# CAMS Regional Production

# QC for AQ forecasts

Fairmode technical meeting, October, 6th, 2021
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INERIS

Copernicus
Europe's eyes on Earth

European
Commission

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- Objective: Extension of the Quality Control to include Fairmode metrics in the process
  - Quarterly evaluation reports
- Fairmode metrics already used in the CAMS regional reanalyse verification reports

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Europe's eyes on Earth
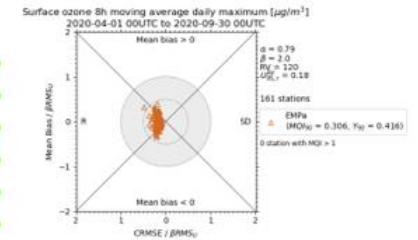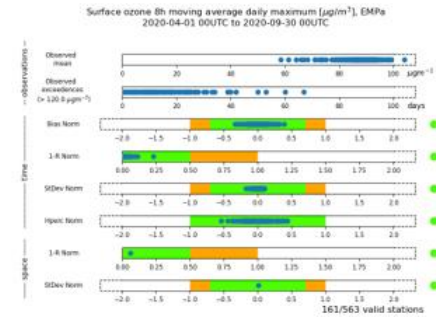
ECMWF COPERNICUS REPORT
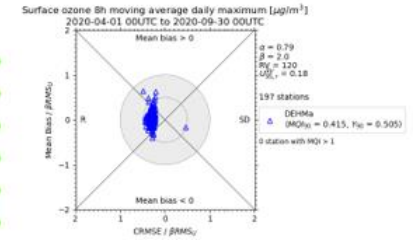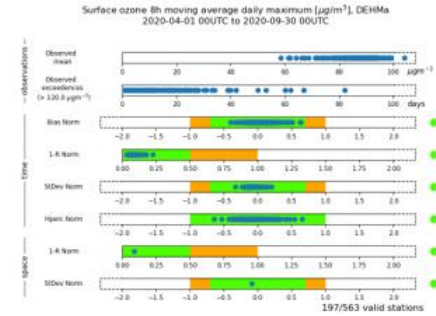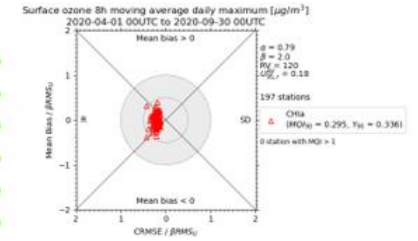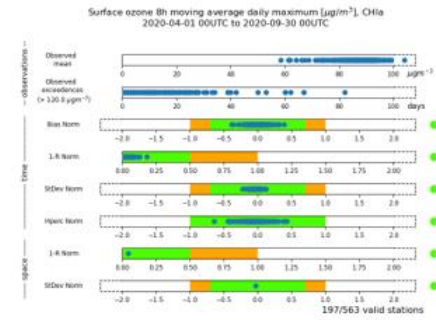
Copernicus Atmosphere Monitoring Service
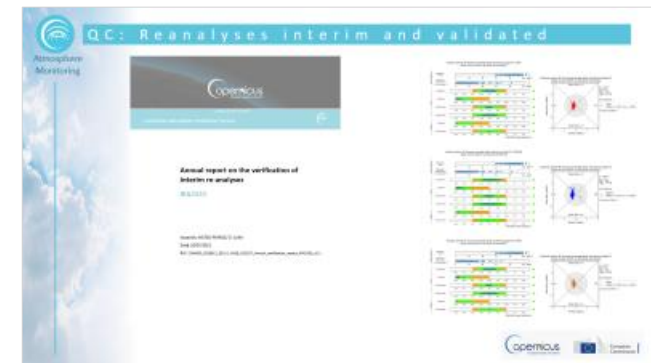
**Annual report on the verification of interim re-analyses**

IRA2020

Issued by: METEO-FRANCE/ G. Collin
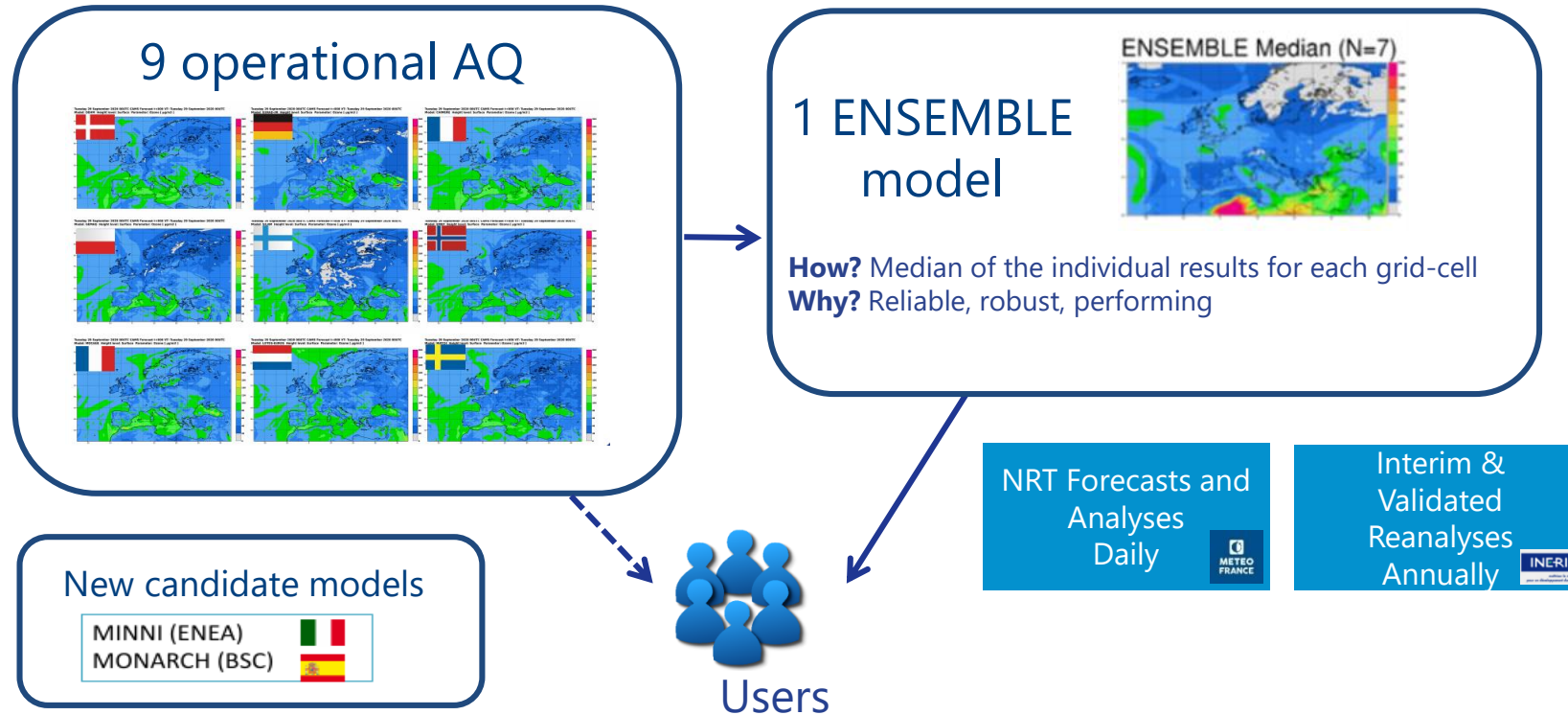
Date: 20/07/2021

Ref: CAMS50_2018SC1_D5.3.1-2018_202107_Annual_verification_report_IRA2020_v0.1
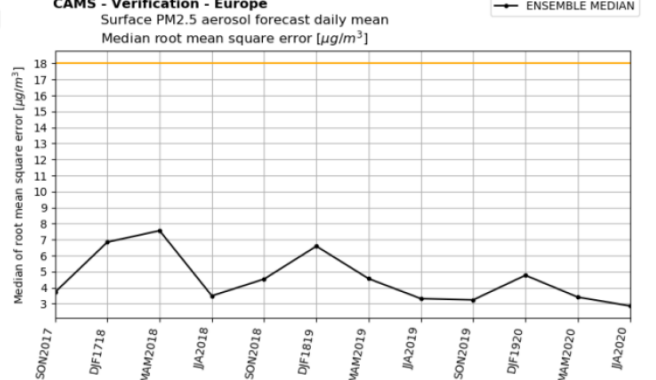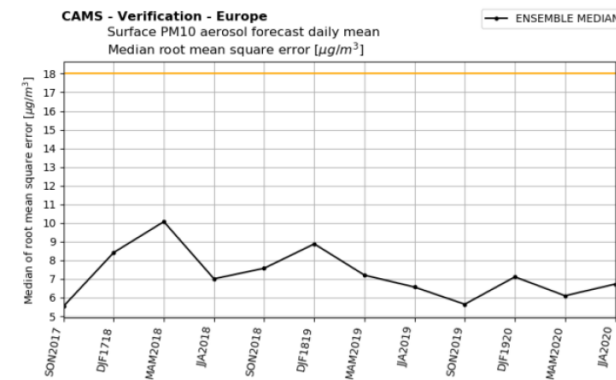
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**Operational Europe-wide Air Quality Service based on:**

9 operational AQ



1 ENSEMBLE model

ENSEMBLE Median (N=7)



**How?** Median of the individual results for each grid-cell
**Why?** Reliable, robust, performing

New candidate models

MINNI (ENEA)
MONARCH (BSC)

Users

NRT Forecasts and Analyses Daily

METEO FRANCE

Interim & Validated Reanalyses Annually

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- Quarterly reports
  - https://atmosphere.copernicus.eu/index.php/regional-services
  - Timeliness of daily production
  - Surface evaluation (E2a): O3, NO2, PM10, PM2.5
  - For each of the 9 operational models + ENSEMBLE
  - KPI: European median of RMSE
    - O3max 18µg/m3, NO2max: 25µg/m3, PM10 18µg/m3, PM2.5 18µg/m3

- Score methodology
  - https://regional.atmosphere.copernicus.eu/doc/USER_GUIDE_VERIFICATION_STATISTICS.pdf

# QC: NRT Forecasts

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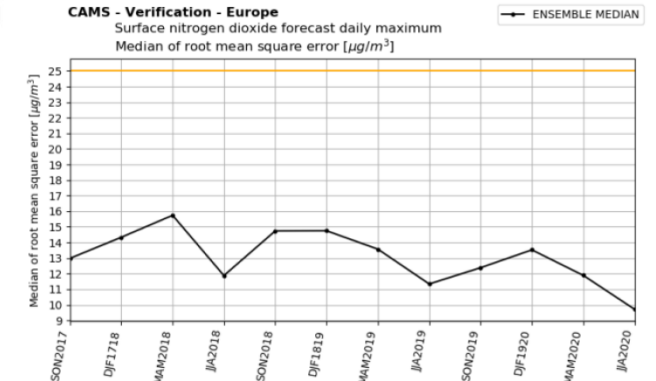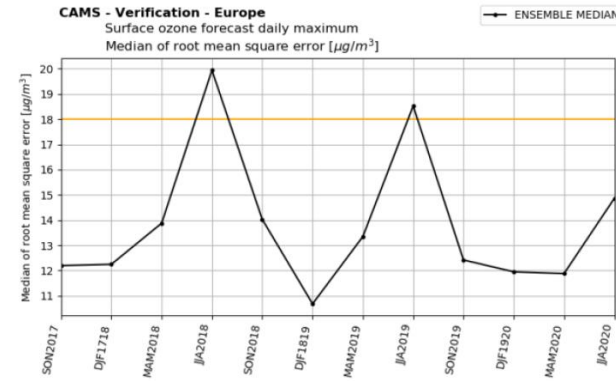
- New since dec. 2020:

- Interactive Webtool

- Forecasts:
    - https://regional.atmosphere.coperni cus.eu/evaluation.php?interactive=c df#

- Analyses
    - https://regional.atmosphere.copernic us.eu/evaluation.php?interactive=cda

- Performances at individual stations and median by country

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- One of the main future evolution in CAMS regional service is to implement the FAIRMODE metrics dedicated to QC of forecasts.
  - Extent evaluations to the thresholds

- Development of an API (python) to compute the Fairmode metrics (assessment so far) with figures similar to the delta-tool representation.

- Ongoing works
  - Based on delta-tool version April, 2021 of the definition of MQO for AQ FC
  - Tested with ENSEMBLE datasets in 2020
  - O3, NO2, PM10
  - Large number of stations dedicated to evaluation (700 stations to 1200 stations)

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## Comparaison for PM10 between Thunis plot and the 2 methods for forecast Target Plot
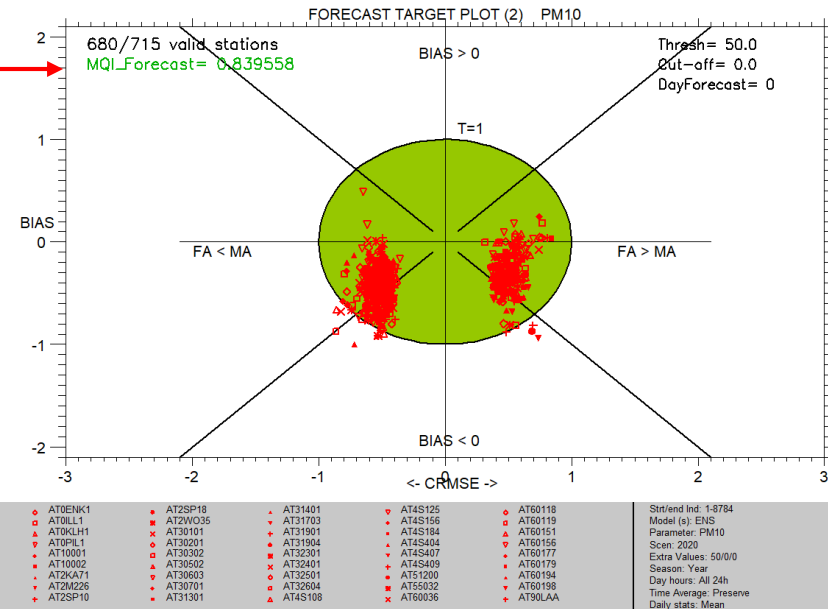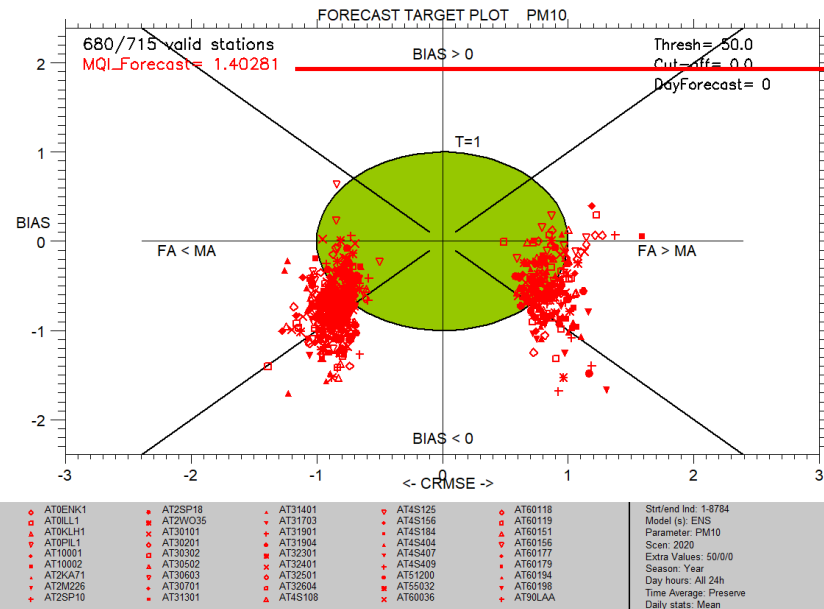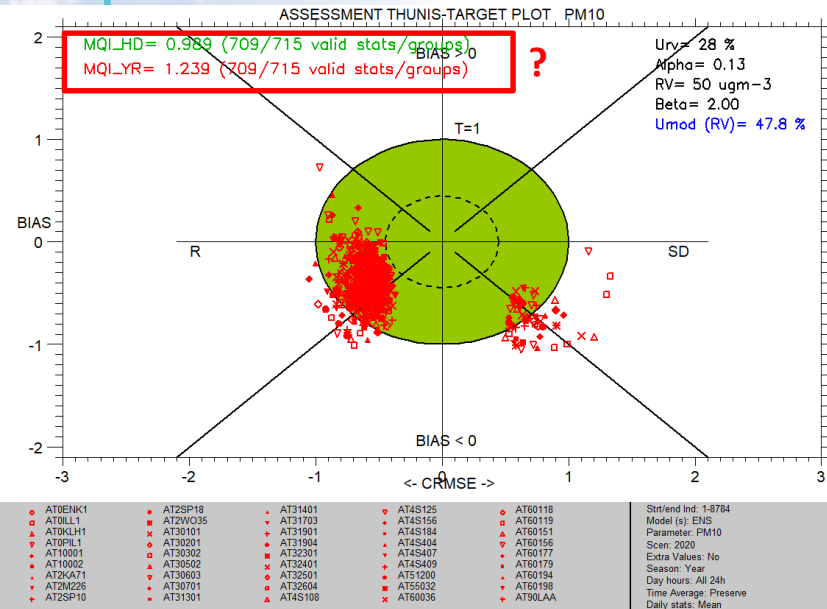


- With all the EEA background stations, we obtain a cloud of points
- The new method (OU) for the forecast target plot gives better results
- The outcomes are very sensitive with the cut-off value (not illustrate here), it is interesting to understand the behavior of the models in higher concentrations.
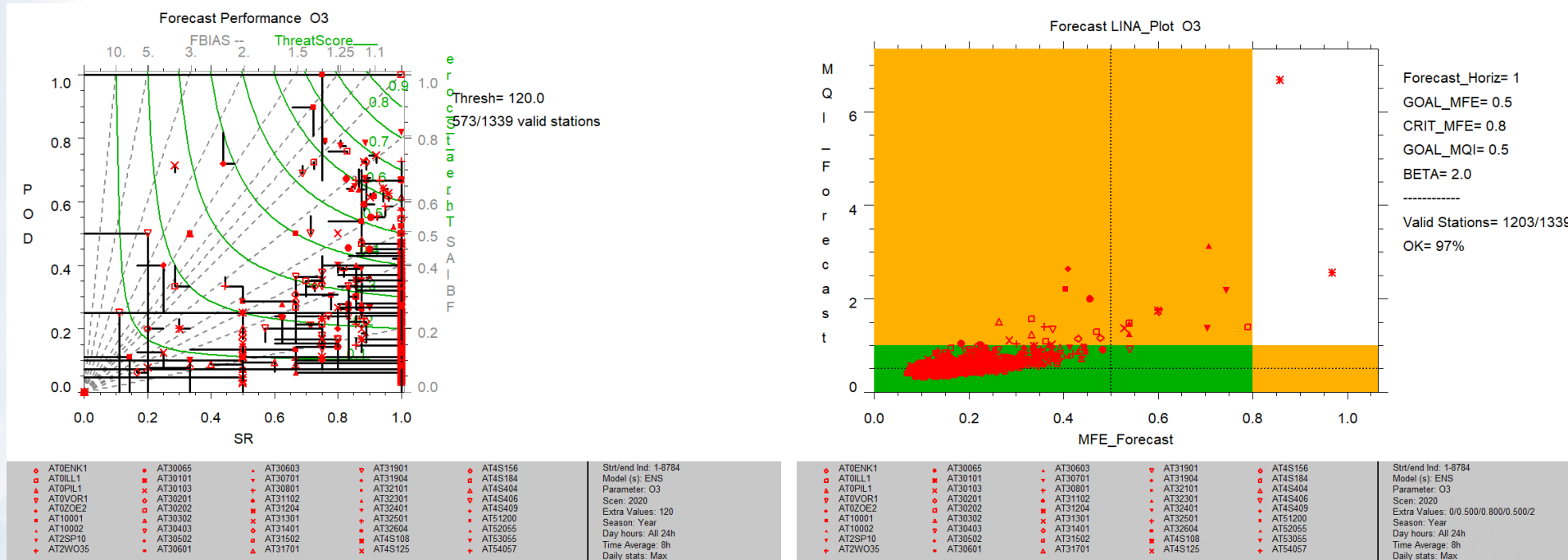
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- For NO2, the difference is quite spectacular with results becoming quite satisfactory with the uncertainties
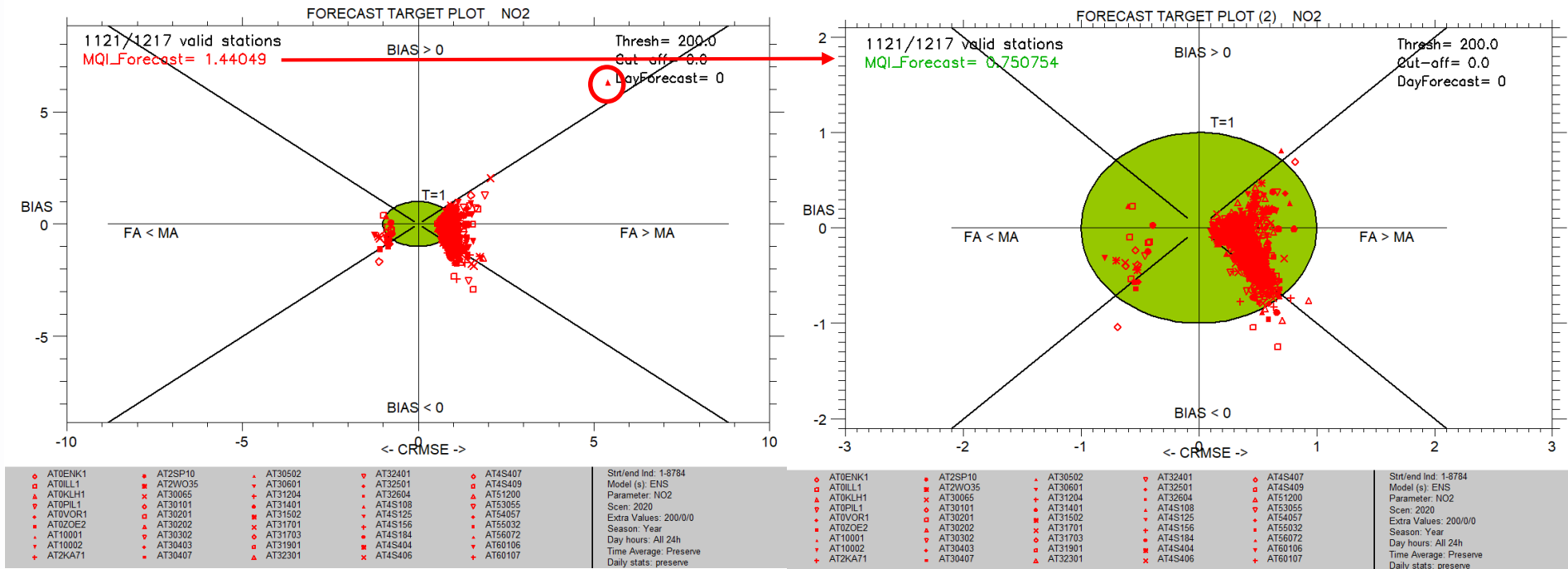


MQI_Forecast is divided by 2
One station is isolated and very far from the origin.

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- Diagram of performance  -  Lina plot



- A small amount of stations exceed the threshold over Europe.
- The isolines are difficult to interpret because here, too many points imply an overlapping reading
- *problem with the y label
- Do stations with only a few exceedances have the same weight as a station with a large number of exceedances?
- At the opposite, the Lina plot gives good indicators

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- # Summary reports for forecasts

PM10                                                    O3
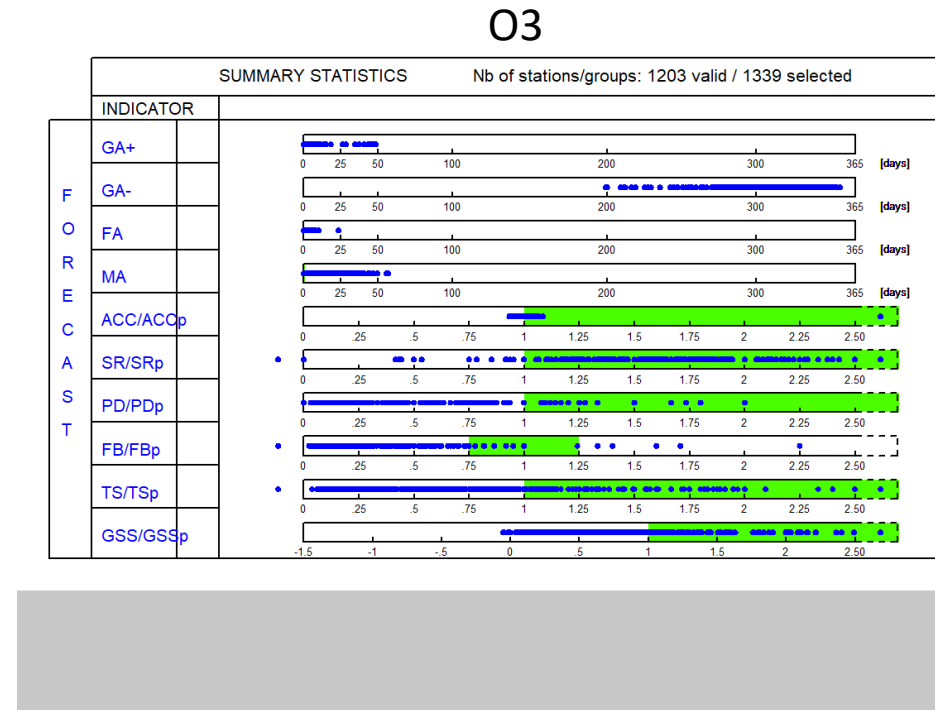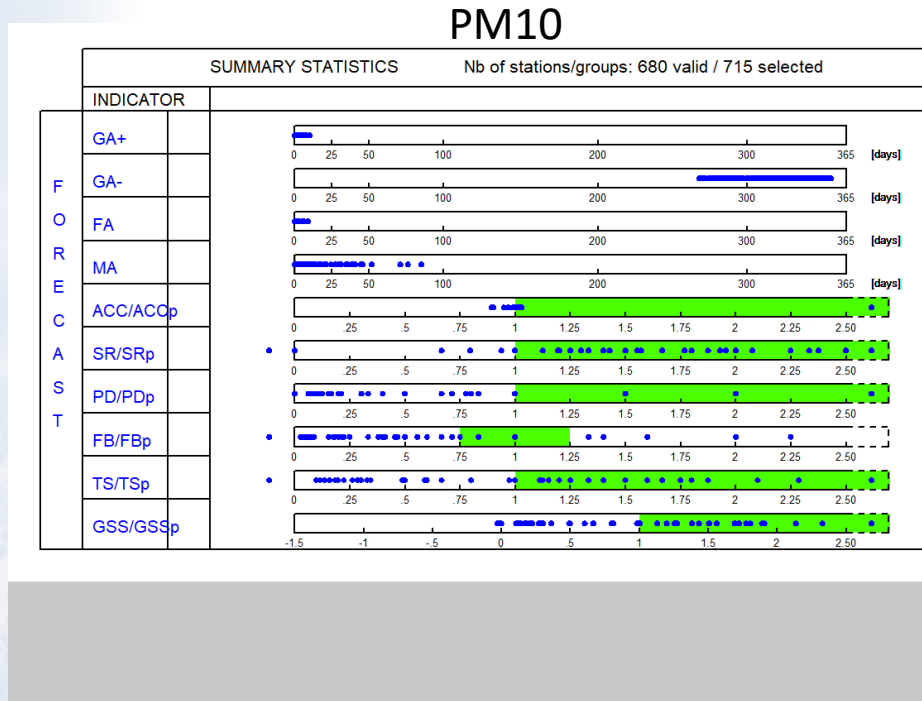


- The number of stations creates a line on the axis.
- No colored marker near to the indicator name as in the assesment report
- Difficult to interpret individually the stations : an overall point would be welcome
- Negative values ?

- Too many stations make it difficult to read and interpret the graphics.

  solution suggested during the last hackathon for the important number of stations : work with subgroups of stations by geographic area to reduce their number

- For CAMS, it will be useful to aggregate the stations to keep only one overall point to illustrate the behavior of each model.

- An output file with the individual values of each station would be welcome

- Need training sessions to learn how to use the metrics efficiently with the associated interpretations

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- Such CAMS evaluations will move into the new CAMS service CAMS2_83 – not yet attributed (soon)

  – The service will have to design how to use the Fairmode metrics over a large number of stations and forecasts to represent a synthetic overview of the performances

- The scores of the individual forecasts and of the ENSEMBLE appear to be perfectible regarding threshold exceedances.

- CAMS regional production  will strengthen its capabilities to detect threshold exceedances with:

  – A new ENSEMBLE method computation (will be introduced next year)

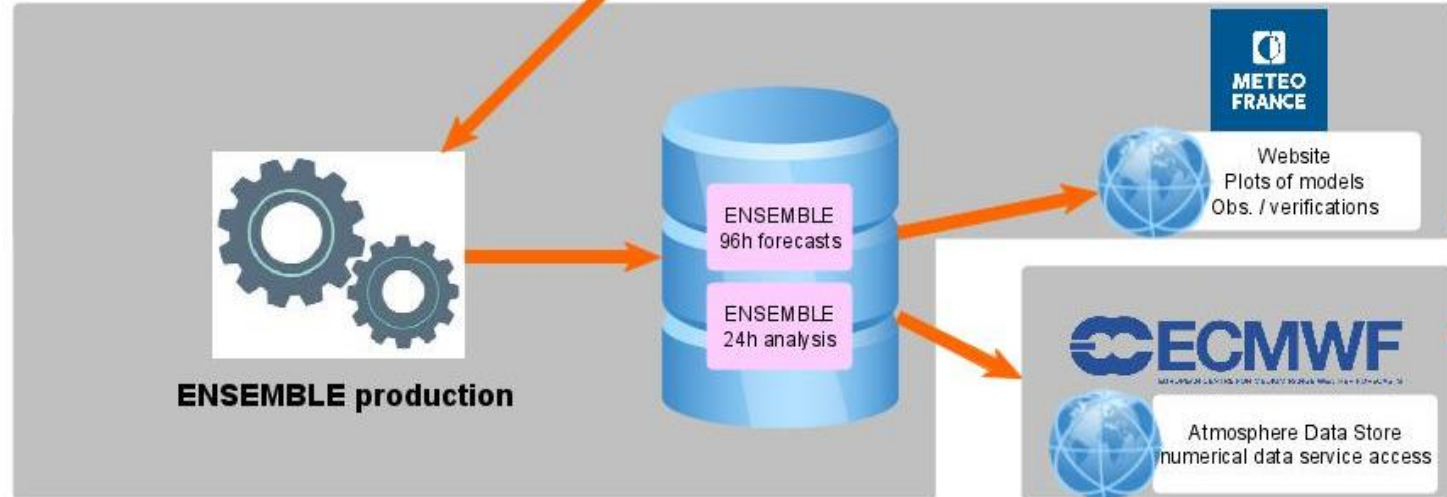  – MOS method will also be computed based on the ENSEMBLE median over European stations

THANK YOU FOR YOUR ATTENTION

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- Near Real Time Forecast (D+0,1,2,3)
- Near Real Time Analyses (E2a, D-1)

- Interim Analyses (E2a, D-20), March YY+1
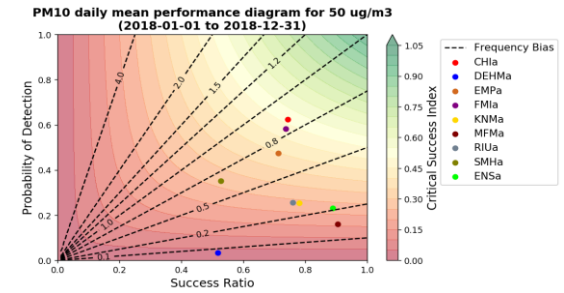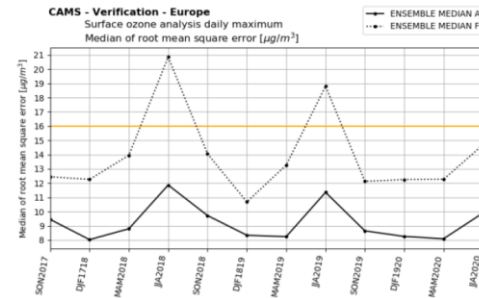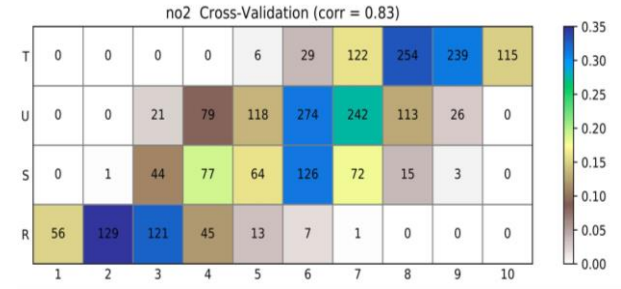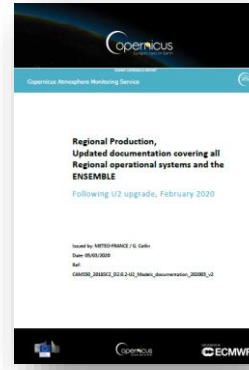- Validated Analyses (E1a), Sep YY+2

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- Quality Assurance
  - Model Documentation
  - EIONET observations

- Quality Control
  - Evaluation reports analyses
  - Continuous improvement

- Future perspectives
  - Use of FAIRMODE MQI/MQO
  - Chemical evaluation
    - Model development
    - Source apportionment