

WIS 2.0

... or how to help Members exchange data and bridge the capacity gap



WMO OMM

World Meteorological Organization

Organisation météorologique mondiale

Overview

What is WIS 2.0 ?

How to implement a WIS 2.0 Node

Capacity Gap



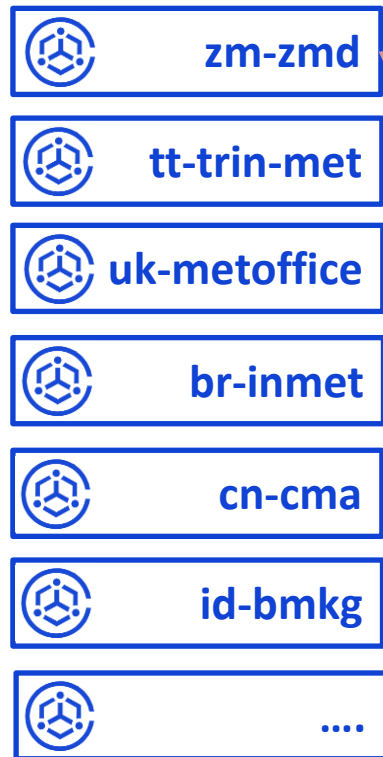
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WIS 2.0: publish-subscribe model

WIS2 uses the MQTT-protocol to advertise and share data in real-time

Each WIS2-notification contains a link to download data over HTTP

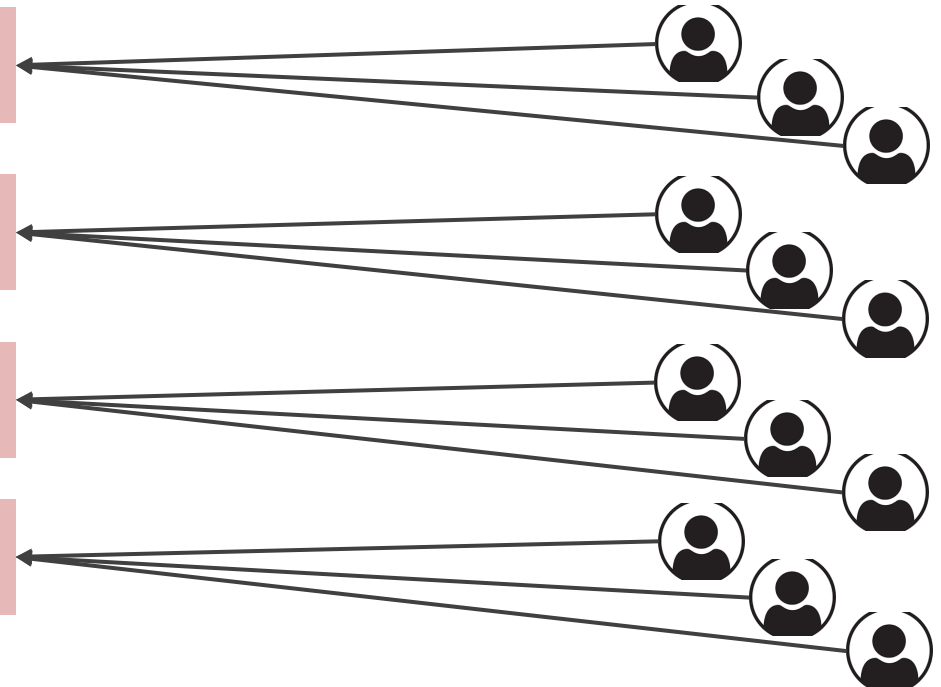
**Data producers publish
WIS2-notification from
local WIS2-nodes**



**Global Brokers subscribe to
WIS2-nodes and re-publish
WIS2-notifications**

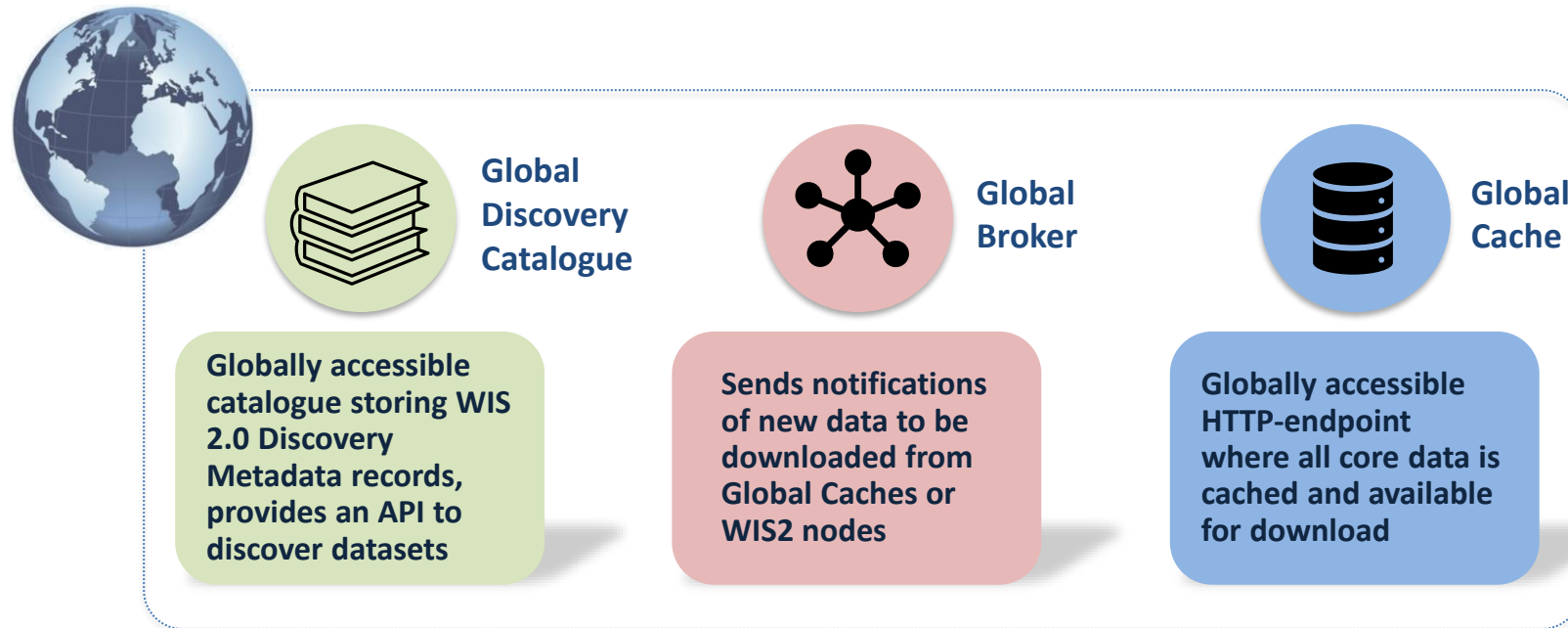


**Data consumers subscribe to
Global Brokers to receive
WIS2-notifications**



WIS 2.0: Global Services

Three types of Global Services are used to enable the dissemination of data in the WIS2 network



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Multiple instances of the Global Services are hosted by Members around the world to ensure resiliency when one Global Service fails

What is a WIS2 Node ?



A WIS2 Node replaces the GTS Message Switching System



Each WMO Member shall implement at least one WIS2 Node to share data in WIS2

How to setup a WIS2 Node:

- Setup an HTTP endpoint for sharing data and an MQTT broker for sending notifications
- Create metadata records for datasets using the WCMP2 standard
- Publish an MQTT-message to notify the availability for each new metadata record and data granule
 - Message payload defined by the WIS2 Notification Message standard
 - Topic defined by the WIS2 Topic Hierarchy
 - Include a URL that is accessible over the public internet to download the data/metadata

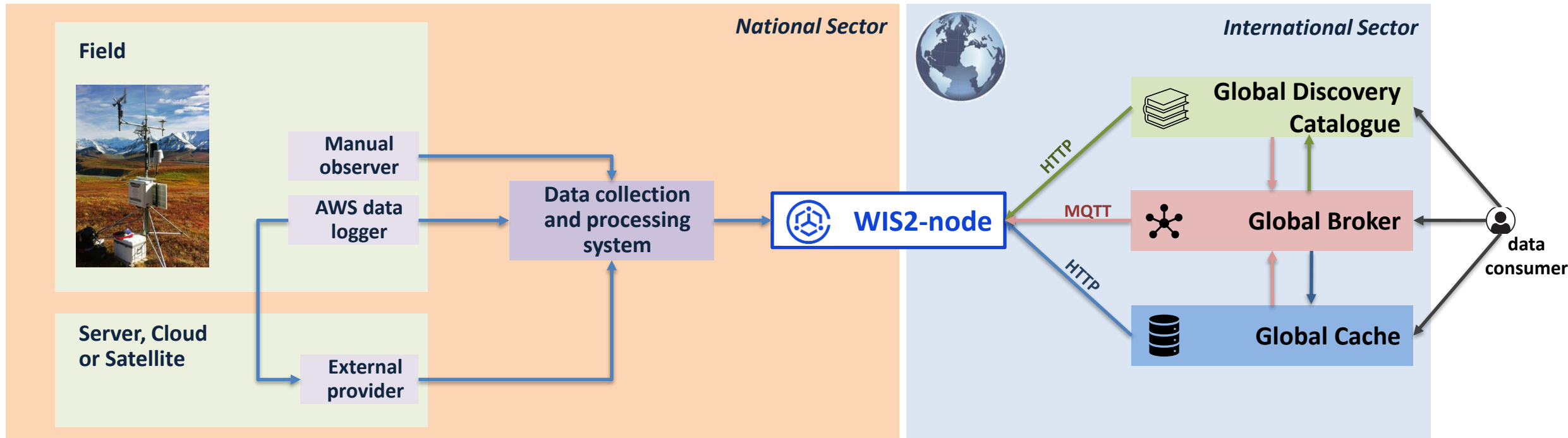


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What is a WIS2 Node ?

The WIS2 Node serves as a gateway between National MET systems and the WIS 2.0 Network

How the data is collected at the source and sent into the WIS2-node is not governed by the WIS2 standard

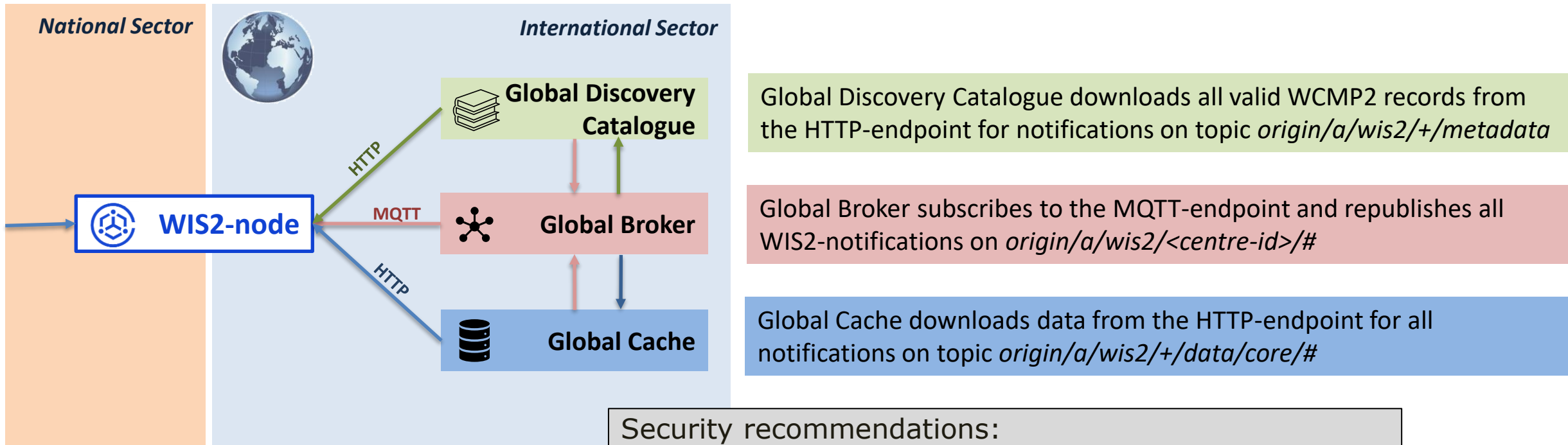


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What is a WIS2 Node ?

The WIS2 node is composed of 2 endpoints that need to be exposed over the public internet:

- MQTT broker: to publish WIS2-notifications for metadata and data
- HTTP endpoint: to enable the download of data-files and metadata records



Security recommendations:

- Encrypt HTTP and MQTT using TLS
- Write-access to HTTP and MQTT limited using ACL and secure credentials
- Firewall to only allow access to trusted incoming connections (Global Services and local partners)



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What is WIS2-in-a-box ?

- WIS2-in-a-box (wis2box) is reference implementation of a WIS2 Node
- Developed as docker-compose stack using pre-existing open source implementations plus wis2box-specific components
- Free Open-Source Software (FOSS) <https://github.com/wmo-im/wis2box>
- Developed by WMO in collaboration with Canada to help accelerate the implementation of WIS 2.0
- Designed to be cost-effective and low-barrier to operate
- **Currently over 45 WMO-Members are using the wis2box-software to share data on the WIS2-network**



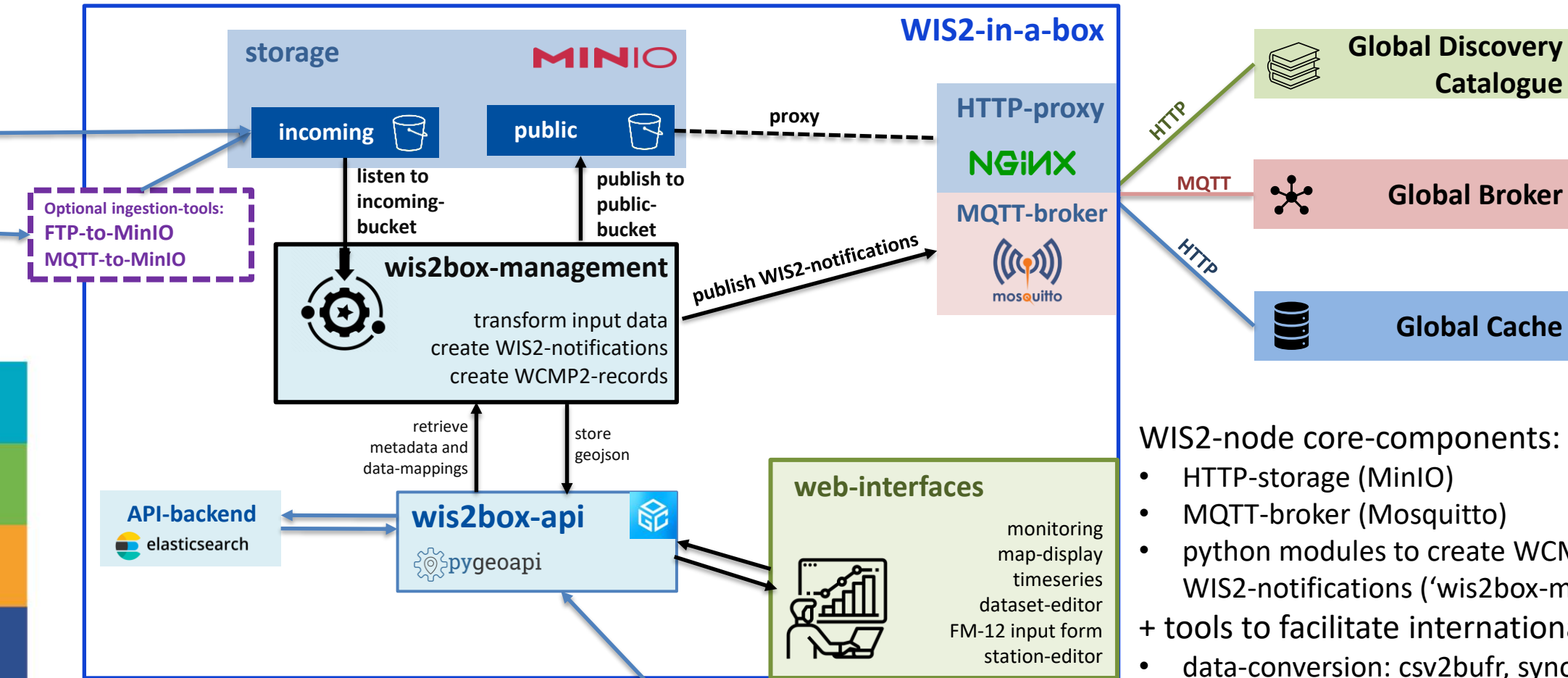
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wis2box host requirements:

- minimum 2 vCPUs with 4GB Memory and 24GB of local storage
- requires Python, Docker and Docker Compose pre-installed
- HTTP and MQTT ports routed to a publicly accessible address

<https://docs.wis2box.wis.wmo.int>

What is WIS2-in-a-box ?



WIS2-node core-components:

- HTTP-storage (MinIO)
- MQTT-broker (Mosquitto)
- python modules to create WCMP2 records and WIS2-notifications ('wis2box-management')
- + tools to facilitate international data sharing:
- data-conversion: csv2bufr, synop2bufr, bufr2bufr
- web-interfaces to configure datasets, data-mappings and station metadata
- web-interface for manual data input (FM-12/csv)
- data visualization and monitoring to detect issues
- OGC-API to share data in GeoJSON format



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WIS2-in-a-box: dataset editor

Dataset Identification

Title: Hourly synoptic observations from fixed-land stations (SYNOP) (maaike-te)

Identifier: urn:wmo.md:maaike-test:surface-based-observations.synop

Centre ID: maaike-test

WMO Data Policy: core

Topic Hierarchy: maaike-test/data/core/weather/surface-based-observations/synop

Earth System Disciplines: Weather

Keywords (3 minimum): observations, temperature, precipitation, pressure, wind, total sunshine, humidity

Temporal Properties

Start Date: 2024-05-13

End Date: End Date in UTC

Dataset ongoing

Resolution: 1

Unit: hour(s)

← Discovery Metadata

Data Mappings

Spatial Properties

Choose an automatic bounding box (optional)


Your country may not have an automatic bounding box

North Latitude: -9.761987

West Longitude: -69.59042

East Longitude: -57.49837

South Latitude: -22.87291



Dataset Mappings Editor

Plugins in use	File extension	File pattern	
BUFR data converted to BUFR	bin	^.*\.bin\$	UPDATE
FM-12 data converted to BUFR	txt	^.*_(\d{4})(\d{2}).*.txt\$	UPDATE
BUFR data converted to BUFR	b	^.*\.b\$	UPDATE
CSV data converted to BUFR	csv	^.*\.csv\$	UPDATE
BUFR data converted to GeoJSON	bufr4	^WIGOS_(\d-\d+ \d+ \w+)_.*\.bufr4\$	UPDATE

[ADD A PLUGIN +](#)

WIS2-in-a-box: data visualization

Fransfontein

0-516-0-68214

Hourly synoptic observations from fixed-land stations (SYNOP) (na-meteona)

PLOT TABLE

Observed Property

Non coordinate pressure

Pressure reduced to mean sea level

3 hour pressure change

Characteristic of pressure tendency

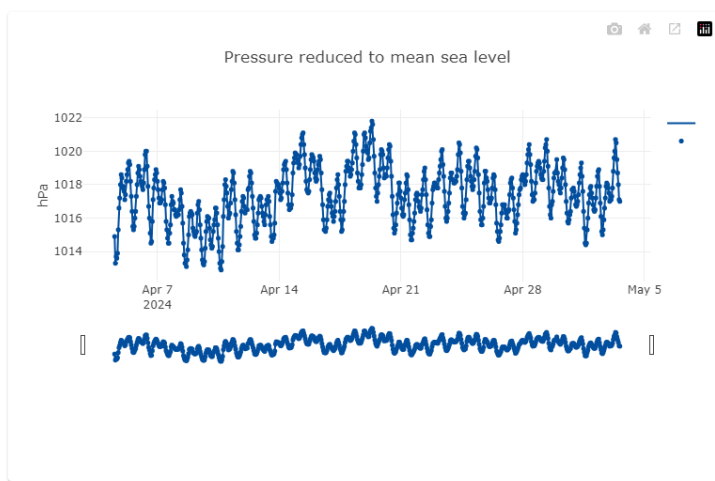
Air temperature

Dewpoint temperature

Relative humidity

Total sunshine (1 hr)

Total sunshine (24 hr)



WIGOS_0-516-0-68214_20240503T135600.bufr4

WIGOS Station Identifier: 0-516-0-68214

Station name: Fransfontein

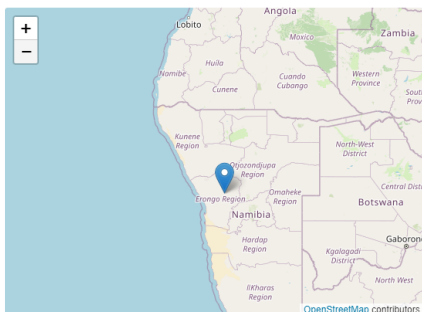
Station latitude: -20.21

Station longitude: 15.02

Station elevation: 1094.00 (m)

Barometer height above mean sea level: 1081.00 (m)

Nominal report time: 2024-05-03T13:56:00Z



observedProperty	value	units	description
non coordinate pressure	893.1	hPa	
pressure reduced to mean sea level	1017	hPa	
3 hour pressure change	-1.5	hPa	
characteristic of pressure tendency	7	CODE TABLE	DECREASING (S UNSTEADILY)
air temperature	31.45	Celsius	
dewpoint temperature	0.05	Celsius	
relative humidity	13	%	
total sunshine (1 hour)	60	min	
total sunshine (24 hours)	355	min	
total precipitation or total water equivalent (1 hour)	0	kg m-2	
maximum temperature at height and over period specified (24 hours)	31.65	Celsius	
minimum temperature at height and over period specified (24 hours)	24.85	Celsius	
wind direction (10 minutes)	6	deg	
wind speed (10 minutes)	2.6	m/s	



WIS2 in a box



WIS2 Notifications Monitoring Dashboard



Topic hierarchy

origin/a/wis2/na-meteona/data/core/weather/surface-based-observations/synop



Hourly synoptic observations from fixed-land stations (SYNOP) (na-meteona)



2024/05/02 16:28 - 2024/05/03 16:28

Choose the datetime range for the notifications (default: previous 24 hours)



WSI

Search a WMO Station Identifier (optional)

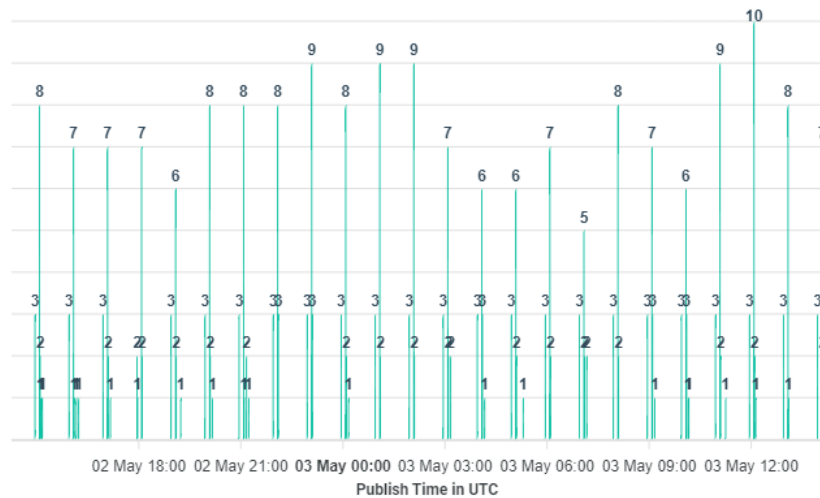
1000

Limit

UPDATE



Notifications



Total number of publications with selected features: **326**

Number of publications per station:

0-20000-0-68014	25
0-20000-0-68300	24
0-20000-0-68114	24
0-20000-0-68116	24
0-516-0-68215	24
0-516-0-68216	24

WIS2-in-a-box: import from OSCAR



WIS2 in a box

Import station from OSCAR/Surface

WIGOS Station Identifier

0-20000-0-15015

Enter WIGOS Station Identifier

SEARCH

Searching for station record on OSCAR/Surface



WIS2 in a box

Import station from OSCAR/Surface

WIGOS Station Identifier

0-20000-0-15015

Enter WIGOS Station Identifier

SEARCH

Station name

OCNA SUGATAG

Enter name of station

WIGOS station identifier

0-20000-0-15015

Enter the WIGOS station identifier

Traditional station identifier

15015

Enter the traditional (5 or 7 digit) station identifier

Longitude (decimal degrees E), -180 to 180

23.9404602638

Enter the station longitude (degrees E)

Latitude (decimal degrees N), -90 to 90

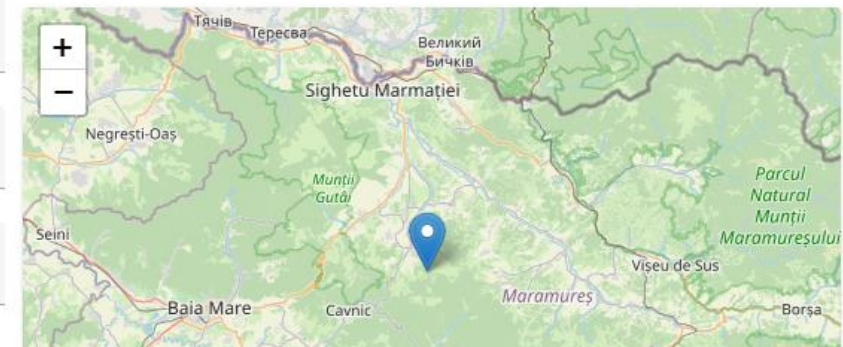
47.7770616258

Enter the station latitude (degrees N)

Station elevation above sea level (metres)

503

Station elevation above sea level (metres)



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WIS2-in-a-box: FM-12 synop form

Submit FM 12-XIV Ext. SYNOP Bulletin

05/2024

Month and year in UTC

FM 12

SMR001 YRBK 171200

AAXX 17121

15015 01597 71702 10057 20036 39390 42628 50004 60021 78082 87300 333

4/000

55304 0//// 20643 3//// 69977 91003 91108=

Raw FM 12 bulletin

Topic hierarchy

origin/a/wis2/io-wis2dev-test2/data/core/weather/surface-based-observations/synop

bibl

wis2box auth token for 'processes/wis2box'

SUBMIT

Publish on WIS2



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WIGOS Station Identifier: 0-20000-0-15015

Station name: OCNA SUGATAG

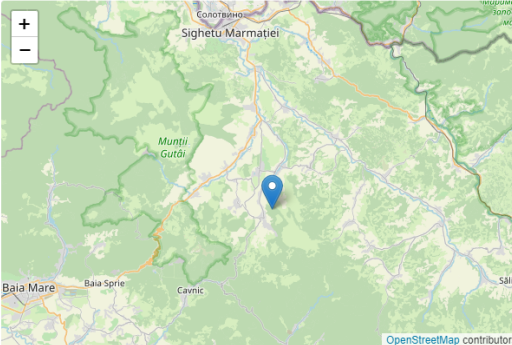
Station latitude: 47.77706

Station longitude: 23.94046

Station elevation: 503.00 (m)

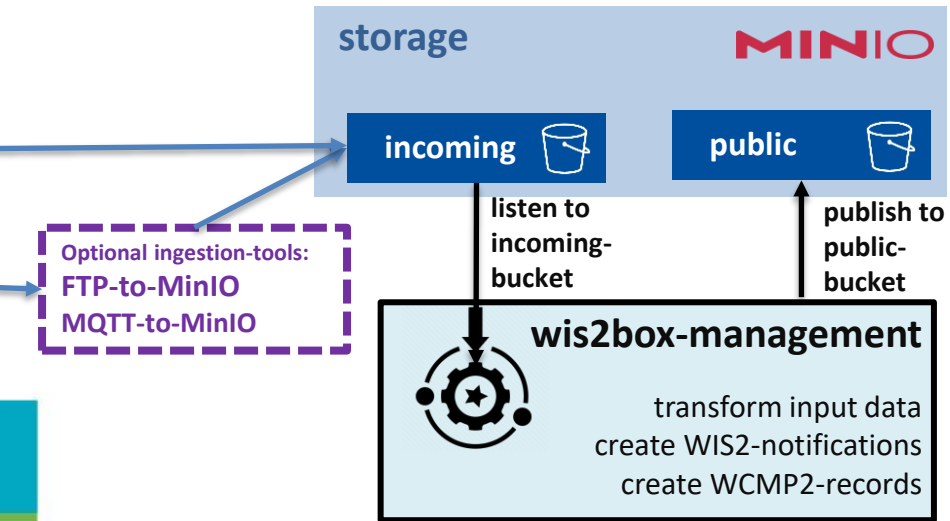
Barometer height above mean sea level: 504.00 (m)

Nominal report time: 2024-05-17T12:00:00Z



observedProperty	value	units	description
non coordinate pressure	939	hPa	
3 hour pressure change	0.4	hPa	
characteristic of pressure tendency	0	CODE TABLE	INCREASING, THEN DECREASING; ATMOSPHERIC PRESSURE THE SAME OR HIGHER THAN THREE HOURS AGO
non coordinate geopotential height	628	gpm	
air temperature	5.7	Celsius	
dewpoint temperature	3.6	Celsius	
relative humidity	86	%	
horizontal visibility	10000	m	
total snow depth	0	m	
cloud cover total	88	%	
cloud amount	7	CODE TABLE	7 OKTAS OR MORE, BUT NOT 8 OKTAS
height of base of cloud	600	m	
cloud type	33	CODE TABLE	CUMULONIMBUS CALVUS, WITH OR WITHOUT CUMULUS, STRATOCUMULUS OR STRATUS
cloud type	20	CODE TABLE	NO CM CLOUDS

wis2box data ingestion



The wis2box data workflow is triggered whenever data is received in the “wis2box-incoming” bucket

Data can be uploaded directly into MinIO-endpoint

Or an intermediate service can be enabled on the wis2box-instance:

- FTP-to-MinIO (‘wis2box-ftp’): expose FTP-endpoint and any file received is copied to local MinIO-endpoint
- MQTT-to-MinIO (‘wis2box-data-subscriber’): subscribes to broker on topic=data-incoming/# and copies payload in message to MinIO

Examples:

- Belize: sends CSV-data from their local Data Management System (“*Surface*”) into wis2box, csv2bufr-plugin in wis2box converts data to BUFR
- Zambia: Campbell-data-loggers send CSV-data over MQTT, csv2bufr-plugin in wis2box converts data to BUFR
- Eswatini: South-Africa MSS forwards FM-12 data over FTP, synop2bufr-plugin in wis2box converts data to BUFR
- Guyana: Manual observers use FM-12 input form to submit data, synop2bufr-plugin in wis2box converts data to BUFR

March 2023, Windhoek, Namibia

1. Algeria
2. Eswatini
3. Kenya
4. Malawi
5. Morocco
6. Namibia
7. Republic of Congo
8. South Africa
9. Tanzania
10. Zambia
11. Zimbabwe

June 2023, Port of Spain, Trinidad and Tobago

1. Antigua and Barbuda
2. Argentina
3. Barbados
4. Belize
5. Cayman Islands
6. Dominica
7. Guyana
8. Jamaica
9. Saint Lucia
10. Sint Maarten
11. Trinidad and Tobago
12. Turks and Caicos Islands
13. Cuba
14. Grenada
15. St. Kitts and Nevis
16. St. Vincent and the Grenadine

October 2023, Jakarta, Indonesia

1. Brazil
2. Brunei Darussalam
3. China
4. India
5. Indonesia
6. Malaysia
7. New Zealand
8. Oman
9. Philippines
10. Republic of Korea
11. Singapore
12. Timor-Leste

WIS 2.0 training workshops



September 2024, Brasília, Brazil (in Spanish)

1. Bolivia
2. Chile
3. Colombia
4. Costa Rica
5. Ecuador
6. Guatemala
7. Honduras
8. Mexico
9. Panama
10. Paraguay
11. Peru
12. Dominican republic
13. Uruguay
14. Venezuela

October 2024, Nadi, Fiji

1. Cook Islands
2. Kiribati
3. Nauru
4. Niue
5. Palau
6. Papua New Guinea
7. Marshall Islands
8. Micronesia
9. Samoa
10. Solomon Islands
11. Tuvalu
12. Tonga
13. Vanuatu
14. Australia

November 2024, Casablanca, Morocco (in French)

1. Mauritania
2. Mali
3. Burkina Faso
4. Benin
5. Togo
6. Senegal
7. Côte d'Ivoire
8. Niger
9. Guinea
10. Chad
12. Cameroon
13. Gabon
14. DRC
15. Equatorial Guinea
16. Djibouti
17. Burundi
18. Rwanda
19. Madagascar
20. Comoros
21. Seychelles
22. Mauritius

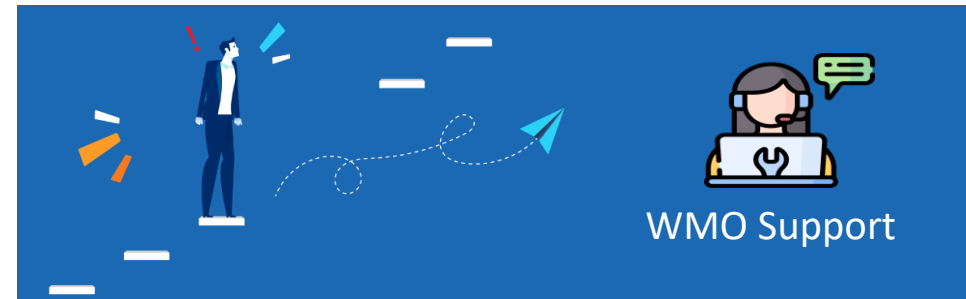
NOTE: all countries for 2024 workshops to be confirmed

WIS 2.0 Capacity Development

- wis2box software:
 - Reference implementation of a WIS2-node
 - BUFR conversion tools
 - Tools to interface with OSCAR and ensure the use of WIGOS-station-identifiers
 - Web-interface to define stations and datasets
 - Web-interfaces to monitor data exchange
- WIS 2.0 Training:
 - Hands-on practice running a WIS2-node
 - Fostering regional collaboration
- Technical support:
 - Proactively assist Members where needed
 - Additional support for developing members to help bridge the capacity gap
 - Answer every question sent to wis2-support@wmo.it



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WEATHER CLIMATE WATER

TEMPS CLIMAT EAU



Thank you
Merci
谢谢

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