time meteorological data broadcasted in 108 data channels.



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Future Plan of GISC Beijing

WIS 2.0:

- As a WIS2 Node, CMA will **share all the data currently available on the GTS**, including satellite data, as well as the newly launched Fengyun satellites through WIS2 in the near future.
- GISC Beijing will be committed to providing stable global services and technical support to WIS2 centers and users, assisting them in completing the transition from GTS/WIS1 to WIS2.

CMACast:

- Establish an **online service platform** for overseas station users and create real-time communication ways to further enhance the timeliness and effectiveness of services for international users.
- Develop **on-site technical support** and training plans for overseas stations, conducting maintenance inspections and **training sessions** at 3-4 overseas stations annually to improve the operational proficiency of local users.

Thank you

Merci

Gracias

شكرا

谢谢

Спасибо



国家气象信息中心
National Meteorological Information Centre