

Introduction to the WDQMS Webtool and potential differences in results of WIGOS monitoring centers

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WDQMS web tool: Landing Page



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Support

Info

User guide

Welcome to the WIGOS Data Quality Monitoring System (WDQMS) webtool

The WDQMS webtool is a resource developed by WMO to monitor the performance of all WIGOS observing components.

For more information about the webtool, click [here](#).

Two modules are currently available for the WIGOS monitoring:

Near-real-time NWP monitoring of the Global Observing System networks



Surface land observations
Availability & Quality



Upper-air land observations
Availability & Quality

Monitoring of the Global Climate Observing System networks



Surface land observations
Availability & Completeness



Upper-air land observations
Availability & Quality

<https://wdqms.wmo.int/>



EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

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WDQMS web tool Support: **FAQs** and **User Guide**

[illegible]

WDQMS web tool: Landing Page



WIGOS Data Quality Monitoring System

[Home](#) [Monitoring](#) [Database status](#) [About](#) [Support](#)

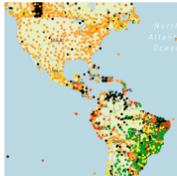
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SurfaceUpper-air

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Surface land observations

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Upper-air land observations

Availability & Quality

This presentation
will be about the
Near-real NWP
monitoring of the
GOS networks

<https://wdqms.wmo.int/>

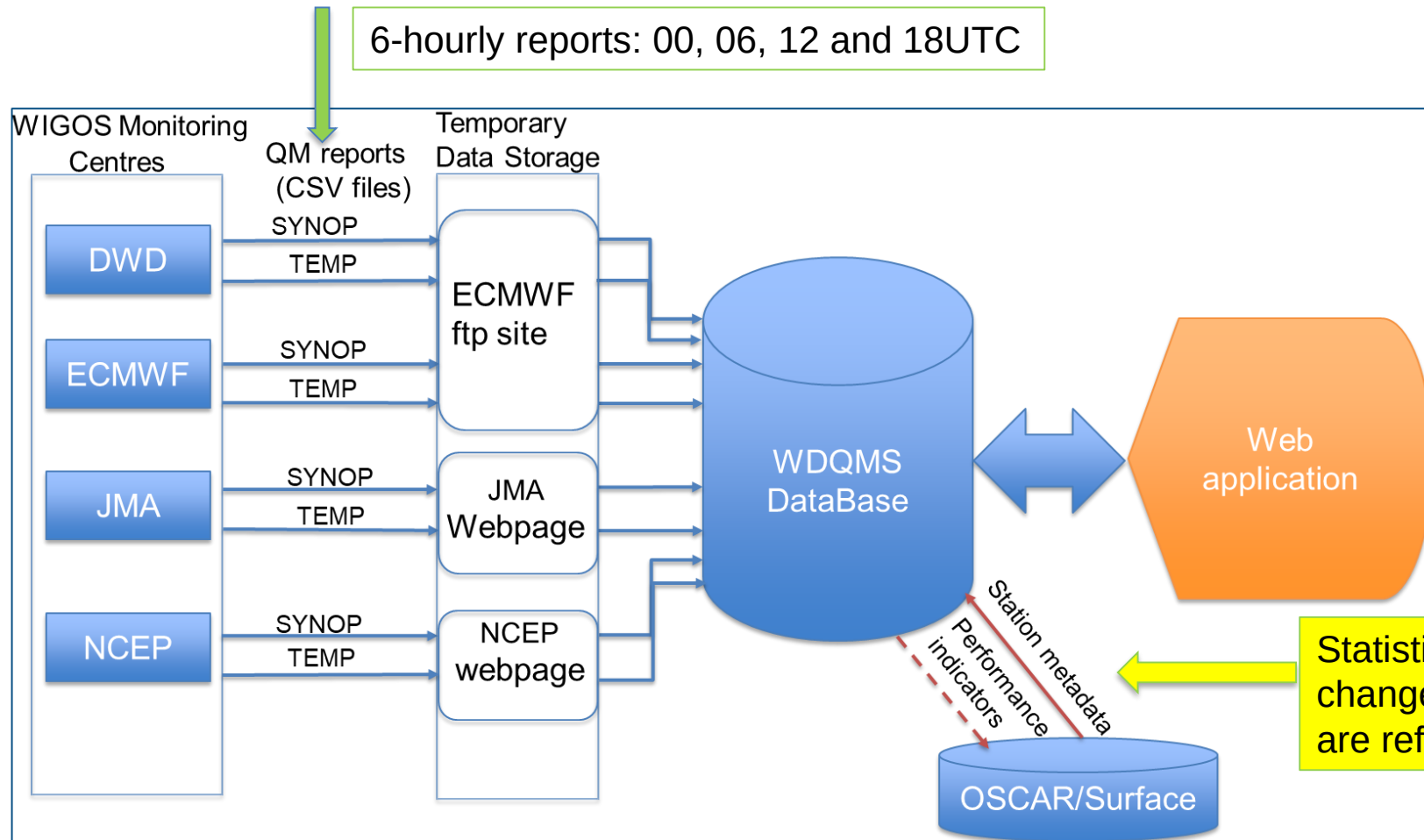


EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

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WDQMS web tool: NWP-based quality monitoring system

6-hourly reports: 00, 06, 12 and 18UTC



The WDQMS web tool offers two different selections under ‘**Monitoring Category**’:

- ‘**Availability**’ - comparing the observations received via the WIS to those expected according to the schedule of international exchange declared in OSCAR/Surface (or GBON) requirements **per variable**.

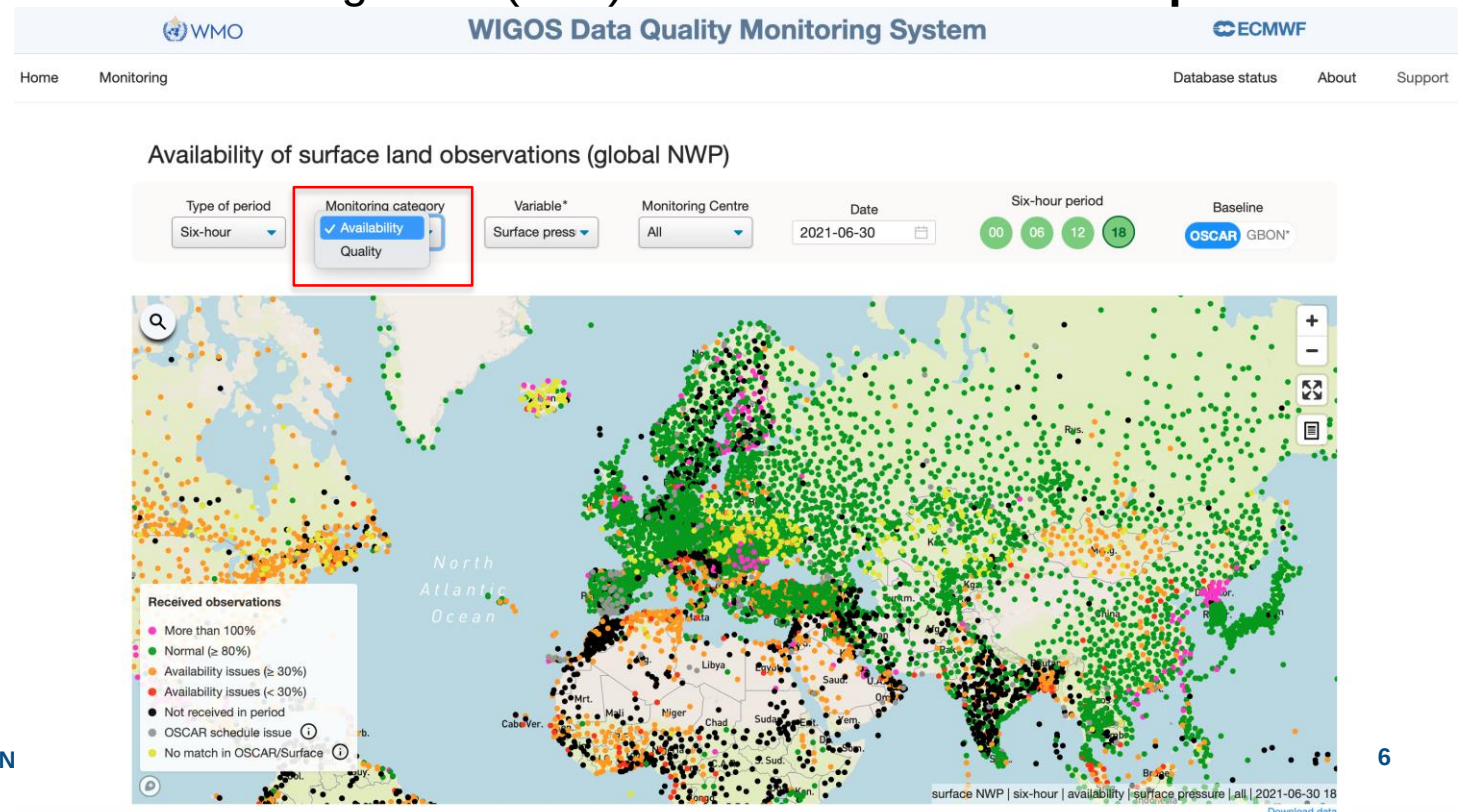
To be noted: in the WDQMS context “observations received” means the observations that were made available to the assimilation system of each NWP centre and are considered as a good proxy for the observations disseminated on the GTS.

- ‘**Accuracy**’ - Average of Observation minus Background (**O-B**) values over the selected **period** (e.g. 6-hour or daily) & **variable**

→ station display only if O-B values available
(no display of “no data” – no black dots)

- ‘**Timeliness**’-

Currently not available!

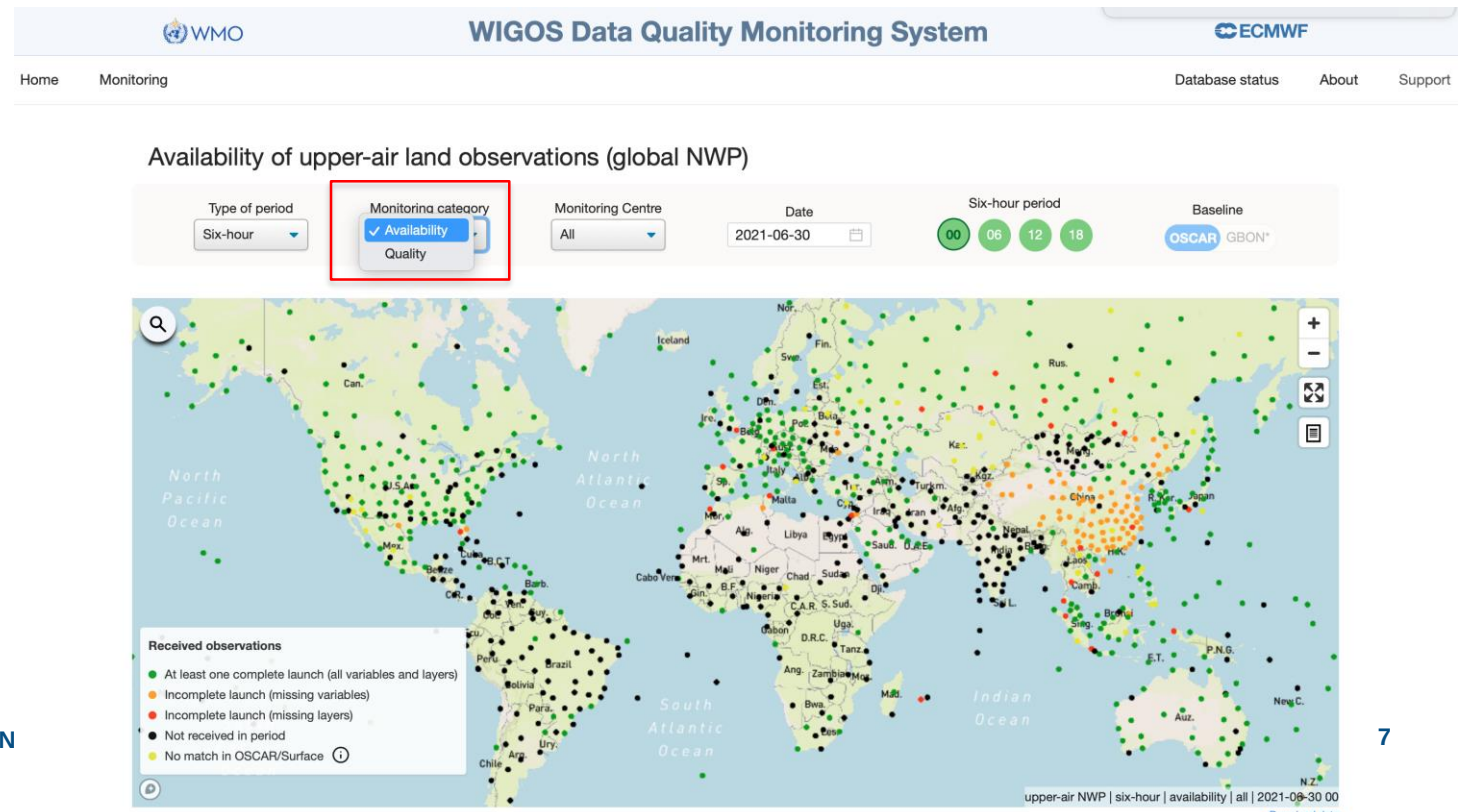


The WDQMS web tool offers two different selections under ‘**Monitoring Category**’:

- ‘**Availability**’ - comparing the observations received via the WIS to those expected according to the schedule of international exchange declared in OSCAR/Surface (or GBON) requirements. This is an aggregated value across the observed variables therefore the **completeness** of the sounding is also assessed.
- ‘**Accuracy**’ - RMSE of Observation minus Background (**O-B**) values over the selected **period** (e.g. 6-hour or daily) & **variable**
→ station display only if O-B values available
(no display of “no data” – no black dots)

- ‘**Timeliness**’-

Currently not available!



WDQMS web tool monitoring category: availability

Surface



Type of period
Daily

Monitoring category
Availability

Variable*
Surface pressure

Monitoring Centre
All

Date
2021-07-04

Availability is calculated per **variable**: **availability maps**

Received observations

- More than 100%
- Normal ($\geq 80\%$)
- Availability issues ($\geq 30\%$)
- Availability issues ($< 30\%$)
- Not received in period
- OSCAR schedule issue ⓘ
- No match in OSCAR/Surface ⓘ

Upper-air

Type of period
Daily

Monitoring category
Availability

Monitoring Centre
All

Date
2021-07-04

Baseline
OSCAR GBON*

Availability is calculated by aggregating the information across variables: only **one map** and a new entry **Completeness**

Received observations

- More than declared in OSCAR/Surface
- No issue
- Completeness issue
- Availability issue
- Not received in period
- No match in OSCAR/Surface ⓘ

WDQMS web tool monitoring category: availability Surface + Upper-air

The WDQMS web tool offers the selection of two different baselines: 'OSCAR' and 'GBON'

'OSCAR' baseline refers to the data availability performance obtained by:

- comparing the observations received via the WIS to those expected according to the schedule of international exchange declared in OSCAR/Surface metadata

Data Generation
▼ Period covered: 2016-04-29

Reporting
Intended for international exchange: Yes
Month: January - December
Day: Monday - Sunday
Hour and minute: 00:00 - 21:59
Diurnal base time: 00:00
Reporting interval: 3 h (hour)
Measurement unit: (unknown) (unknown)
Reference datum: mean sea level

Example of an OSCAR/Surface pressure reporting interval

Availability of surface land observations (global NWP)

Surface

Type of period
Six-hour

Monitoring category
Availability

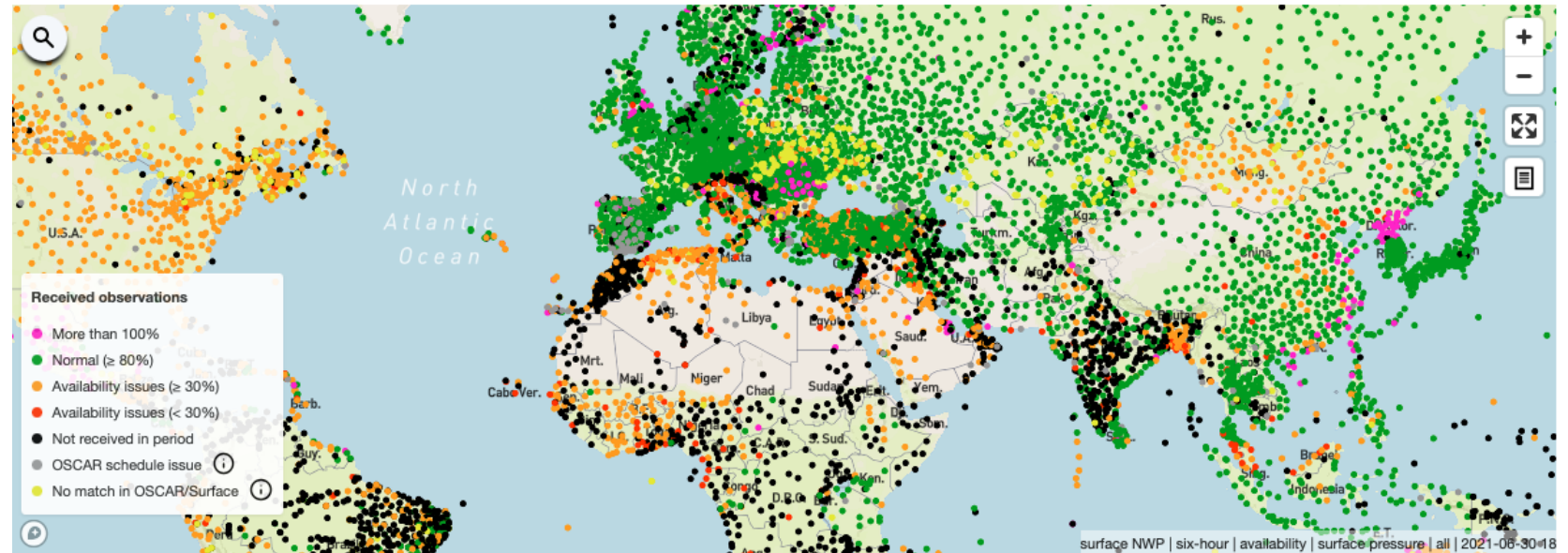
Variable*
Surface pressure

Monitoring Centre
All

Date
2021-06-30

Six-hour period
00 06 12 18

Baseline
OSCAR GBON*



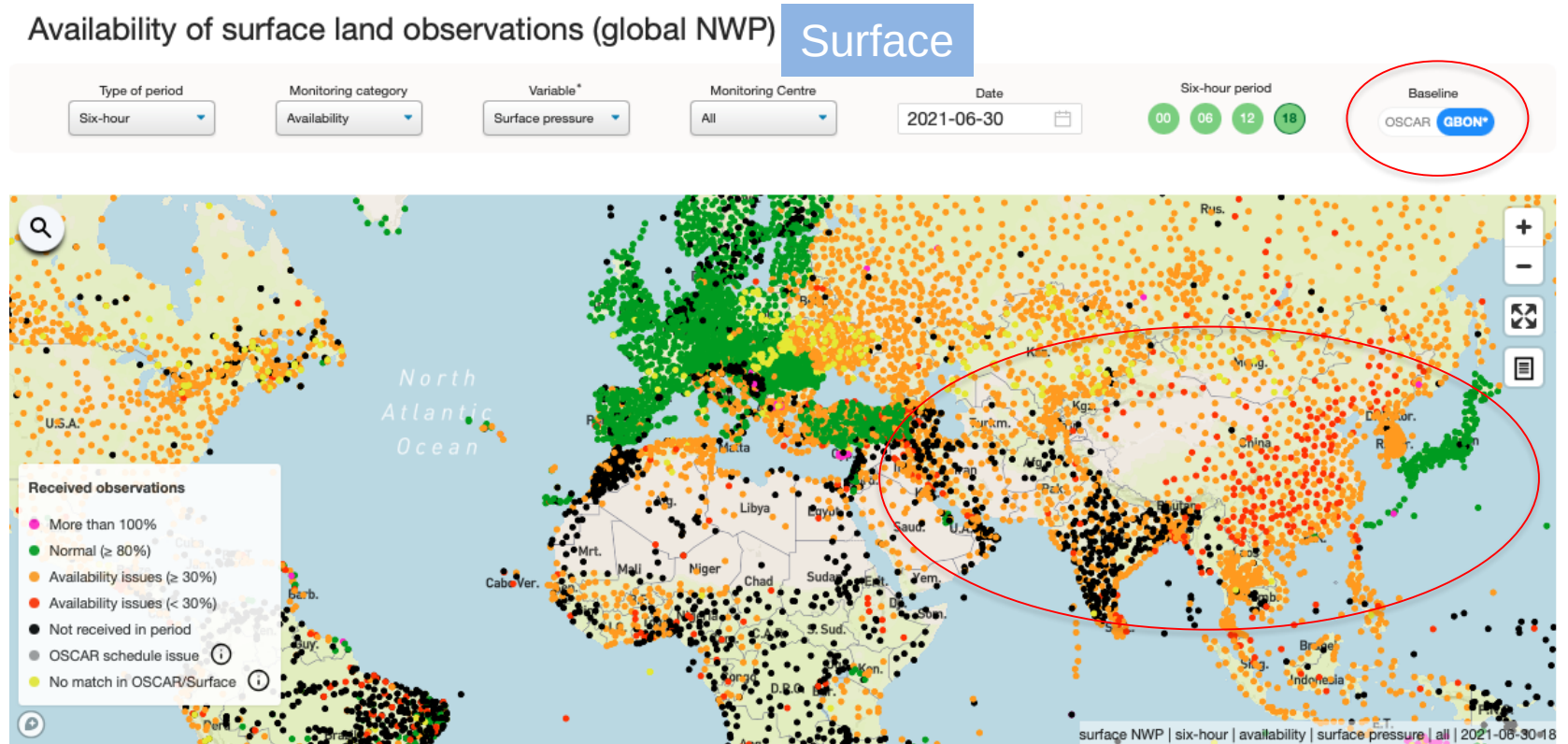
WDQMS web tool monitoring category: availability Surface + Upper-air

The WDQMS web tool offers the selection of two different baselines: ‘OSCAR’ and ‘GBON’

‘**GBON**’ **baseline** refers to the data availability performance obtained by:

- comparing the observations received via the WIS to those expected according to GBON schedule. Currently based on the provisional GBON requirements, i.e., hourly observations for surface and 12-hourly for upper-air.

In some regions the stations perform worse compared to the display considering ‘OSCAR’ as baseline.

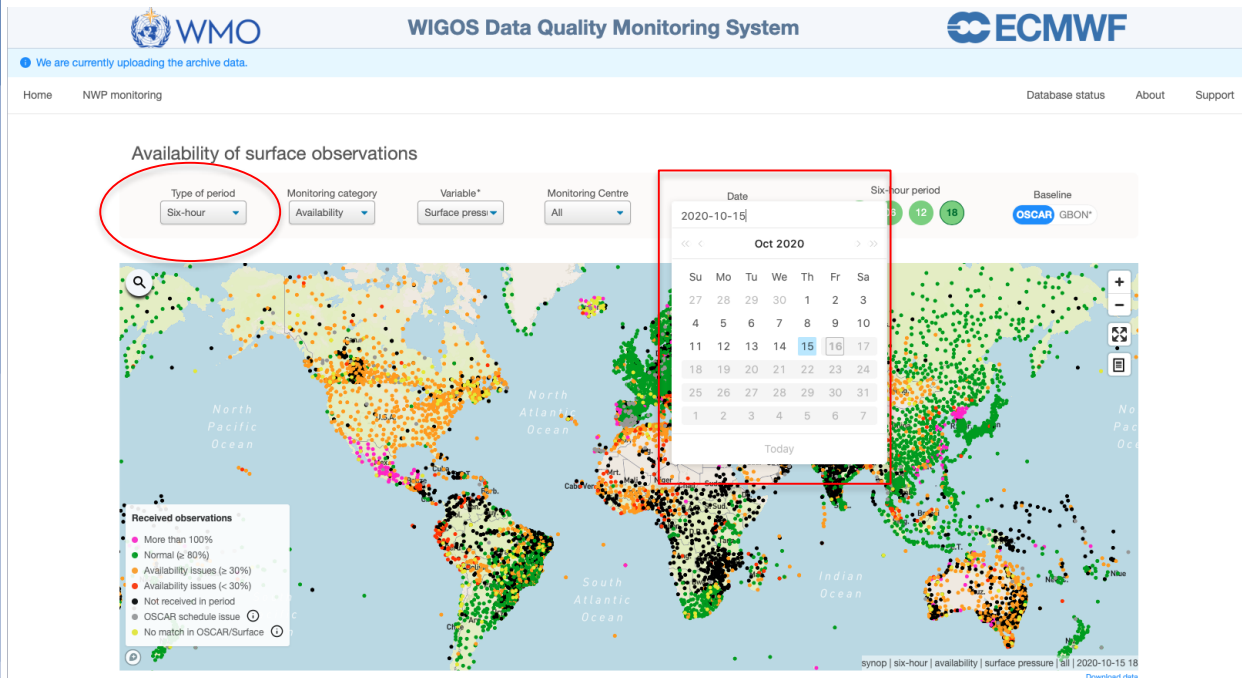


Date and Temporal aggregation (Period)

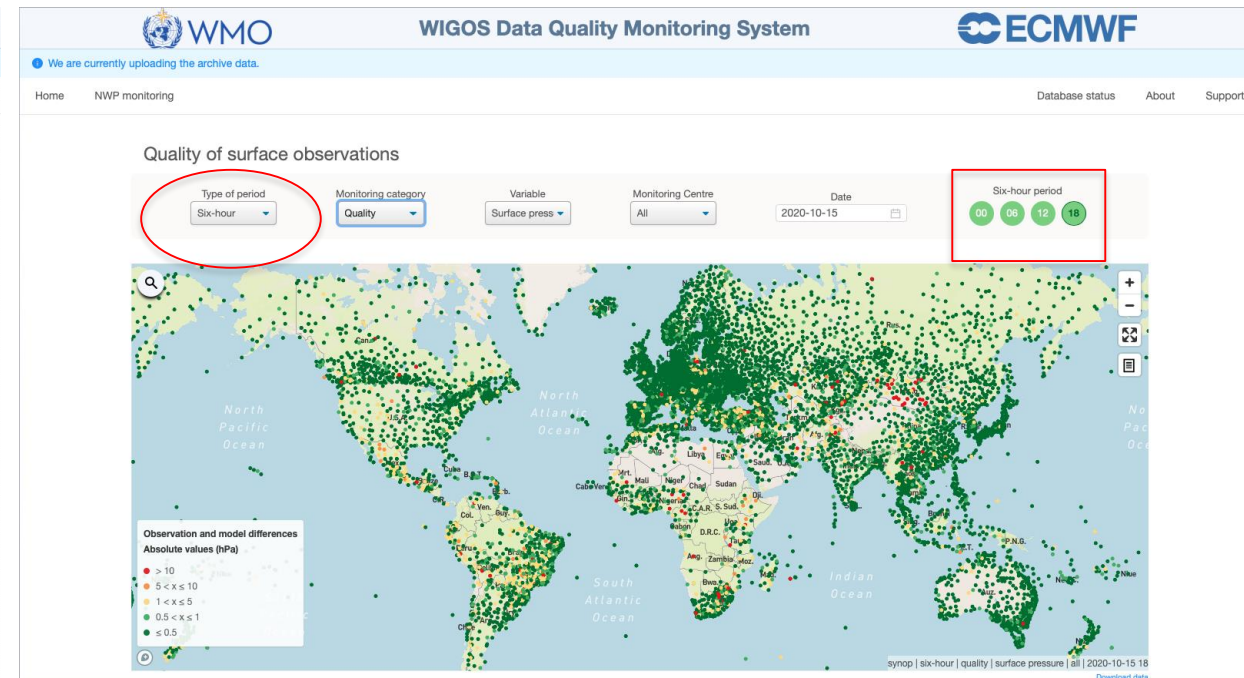
Surface + Upper-air

The WDQMS web tool offers the selection of a particular **date** and three different **types of periods**

- 6-hour period (the monitoring information is aggregated in four 6-hour periods: 00, 06, 12 and 18UTC)
→ available for 'Availability' and 'Accuracy'



The map displays the availability performance for each station highlighting differences in reporting performances as well as issues related to the station metadata recorded in OSCAR/Surface.



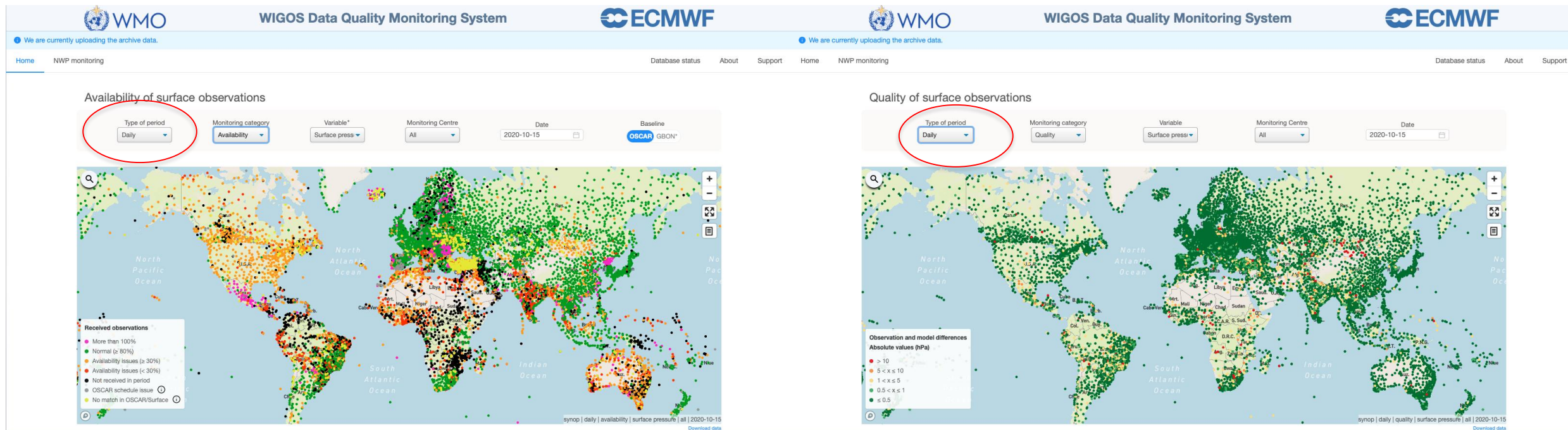
The map shows how the observing network complies with the NWP requirements set for the selected variable.

Date and Temporal aggregation (Period)

Surface + Upper-air

The WDQMS web tool offers the selection of a particular **date** and three different **types of periods**

- Daily (the monitoring information is aggregated over a 24-h period)
→ available for 'Availability' and 'Accuracy'

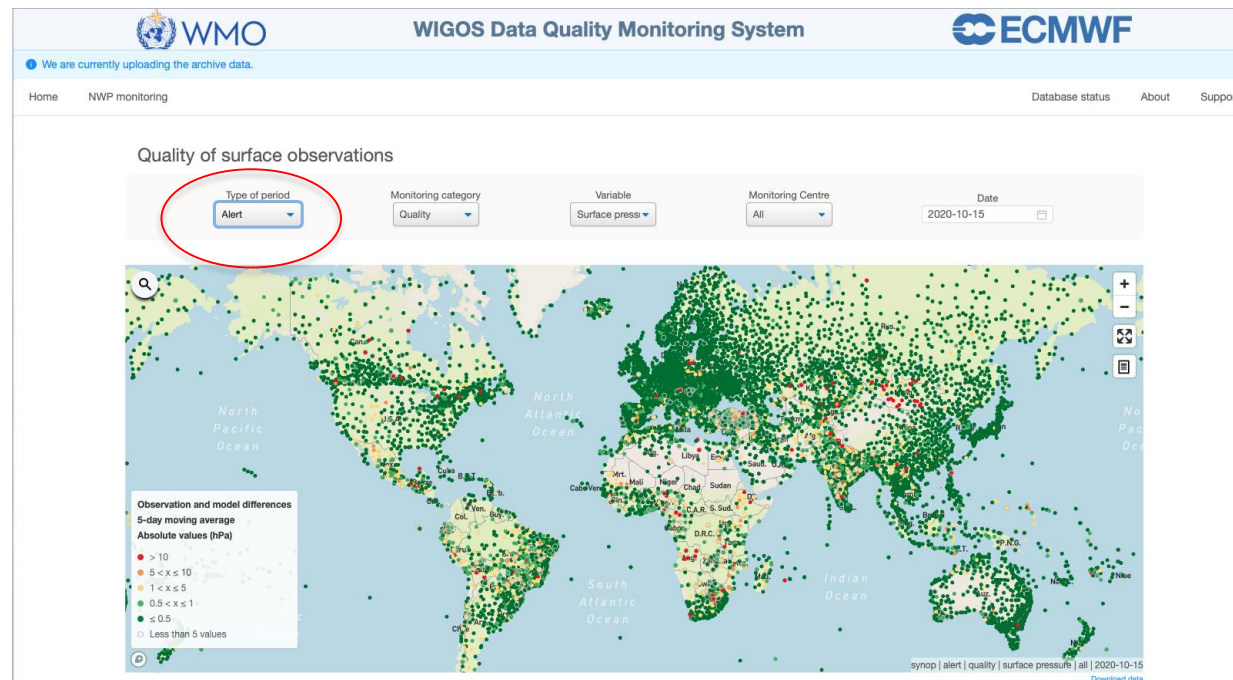


Date and Temporal aggregation (Period)

Surface

The WDQMS web tool offers the selection of a particular **date** and three different **types of periods**

- Alert (an aggregation based on a 5-day moving average which relies on daily values for a 5-day period)
→ currently only available for surface observations and 'Accuracy'



Type of Period: Daily versus Alert

Surface

- The alert map is based on the **5-day average** (which is based on the latest 5 daily mean values when available).
- This measure is mainly used to take into account the persistence of an existing daily issue.
- Cases in which an issue deteriorates may be reflected in the daily map quicker than in the alert map.
- However, model performance under certain conditions might be the reason for sudden outliers that wouldn't last more than a couple of days (such as in the case of a bad short-range forecast)
- Hence, it is better to have the **alert with 5-day average** because the influence of different model performance will probably not be seen in the 5-day average and will not trigger a false issues.

Variables monitored in the WDQMS web tool

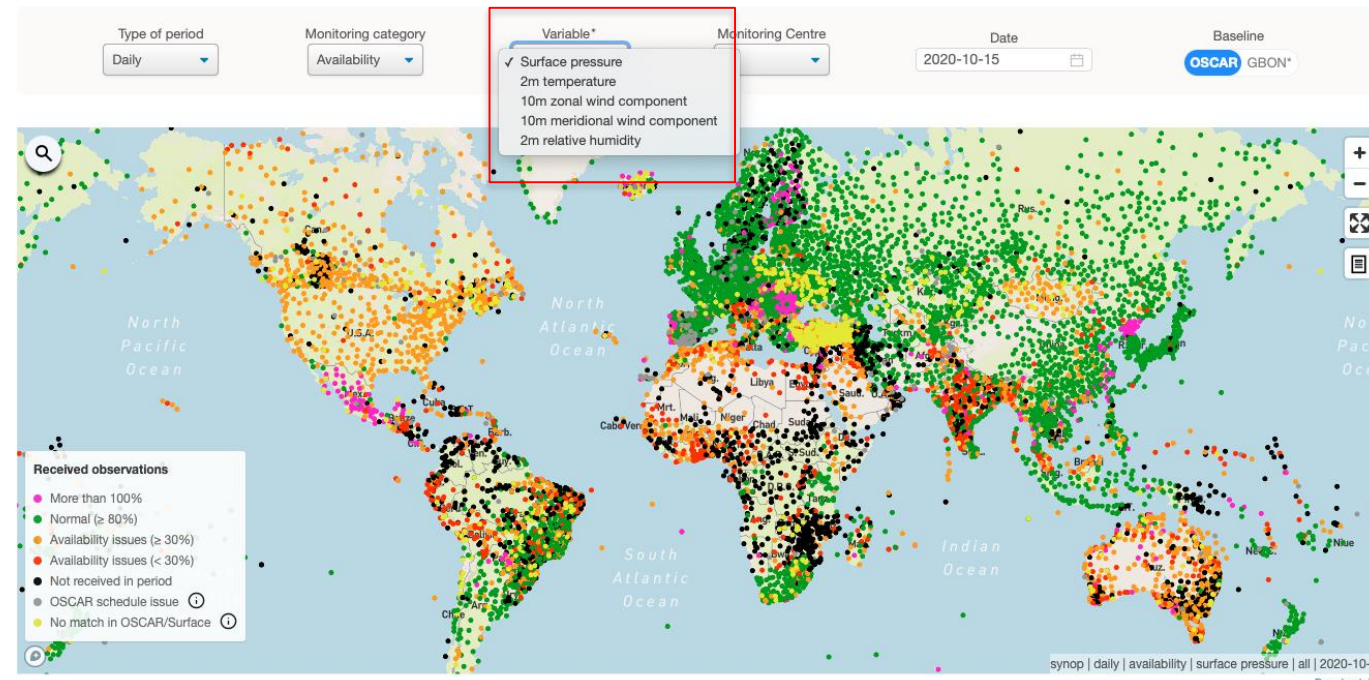
Surface

The WDQMS web tool allows the selection of a **particular variable** for evaluation: *surface pressure, 2m temperature, 10m zonal wind component, 10m meridional wind component, 2m relative humidity*)

To be noted: most of the land surface messages received from GOS stations contain several variables → in most cases if one variable is missing all other variables will be missing too, for a particular station. However it's worth checking because in some cases surface pressure can be missing whereas the others may not.



Availability of surface observations



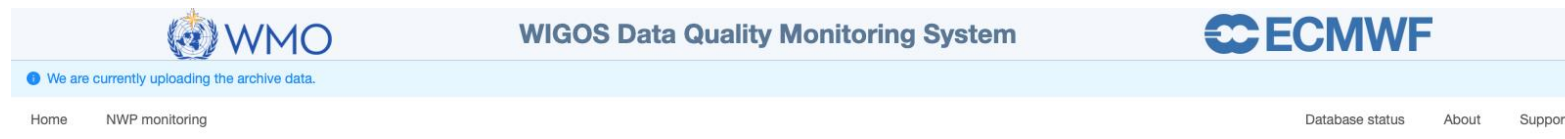
Availability



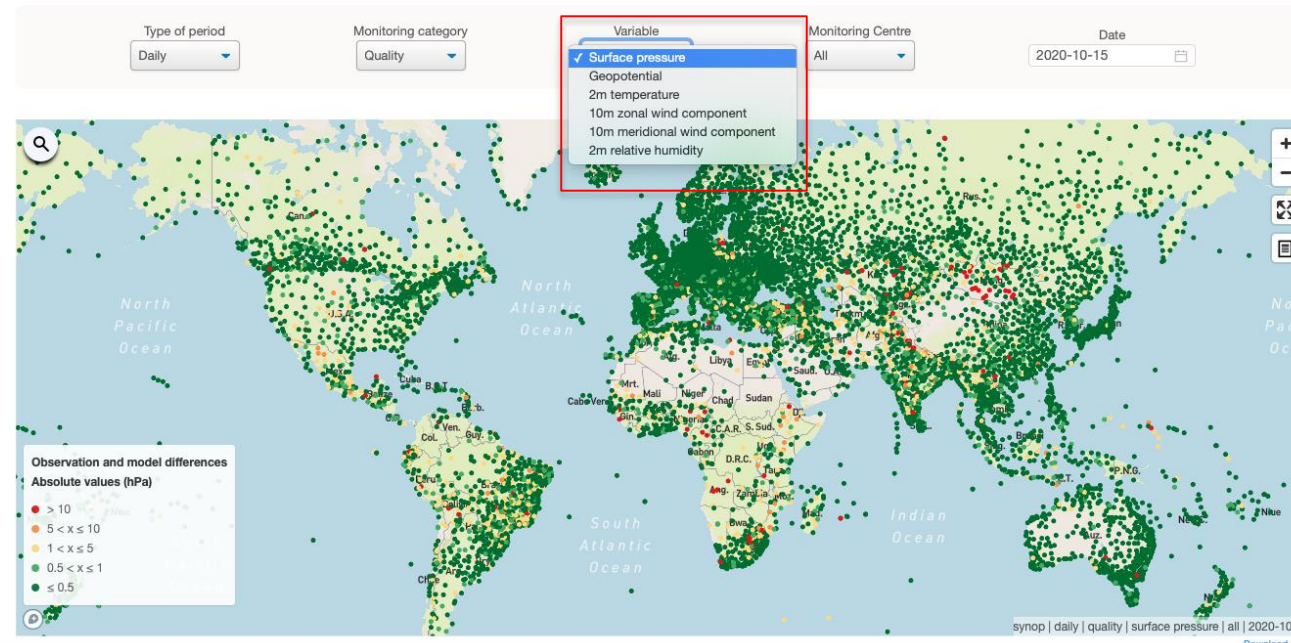
Variables monitored in the WDQMS web tool

Surface

- The WDQMS web tool allows the selection of the variables '**Surface pressure**' and '**Geopotential**' for accuracy
- To distinguish between land stations in mountainous areas (high elevation stations which report geopotential instead of mean sea level pressure) and the rest of the land surface stations
- WIGOS MCs assess surface pressure, while in the case of stations in mountainous areas some assess geopotential height (ECMWF and JMA only).



Quality of surface observations

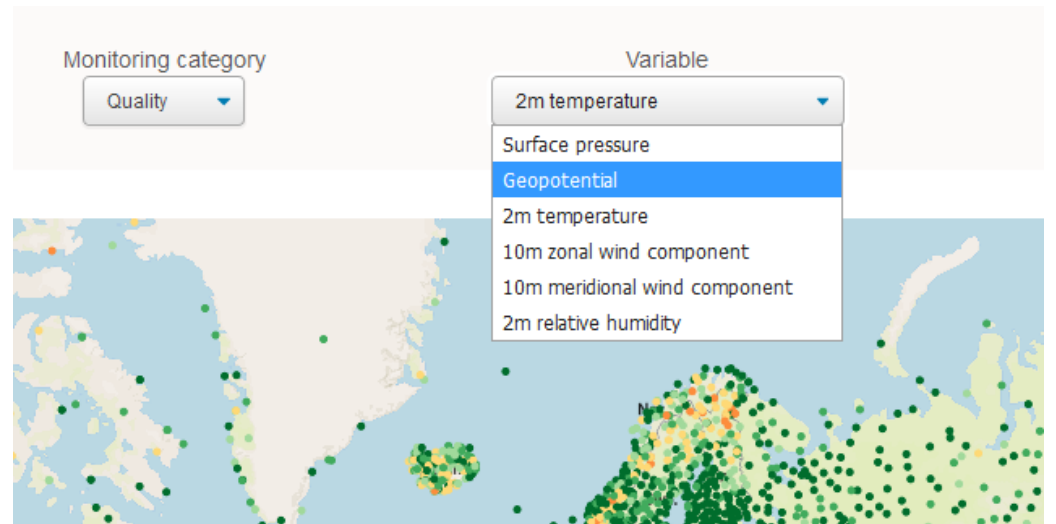
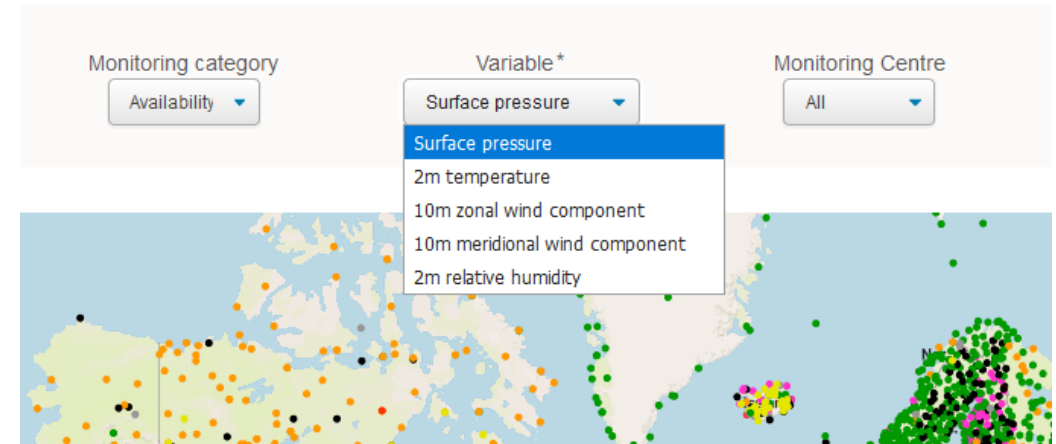


Quality/Accuracy

Variable 'Surface pressure' and 'Geopotential'

Surface

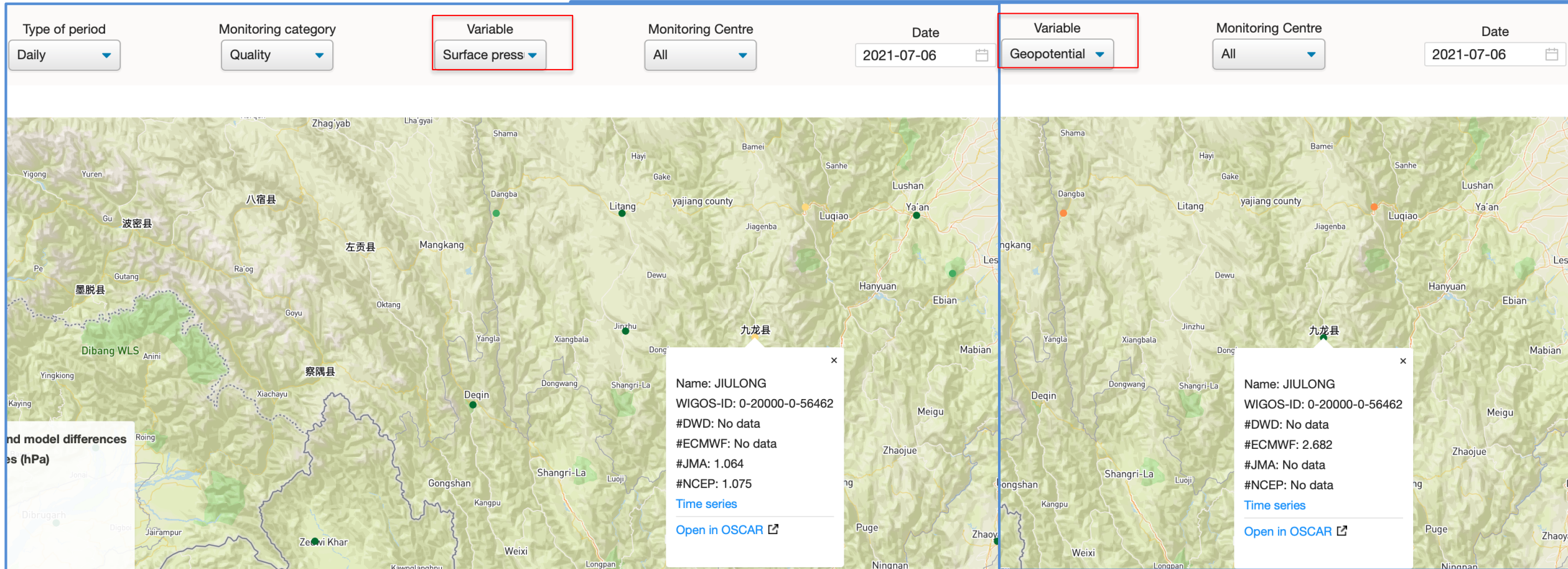
- In the '**Availability**' map these two variables are combined to '**Surface pressure**'
- In the '**Accuracy**' map these **two variables are displayed** to be able to evaluate the results for surface pressure and geopotential height separately.



Variable 'Surface pressure' and 'Geopotential'

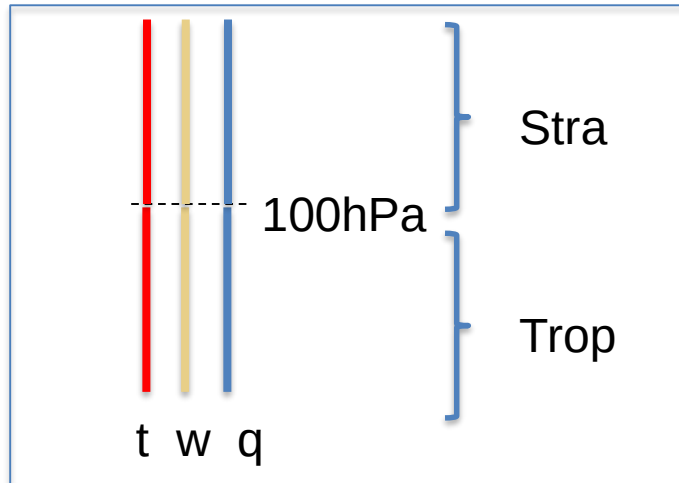
Surface

- Same station can appear in both (Surface pressure and Geopotential) view maps (option "All" selected) due to differences in the monitoring results provided by the different WIGOS MCs.
- JIULONG (2931 m): results for surface pressure (JMA and NCEP) and geopotential (ECMWF).



Variables monitored in the WDQMS web tool

Upper-air



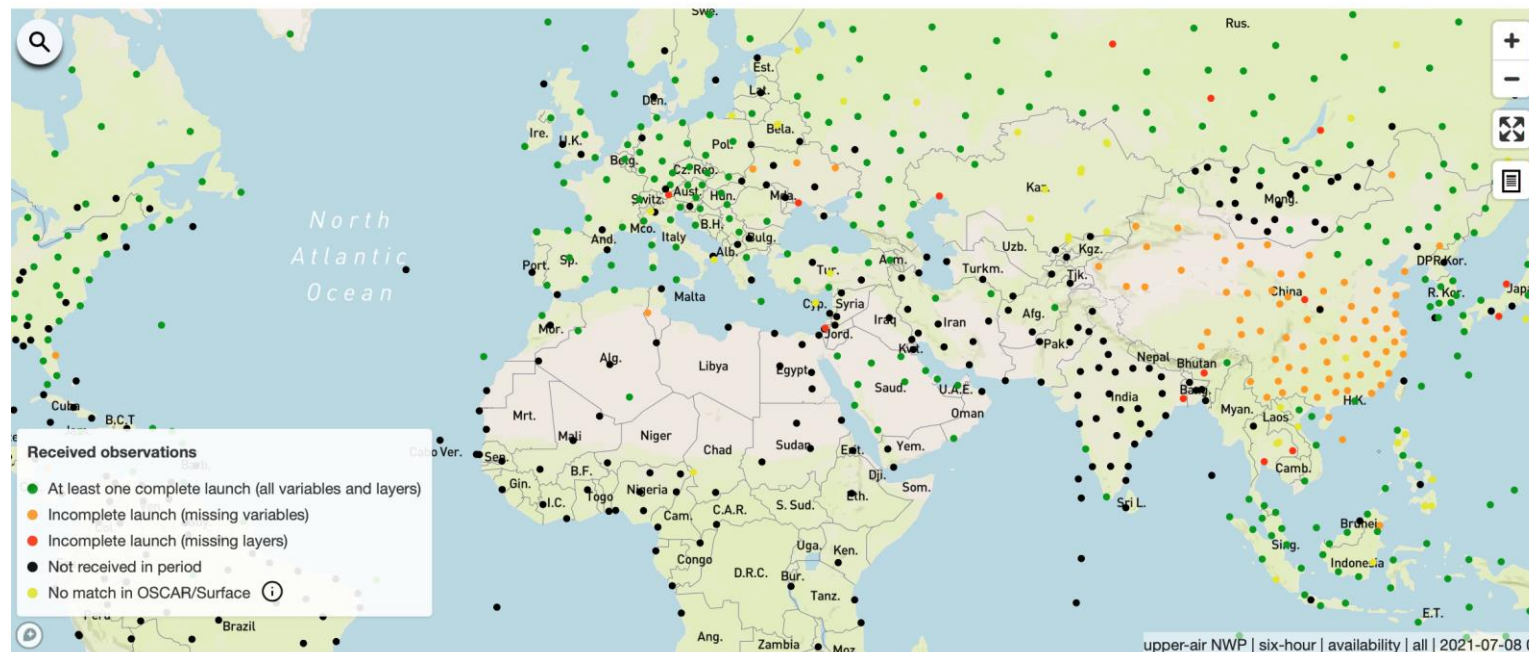
The quantitative information provided for temperature(**t**), wind (**w**) and humidity (**q**) is obtained by aggregating the O-B departures into two main categories:

- layer between the first pressure level up to 100 hPa inclusive (**Trop**)
- layer from 100 hPa up to the last reported level (**Stra**).

Interface elements for the WDQMS web tool:

- Type of period: Six-hour
- Monitoring category: Availability
- Monitoring Centre: All
- Date: 2021-07-08
- Six-hour period: 00, 06, 12, 18
- Baseline: OSCAR, GBON*

Availability



Availability is calculated aggregating across the observed variables and layers:

- Orange dot: Incomplete launch (missing variables)
- Red dot: Incomplete launch (missing layers)

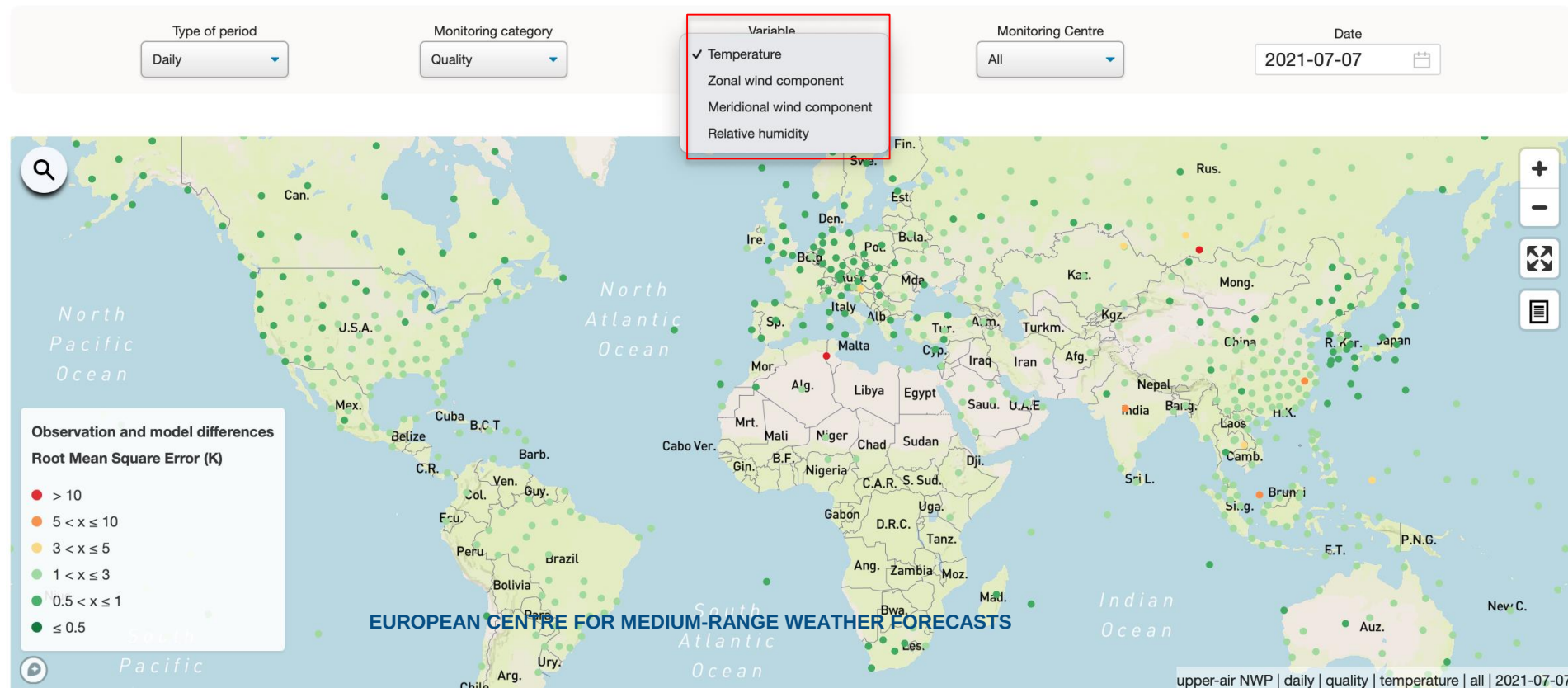
Variables monitored in the WDQMS web tool

Upper-air

The WDQMS web tool allows the selection of a **particular variable** for evaluation: *temperature, zonal wind component, meridional wind component, relative humidity*

Quality/Accuracy

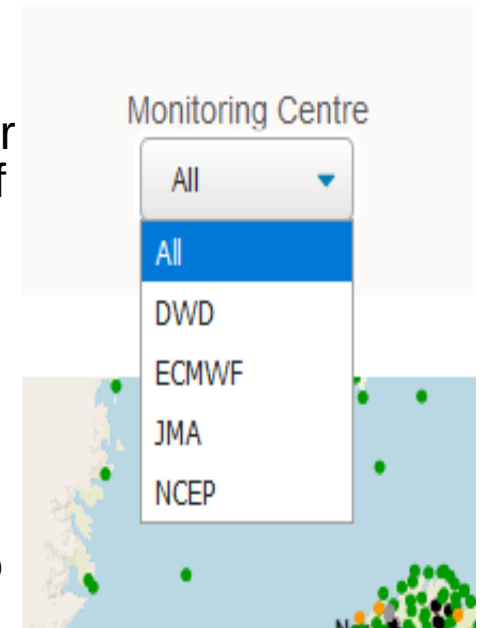
Quality of upper-air land observations (global NWP)



NWP Centre aggregation – Monitoring Centre

Surface + Upper-air

- The WDQMS web tool allows selecting results of a **particular WIGOS Monitoring Centre (MC)** or the aggregation of all centres.
- If 'All' is selected the results of all WIGOS MCs are combined into **one figure** concerning 'Availability' and one figure for 'Accuracy'.
- The WIGOS MC results might differ due to various reasons (e.g. higher number of received observations in availability due to longer DA cut-off times)
- Hence, the combined selection of daily performance of the quality monitoring category **availability** will show **the best of all Centres**, respectively the **maximum availability result**.
- For **accuracy** the NWP model **whose background field is closest to the observed value** (i.e. smaller O-B values) will be selected as it exhibits the best performance result.



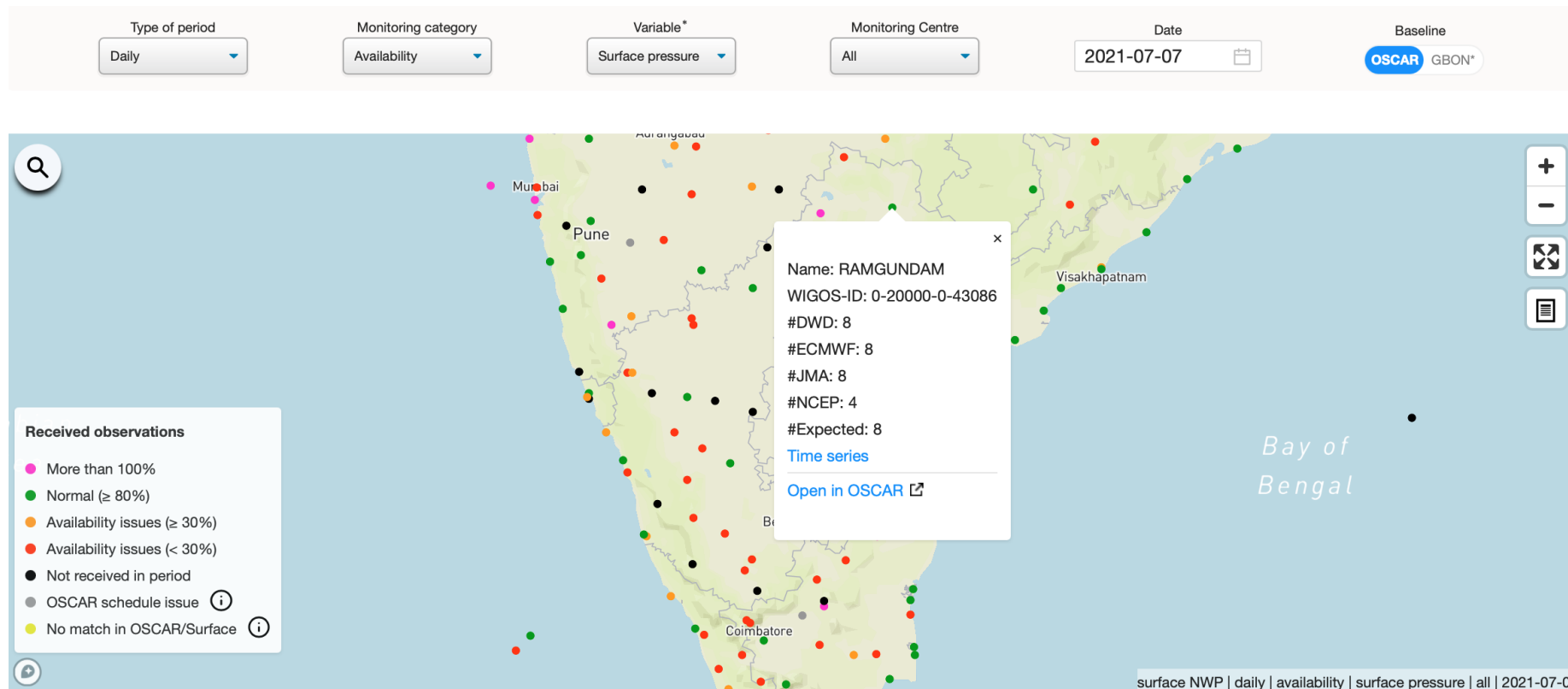
Detailed performance of a particular station for 'Availability'

Surface

Clicking on a dot on the map opens up a screen with detailed information about the station data availability.

The popup window displays:

- the station **name** and **WIGOS Station Identifier (WSI)**
- the **number of received messages** of a selected **WIGOS MC** or each WIGOS MCs (if 'All' selected under 'Monitor Center') and the number of expected messages according to the schedule declared in OSCAR/Surface for the selected type of period (6-hour, daily)

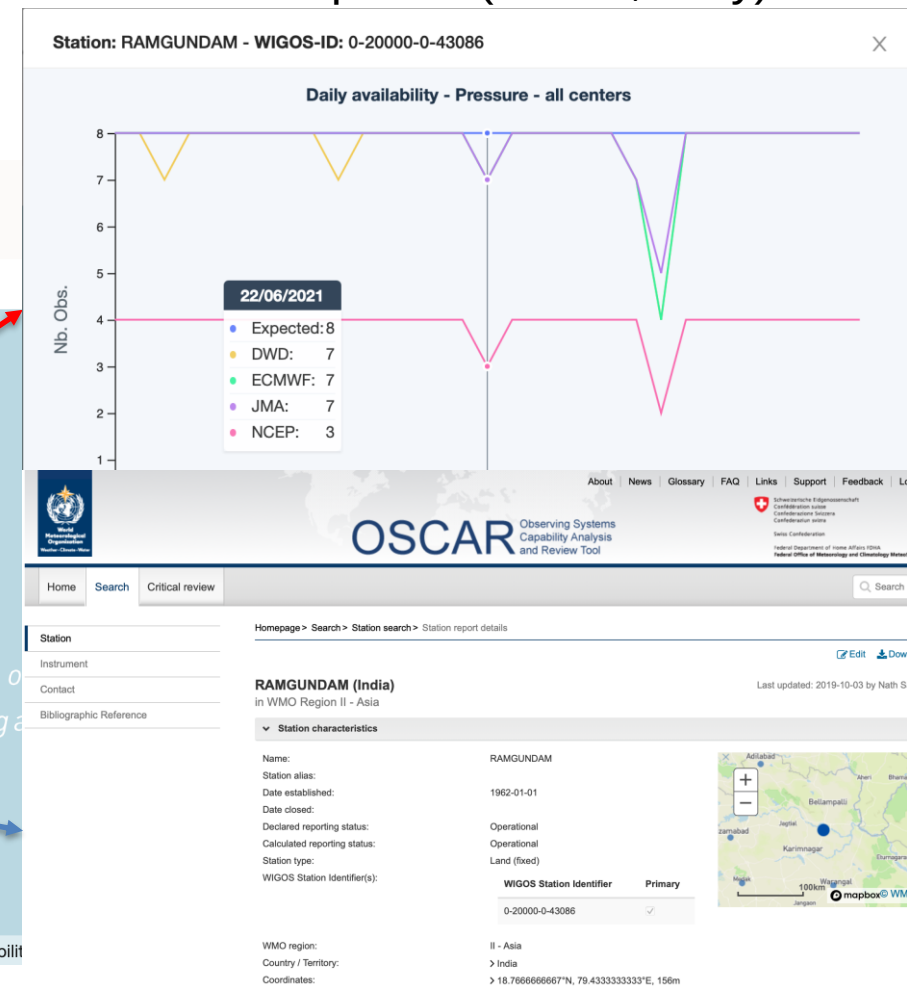
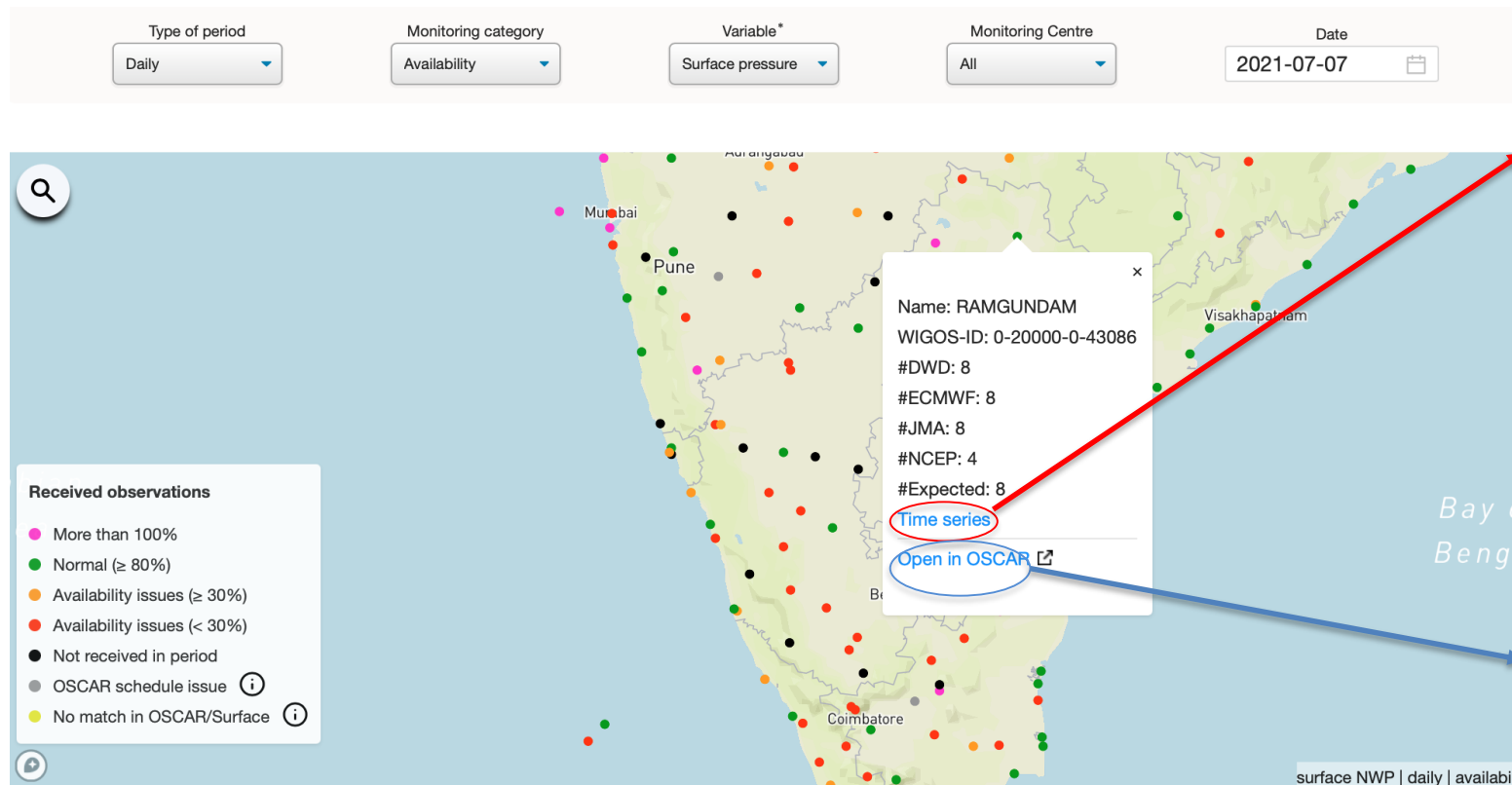


Detailed performance of a particular station for 'Availability'

Surface

The popup window contains:

- link to the station's availability [time series](#) (30 days) with the number of messages of a selected WIGOS MC or each WIGOS MCs (if 'All' selected under 'Monitoring Center') and the number of expected messages according to the schedule declared in OSCAR/Surface for the selected period (6-hour, daily)
- link to the metadata page of the station in [OSCAR/Surface](#)



Detailed performance of a particular station for 'Accuracy'

Surface

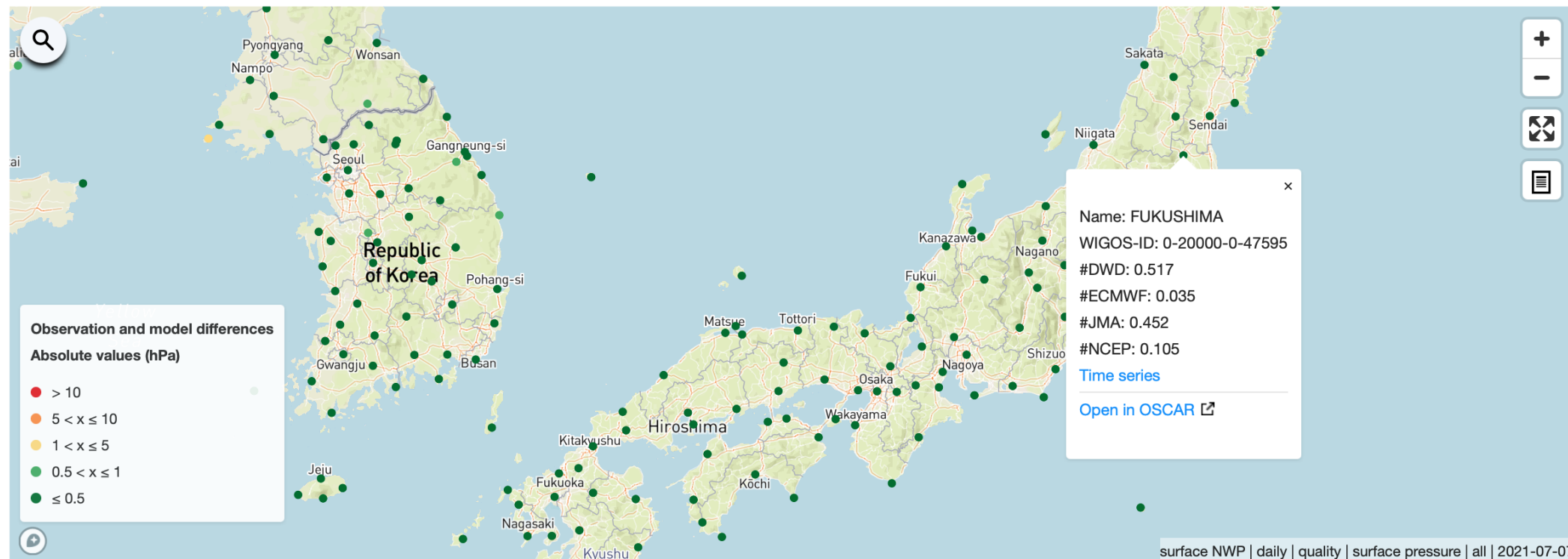
Clicking on a dot the WDQMS web tool displays more details about the accuracy performance of the station.

A popup window displays:

- station name and WIGOS Station Identifier (WSI)
- O-B values of a selected WIGOS MC or each WIGOS MCs (if 'All' selected under 'Center') of the selected variable (e.g. surface pressure)

Form fields for filtering data:

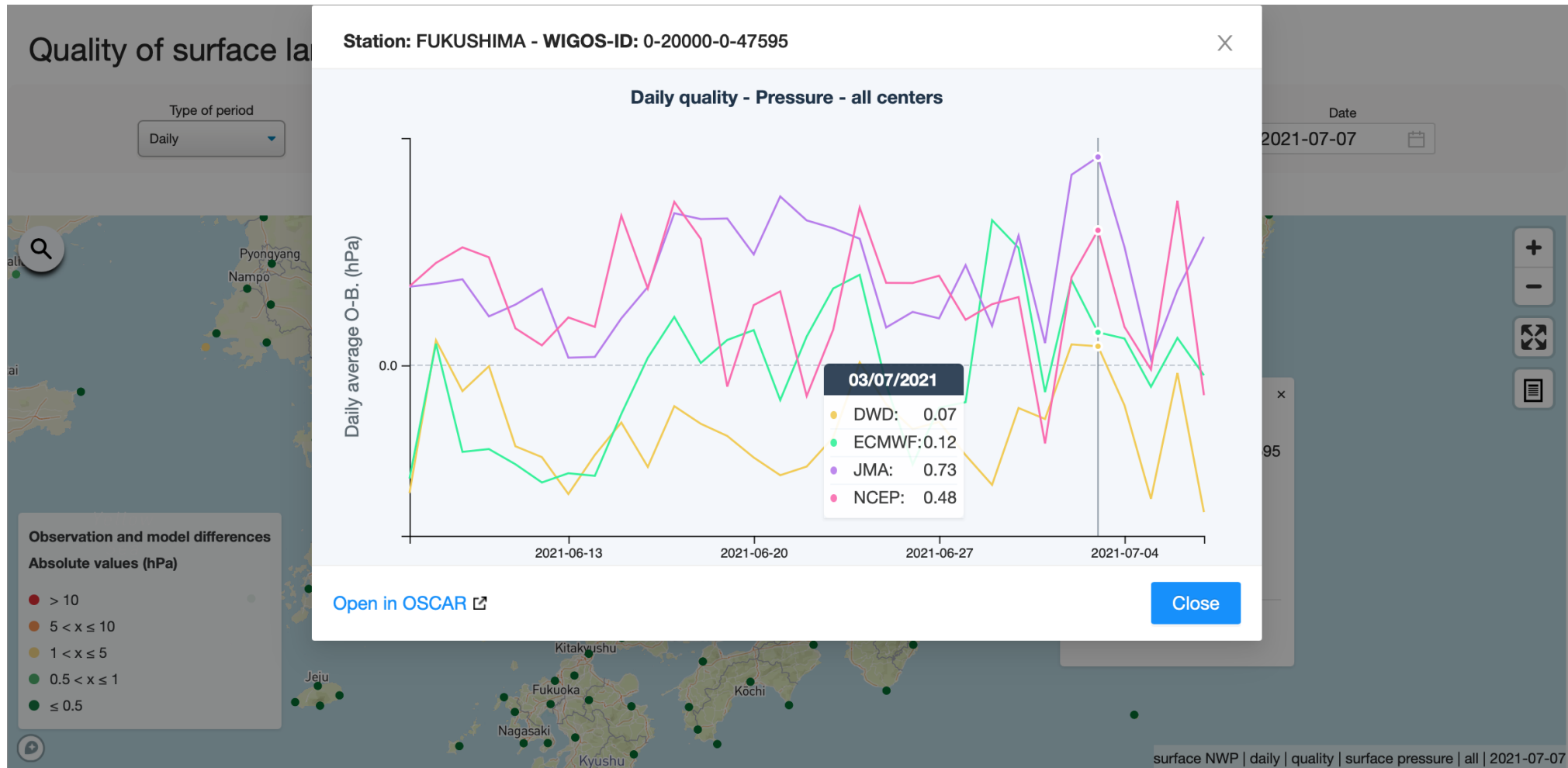
- Type of period: Daily
- Monitoring category: Quality
- Variable: Surface pressure
- Monitoring Centre: All
- Date: 2021-07-07



Detailed performance of a particular station for 'Accuracy'

Surface

The popup window contains a link to the station's time series: displays the O-B results of the previous periods (6h/daily steps) for each WIGOS MC (WIGOS MCs with the same results will overlap, the cursor popup information shows the results of each WIGOS MC)

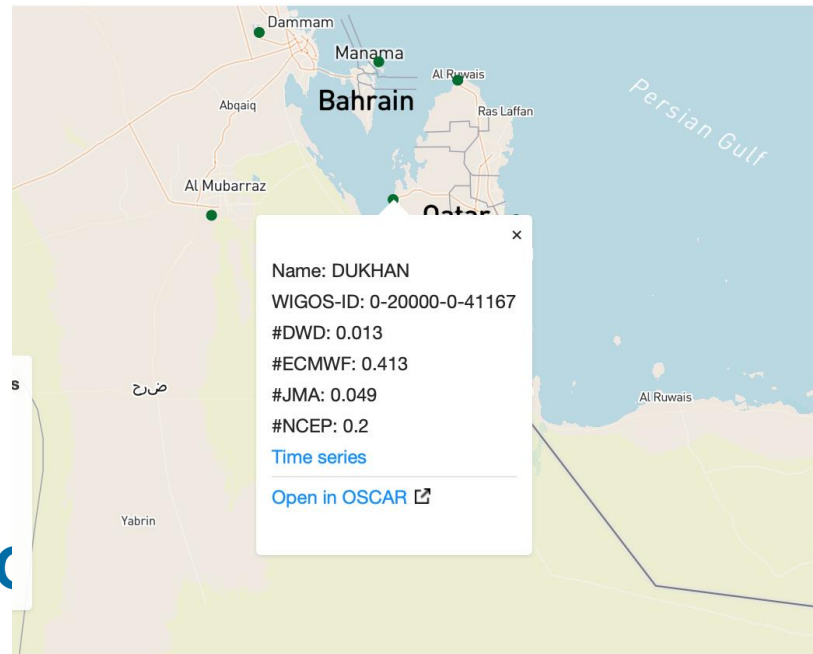


Detailed performance of a particular station for 'Accuracy'

The option **6-hour interval** for a **particular WIGOS MC** allows for the details of individual observations that contribute to the average displayed on the map to be shown. By hovering the mouse over a dot, a pop-up shows the **observation** (identified by date and time) details:

- the **O-B** value for the selected variable
- the usage (**Status**, i.e., **used** or **not used** because it was rejected by/before the assimilation or other reasons)
- the type of report (**Type**, i.e., TAC or BUFR)

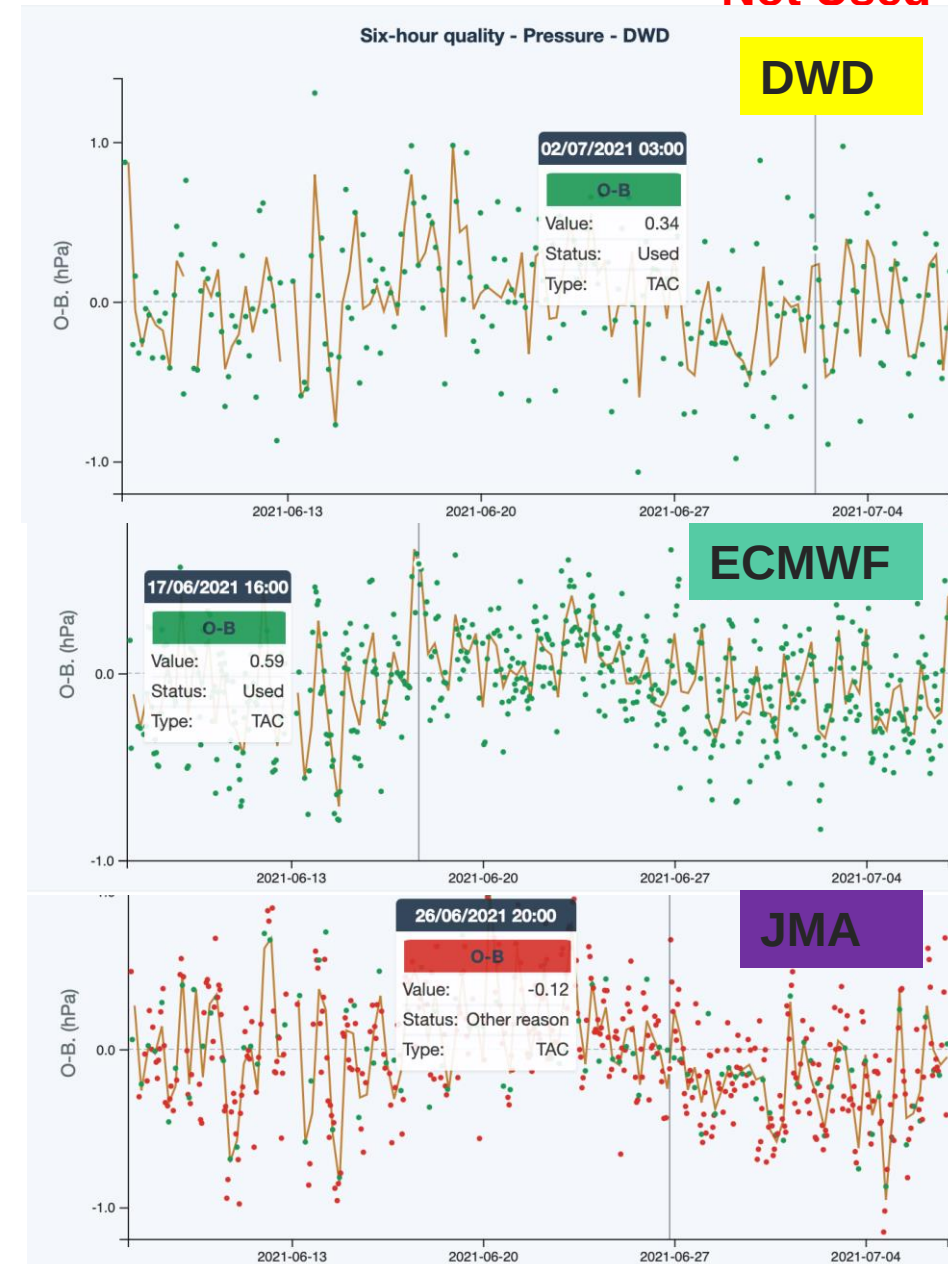
DUKHAN (Qatar) in
WMO Region II -
Asia



FORECASTS

Surface

- **Used**
- **Not Used**



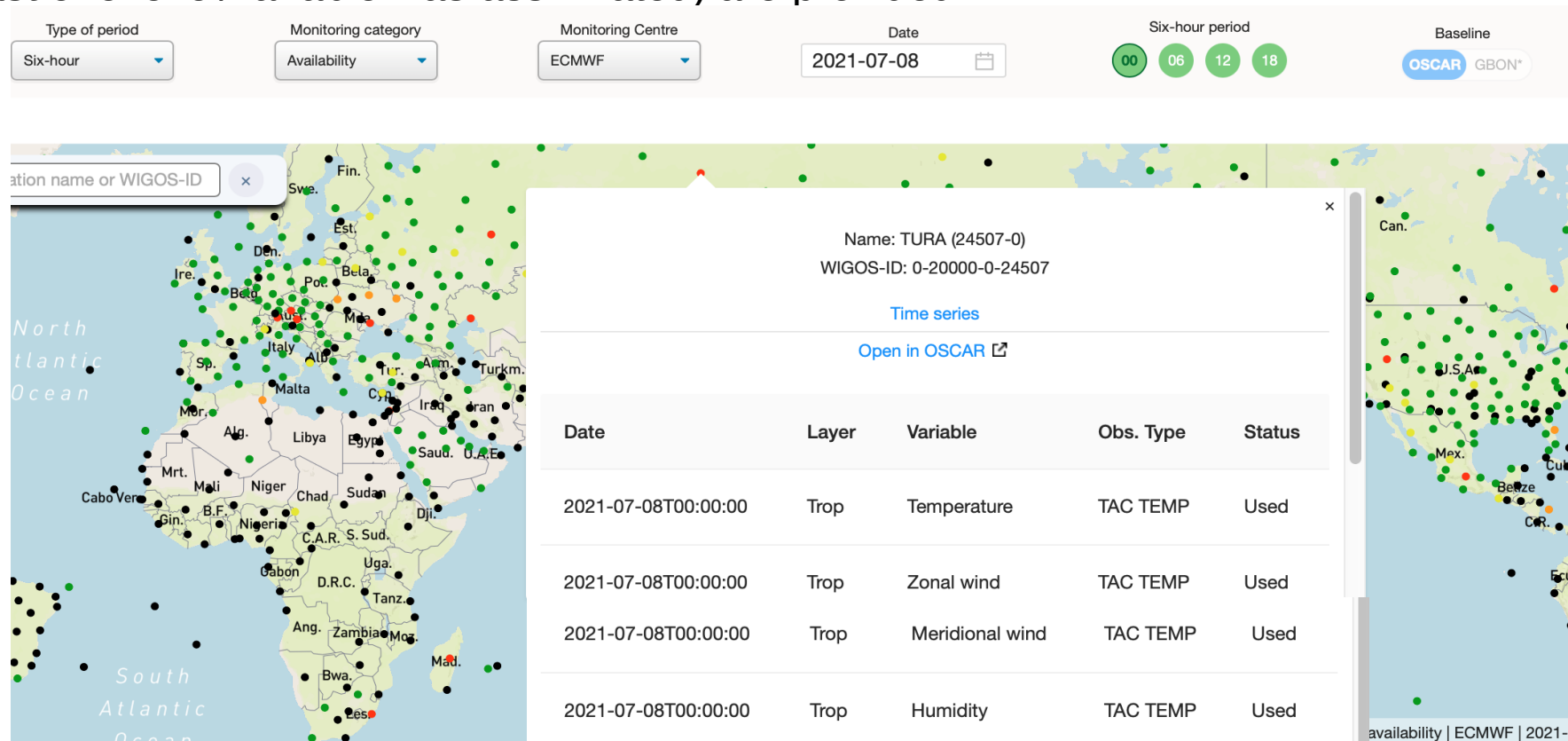
Detailed performance of a particular station for 'Availability'

Upper-air

Clicking on a dot on the map opens up a screen with detailed information about the station data availability.

The popup window displays:

- the station **name** and **WIGOS Station Identifier (WSI)**
- for the **6-hour** period, details of the observations received such as **Layer**, **Variable** and **Observation type** (TAC or the new high resolution BUFR reports) and **status** (used / not used, “used” meaning that at least one level/variable was assimilated) are provided.



Detailed performance of a particular station for 'Accuracy'

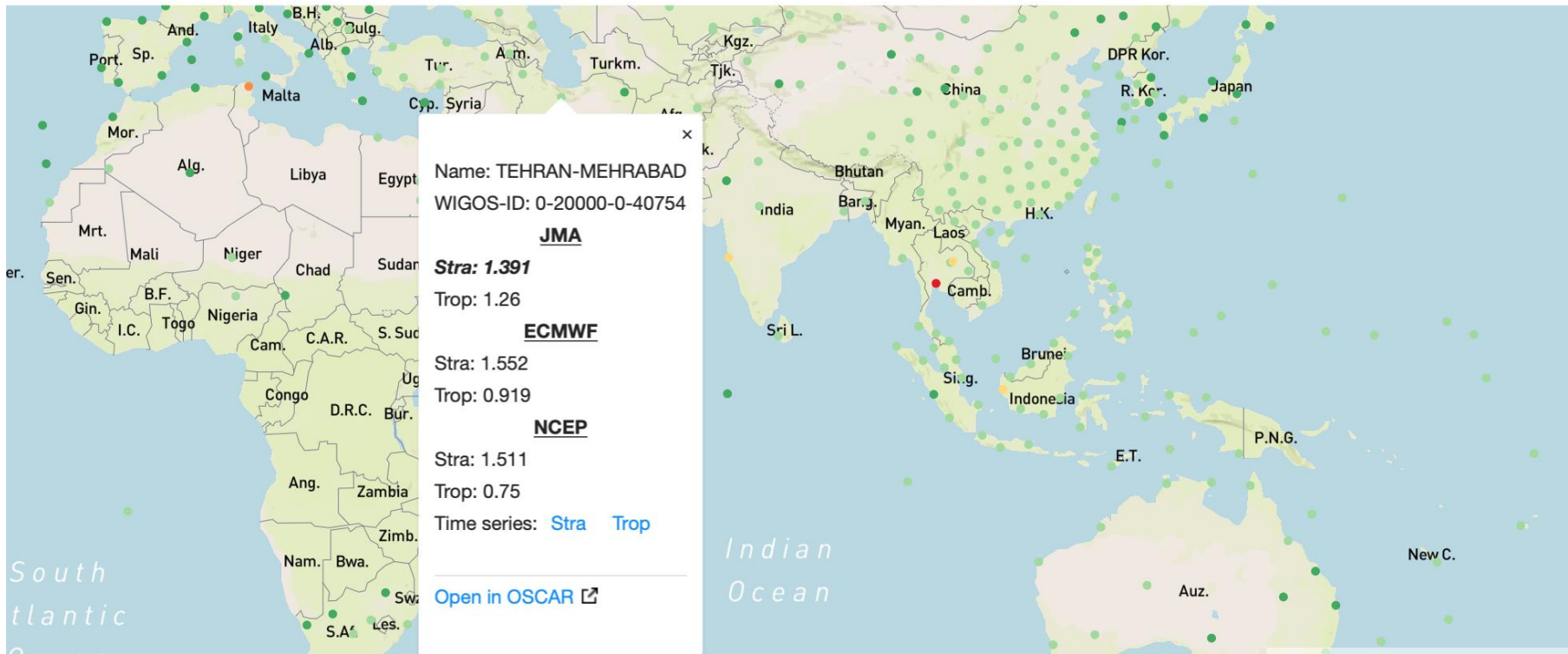
Upper-air

Clicking on a dot the WDQMS web tool displays more details about the accuracy performance of the station.

A popup window displays:

- station name and WIGOS Station Identifier (WSI)
- RMSE of O-B for **Stra** and **Trop** layers of a selected WIGOS MC or each WIGOS MCs (if 'All' selected under 'Center') of the selected variable (e.g. temperature)

Type of period: Monitoring category: Variable: Monitoring Centre: Date:



Detailed performance of a particular station for 'Accuracy'

Upper-air

Name: TEHRAN-MEHRABAD
WIGOS-ID: 0-20000-0-40754

JMA

Stra: 1.391

Trop: 1.26

ECMWF

Stra: 1.552

Trop: 0.919

NCEP

Stra: 1.511

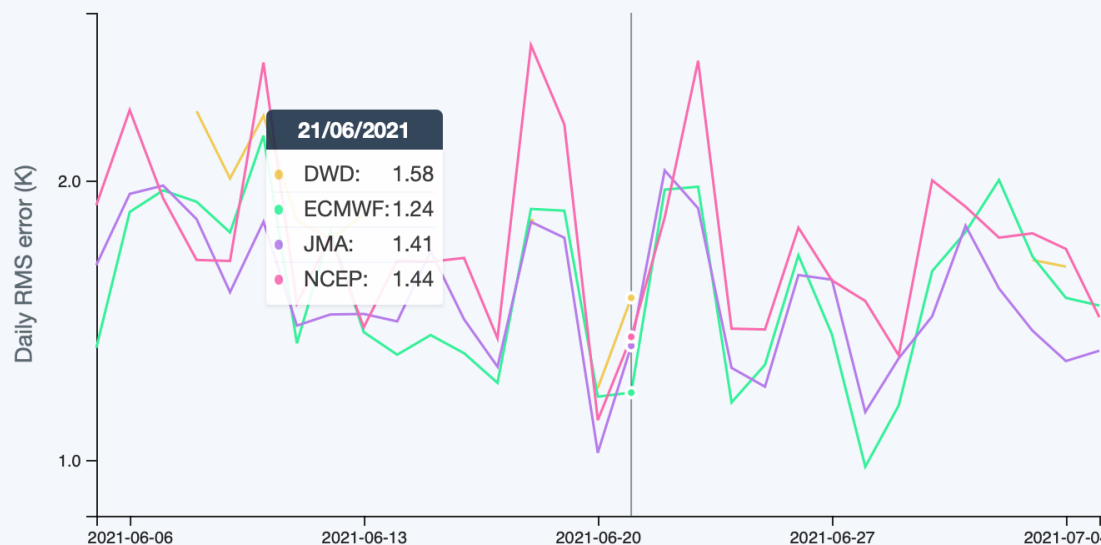
Trop: 0.75

Time series: [Stra](#) [Trop](#)

The popup contains two links to the station's time series for **Stra** and **Trop** layers: displays the rmse of O-B of the previous periods (6h/daily steps) for each WIGOS MC (WIGOS MCs with the same results will overlap, the cursor popup information shows the results of each WIGOS MC)

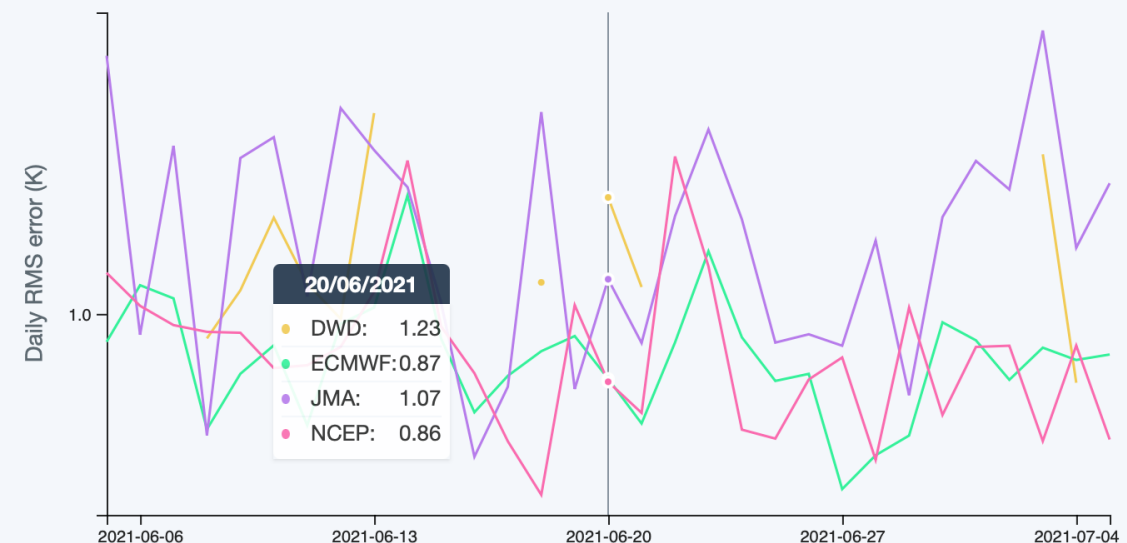
Station: TEHRAN-MEHRABAD - WIGOS-ID: 0-20000-0-40754

Daily quality - Temperature - Stratosphere - all centers



Station: TEHRAN-MEHRABAD - WIGOS-ID: 0-20000-0-40754

Daily quality - Temperature - Troposphere - all centers



Thank You for listening!

Questions?

WDQMS: Differences in NWP monitoring reports

But we need to bear in mind the way the four different NWP DA systems deal with observations:

- **NCEP**, provides information only on the data that pass a quality control step prior to DA, therefore part of the data available that is deemed to be of poor quality or duplicate is filtered out and not available to the DA.
- **ECMWF**, provides monitoring information of all observations available to the DA, even data deemed to be of poor quality (rejected and/or blacklisted by the system). Observations may not be available when a serious coding issue prevents the acquisition system to extract any meaningful value. Assimilates surface pressure observations hourly and geopotential height for some high-altitude stations.
- **DWD** doesn't provide O-B values if the observation is not considered in the assimilation. For example, humidity above 100hPa (Stra) is never available as it is not assimilated by the model. And they tend to assimilate surface pressure observations every 3h rather than hourly.
- **JMA** provides O-B values even if the observation is not used in the assimilation although they tend to assimilate surface pressure observations every 3h rather than hourly. Also assimilate geopotential height in some high-altitude stations.