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Date: 15/05/2024 10:20:39

Green Book 2024 - aka Use and verification of ECMWF products in the Member and Co-operating States

Fields marked with * are mandatory.

Introduction

Welcome to ECMWF new "Green Book" online submission system (aka "Use and verification of ECMWF products in the Member and Co-operating States")

This time we have two options for completion:

- Filling out the online questionnaire below (new for this year based on feedback from the Meteorological Representatives meeting in November 2023)
- Producing a single report offline (as done in previous years), and emailing the report as detailed in Section 1.

Both methods ask the same questions, however the questionnaire method requires no formatting and aims to make analysis of all responses easier. The questionnaire option also allows you to part-complete, and save your entries to come back to later (using the "Save as Draft" button in the top right corner of this page). Note that the EUSurvey page will timeout after 60 minutes of no activity, responses are usually saved however to be sure please "Save as Draft" to avoid losing responses.

The deadline for all submissions is 23:59UTC on Wednesday 15th May 2024

A summary of responses will be presented at UEF2024 with a summary report available in the ECMWF Publications library in due course.

Section 1: Background - please fully complete

* **1.1 Which Country is your submission for?**

FI - Finland

* **1.2 Please provide your name(s)**

Anssi Vähämäki

* **1.3 Please provide your organisation**

Finnish Meteorological Institution

* **1.4 Please select your preferred submission method:**

- ( ) Producing a single report offline
- (•) Online questionnaire

Online questionnaire

Please answer the following questions, and illustrate your answers, where appropriate, by also uploading clearly annotated images with image/figure numbers (max 1MB per file). More questions or options may appear, depending on answers to particular questions. Mandatory questions are marked with a '*'. Free text boxes appear to have a 5000 character limit (if your answers are longer than this please email them to Becky and they will manually added), answers don't need to fit the box size given, the boxes expand.

Responses to the questionnaire can be saved and returned to at a later date before submitting. To do this click the 'Save as Draft' button on the left, this will provide you with a link which you can return to to continue /complete your submission.

Section 2: Summary of major highlights

* **Please detail major highlights since January 2022**

You may wish to complete this section at the end, after completing all others**.**

ECMWF model is still the backbone of FMI production especially from lead times 2 day forward. We are still in general happy with the model performance. We are pleased to see the higher resolution of ensemble forecasts and in our northern latitudes for example the effects of multi layer snow scheme.
Major changes in many areas include nowadays development of AI/ML techniques and that applies also already some parts of FMI production. We are very pleased to see that ECMWF is active in the field of AI.

Section 3: Forecast products

3.1. Please outline what direct use you make of standard ECMWF model products (on ecCharts / OpenCharts / own workstation), for operational duties, in the following 4 categories (noting that new AI model output should be dealt with separately, via question 3.4).

* **a) Medium Range (e.g. for high impact weather forecasting)**

ECMWF is the backbone of FMI weather production especially in lead times from 2 days forward.

*** b) Extended Range (monthly)**

FMI updates every Friday an extended forecast for the next four weeks, based on ECMWF monthly forecast, as a short text outlook to its website: https://www.ilmatieteenlaitos.fi/pitkan-ennusteen-seuranta

FMI publishes extended range forecasts every months for temperature anomalies and absolute weekly average values, based on ECMWF extended range (weekly) forecasts as a result of the SA CLIPS project, which FMI conducted with support of ECMWF. Other weekly impact outlooks were also developed but they have not been used in FMI production pipeline yet. Example of the regularly produced Climate Bulletin and the extended range outlook prepared on page 22 can be seen at Ilmastokatsaus 2/2024 by Ilmastokatsaus, Ilmatieteen laitos - Issuu This product is managed and updated from the Research Performing Units of FMI.

*** c) Long Range (seasonal)**

FMI updates every Friday a long range forecast for the next three months, based on ECMWF seasonal forecast, as a short text outlook to its website: https://www.ilmatieteenlaitos.fi/pitkan-ennusteen-seuranta

FMI earlier also updated a seasonal outlook via WMO Regional Arctic Climate Centre Nordic Node | Arctic Regional Climate Centre Network (arctic-rcc.org) and this outlook is based on the product that has been designed for ice breakers operating in the Baltic Sea region.

*** d) CAMS and Fire-related output (ecCharts mainly)**

-

3.2. ECMWF cycle 48r1 went live at the end of June 2023. Changes included a much higher resolution medium range ensemble, and much more frequent monthly forecasts.

*** a) Please describe any positive impacts of model cycle 48r1 for your service**

We have updated our operational products to utilize a more precise horizontal resolution in ensemble forecasting for surface parameters.

Multi-layer snow scheme (!?) seems to improve temperature in very cold situations when we compare winter 2023-2024 to previous winter. MEPS is still better, however (fig1 and fig2)

Visibility has improved, especially the amount of major errors in aviation. Model still has a bias of forecasting greater visibility but it's less common in 48r1 (fig3). Extra information is provided in pdf1 and pdf2

If you have any annotated graph/diagram/plot that would help clarify your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

9321fedd-899e-45a6-ad7a-bc23237fa1db/Fig1.png
0f8b558a-7460-4821-a082-1cd955b072d6/Fig2.png
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7a1881c3-36cd-47fa-a642-b7b9e9ae2d83/pdf1.pdf
422534d7-2914-4c7f-a201-1072d28ab94a/pdf2.pdf

* **b) Please describe any negative impacts of model cycle 48r1 for your service**

The increased spatial and temporal resolution has significantly increased the amount of data, which has also slowed down the post-processing of the data. There's a trade off with how precise data the users want and how long they can wait to get the data in use. As a result, we are not yet utilizing the more precise resolution across the entire ensemble forecast, but only the better horizontal resolution for surface parameters.

If you have any annotated graph/diagram/plot that would help clarify your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

* **c) Have you noticed any systematic changes in forecast output since model cycle 48r1 was implemented?**

- ○ Yes
- ◉ No

* **3.3: Do you modify ECMWF model output to create 'derived fields' (e.g. post-processed output, regimes, probabilities).**

- ◉ Yes
- ○ No

Please describe what you modify and how

ECMWF data is visualised for forecasters at FMI in house made workstation SmartMet. ECMWF is base data for FMI official production, at least in lead times from 2 days forward, often also in the first two days. Forecasters are able to manually edit the gridded model output using SmartMet workstation.

We also produce derived quantities from ECMWF raw model fields, that the model does not directly predict, to support meteorological work and to forecast weather impacts. Many of these methods are developed by forecasters. From ensemble information, we calculate probabilities for predefined thresholds and fractals for forecasters.

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

* **3.4: Do you currently use Artificial Intelligence (AI) and/or Machine Learning (ML) techniques in your service, in conjunction with standard ECMWF model output?**

- (●) Yes
- ( ) No

Please describe any such techniques and/or any future plans you have in this area

We have used Model Output Statistics (MOS) method for years in our operational production to post-process ECMWF temperature, min/max temperature and dew point temperature over European domain. We are also using EMOS to calibrate ECMWF ENS temperature forecast.

The nowcast part of our operational forecast is produced by utilizing multiple parameter-specific methods. We are using data from a limited-area model (MEPS) as a background information of our observation based methods, due to its better horizontal resolution (~2.5km) compared to ECMWF. We employ ML/AI methods operationally in nowcast for total cloudiness, with forecasts based on a neural network trained on satellite data. Additionally, we have a gradient boosting random forest-based error correction method for several key parameters. The nowcast forecast (0-12h) is seamlessly blended with 10 day forecast data which is based on EMCWF forecast and manually edited by forecasters.

We have also developed several ML/AI methods to do impact based forecasting for several use-cases.

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

* **3.5: Does your NMHS use ECMWF data for modelling purposes - e.g. by providing initial/boundary conditions for limited area model runs, or for hydrological models, or for dispersion models, etc...**

- (●) Yes
- ( ) No

Please describe these activities

FMI uses ECMWF data as lateral boundary conditions in operational NWP runs and research experiments based on the HARMONIE limited-area model. The operational activity is in collaboration with other countries within the MetCoOp project. Both the HRES and IFSENS data streams are used for this purpose.

Finnish environment institue uses ECMWF's ensemble forecasts (2 weeks and monthly forecast) in operational hydrological forecasting in Finland. As a result, hydrological model generates ensemble forecasts for water level, discharge and other hydrological variables. The beginning (about 4 days) of the two weeks temperature forecast is bias-corrected towards FMI's official 10 days forecast.

Additionally, Finnish environment institute uses ECMWF's seasonal ensemble forecasts in experimental hydrological forecasts. By the verification done, seasonal forecasts are not as good input for the model as historical weather data (climatology). Operational hydrological forecasts are done as long as one year to the future (or even longer), and in operational forecasts climatology is used as input of the model after monthly forecast ends. (After 4 weeks from current date). Our verification has not been very comprehensive and

continuous numerical verification is mainly based on medium forecasts only (probability distributions of the forecasts are verified mainly visually and non-systematically).

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

* **3.6: In the last year or so ECMWF has made available, on ecCharts and OpenCharts, selected fields from AI models (e.g. Pangu Weather, AIFS). Were you aware of this?**

- (●) Yes
- ( ) No

* **a) What are your views on this initiative?**

We are pleased that ECMWF has been active in AI development.

* **b) Do you currently use AI forecasts for operational purposes?**

- ( ) Yes
- (●) No

What would you need in order to use AI models in your forecast activities?

We are not using data-driven AI models (AIFS or models developed by tech companies) in operational production, but we have been running Pangu weather as an experiment in operational like setting since last summer and we have made the real-time data available for forecasters in meteorological workstations and we have been verifying the forecasts against Finnish observation stations. The results of the experiment were presented in AMS annual meeting.

If we think about global data-driven AI models, we would need to have the model weights or the data from a reliable source. And we would need the model to produce more parameters, with similar resolution as global physics-based NWP models. And we would need to have knowledge that the AI model is adding value compared to traditional NWP and that the AI output is reliable.

Section 4: Verification

ECMWF does extensive verification of its products in the free atmosphere. However, our verification of surface parameters is more limited and can be constrained to only using synoptic observations. More detailed verification of these surface weather parameters by National Services is always valuable to us. We are most interested in results for the last 1 or 2 years. Also, any evidence you have of performance changes since the introduction of cycle 48r1 would be very valuable.

*

4.1 Do you routinely verify raw model output from ECMWF model(s) and/or other operational models /ensembles?

- (●) Yes
- ( ) No

Please describe your verification activities and show and discuss related scores in the the two lead-time categories shown below, including, where possible, comparisons with your own models /ensembles, and other models/ensembles.
Ideally focus on surface weather parameters in your own territory. Inclusion of conditional verification results is also strongly encouraged - e.g. stratification by a weather type - as these can provide very useful insights into model weaker points.

a) Short Range and Medium Range

FMI follows internally (some of these are also reported to our guiding ministry) among other following verification scores:
temperature 24h hit rate, temperature 24-120h hitrate, forecaster added value compared to raw model data in 24h temperature forecasts (separately followed min/max temperature hitrate and hourly temperature hit rate from Synop hours). The definition for temperature "hit" is constant when temperature is higher than zero, otherwise it is adjusted to take into account climatological variability ie. when it is cold the range for "hit" is larger. This is done because metrics is for administrative purposes. And hit rate for wind warnings at sea areas. We also have hit rate value for aerodrome forecasts.

As betametrics, among others, we follow temperature hit rate near zero and for example forecaster added value in aerodrome forecasts compared to auto TAF based on raw model data.

In the fi4 and fig 5 is shown FMI forecaster T2m hit rate for 24hour forecasts for min/max (fig4) and for synop hours (fig5). Shown data is ECMWF raw model hit rate, MEPS hitrate, SmartMet (=forecaster) and MOS calibrated ECMWF data. Comparison is done against 30 Finnish observationstations, which are selected round the country and are supposed to be located in meteorologically representative places.
In fig6 is shown verification score (ROC2) for wind warning at sea for the warning threshold 17 m/s.Shown data is for SmartMet (= forecaster), ECMWF and MEPS.

In metcoop framework ECMWF and MEPS (harmonie) raw output is continuosly verified against each other since MEPS aims to improve over ECMWF. MEPS is usually better when it comes to parameters like t2m, precipitation, wind, gust and cloudiness but ECMWF is often better when it comes to humidity, visibility and often cloud base. There is some variation from month to month. Ensemble verification reflects same results with deterministic. Extra information is provided in pdf3.

In Aviation and Military Weather Services we write biweekly reports for our forecasters. In these reports we compare MEPS, DWD's EU-ICON and ECMWF aviation related parameters, mainly ceiling and visibility. We analyze the models' biases and hit-rates based on the aviation rule-set, and focus on major errors with short case studies.

Concerning hydrological models Finnish environment institute doesn’t verify raw output, only hydrological forecasts where ECMWF products are used as input.

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

70d4327b-a24c-46e8-ba0d-1ddd5f5eaf8b/Fig4.png
bea8df6b-36ba-4eb6-ae32-704d7ab82063/Fig5.png
f9413f8d-0a92-48d9-a922-69405108ebd7/Fig6.png
60de1ed0-0f07-4a4c-8ed1-d5b21a4e8ef7/pdf3.pdf

b) Extended Range (Monthly) and Long Range (Seasonal)

-

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

* **4.2 Do you routinely verify post-processed products and/or tailored products delivered to users?**

- (●) Yes
- ( ) No

Please describe these activities and show and discuss related scores

One example of these activities is AUTOTAF verification. We have a robust AUTO-TAF product which generates a common aviation related short-term forecast, TAF. This product is generated from various post-processed parameters. However, in this graph we have plotted only the combination of visibility and ceiling. AUTO-TAF is not delivered to customers directly but can be a good initial guess for forecaster to start their work.

Each month is an average of hundreds of single forecasts scored between zero and ten. A perfect forecast gets a score of ten. With this graph we can compare the models (MEPS, ECMWF) AUTO-TAF scores and the published (man-made) TAFs score. Based on these scores we can see that MEPS is most of the time better than ECMWF, and that forecasters provide a significant added value (Fig7)

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

e4aae251-2d54-4790-a2e8-6e942c896e4a/Fig7.png

* **4.3 Do you perform any subjective verification of forecasts?**

- (●) Yes
- ( ) No

Please describe and illustrate any activities and results in this area

For example in Aviation and Military Weather Services we write biweekly reports for our forecasters. In addition to statistical verification we include subjective verification as well. The subjective verification is based on the subjective scores given by forecaster after each shift.
In the Aviation and Military Weather Services' biweekly report we include brief case studies and communicate about the models' systematic errors. For example the ECMWF's tendency to forecast too widespread stratus on the wintery high pressures, and all models missing the stratus formation near coast in southern flow during early autumn. We hold 2-3 times a year a discussion session about our findings open for all FMI staff.

On the other hand case studies are collected and presented in MetCoop framework, mostly in order to compare MEPS to ECMWF performance. There are four feedback sessions per year where forecasters present their experiences and case studies and verification to developers.

Finnish environment institute does subjective verification for the hydrological forecasts.

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

4.4: Case Studies. Please describe and illustrate any case study verification you have undertaken. Examples of both good and bad model performance are welcome. Severe weather events (and non-events) are of particular interest to us.

a) Case Study 1 - Please describe the forecast(s) and what happened

ECMWF forecasts too widespread low clouds and too low ceiling in general during the cold winter high pressures. The model performs poorly and from aviation point of view, this is currently the biggest problem with the model. Here is a sample of typical performance. See fig8

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

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4a2656a5-a0d1-443b-949f-106730ef6480/Fig9.png

Case Study 1 is an example of:

- ○ Good model performance
- ◉ Bad model performance
- ○ Mixed (good and bad) model performance
- ○ Other (please describe above)

Add another Case Study?

- (●) Yes
- ( ) No

b) Case Study 2 - Please describe the forecast(s) and what happened

ECMWF forecasting freeing rain reasonably wel

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

4cce9cd2-687c-4e25-b76a-8b471b52e3c7/FreezingRain.pdf

Case Study 2 is an example of:

- (●) Good model performance
- ( ) Bad model performance
- ( ) Mixed (good and bad) model performance
- ( ) Other (please describe above)

Add a third Case Study?

- (●) Yes
- ( ) No

c) Case Study 3 - Please describe the forecast(s) and what happened

Exceptionallyheavy rain was not well predictedby ECMWF, it wasunderestimation and the low pressure also took more westerly route

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

bb266133-64c7-4364-a3c8-7a5c3956c638/HeavyRain.pdf

Case Study 3 is an example of:

- ( ) Good model performance
- (●) Bad model performance
- ( ) Mixed (good and bad) model performance
- ( ) Other (please describe above)

Add a forth Case Study?

- (●) Yes

- ○ No

d) Case Study 4 - Please describe the forecast(s) and what happened

ECMWF often cloudier than reality in winter

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

0551c58f-60f7-4b01-af99-67f603448c25/ECMWF_too_cloudy.pdf

Case Study 4 is an example of:

- ○ Good model performance
- ◉ Bad model performance
- ○ Mixed (good and bad) model performance
- ○ Other (please describe above)

Add a fifth Case Study?

- ○ Yes
- ○ No

Section 5: Output Requests

5. Please describe, and illustrate if necessary, any particular requests you may have for new or modified ECMWF products.

a) Product request 1 - title / summary

-

Product request 1 - description of request

-

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

Add another Product Request?

- Yes
- No

Section 6: References

6. Are there any recent internal or external publications that relate to the questions in this survey? Please list them including the respective link/s. For any publications that cannot be readily downloaded via a link please attach a copy below (or email Becky Hemingway (becky.hemingway@ecmwf.int) and Tim Hewson (timothy.hewson@ecmwf.int) if too large to upload here).

16A.4 - Exploring the Potential of Data-Driven AI Models for Operational Weather Forecasting in Finland
https://ams.confex.com/ams/104ANNUAL/meetingapp.cgi/Paper/432199

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

Section 7: Additional comments and Feedback

7.1. Please use the box below if you have additional comments on topics that have not been covered in any of the questions above

-

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

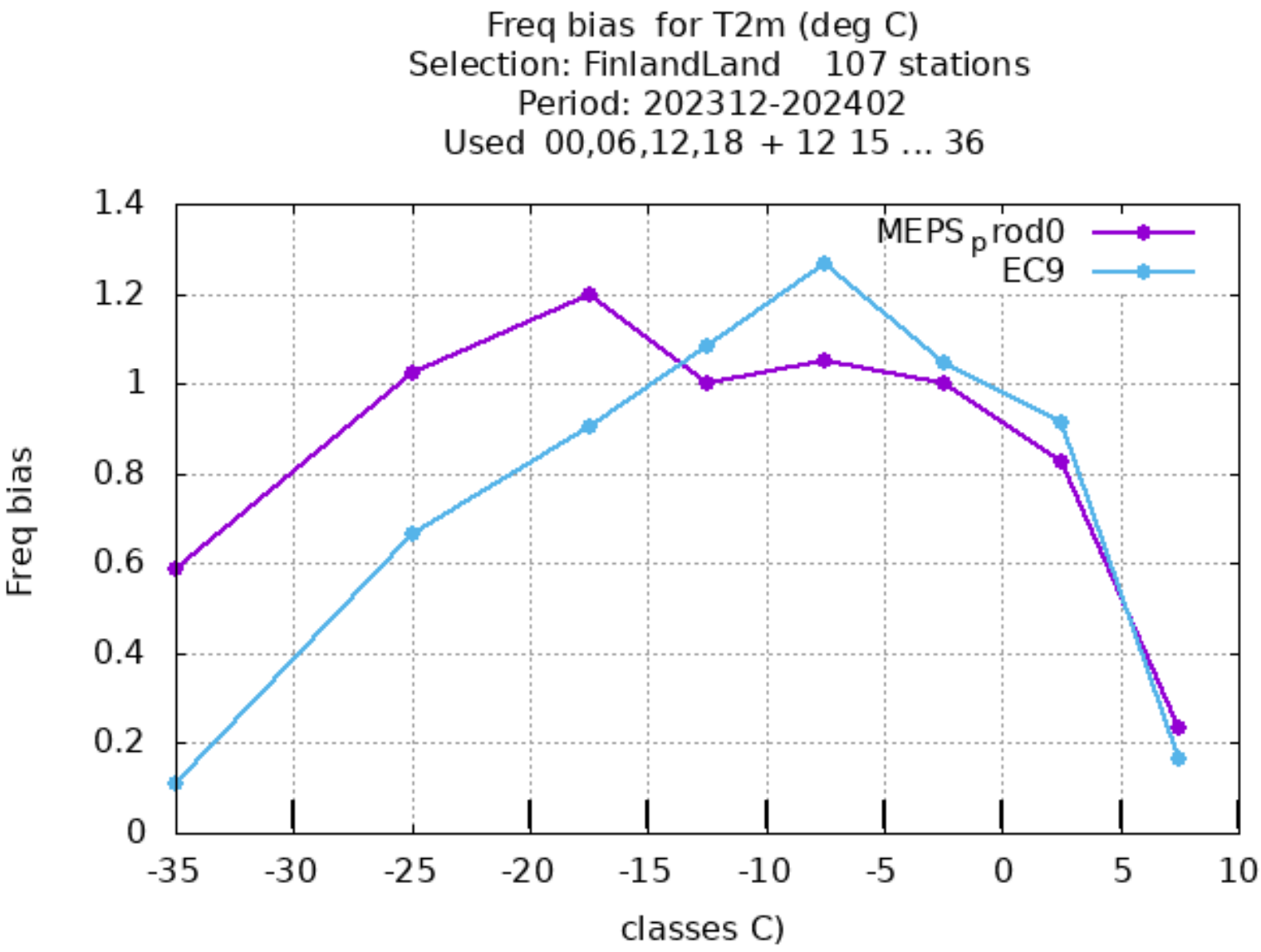
7.2. This is the first time we have used a survey style structure for Green Book submissions. You thoughts and feedback on this process are very welcome

-

Thank you for taking the time to complete your Green Book report. Your feedback and comments are very valuable to us!

Contact

Contact Form


Freq bias for T2m (deg C)
Selection: FinlandLand 107 stations
Period: 202312-202402
Used 00,06,12,18 + 12 15 ... 36
MEPS_prod0
EC9
Freq bias
classes C)
1.4
1.2
1
0.8
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0.2
0
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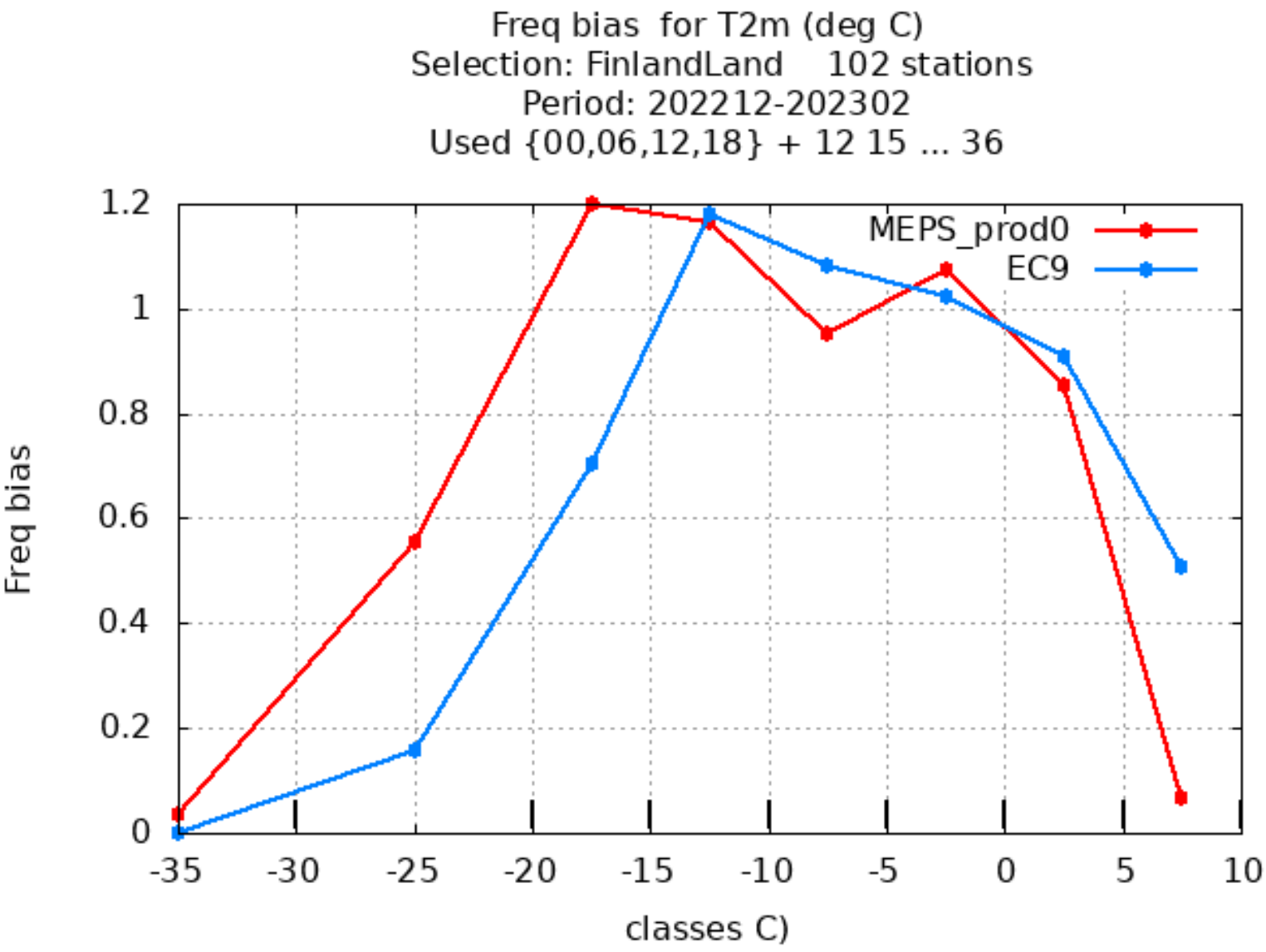
Freq bias for T2m (deg C)
Selection: FinlandLand 102 stations
Period: 202212-202302
Used {00,06,12,18} + 12 15 ... 36
MEPS_prod0
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1.2
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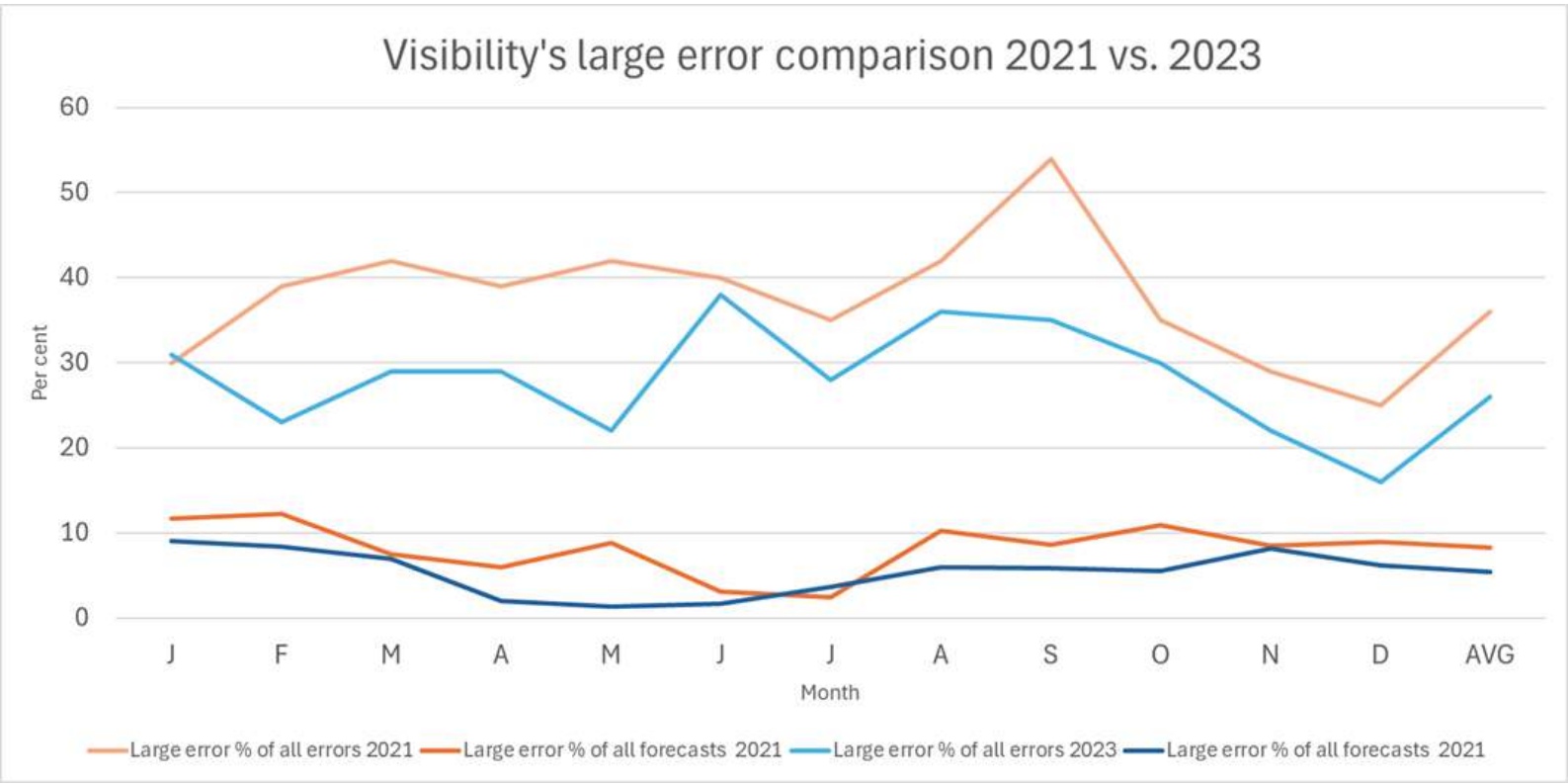
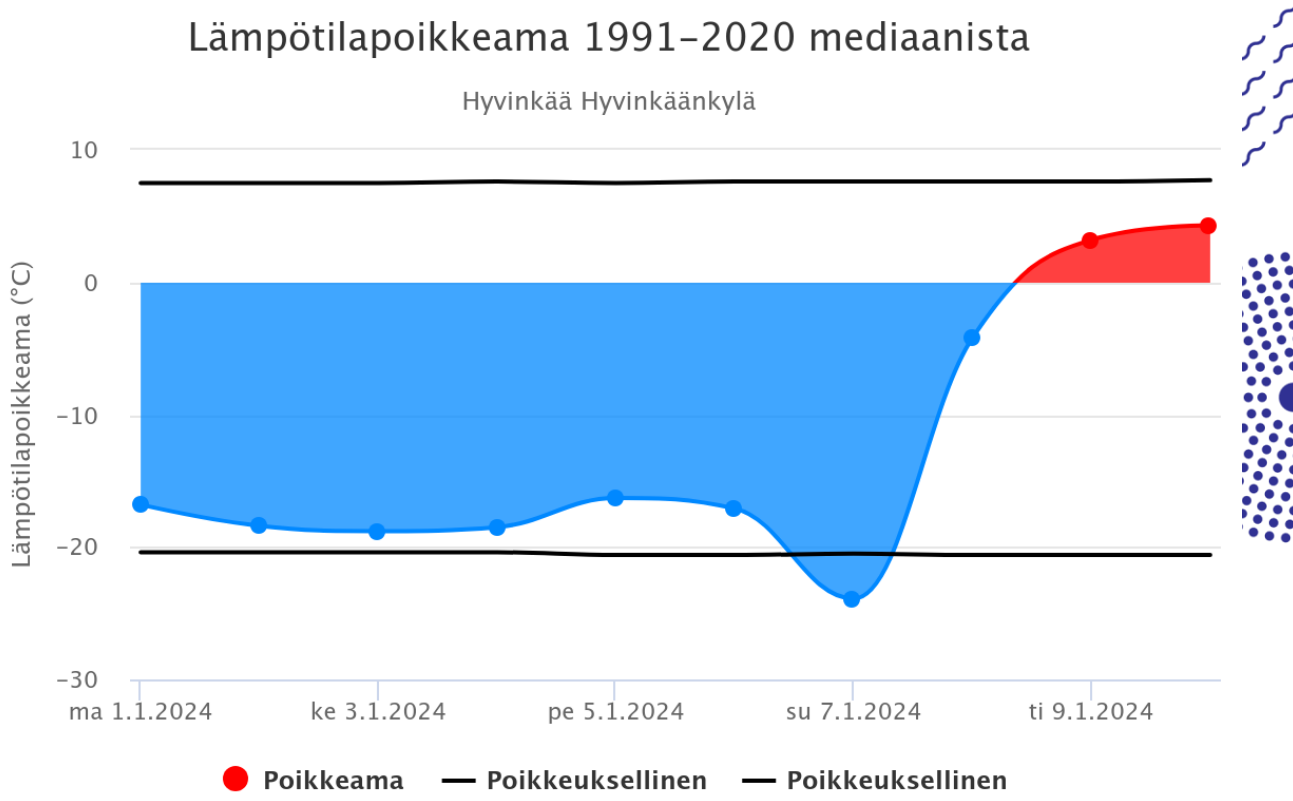

Visibility's large error comparison 2021 vs. 2023
60
50
40
30
20
10
0
Per cent
J
F
M
A
M
J
J
A
S
O
N
D
AVG
Month
Large error % of all errors 2021
Large error % of all forecasts 2021
Large error % of all errors 2023
Large error % of all forecasts 2021

Verification

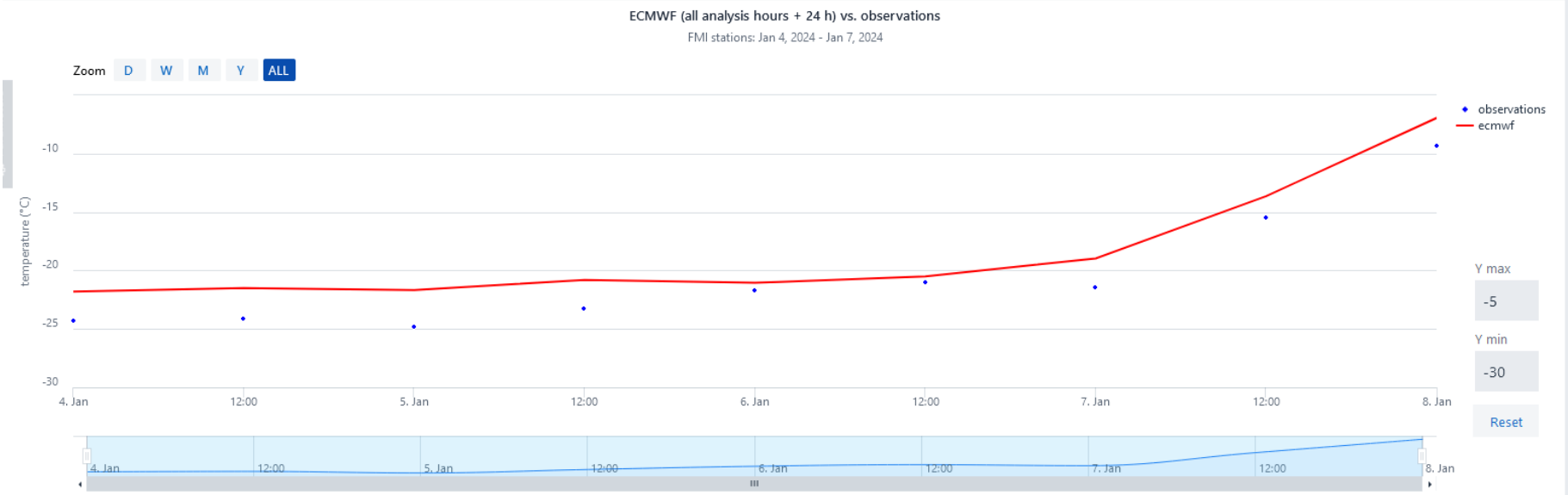
A very cold period 2nd Jan – 7th Jan

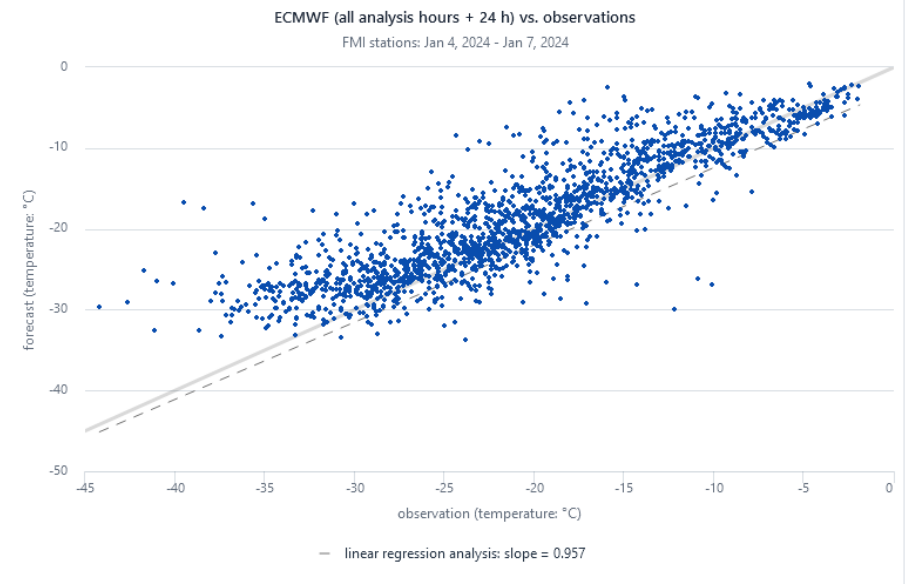
-colder than average december-january

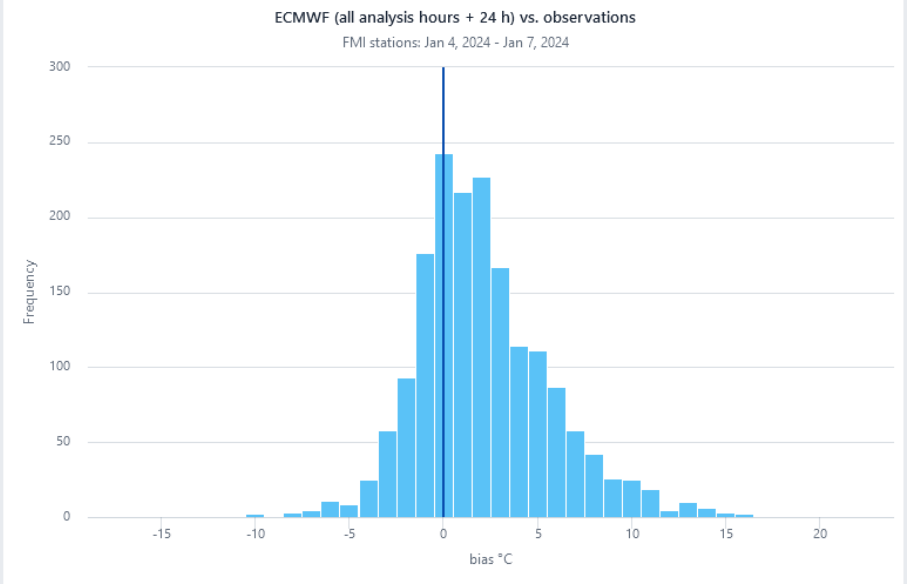


ECMWF

- Too warm
- On average two to three degrees too high







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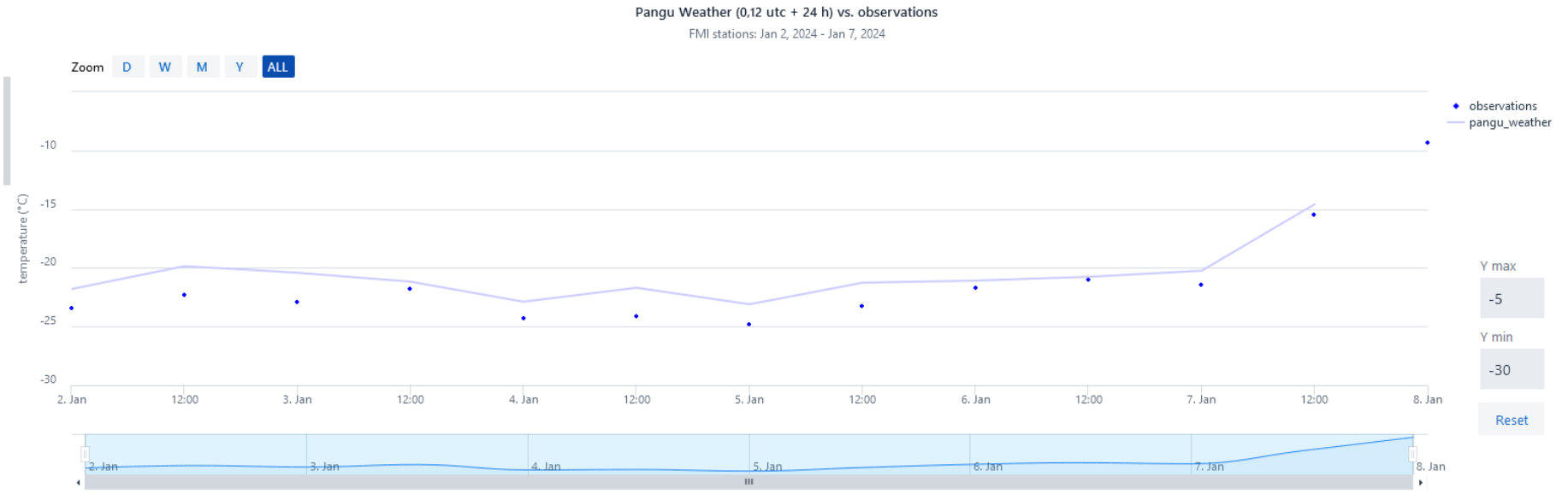
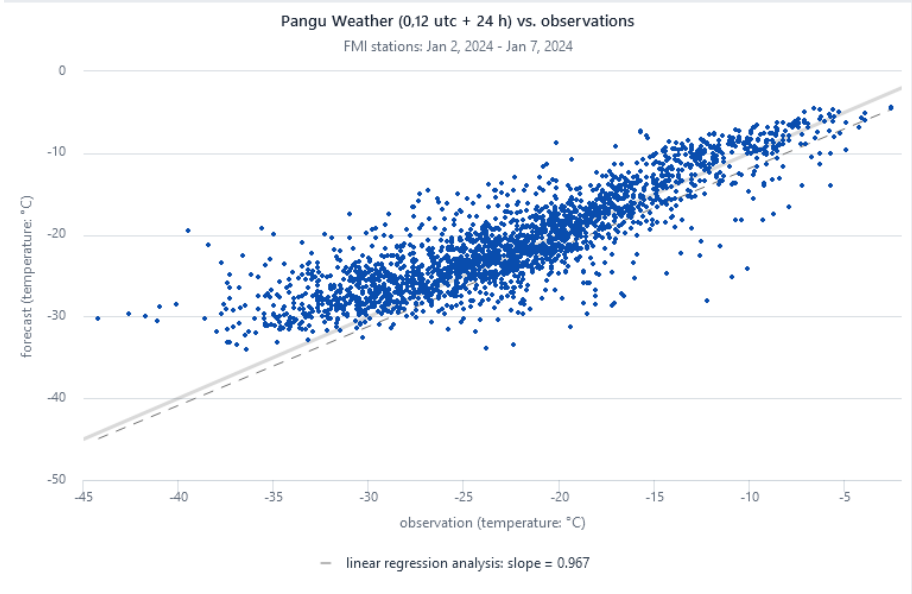
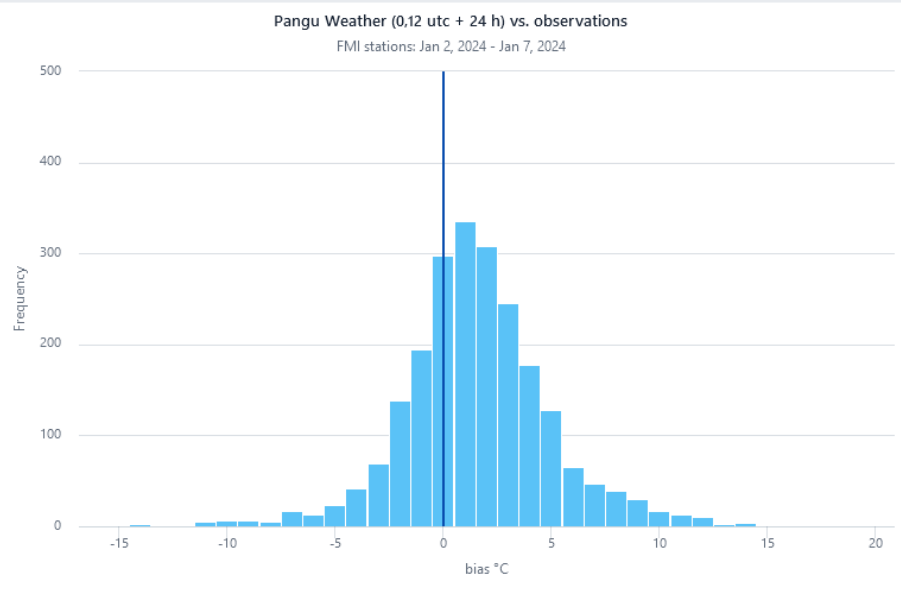
FINNISH METEOROLOGICAL INSTITUTE

Pangu weather

- Too warm
- Average error two to three degrees- comparable to ECMWF







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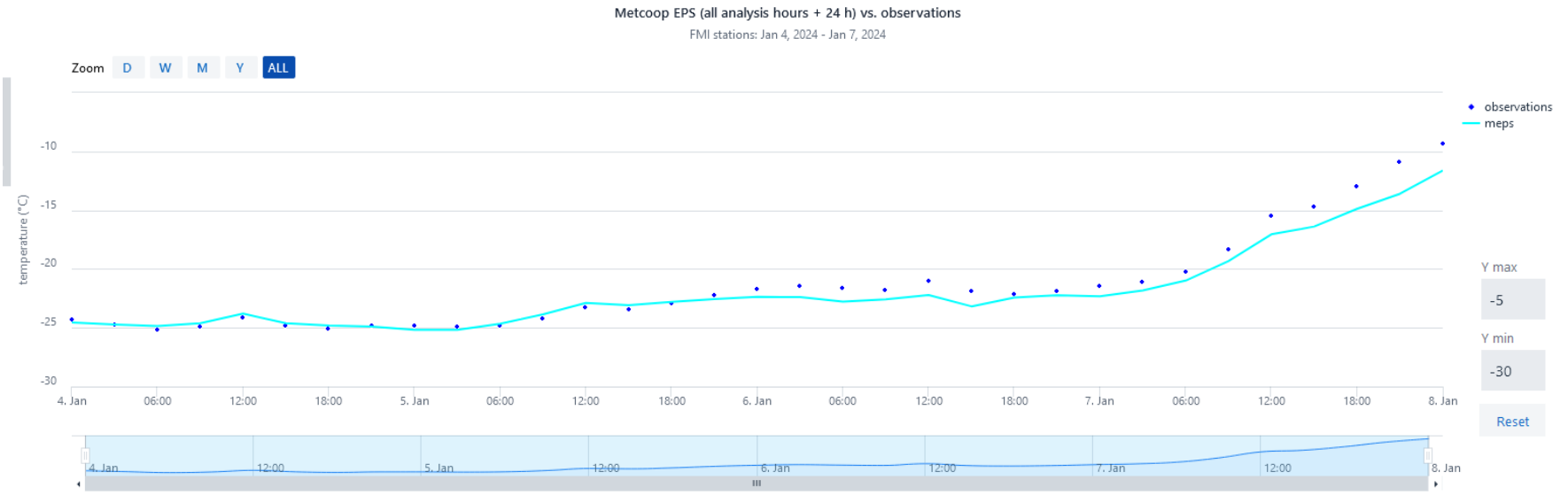
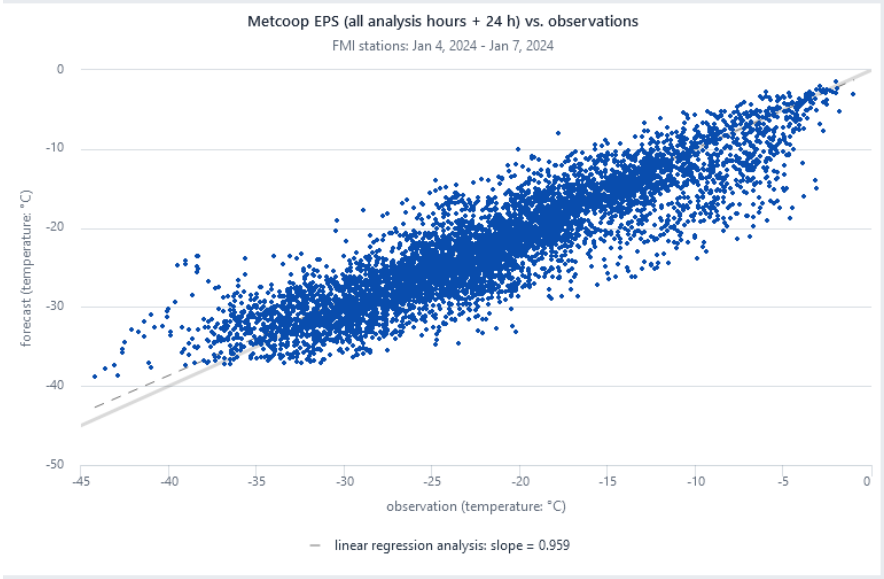
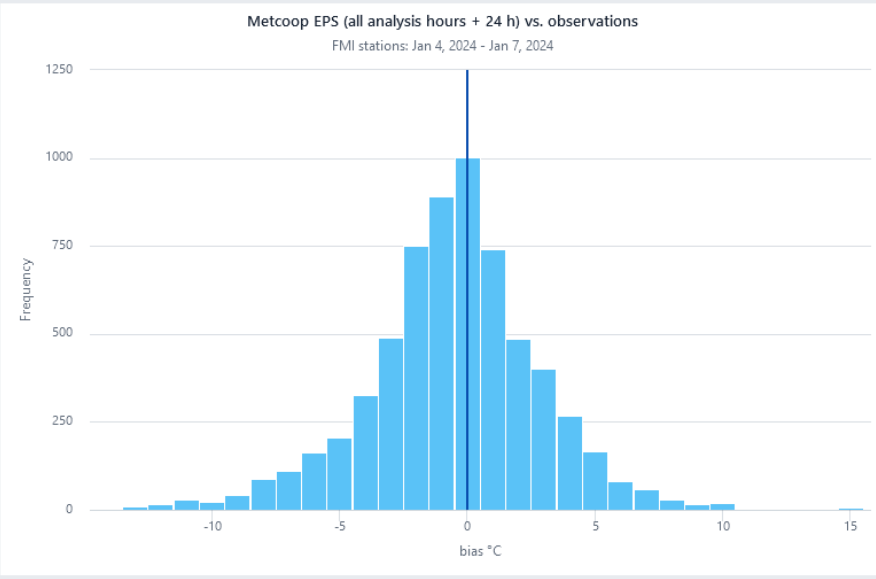
MEPS

- Really good mostly
- In the end of cold event too cold
- Average error one degree too low







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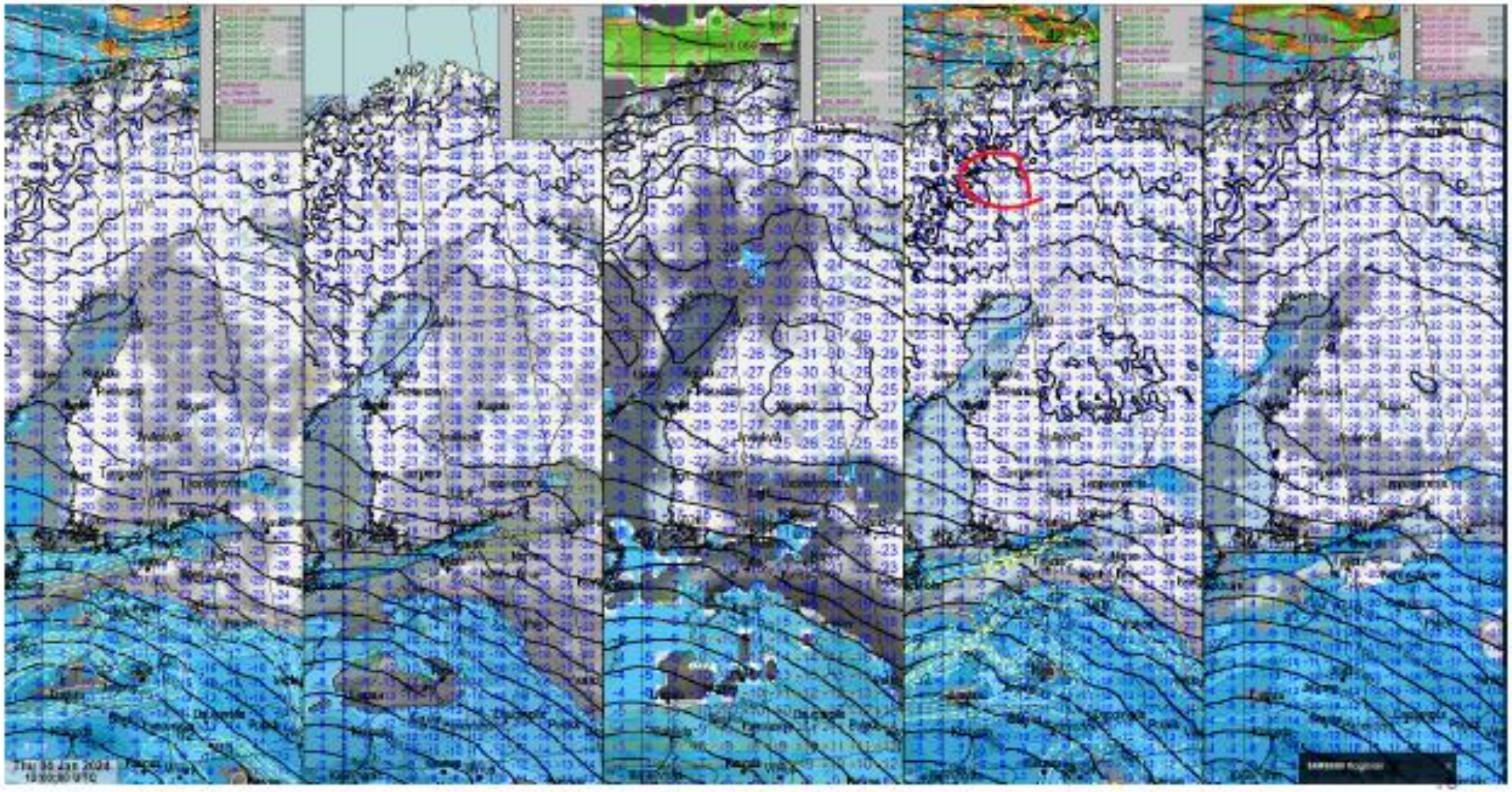
Notes regarding temperature

- A very cold period well forecasted by MEPS
  - ECMWF and Pangu weather too warm
  - However, error (positive bias) much smaller than before – thanks to the multi layer snow scheme?
- In November too warm while too clear (compared to obs), ECMWF colder but cloudier – non-intuitive result

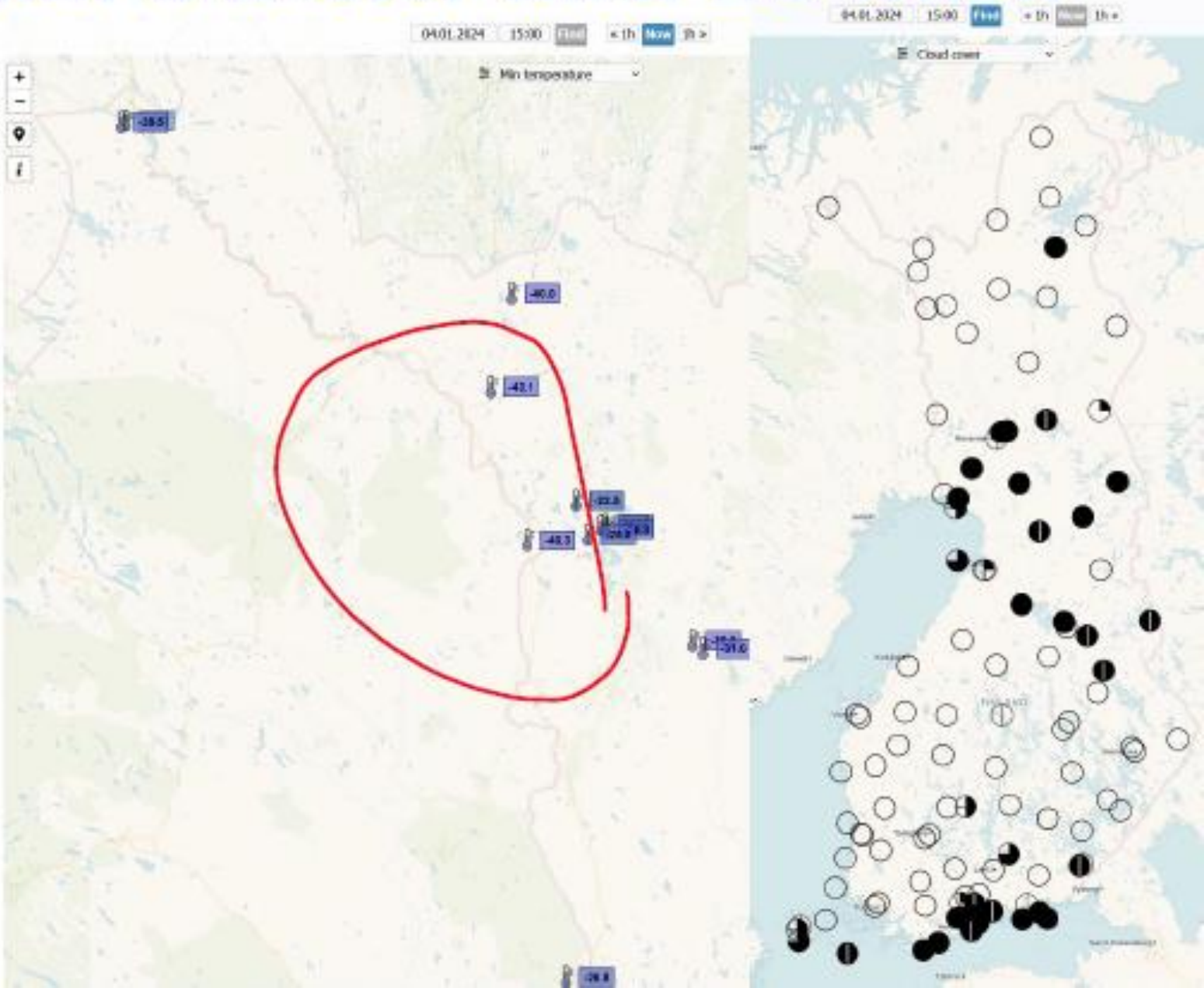
4th Jan 2024 – ”MEPS better than EC when very cold”

- FMI and MEPS forecasted colder than -40 in Lappland
- Also you MEPS less cloudy than other



4th Jan 2024 – ”MEPS better than EC when very cold”

- ECMWF bit too warm, MEPS better
- Clouds too few in MEPS
- Cloudiness better in MEPS in south but ECMWF better in middle parts of country



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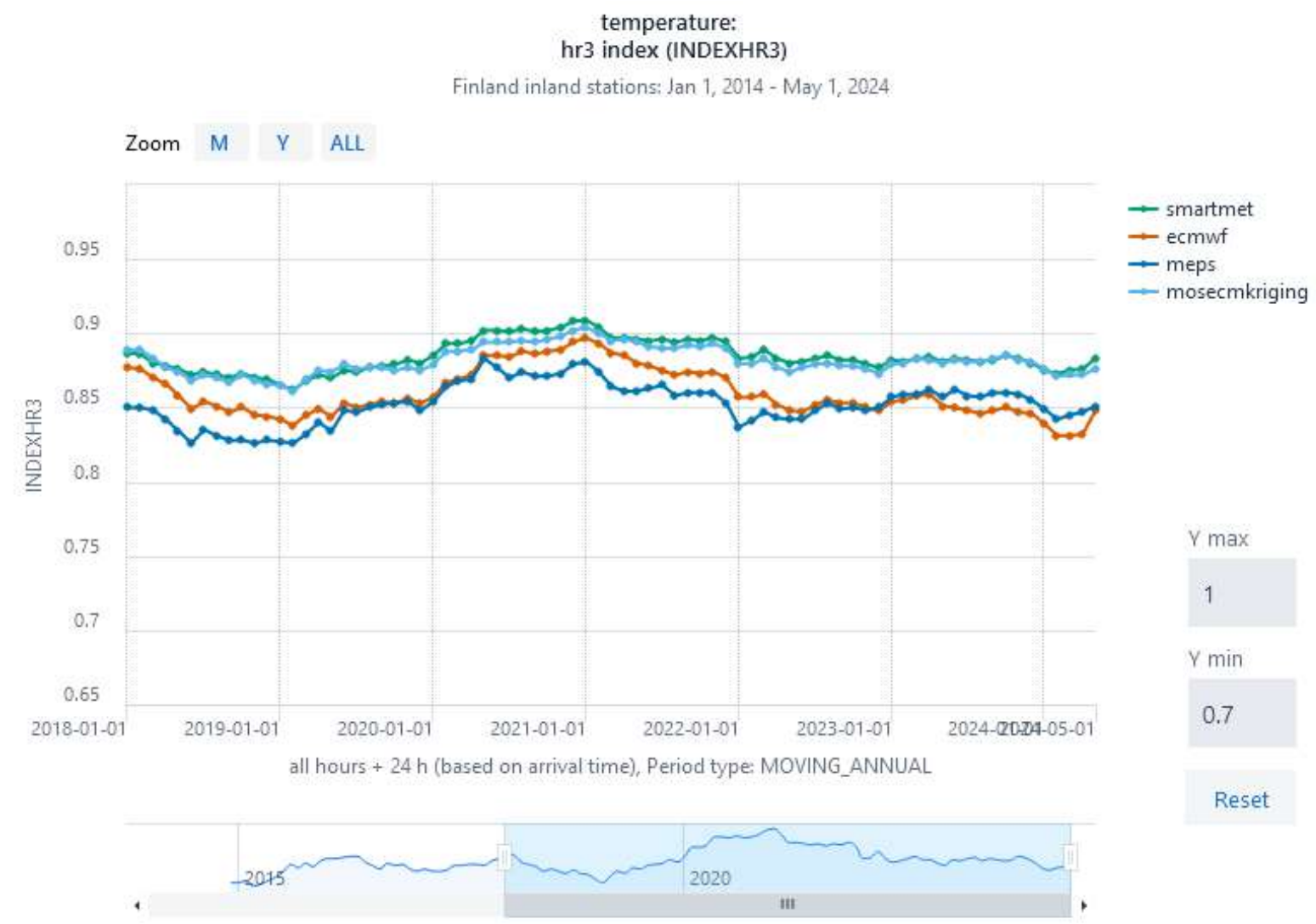
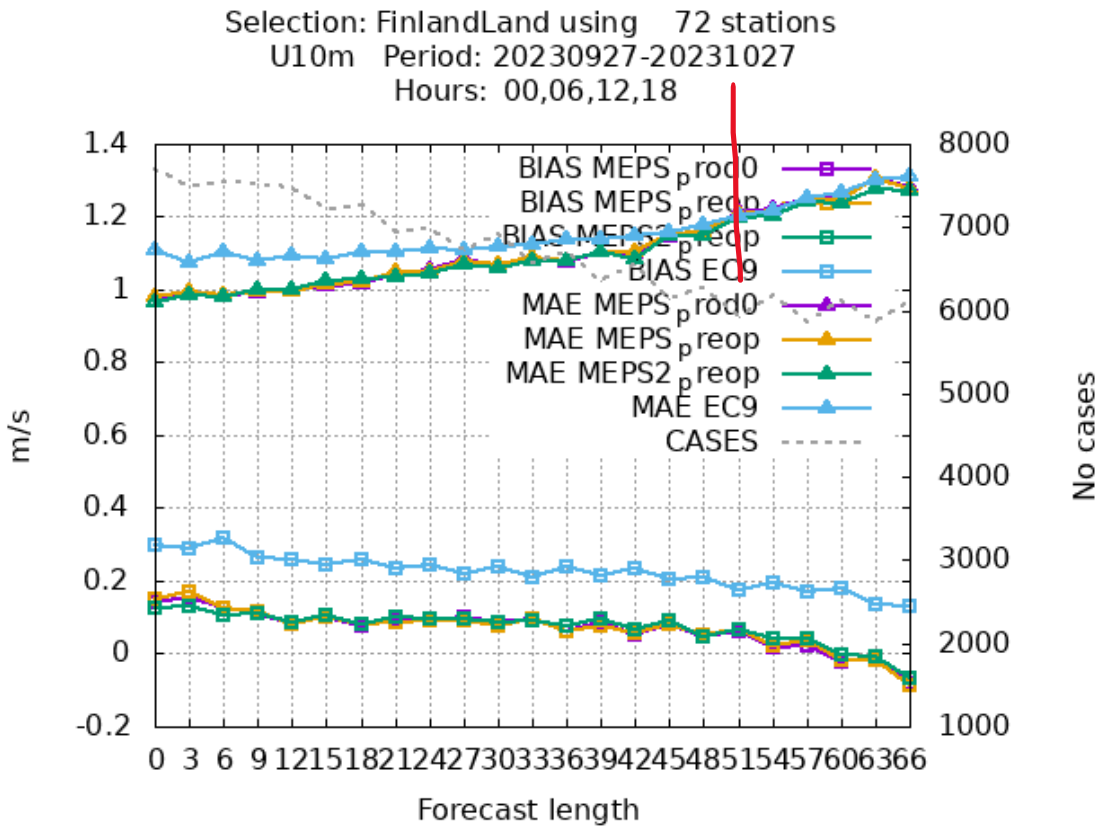
temperature:
hr3 index (min/max) (INDEXHR3_M)
Finland inland stations: Jan 1, 2008 - May 1, 2024
Zoom
M
Y
ALL
smartmet
ecmwf
meps
mosecmkriging
INDEXHR3_M
0.95
0.9
0.85
0.8
0.75
0.7
0.65
2018-01-01
2019-01-01
2020-01-01
2021-01-01
2022-01-01
2023-01-01
2024-01-01
2024-05-01
all hours + 24 h (based on arrival time), Period type: MOVING_ANNUAL
Y max
1
Y min
0.7
Reset
2010
2015
2020


temperature:
hr3 index (INDEXHR3)
Finland inland stations: Jan 1, 2014 - May 1, 2024
Zoom
M
Y
ALL
smartmet
ecmwf
meps
mosecmkriging
INDEXHR3
0.95
0.9
0.85
0.8
0.75
0.7
0.65
2018-01-01
2019-01-01
2020-01-01
2021-01-01
2022-01-01
2023-01-01
2024-05-01
all hours + 24 h (based on arrival time), Period type: MOVING_ANNUAL
Y max
1
Y min
0.7
Reset
2015
2020

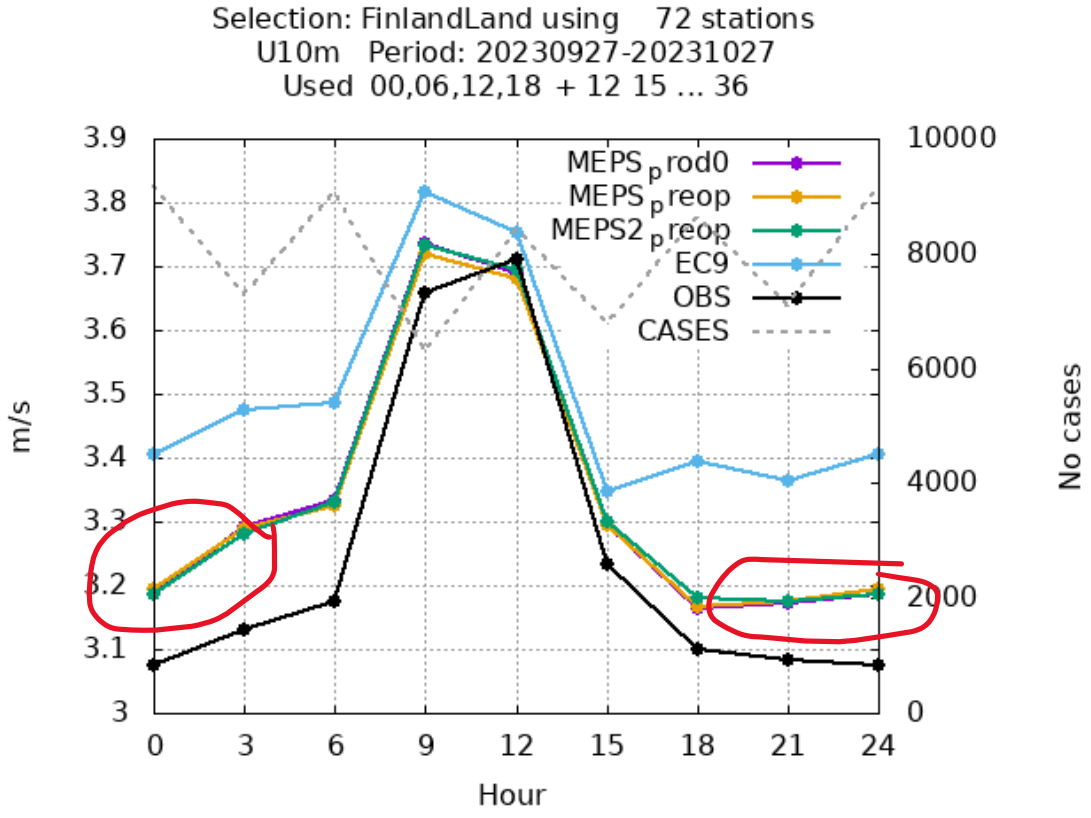

region ws_max_24h ≥ 17 m/s (20 km, corrected observations):
relative operating characteristic 2 (ROC2)
Finland sea areas: Jan 1, 2014 - May 1, 2024
Zoom M Y ALL
smartmet
ecmwf
meps
ROC2
0.9
0.8
0.7
0.6
0.5
2021-01-01
2022-01-01
2023-01-01
2024-01-01
2024-05-01
all hours + 24 h (based on arrival time), Period type: MOVING_ANNUAL
Y max
1
Y min
0.5
Reset
2014
2016
2018
2020
2022
2024

Wind needs improvement

MEPS more skillful and less biased

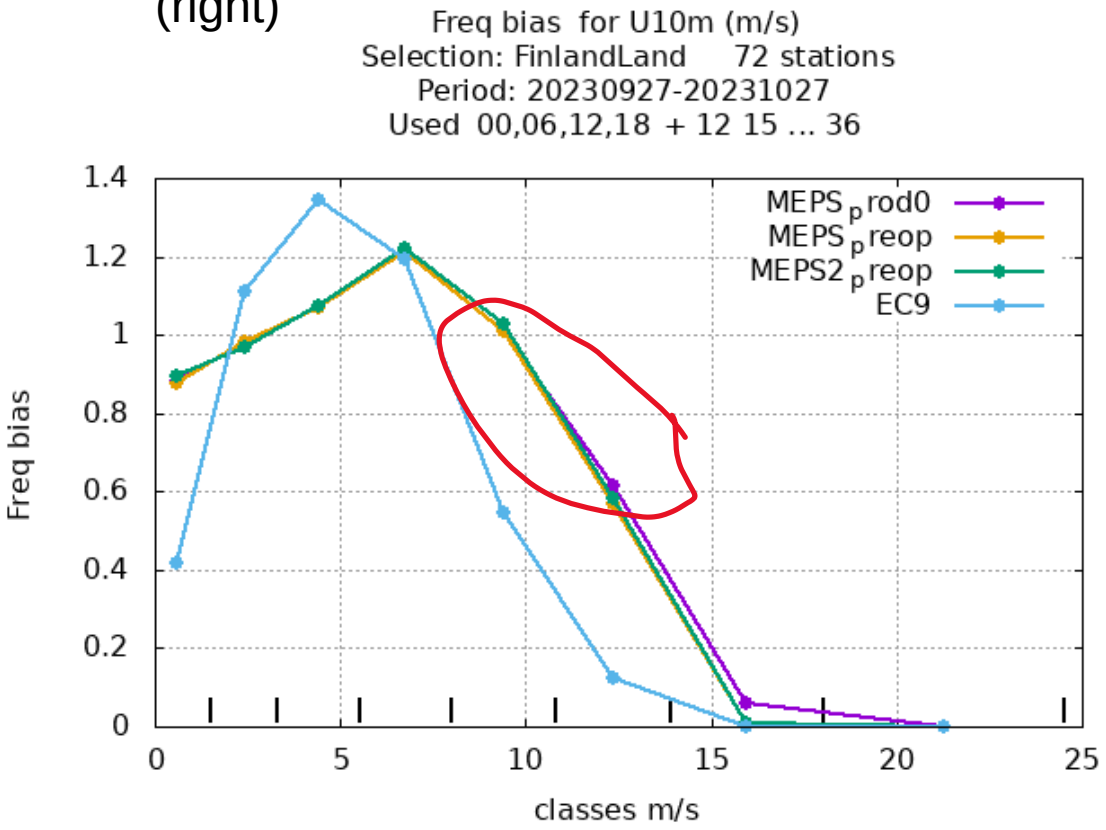


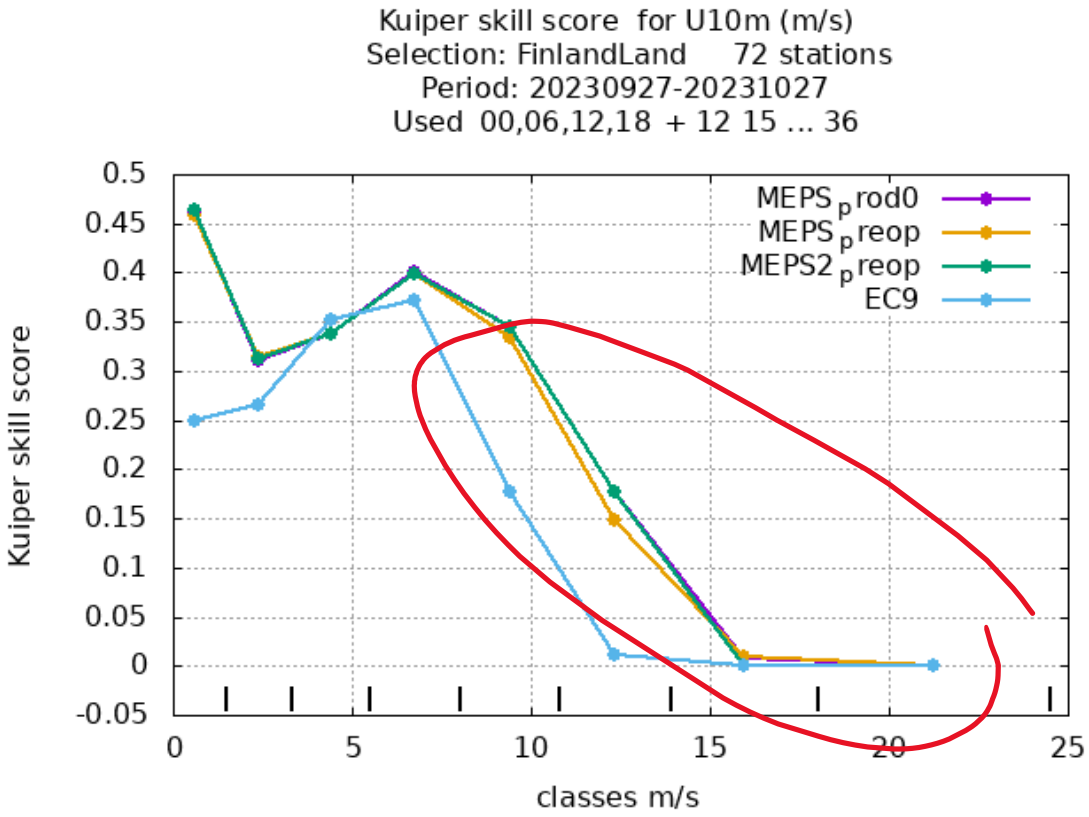
Nighttime too high winds



Wind – FBI and Kuiper's skill

MEPS better than EC when high wind speeds (>11 m/s). Freq bias (left) and Kuiper's skill score (right)





MEPS (harmonie has improved compared to ECMWF From 2021-> 2023

Figure is based on MetCoop monthly verification reports

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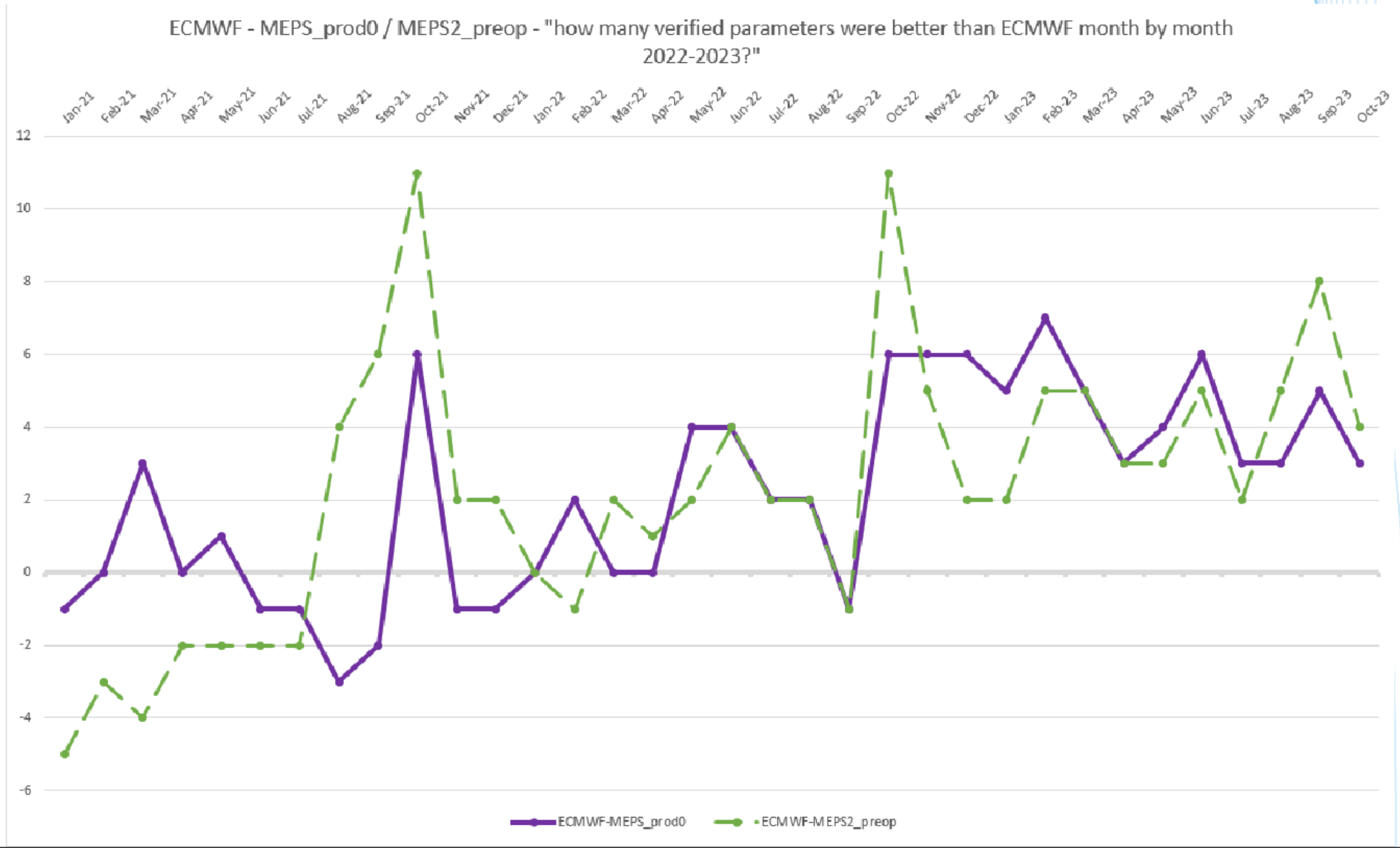
More added value over ECMWF!



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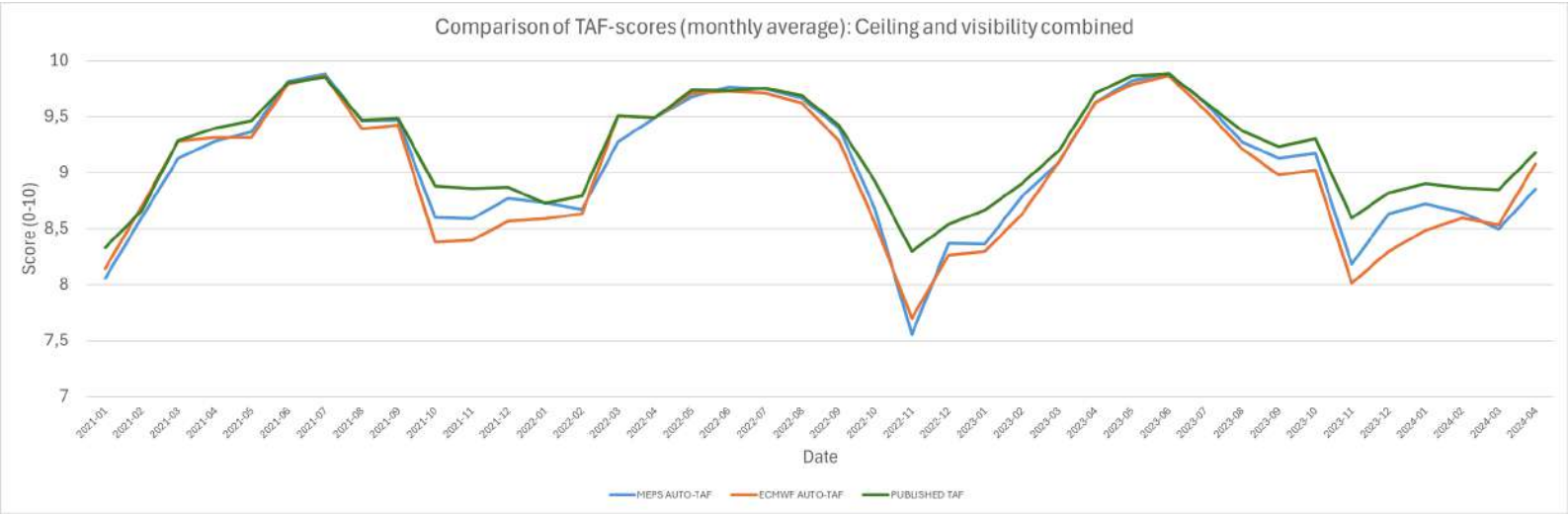
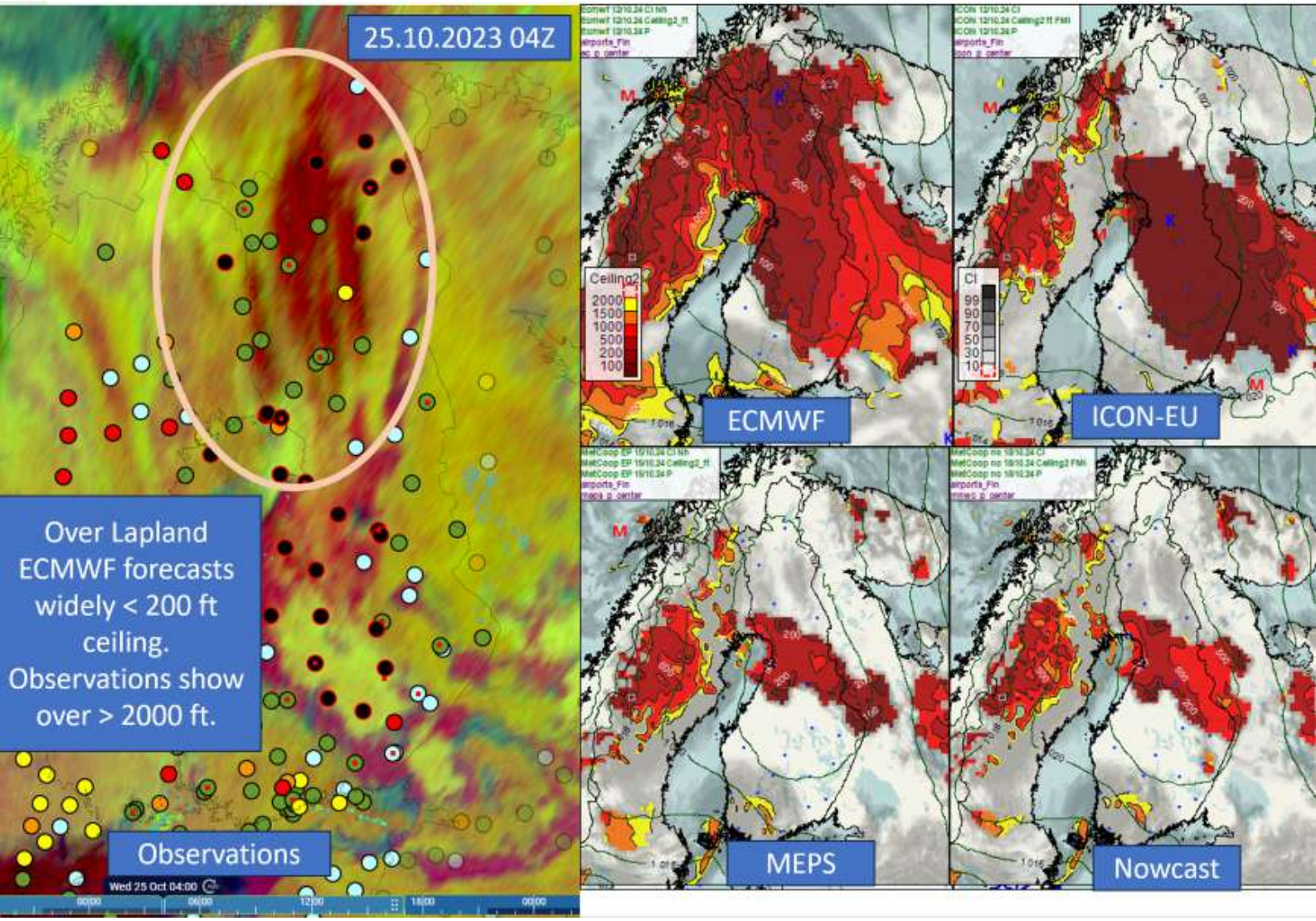
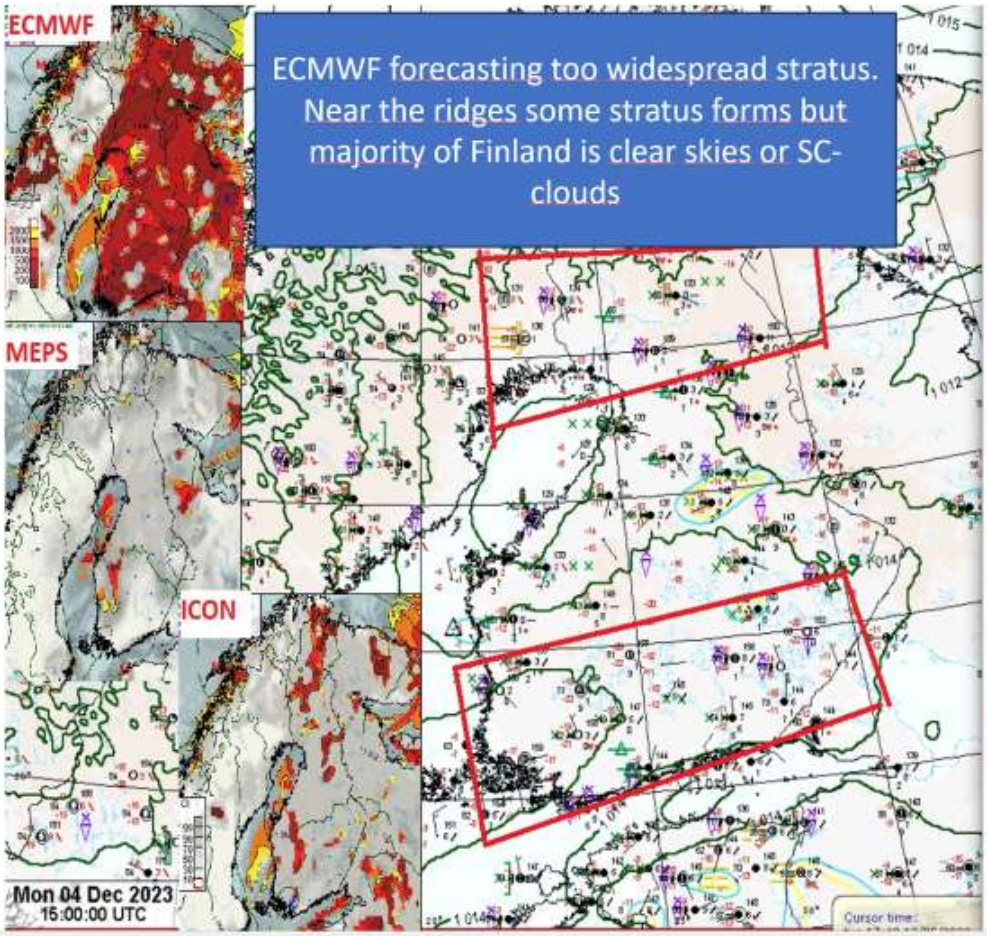
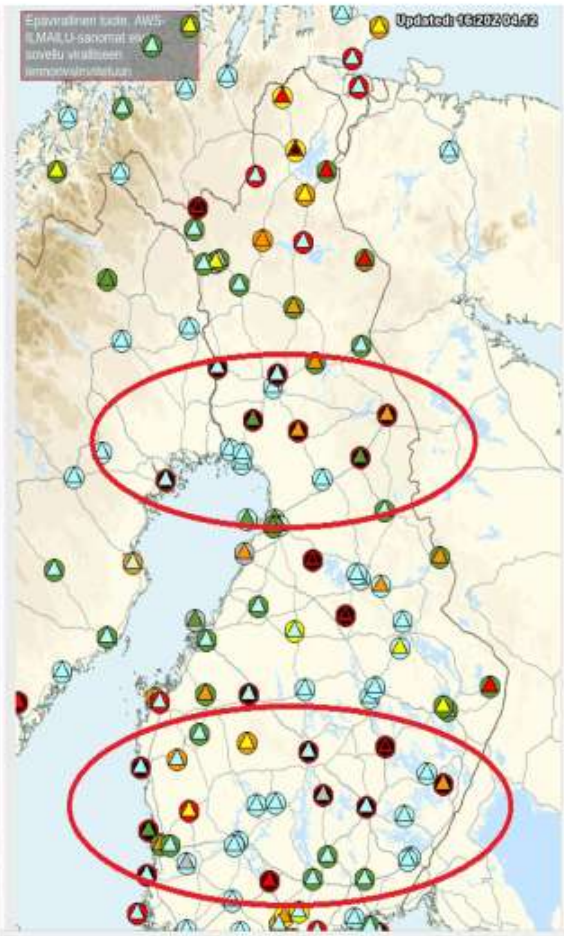

Comparison of TAF-scores (monthly average): Ceiling and visibility combined
Score (0-10)
10
9,5
9
8,5
8
7,5
7
Date
MEPS AUTO-TAF
ECMWF AUTO-TAF
PUBLISHED TAF


25.10.2023 04Z
Over Lapland ECMWF forecasts widely < 200 ft ceiling. Observations show over > 2000 ft.
Observations
Wed 25 Oct 04:00
ECMWF
ICON-EU
MEPS
Nowcast

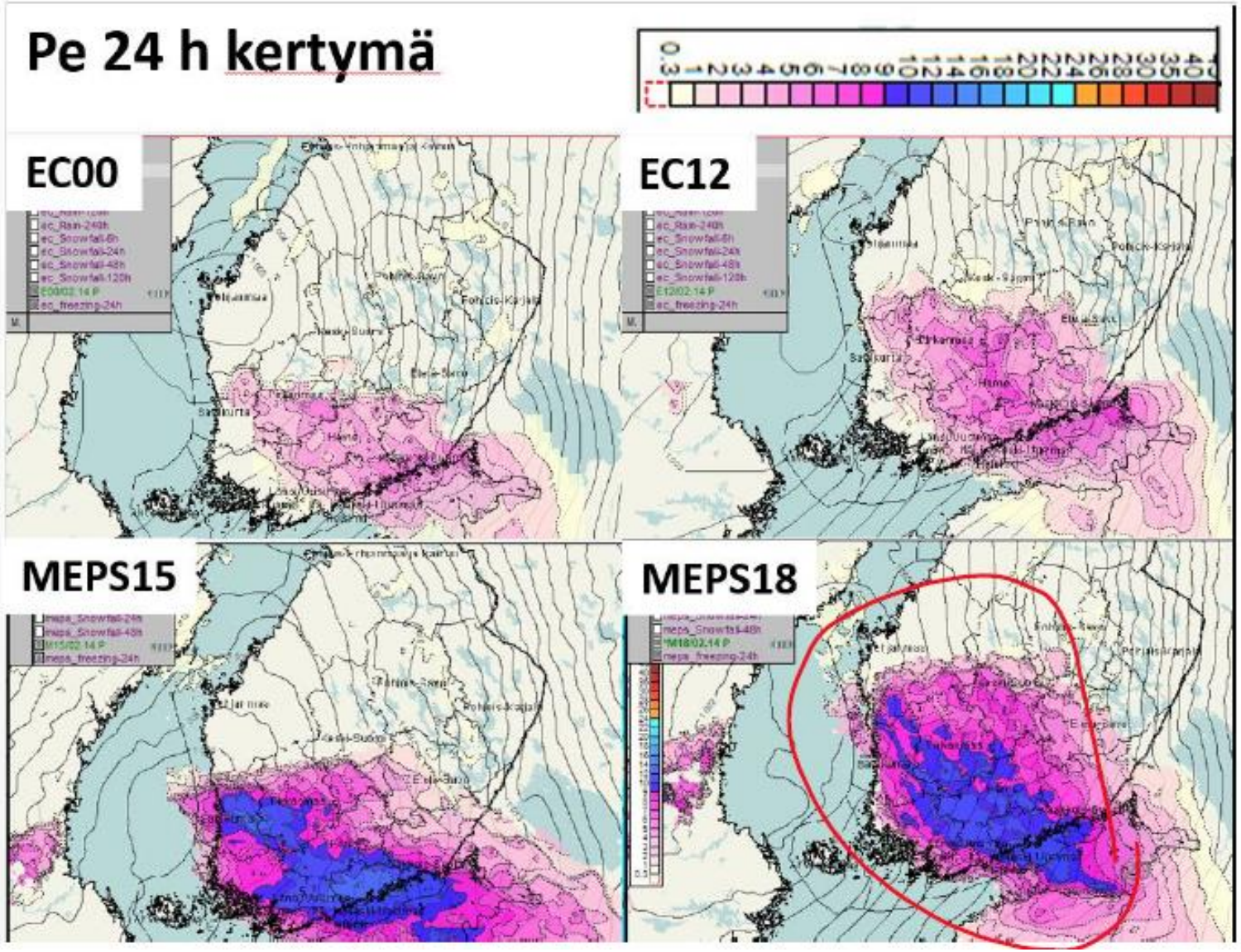
04.12.2023 - 15.00 UTC





16th-17th Feb 2024 – ”ECMWF good in freezing rain”

- MEPS forecast 10-15mm in large areas (also in ensemble)
- There was freezing rain mostly 5-10mm
- More conservative in ECMWF and MEPS overpredicted



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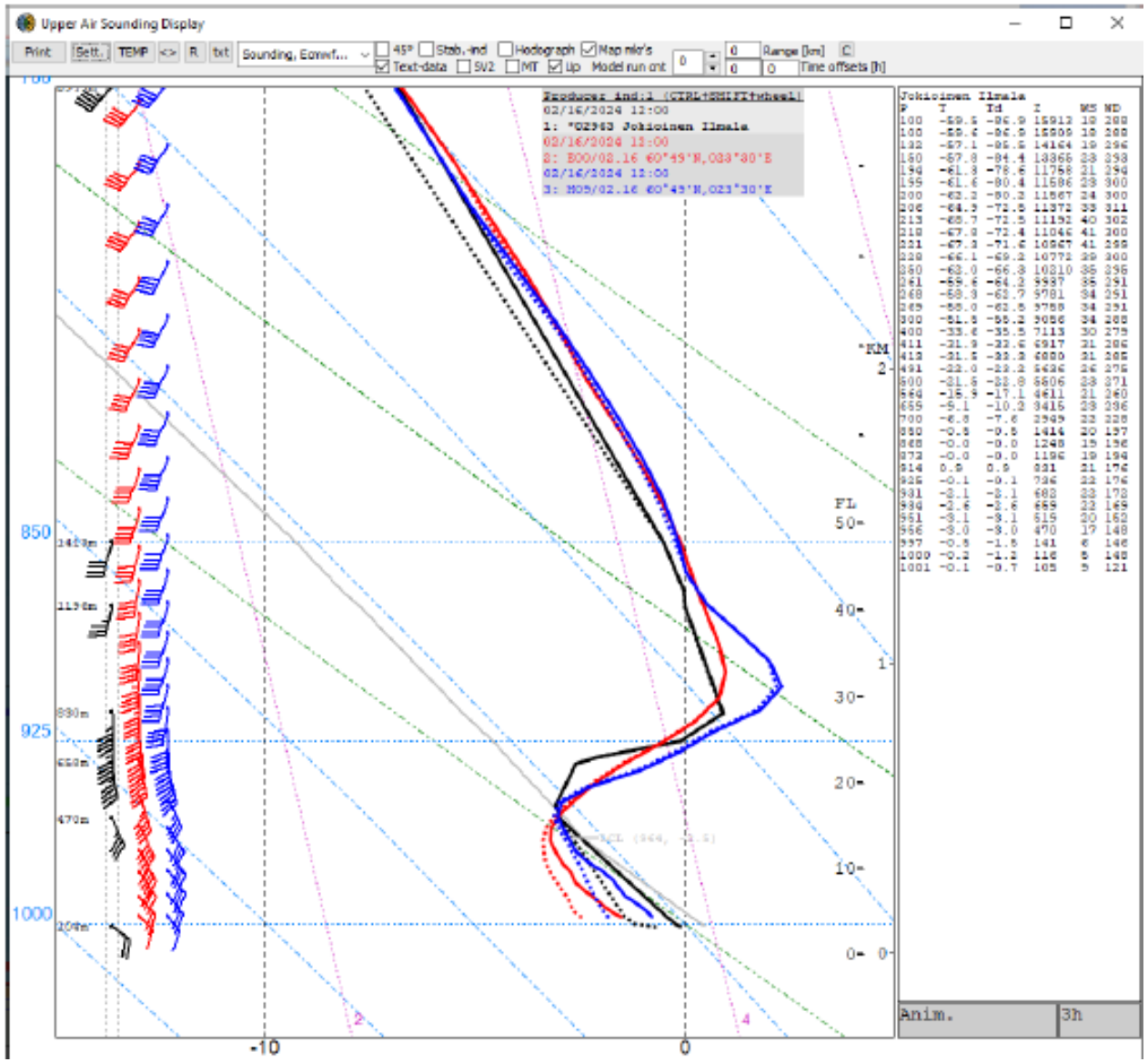
16th-17th Feb 2024 – ”ECMWF good in freezing rain”

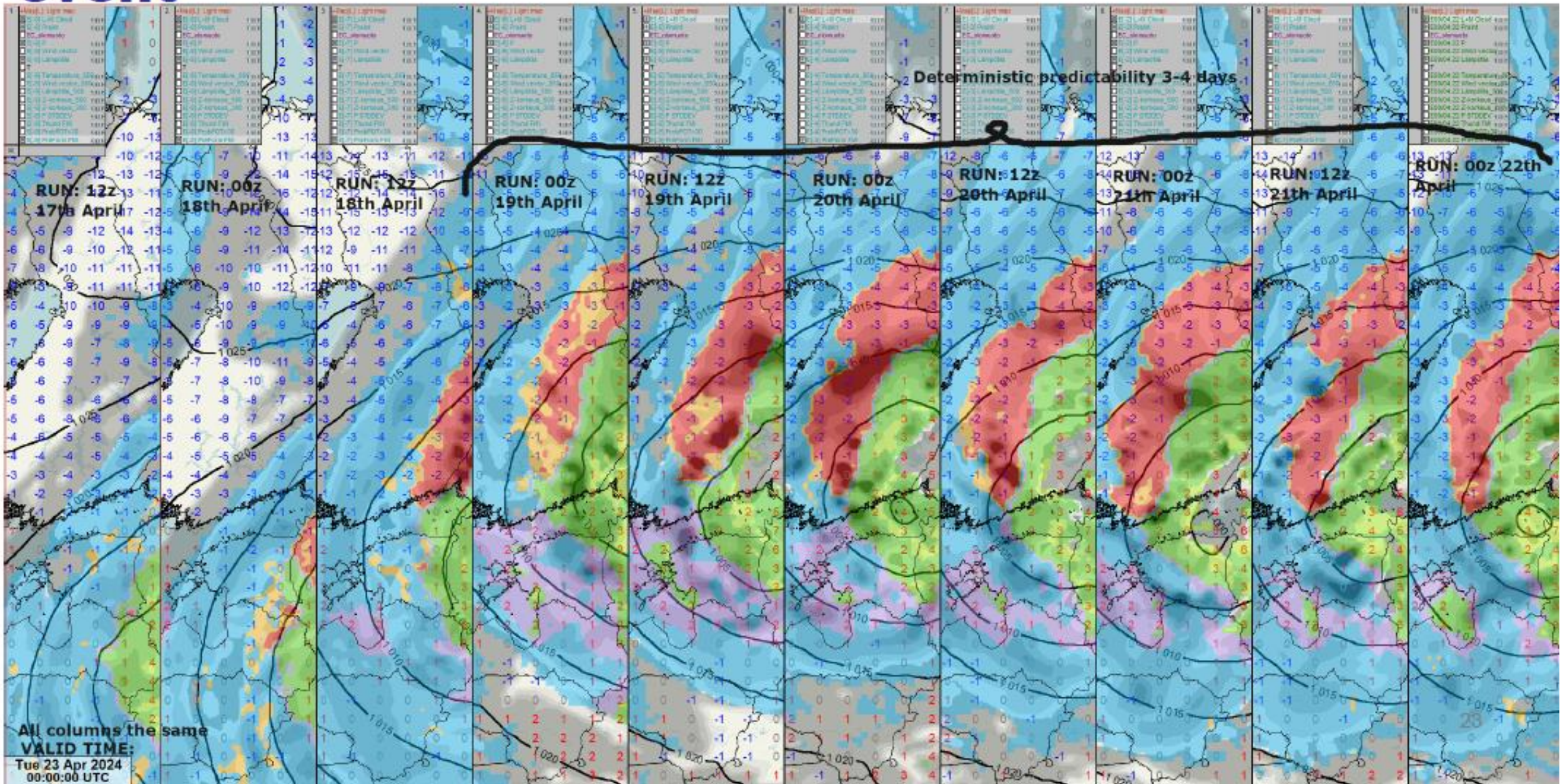
- Observed sounding in black, MEPS blue, ECMWF red – observed closer to EC
- MEPS worse



16th-17th Feb 2024 – ” ECMWF good in freezing rain”

- There was fears that more severe things will happen to power lines if MEPS is correct
- We had mostly bad road conditions, no damage to powerlines/trees
- ECMWF forecast realistic
- My car observed some freezing rain!

22th-23rd April: exceptional snow/freezing rain event

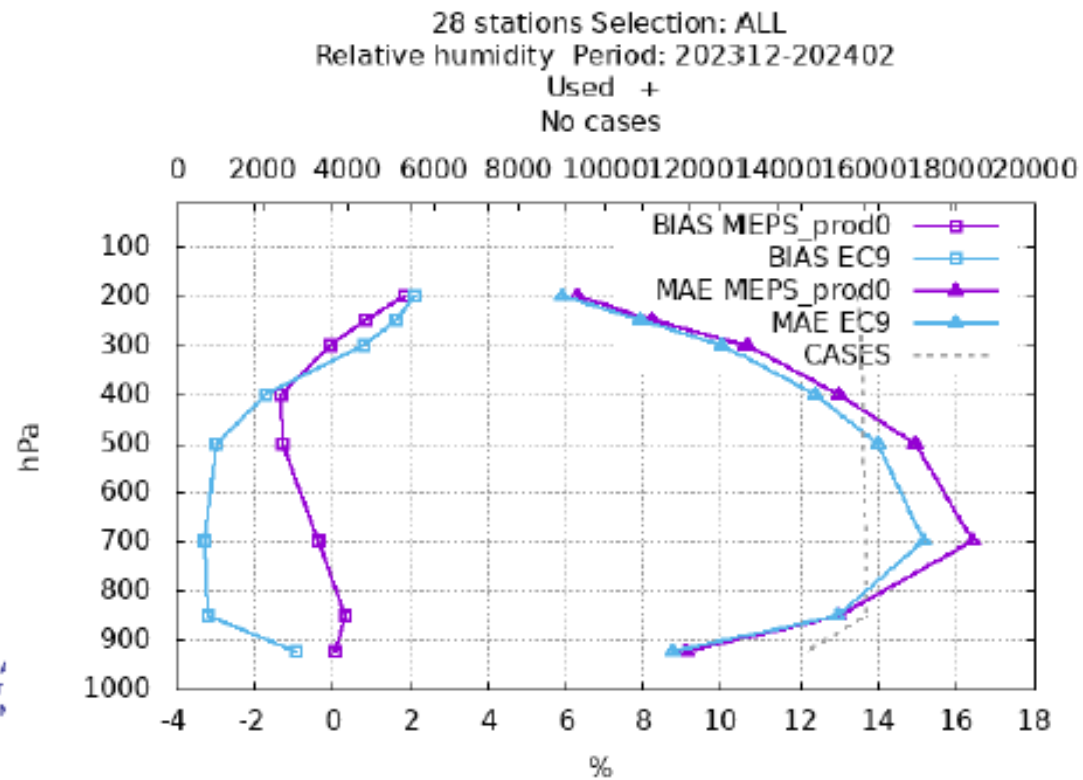


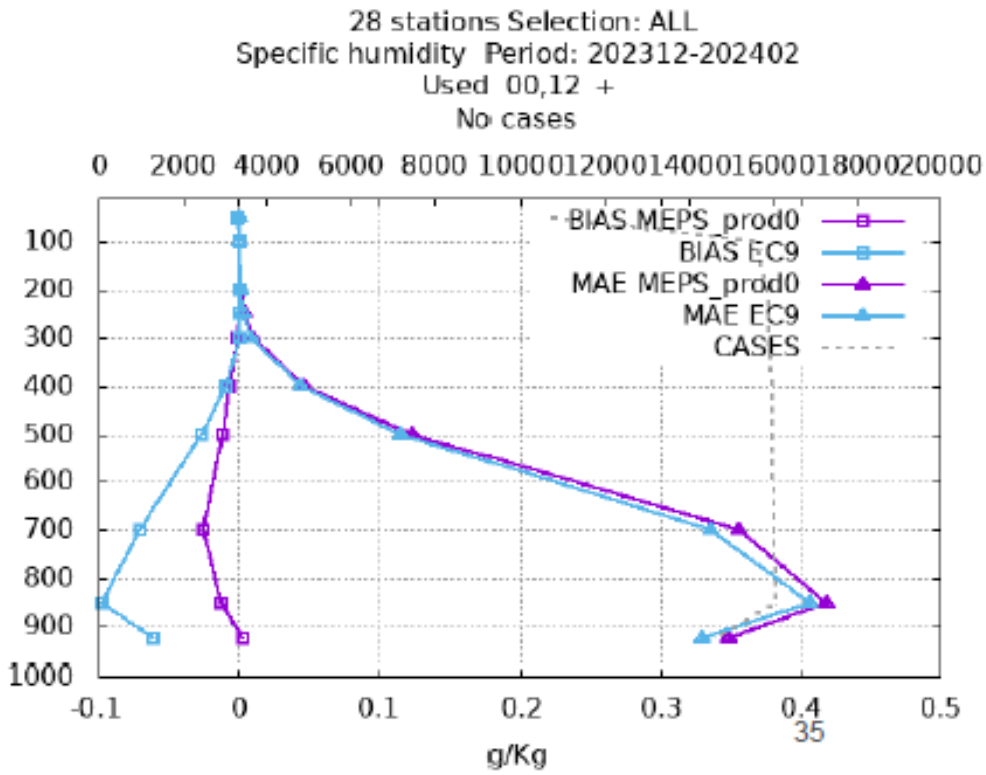
22th-23rd April: exceptional snow/freezing rain event

Well forecast by ECMWF

Humidity - soundings

- RH: Mean absolute errors worse than ECMWF, MEPS less biased (left)
- Absolute humidity: ECMWF better





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28.8. small scale low pressure

Forecaster's analysis

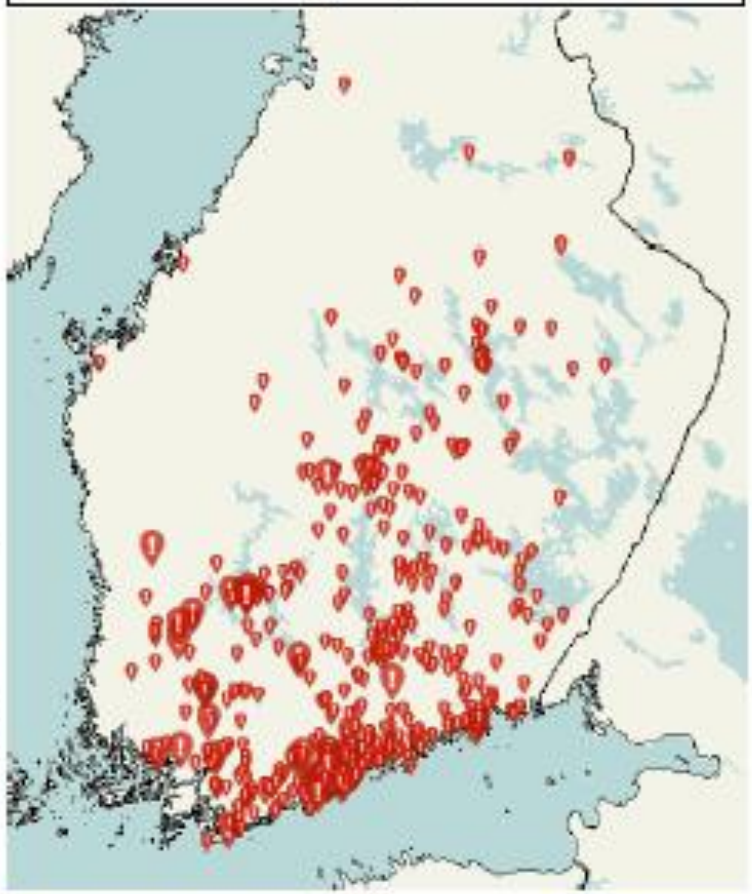
Weather event

Very strong small scale summer low pressure passed over Finland. Very moist and warm airmass, no thunder however.

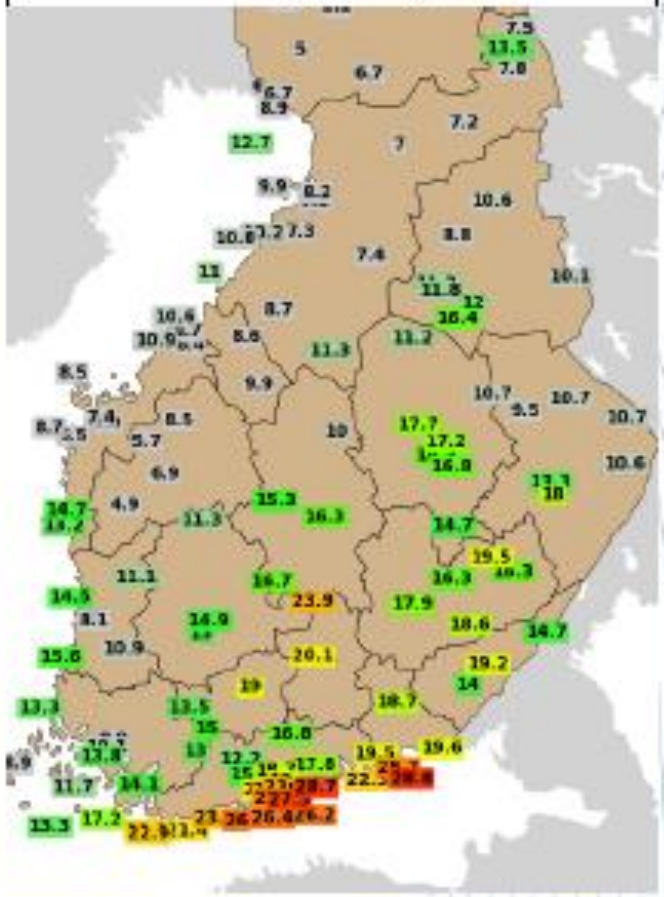
Forecast accuracy

There was signs of small low pressure deepening over Finland but finally it was more west and stronger than forecast by ECMWF and MEPS.

Emergency tasks



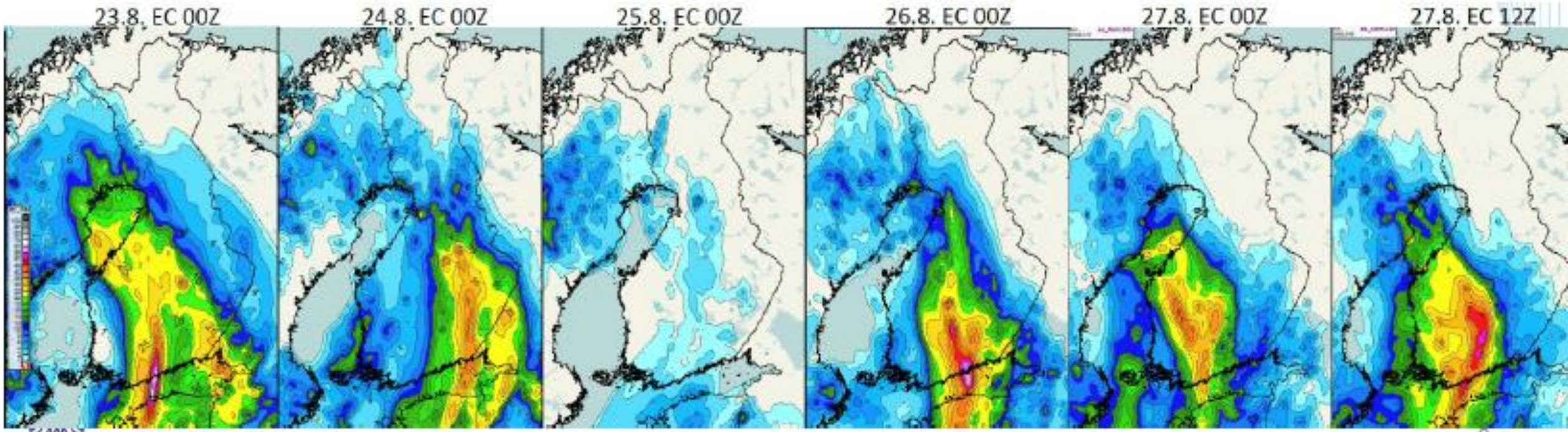
28th Aug max gusts



Electricity cuts	Wind and precipitation damages	Heavy rain proportion of emergencies
n. 19 000 households	~800 kpl	30-40% ?

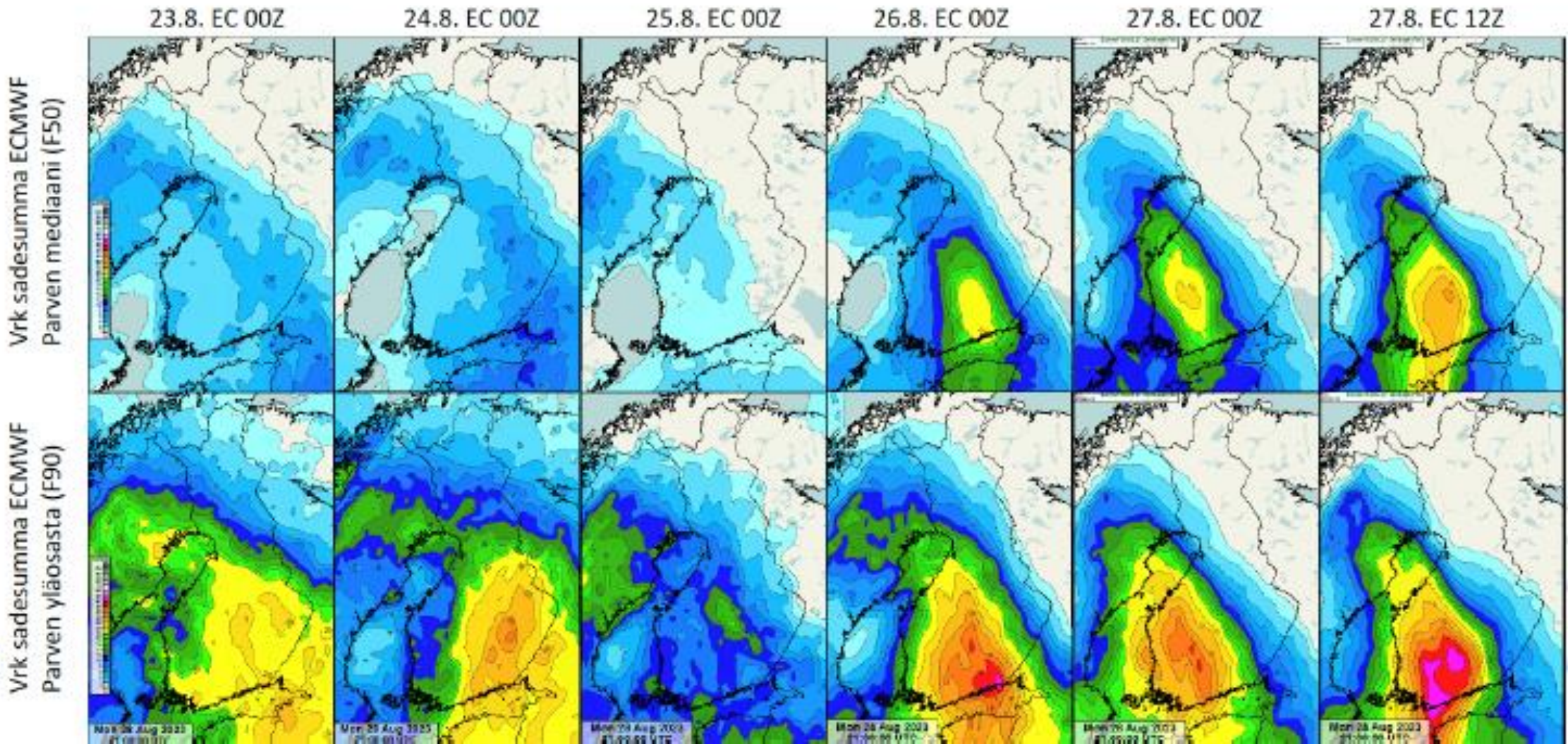
28th-29th Aug 2023 – ”very heavy rain”

- Deterministic 24h precipitation



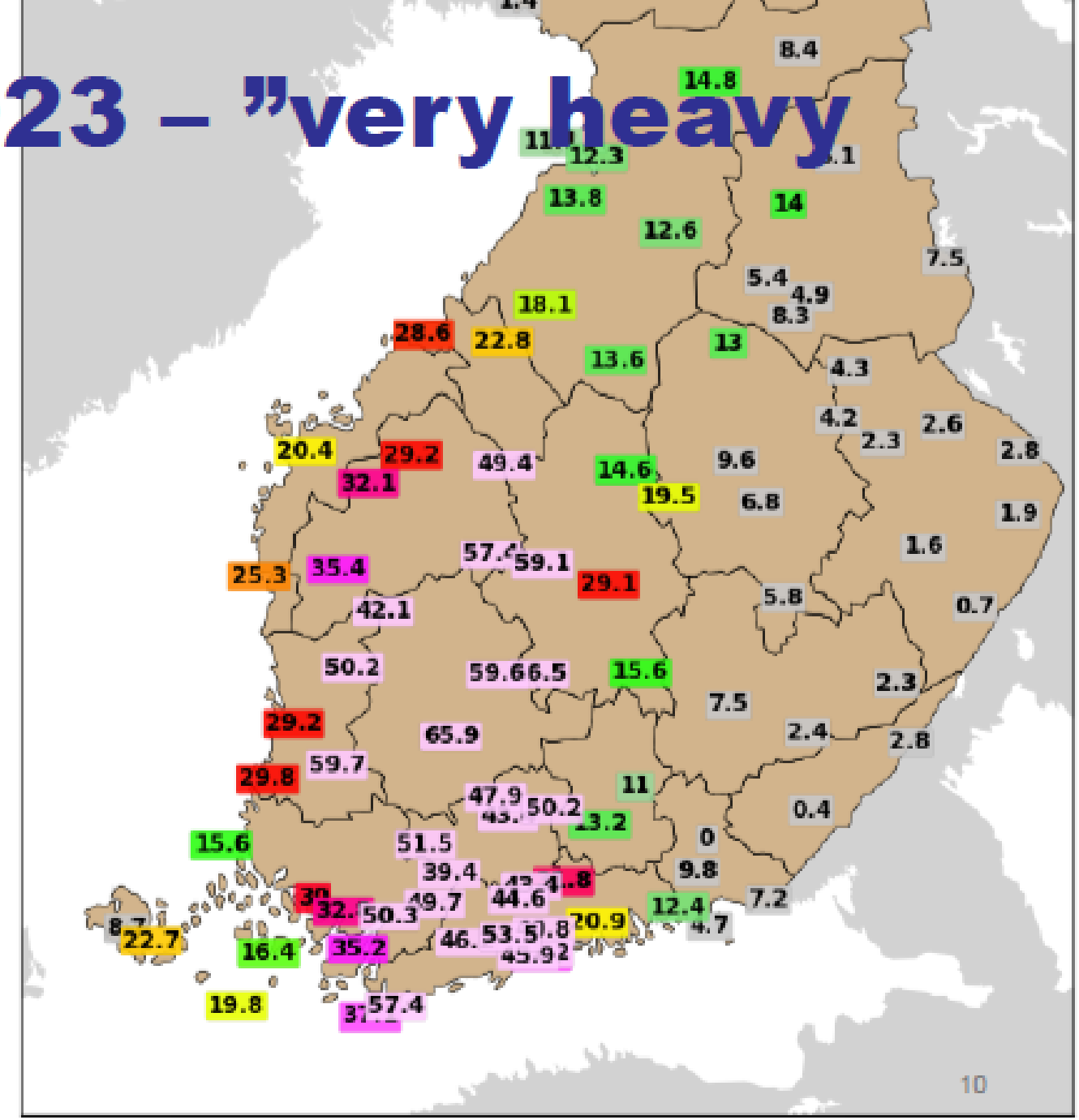
28th-29th Aug 2023 – ”very heavy rain”

- F50 24h prec (upper row)
- F90 24h prec (lower row)



28th-29th Aug 2023 – ”very heavy rain”

Exceptionally heavy rain was not well predicted by ECMWF, it was underestimation and the low pressure also took more westerly route



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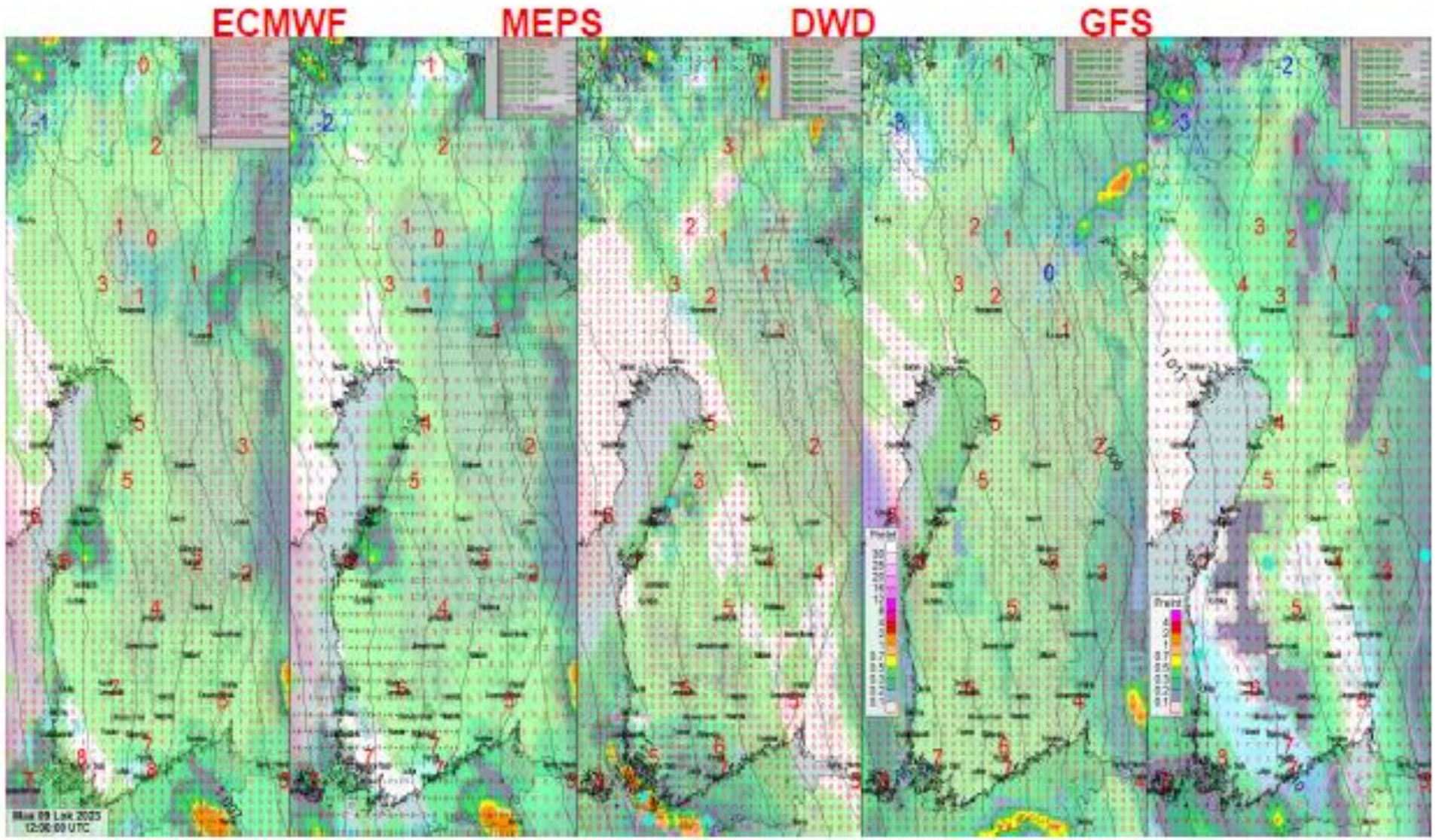
28th Aug 2023 – Summary

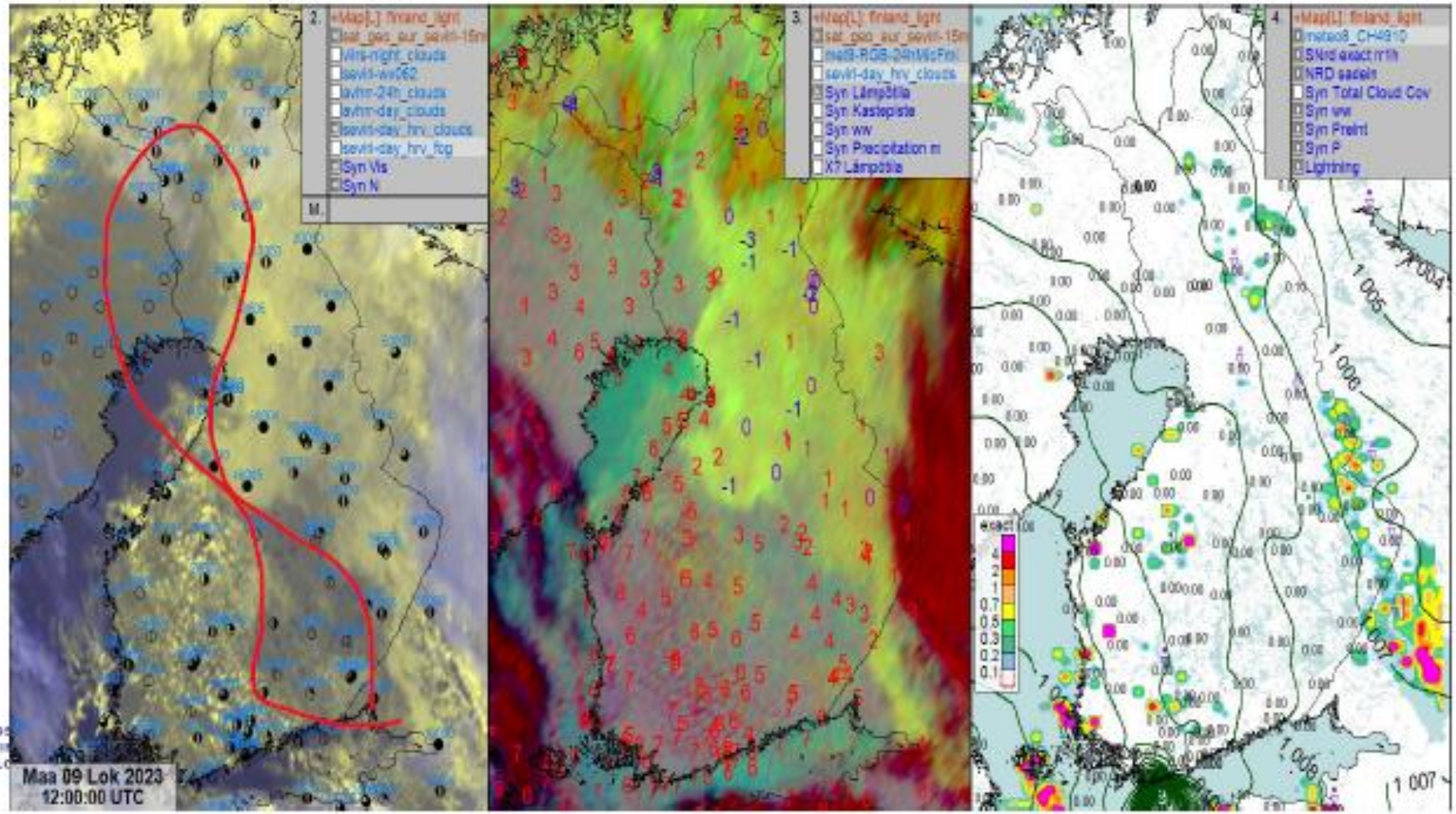
- Strong and small low pressure was somewhat able to surprise ECMWF and also other models
- Gusts and rain forecasts were underestimated
- MEPS was not clearly better than ECMWF
- Yellow warning level was not enough

9th Oct 2023 – ”ECMWF too cloudy”

Often we see that ECMWF is too cloudy, this case illustrates the difference

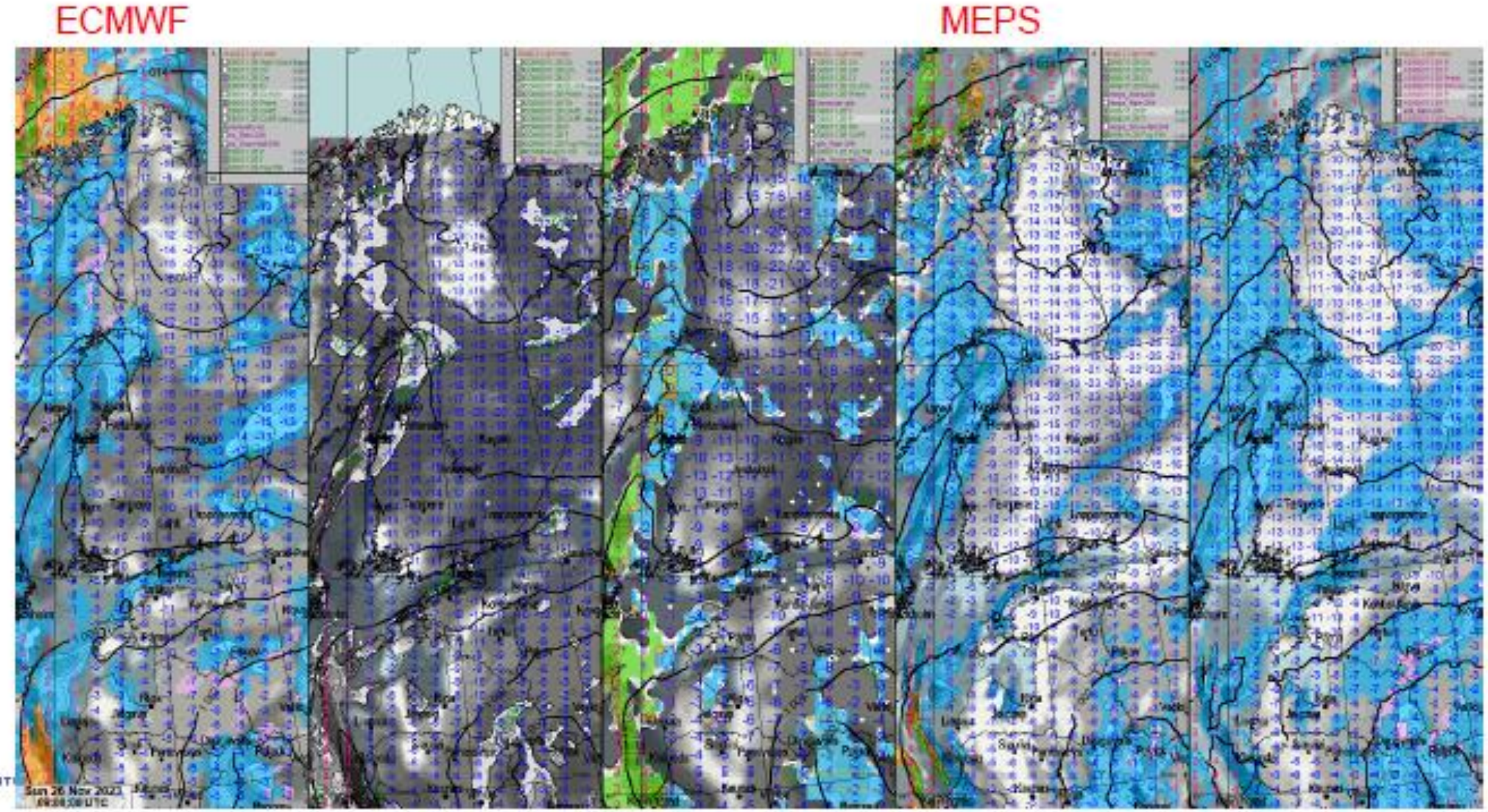


9th Oct 2023 – ”ECMWF too cloudy”



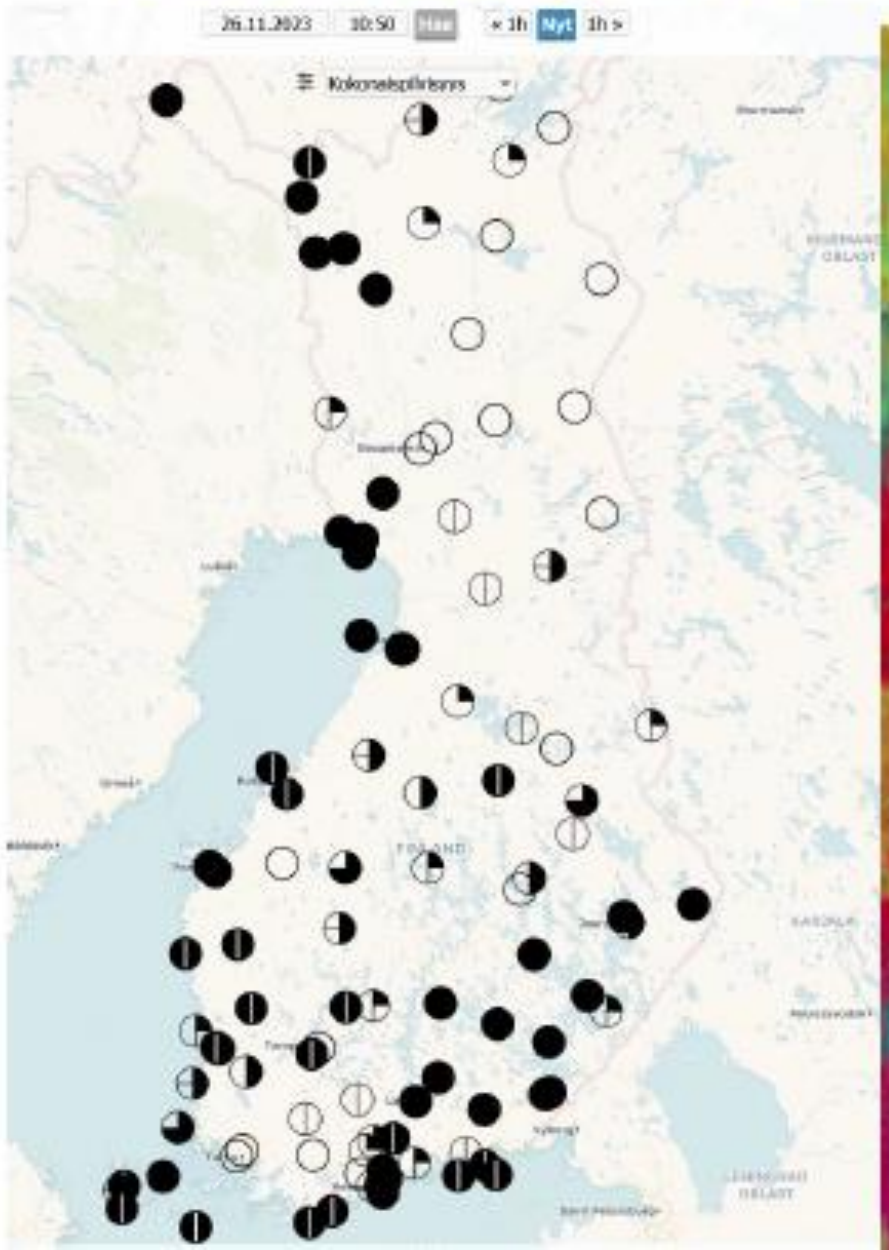
26th Nov 2023 – ”Too cloudy in EC when cold”

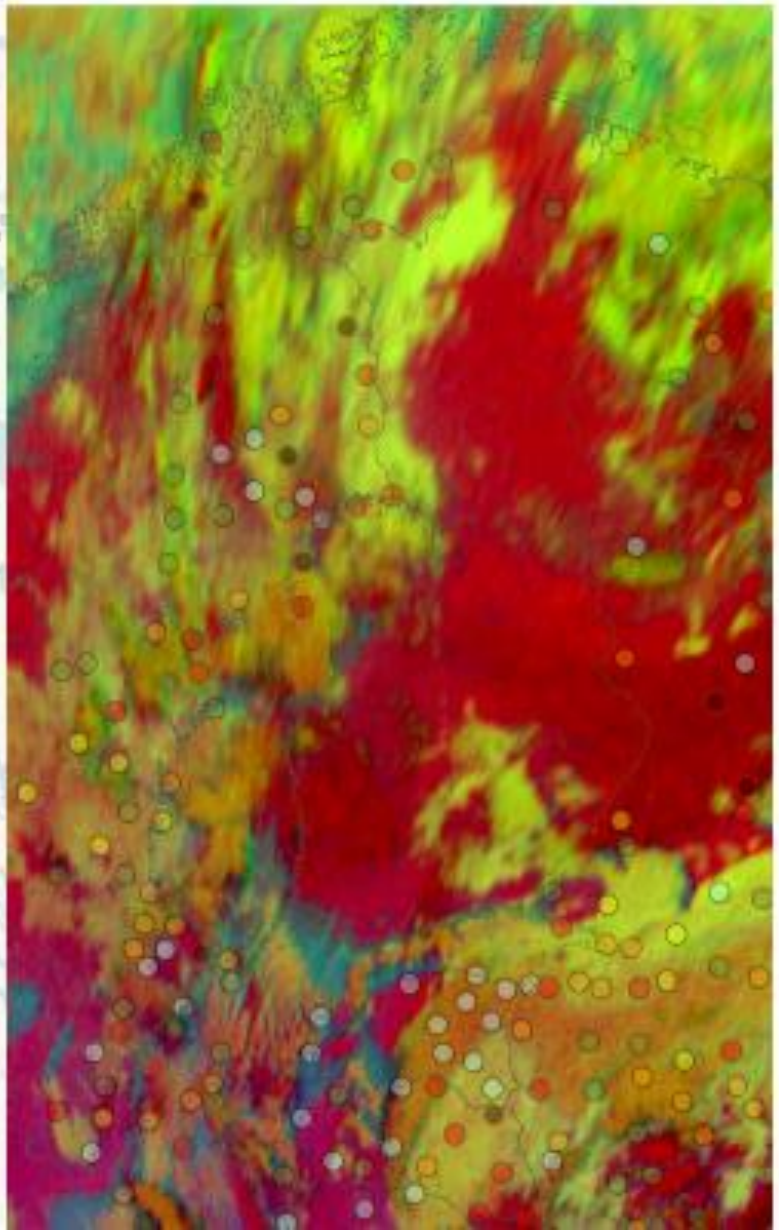
- MEPS better than ECMWF which was cloudier



26th Nov 2023 – ”Too cloudy in EC when cold”

- ECMWF often cloudier than reality in winter
- MEPS less cloudy (even too clear)





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