European Commission

FAIRMODE
Forum for air quality modelling in Europe

WG3 session
Forecast indicators

Fairmode Plenary Meeting

Rome - Italy, March 2-3 2023

agenda

17:30 – 17:35	A. Piersanti	Status of WG3 activities
17:35 – 17:45	M. Gauss	QA/QC of Forecast CAMS policy products
17:45 – 17:55	A. Monteiro	Future activities & links to AAQD
17:55 – 18:05		Discussion

European Commission
FAIRMODE
Forum for air quality modelling in Europe

Italian National Agency for New Technologies,
Energy and Sustainable Economic Development

European Commission

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WG3

STATUS OF WG3 ACTIVITIES

Fairmode Plenary Meeting
Rome - Italy, March 2-3 2023

Antonio Piersanti, Alexandra Monteiro, Lina Vitali

What did we achieve (2020-2022)?

- Elaborating a guidance document on the use of forecast indicators for the assessment of the quality of forecast applications.
- Testing the forecast indicators with additional datasets:

  ✓ national data

  ➢ CAMS

- Presentation at Harmo 2022

Fairmode Tech Meeting
Oslo, October 2022

Developed Methodology

MAIN FEATURES

Within the proposed formulation, Forecast Evaluation addresses three main topics

1. An overall assessment in order to evaluate if the forecast application is “good enough” based on the Comparison with the Persistence Model

2. An assessment of the model Capability in predicting Exceedances

3. An assessment of the model Capability in predicting Air Quality Indices

Comparison with the Persistence Model: Target Plot and MPI Plot

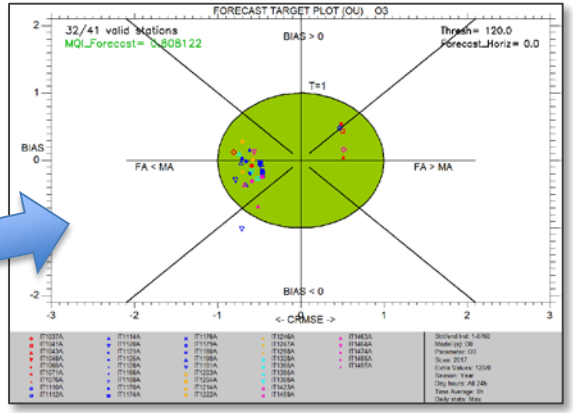
Comparison with the Persistence Model

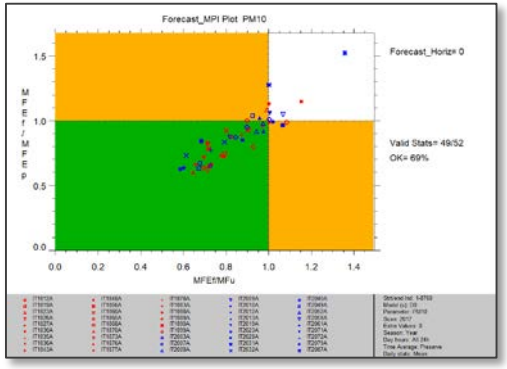
MAIN OUTCOME:
FORECAST TARGET PLOT

Formulation

$$MQI_f = \sqrt{\frac{\frac{1}{N}\sum_{i=1}^{N}(M_i - O_i)^2}{\frac{1}{N}\sum_{i=1}^{N}(P_i - O_i)^2}}$$

$$P_i = O_{i-1-FH} \pm U(O_{i-1-FH})$$





Comparison with the Persistence Model

SIDE OUTCOME:
FORECAST MPI PLOT

Formulation

$$MFE_f = \frac{2}{N}\sum_{i=1}^{N}\frac{|M_i - O_i|}{(M_i + O_i)}$$

$$MFE_p = \frac{2}{N}\sum_{i=1}^{N}\frac{|P_i - O_i|}{(P_i + O_i)}$$

$$MF_U = \frac{1}{N}\sum_{i=1}^{N}\frac{2U(O_i)}{O_i}$$

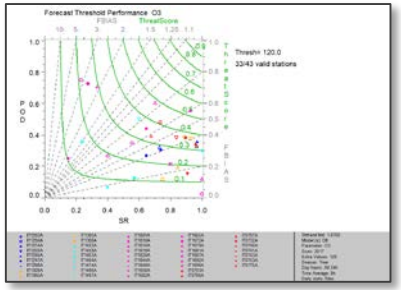
$$MPI_1 = MFEf\ /MFE_p\ (Yaxis)$$
$$MPI_2 = MFEf\ /MFU\ (X\ axis)$$

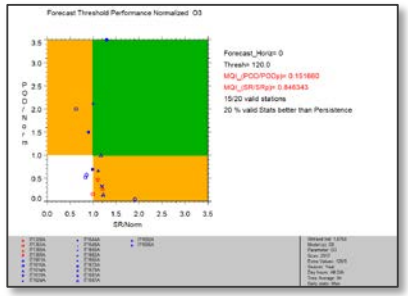
Capability in predicting exceedances

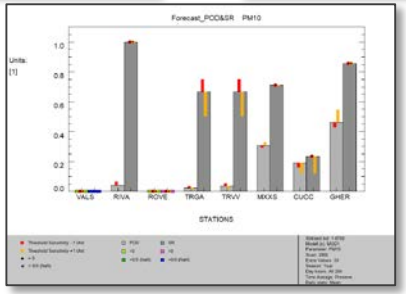
- Model performances skills in predicting Exceedances are presented in 2 plots, both with (Forecast Threshold Performance Normalized) and without (Forecast Threshold Performance) the comparison with Persistence Model ones…

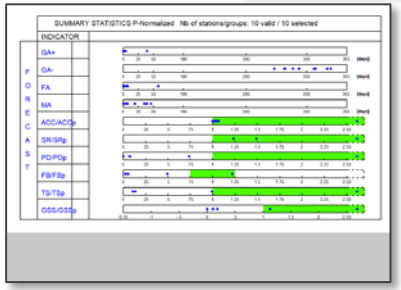
- …and are also plotted on each station, with the sensitivity to thresholds

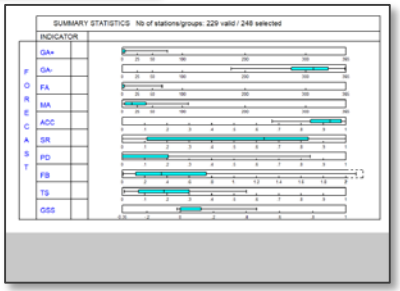
- Forecast Summary Report: a different graphical layout is applied depending on the number of stations taken into account in the analysis:
  if number of stations < 15 → “dots style”
  if number of stations ≥15 → “boxplots style”









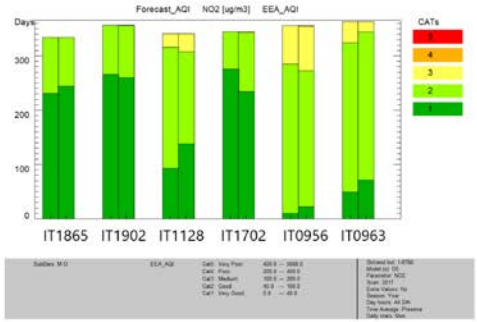


Capability in predicting Air Quality Indices

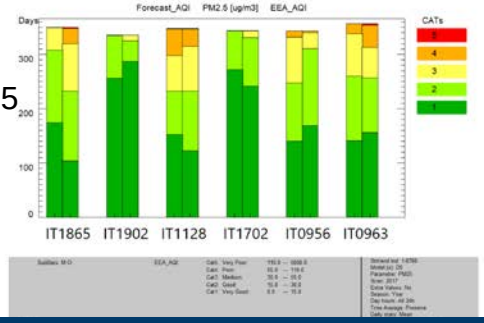
A simple multiple thresholds assessment is included in the developed approach, based on Air Quality Indices

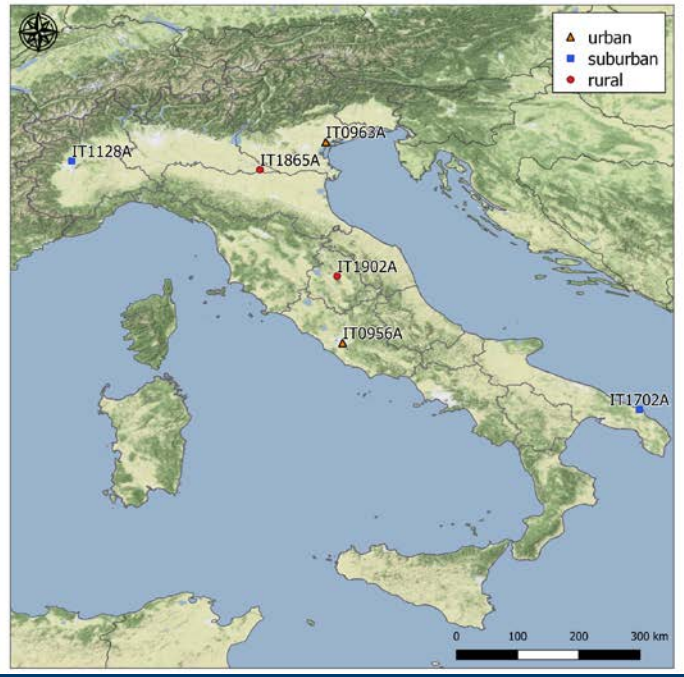
The AQI is used for public information, also an obligation under the Ambient Air Quality Directive

NO_2



PM2.5



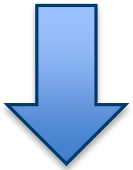


….but there is no information about the timing of the forecasted AQI levels → room for future improvement

Paper describing FAIRMODE approach on Quality control indicators for AQ forecasts

from NEWS AND IDEAS wish list at Last FAIRMODE TM (October 2022)

“the submission of a full paper is foreseen”



a paper is now ready for submission

Paper describing FAIRMODE approach on Quality control indicators for AQ forecasts

(tentative) TITLE ***A standardized methodology for the validation of air quality forecast applications: Lessons learnt from its application***

OUTLINE

- Presentation of the standardized validation methodology
- Lessons learnt from its application to validate several forecast applications across Europe
  - different modelling paradigms (CTM, IA)
  - different spatial scales (from European to very local scales) and geographical contexts (Portugal, Ireland, Kosovo, Po-valley)
- Conclusions and hints for further developments

INVOLVED TEAMS

- ENEA (National Agency for New Technologies, Energy and Sustainable Economic Development), Italy
- CESAM, Department of Environment, University of Aveiro, Portugal
- JRC (European Commission - Joint Research Centre)
- VITO (Flemish Institute for Technological Research), Belgium
- IEP (Institute of Environmental Protection - National Research Institute), Poland
- ARPAE (Regional Agency for Prevention Environment and Energy of the Emilia-Romagna Region), Italy
- ATMOTERM, Poland

WG3
future activities

Alexandra Monteiro

Air Quality Directive (AAQD)

Roadmap

Feedback period

17 December 2020 - 14 January 2021

FEEDBACK: CLOSED

Public consultation

Consultation period

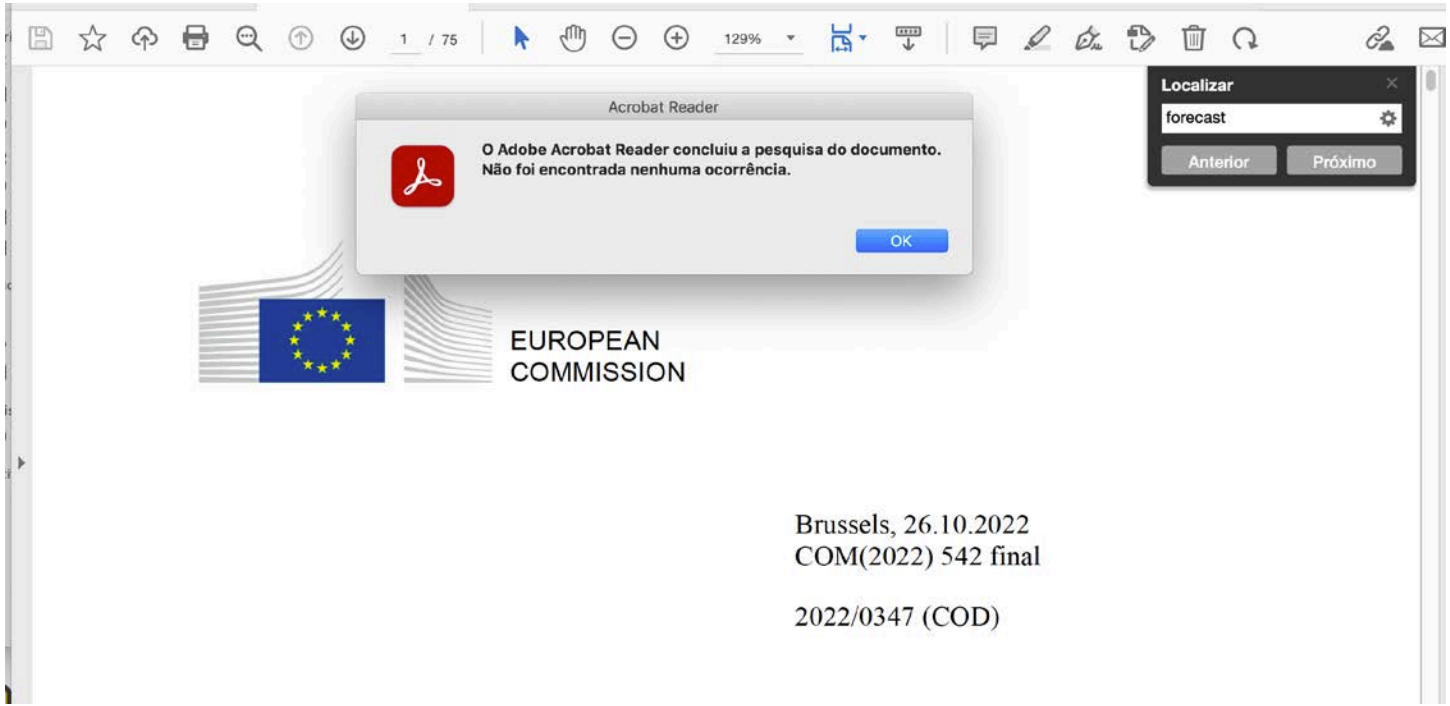
23 September 2021 - 16 December 2021

FEEDBACK: CLOSED

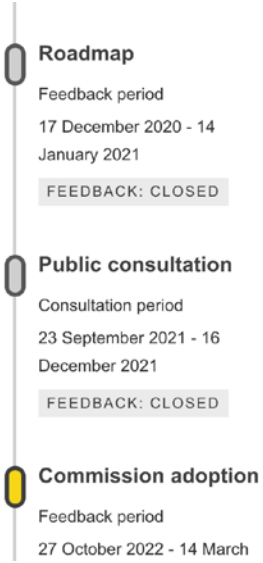
Commission adoption

Feedback period

27 October 2022 - 14 March



Air Quality Directive (AAQD)



ANNEX IX
PUBLIC INFORMATION

2. Member States shall ensure that timely information about actual or predicted exceedances of alert thresholds, and any information threshold, is provided to the public. Details supplied shall include at least the following information:

(a) information on observed exceedance(s) (...)

(b) forecast for the following afternoon/day(s):

- geographical area of expected exceedances of information and/or alert threshold,
- expected changes in pollution (improvement, stabilisation or deterioration), together with the reasons for those changes;

Same as AAQD 2018

Air Quality Directive (AAQD)

NEW

AQD now has the definition of the MQO for assessment, this will enhanche the use of Fairmode MQIs, including the one for forecast (which is not mandatory)

Roadmap

Feedback period

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FEEDBACK: CLOSED

Public consultation

Consultation period

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FEEDBACK: CLOSED

Commission adoption

Feedback period

27 October 2022 - 14 March

The modelling quality objective (i.e. MQI < 1) shall be verified at least at 90% of the available monitoring points, over the assessment area and period considered.

At a given monitoring point, the modelling quality indicator shall be calculated as the ratio of the root mean square error(s) between modelling results and measurements over the square root of the quadratic sum(s) of the modelling and measurement uncertainties, over an entire assessment period.

All fixed measurements meeting the data quality objectives located in the modelling assessment area shall be used for the evaluation of uncertainty of modelling.

For short-term mean concentrations, the maximum uncertainty of measurement data used to assess the modelling quality objective shall be the absolute uncertainty calculated using the relative value expressed in this Section, above the limit value and shall decrease linearly from the absolute value at the limit value, to a threshold at zero concentration.

WG3 Future activities

ROADMAP 2023-2025

Future WG3 activities will focus on:

1) Documenting the procedure for experts (slideshow, video, training sessions)

2a) Further testing of the indicators

2b) Assessing clarity of the output of the forecast evaluation and discussing possible tiered approach

3) Developing the AQI plots in view of improving the communication of results to non-experts

4) Developing an open and user-friendly software platform

WG3 Future activities

Trainning workshop (online)

- Purpose: Testing the DELTA-tool FORECAST with your own forecast data
- Date: Spring/Summer (before Technical meeting)
- Trainers: Kees(?)/ Lina/Alexandra/Antonio

Who would be potential interested on this training session?

Slido

Participants can vote at Slido.com with **#3718891**

or anytime at

https://app.sli.do/event/cKan7oViagwto5Ct4emKre