GTS to WIS2.0 data acquisition migration at ECMWF

2nd observational campaigns workshop for better weather forecasts

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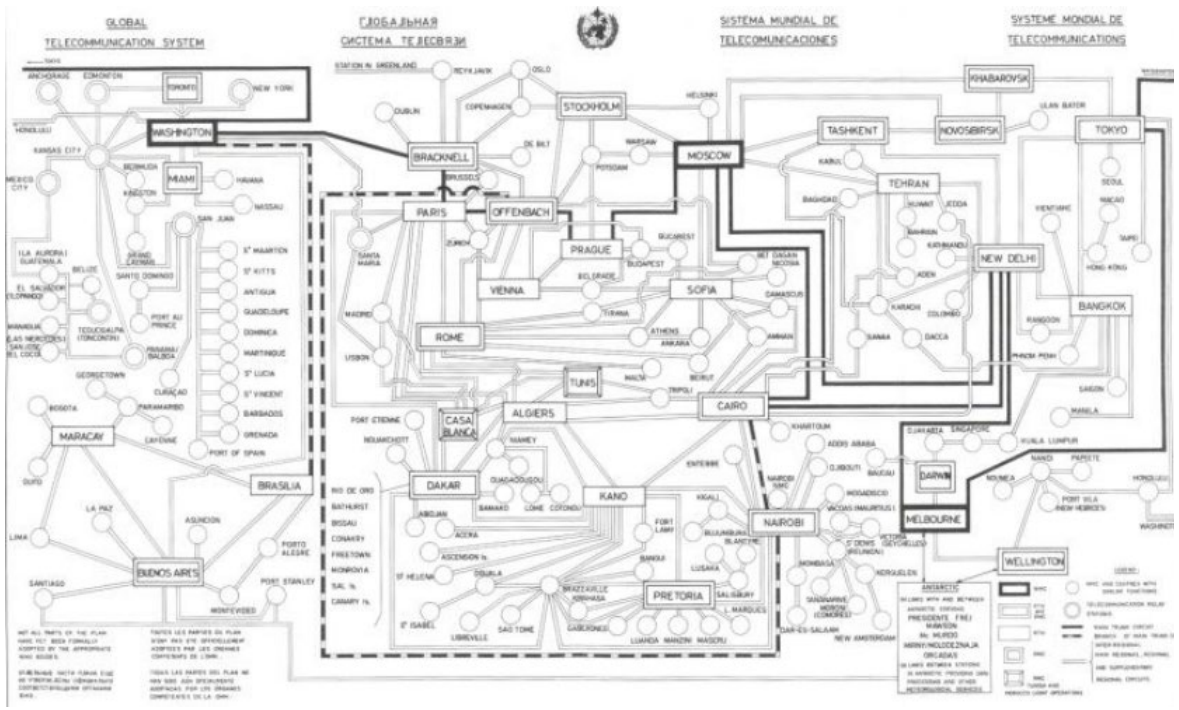
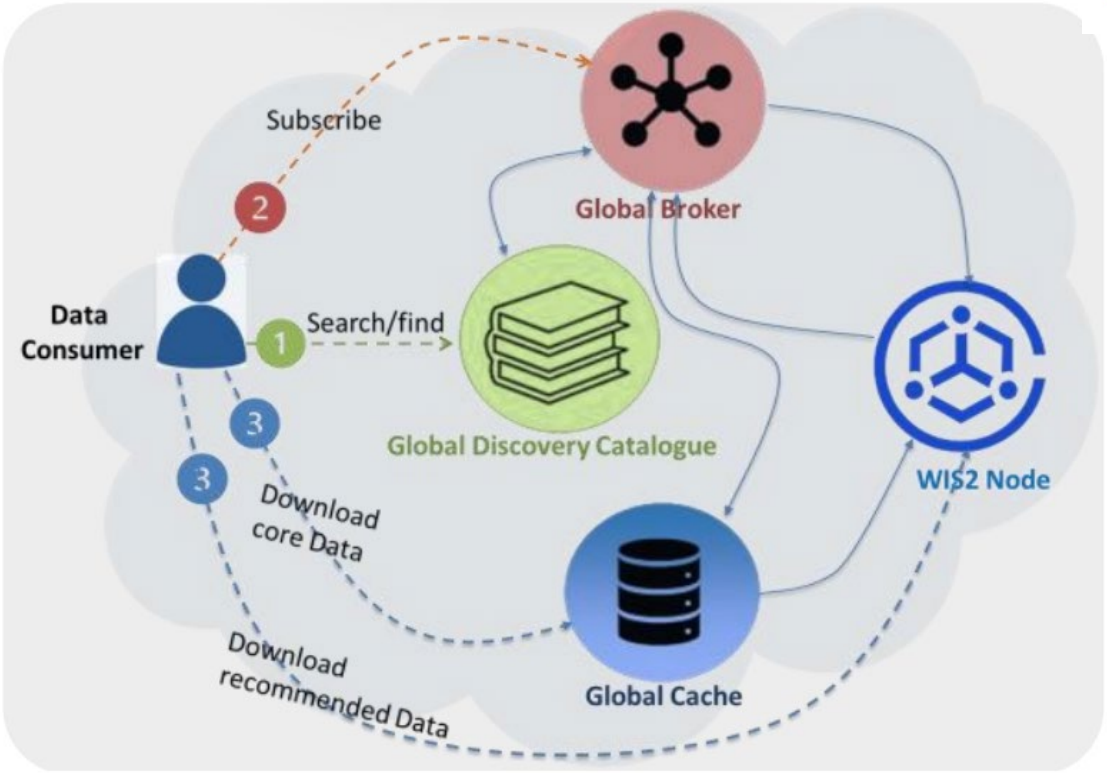
ECMWF

GTS (1970s) → WIS 2.0

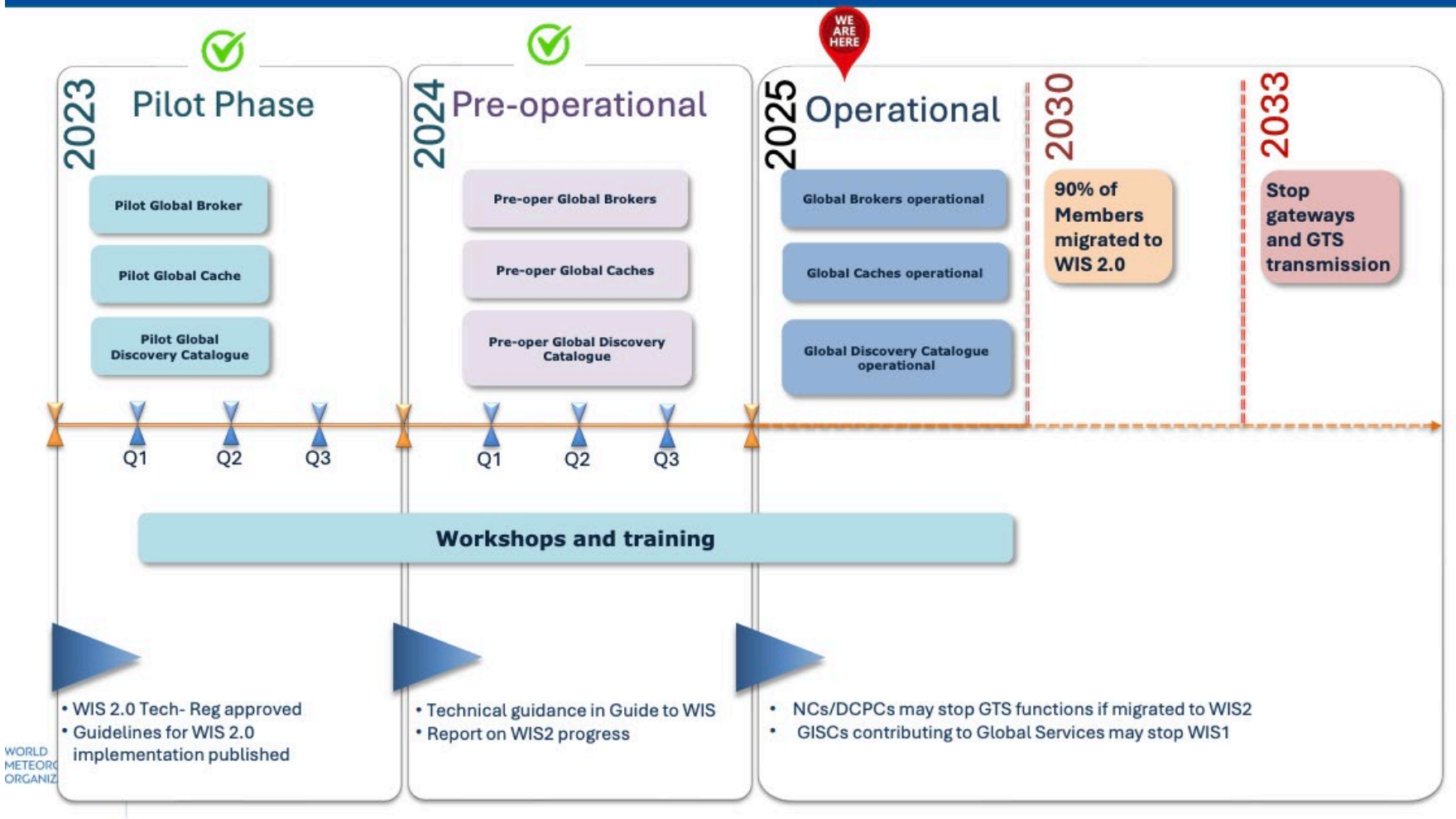




- **Pre-internet era; dedicated lines and private networks**.
- **complex topology and "store and forward"** logic: a message received by a centre is stored and forwarded to the "next" centre
- Thousands of "**GTS headers**" used to route and describe the data;
- **routing tables** are maintained **in each** transmission **centre** to direct the messages along the planned route through the network
- **data volumes and bandwidth limits**
- WMO **data formats** only

- low-barrier system, **distributed web architecture**
- **Open Standards** (OGC, W3C, …) and Open-Source COTS; Cloud ready
- **Web APIs** and **publication/subscription** (pub/sub) MQTT **protocols**
- **GeoJSON notifications** describing the available data and the method (URL) to access it;
- **Not restricted to WMO data formats**
- **WIS2 Node and downloader** reference implementations available

WIS2 Implementation plan



Global Broker	Brazil
	China
	France
	USA
Global Discovery Catalogue	Canada
	China
	Germany
GTS-WIS2 Gateway	Germany
	Japan

Global Cache	China
	Germany
	Japan
	Republic of Korea
	USA/UK
	Saudi Arabia
Global Monitor	China
	Morocco
WIS2-GTS Gateway	China
	UK

- https://community.wmo.int/en/GTS_WIS2_Transition_Guidance
- https://community.wmo.int/en/activity-areas/wis/WIS2-overview

WIS2 Topic Hierarchy (WTH)

level	name	desc	example
1	channel	WIS2 nodes/ data providers -> '**origin**' Global services -> '**cache**'	cache
4	**centre-id**	Acronym proposed by member and endorsed by WMO Secretariat Unlike the GTS, more than one National Centre can provide natively data on WIS 2.0. The process involves requesting to host a **WIS2 Node through the WIS National Focal Point (NFP), WMO secretariat registering the new centre-id and GISCs assessing compliance with WIS2 requirements**	de-dwd
5	notification-type	WIS2 notification types ('data' or 'metadata')	data
6	**data-policy**	**Data policy** as defined by the **WMO Unified Data Policy (resolution 1)** • **core** ~ free and unrestricted • **recommended** ~ direct access to the publisher (access restrictions, licenses)	core
7	**earth-system-discipline**	high-level categories as defined by the WMO Unified Data Policy *atmospheric-composition', 'climate', 'cryosphere', 'hydrology', 'ocean', 'space-weather', or 'weather'*	weather
8+	**Sub-discipline** **Leaf**	topics proposed by domain experts and user communities and coordinated by WMO NB: WMO recommends data to to be publish on a "leaf" topic if the observational type is not yet formally approved in the WMO registry, **experimental** tier can be used ../<discipline>/**experimental**/<exp-sub-discipline>	surface-based-observation/synop space-based-observations/noaa-21/cris

Hourly synoptic observations from fixed-land stations (SYNOP) (bz-nms)

Product: **urn:wmo:md:bz-nms:belize-hourly-synop**

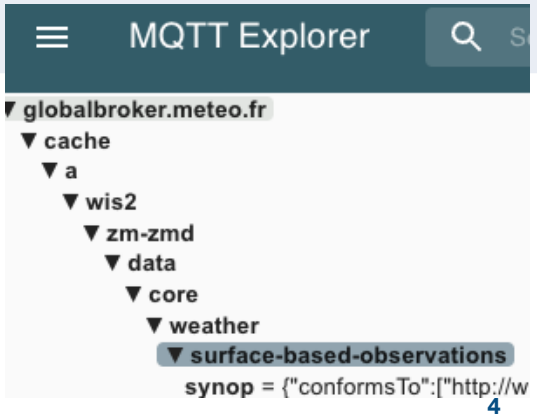
Originator: **National Meteorological Service of Belize**

License: **core**

Topic: **wis2 > bz-nms > data > core > weather > surface-based-observations > synop**

Keywords | Theme Keywords

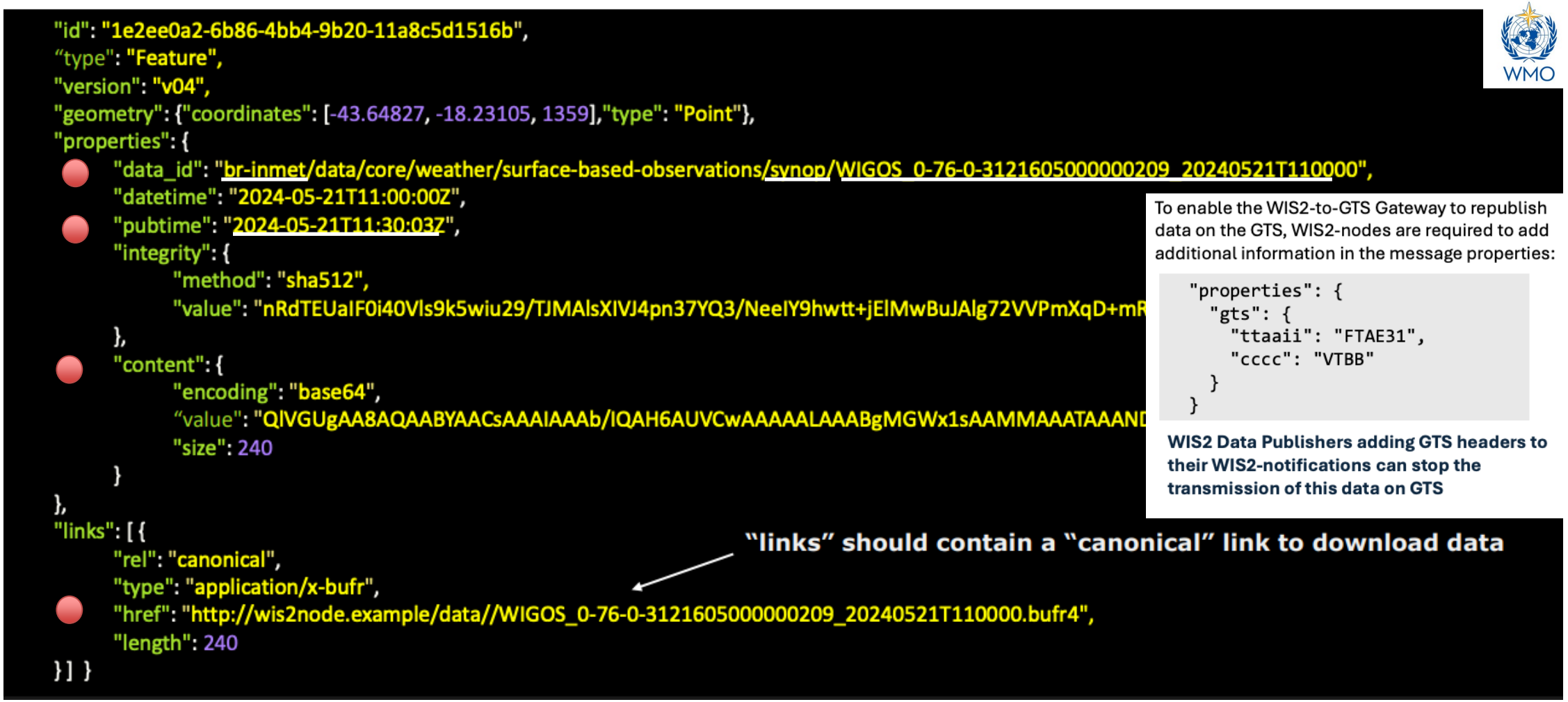
Show product details...



WIS2 Notifications (WNM)

WIS2 Notification Message Encoding defines the payload of a WIS2 notification

Link to WIS2 Notification Message
https://wmo-im.github.io/wis2-notification-message/



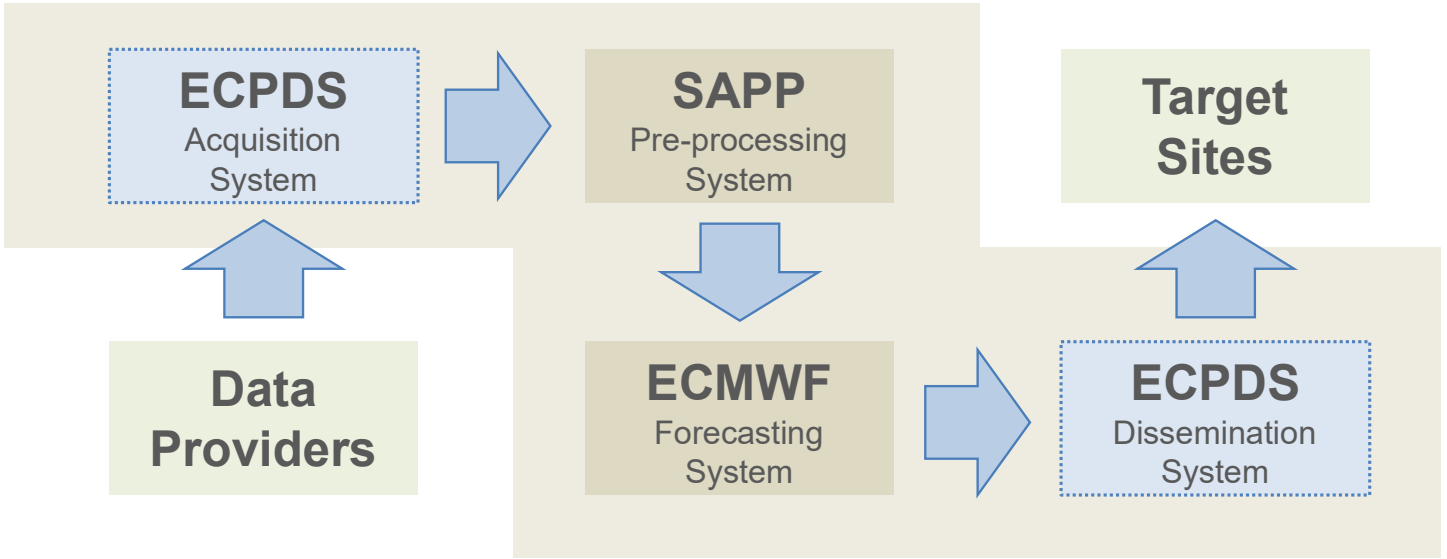
To enable the WIS2-to-GTS Gateway to republish data on the GTS, WIS2-nodes are required to add additional information in the message properties:

```
"properties": {
  "gts": {
    "ttaaii": "FTAE31",
    "cccc": "VTBB"
  }
}
```

WIS2 Data Publishers adding GTS headers to their WIS2-notifications can stop the transmission of this data on GTS

ECMWF GTS/WIS2 data handling systems

- ECMWF relies on the ECMWF Production Data Store (**ECPDS**) to
  - **receive GTS** data from **UKMO** (EGRR) and **DWD** (EDZW)
  - **connect to WIS2.0** both for acquisition and dissemination purposes
- files acquired via ECPDS (in TAC, BUFR, NetCDF, HDF, JSON, CSV formats) are pushed to the observation **pre-processing system** (**SAPP**) for BUFR conversion and harmonization
- SAPP feeds the IFS Forecasting System with a stream of de-deduplicated BUFR reports (extractions run every 10 minutes in COPE “continuous processing” mode)



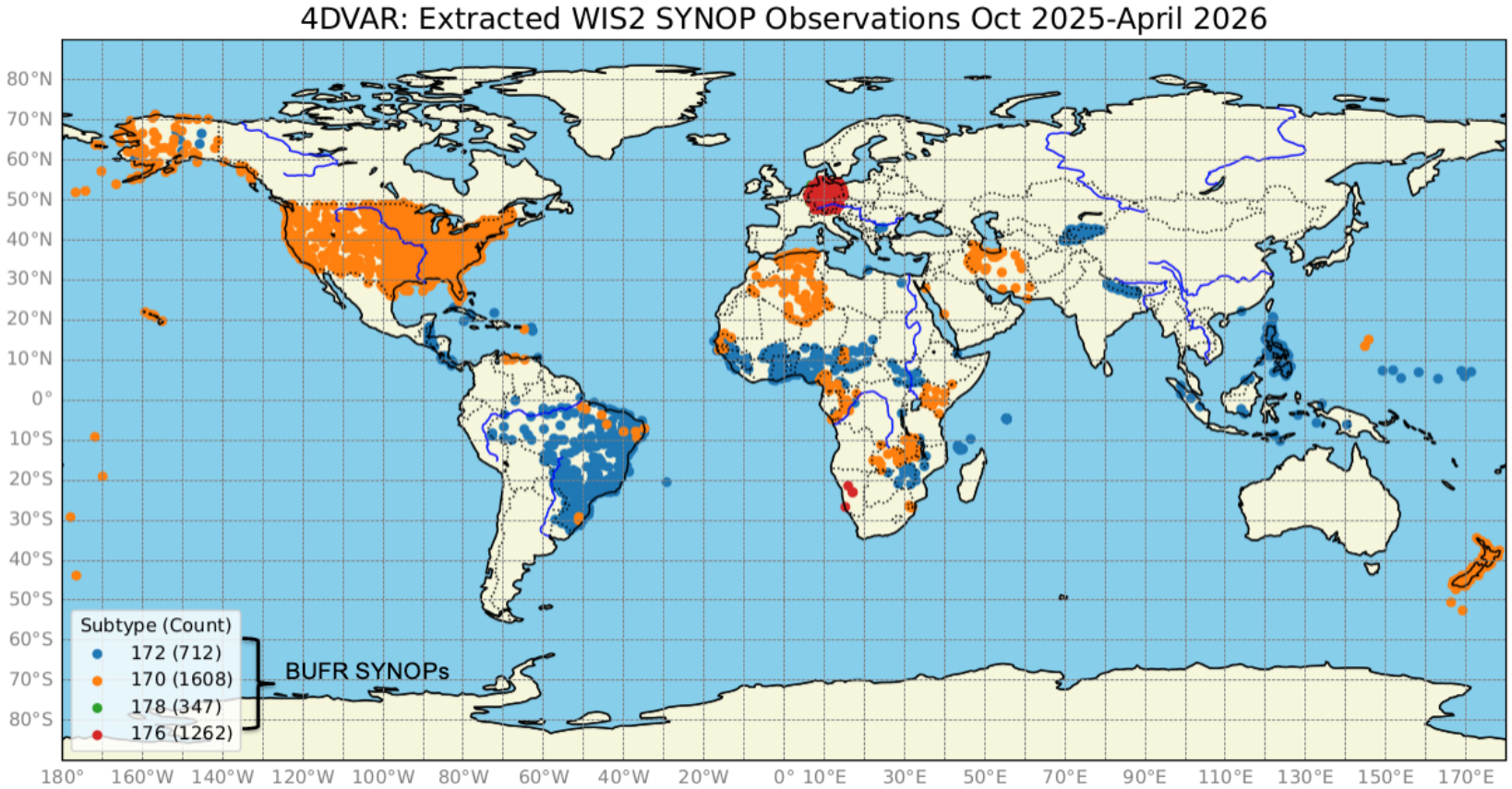
ECPDS WIS2 data source configuration

- WIS2 **topic subscriptions** are configured at ECPDS acquisition-host level by defining
  - **GLOBAL BROKERs** as ECPDS acquisition hosts e.g. *globalbroker.meteo.fr*
  - **TOPIC** subscriptions as ECPDS destination dirs e.g. ***cache**/a/wis2/**+**/data/**core**/weather/surface-based-observations/**synop***
- **Client-side notification Filtering** is implemented in ECPDS to decide whether data should be downloaded
  - **regex patterns** can be added to filter the notifications **by centre-id , data-id** or other **WSN properties**
  - **obstype+ data_id based filename** (<obstype>.<centre-id>. *<data_id>.PT:<pubtime>)* generated based on topic and notifications elements; these filename fields can be used by SAPP to route the data to specific decoder/pipelines (in the absence of GTS headers)
    - ***temp.us-noaa-nws.****TEMP_CC_72645_20250523T120000.bufr4.PT:2025-05-23T14:11:35Z*
    - ***synop.us-noaa-nws****.WIGOS_0-20000-0-70271_20250603T085300.bufr4.PT:2025-06-03T12:15:43Z*
    - ***meteosat-10:seviri.int-eumetsa****t.H-000-MSG3__*_-202506160700-C_.bin.PT:2025-06-16T07:11:43Z*
- **Fault tolerance** configuration
  - **multiple brokers** can be defined for increased resilience
  - **failed downloads** can be automatically **retried and** alternative global caches used

WIS2 data activation in operations (SYNOP)

We are currently activating **WIS2 SYNOP** data **"by centre-id"** whenever additional BUFR reports are found to **complement or enhance GTS** data availability. Specifically, we enable extraction of stations/reports that meet one of the following criteria

1) **not available** on the GTS **2) having higher reporting frequency 3) in BUFR format** (vs GTS TAC)

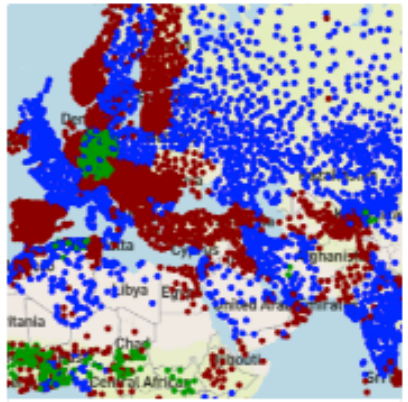


- **BUFR (vs TAC):** higher precision, higher spatial/temporal resolution (e.g. sonde drift tracking), extra metadata (quality, instrument types, etc)
- More BUFR data is available on WIS2 thanks to **TAC and CSV conversion tools** included in wis2box
- LDCs and SIDs countries clearly benefitting from **SOFF** funding (Zambia, Burkina Faso, Chad, …) and WIS2 **training** initiatives
- !! Major **increase** in **number of files** (200K/day vs 2K GTS) due to WIS2 **recommended practice to send individual reports**, as soon as stations make them available

WDQMS transition monitoring

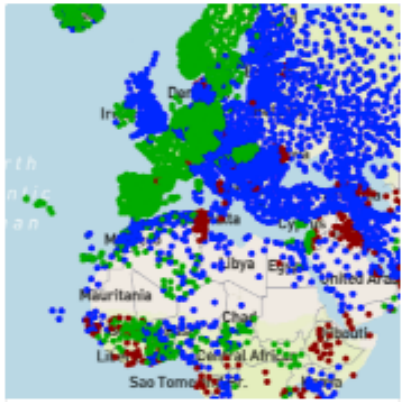
Four modules are currently available for the WIGOS monitoring:

Near-real-time NWP | GBON | GCOS | **Transition monitoring**



GTS to WIS2 transition

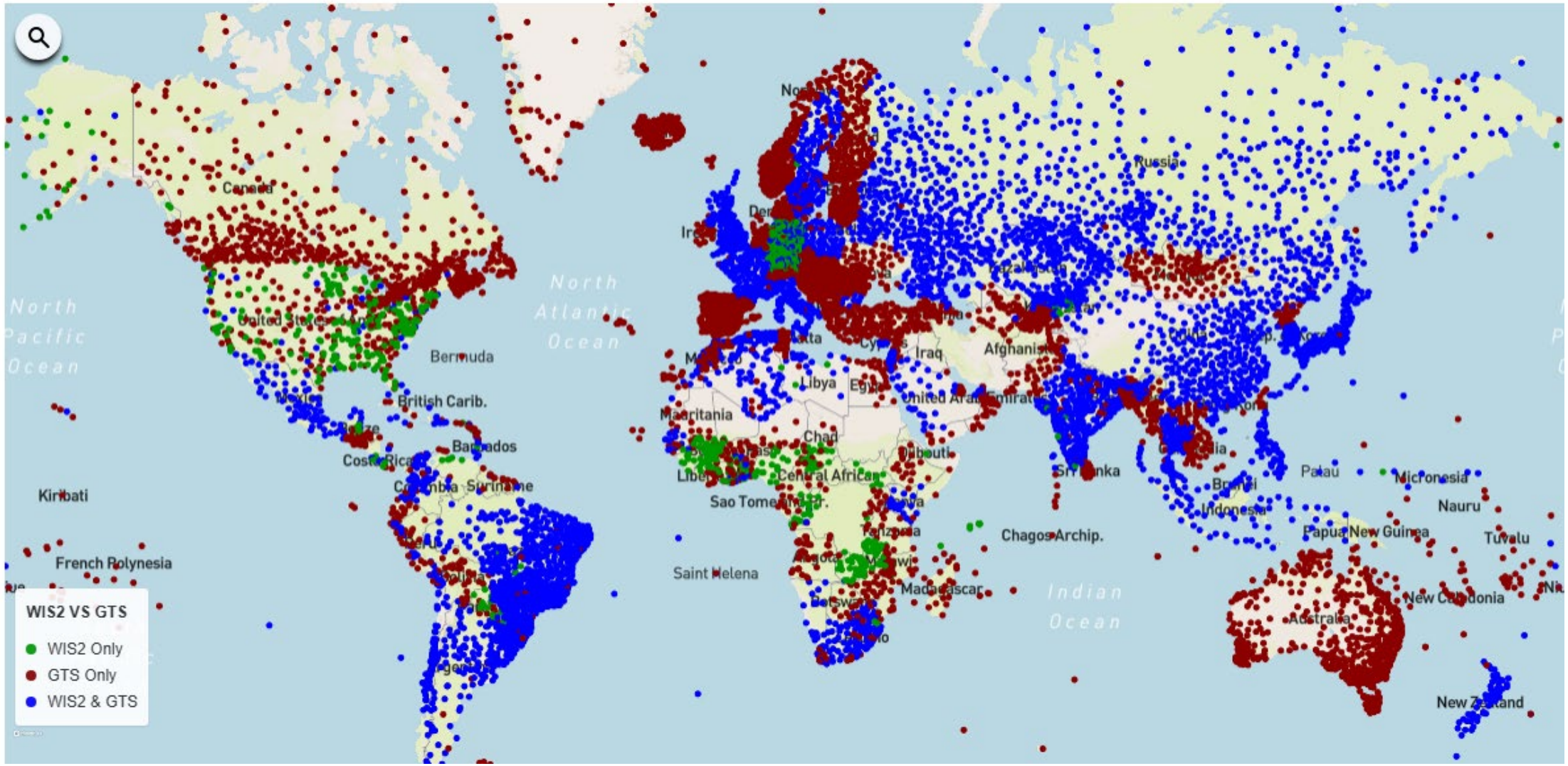
Transition Status



TAC to BUFR transition

Transition Status

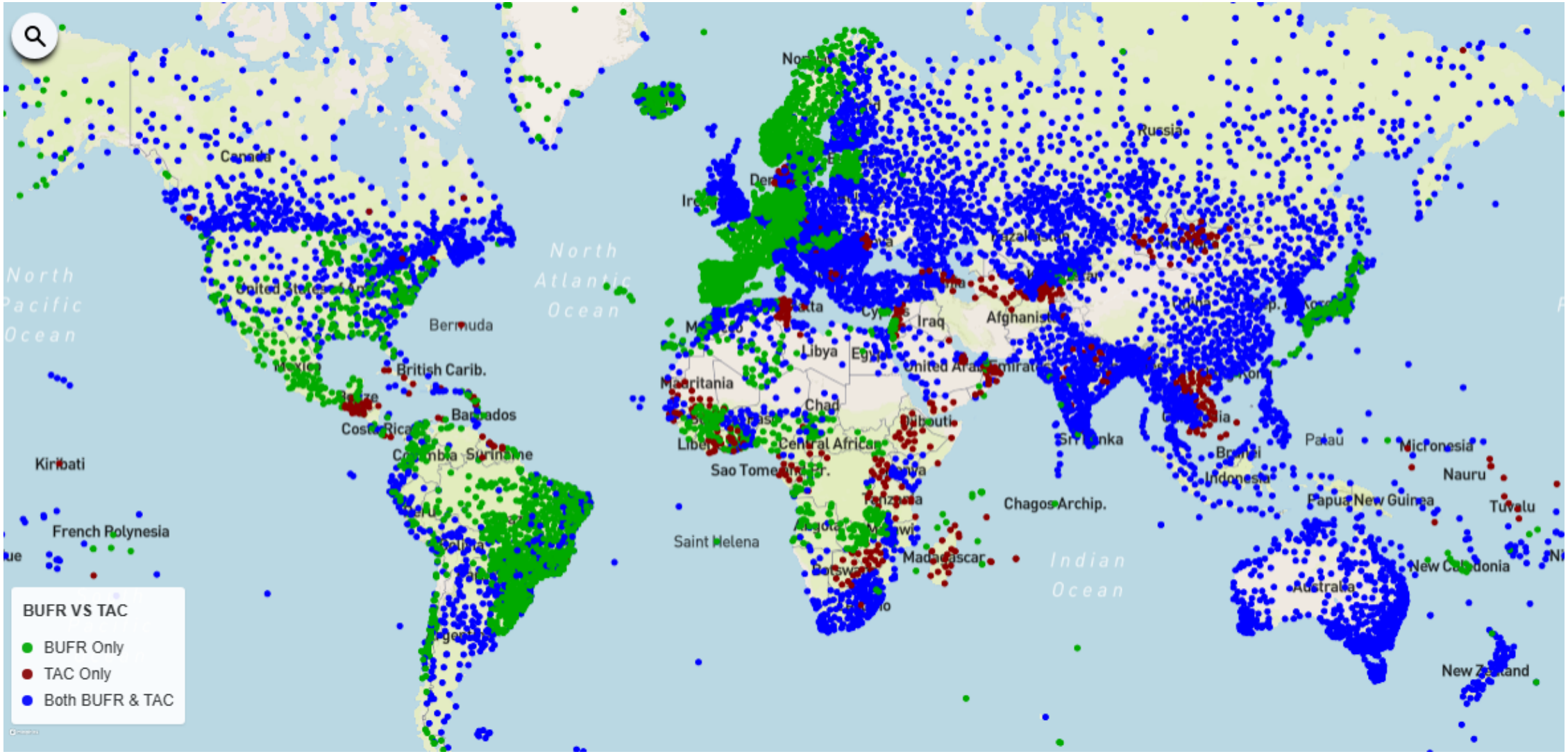
SYNOP GTS to WIS2 transition monitoring https://wdqms.wmo.int/transition/gts-to-wis2



- SHIP,BUOYS and other data types will be added in future

TEMP GTS to WIS2 transition monitoring https://wdqms.wmo.int/transition/gts-to-wis2

SYNOP TAC to BUFR transition monitoring https://wdqms.wmo.int/transition/tac-to-bufr



- For more info on TAC to BUFR migration also check https://confluence.ecmwf.int/spaces/TCBUF/pages/28317022/Data+availability

TEMP TAC to BUFR transition monitoring https://wdqms.wmo.int/transition/tac-to-bufr

Availability of new data on the GTS

- WIS portals (like https://gisc.dwd.de) allow **searching GTS headers** such as **IUSN21 EDZW :** (I) BUFR, (U) Upper air, (S) Radio soundings from mobile land stations (entire sounding), (N) Northern hemisphere, (EDZW) originator DWD /Offenbach
- WIS operational newsletter https://community.wmo.int/media/news/operational-newsletter-2025 (discontinued)

Arctic Ocean Radio Soundings Available from 10 August to 18 September 2025

Notification from the Swedish Meteorological and Hydrological Institute (SMHI)

Arctic Ocean radio soundings will be available four times daily (00, 06, 12 & 18 UTC) from 10 August to 18 September 2025 as a part of the Canada-Sweden Arctic Ocean 2025 research expedition. Soundings will be released from Swedish research icebreaker Oden (call sign SMLQ) in the central Arctic Ocean north of 80 °N, and reported using BUFR 309057.

The GTS headers are as below:

- IUSN41 ESWI (complete sounding)
- IUKN41 ESWI (up to 100 hPa)

You can find more information about the expedition here. If you have any questions, please contact Åsa Lindgren, Head of Marine Operations, Swedish Polar Research Secretariat at asa.lindgren@polar.se.

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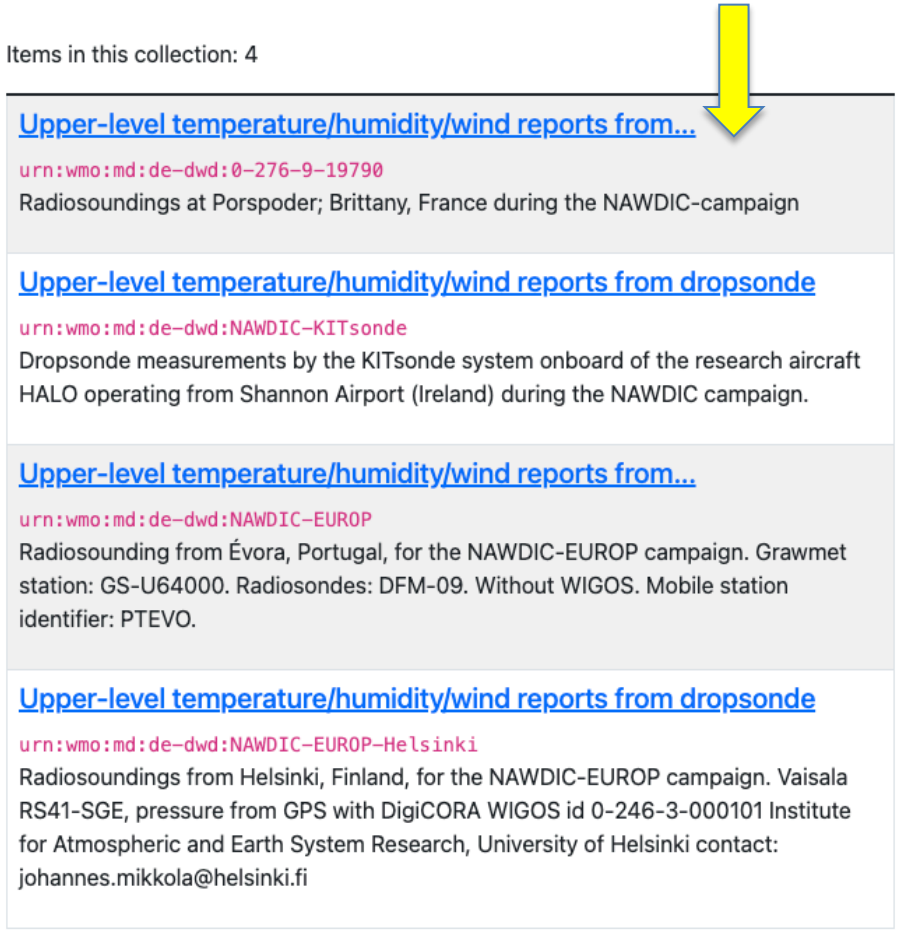
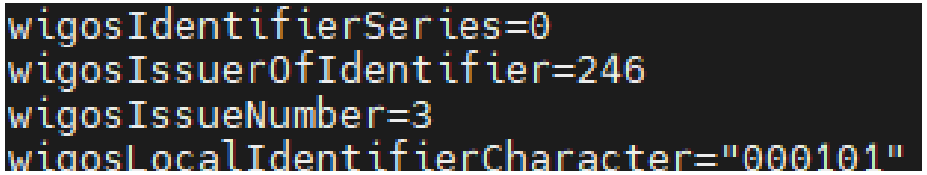
Availability of new data on WIS2

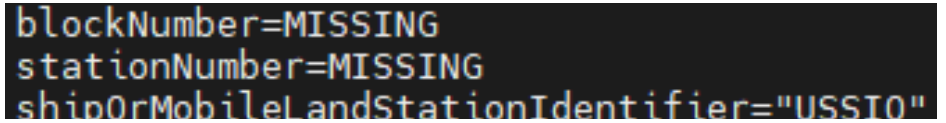
- WIS2 operational newsletter https://community.wmo.int/media/news/wis2-operational-newsletter-no2 (yearly)
- WIS2 discovery catalogue e.g. https://wis2-gdc.weather.gc.ca/collections/wis2-discovery-metadata/items?q=NAWDIC
- WIS portal (e.g. https://gisc.dwd.de**.)** allows searching **WIS2 topic/metadata**



BUFR templates and station identifiers

- Choose a **BUFR template** and set **data category and sub-category** accordingly (common table C-13)
  - TEMP **ascents** 3-09-052 (sub-category 4,6) or 3-09-057 (higher precision for height/pressure, extra metadata)
  - TEMP **descents** 3-09-056 (sub-category 14-16) **dropsondes** 3-09-053 (sub-category 7)
  - See https://confluence.ecmwf.int/spaces/TCBUF/pages/265032330/Radiosonde+BUFR+templates and https://vocabulary-manager.eumetsat.int/vocabularies/WMO-Common/WMO/Current/C13
- Set **Station Identifier(s)**
  - **TSI** (Traditional WWW id) and/or **WSI** (sub-category 14-16)
  - **shipOrMobileLandStationIdentifier** (mobile platforms)
  - **aircraftFlightNumber** (dropsondes)
  - **WSI** (typically issued by NMHSs) should ideally be registered in **OSCAR surface catalogue** along with station (and instrument) geolocation typically matching BUFR encoded station lat,lon,h





- **Validate BUFR** encoding using online tools (e.g. https://codes.ecmwf.int/bufr/validator)

Questions ?

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