Evaluation of UWC-W ~~pre-~~operational forecasts

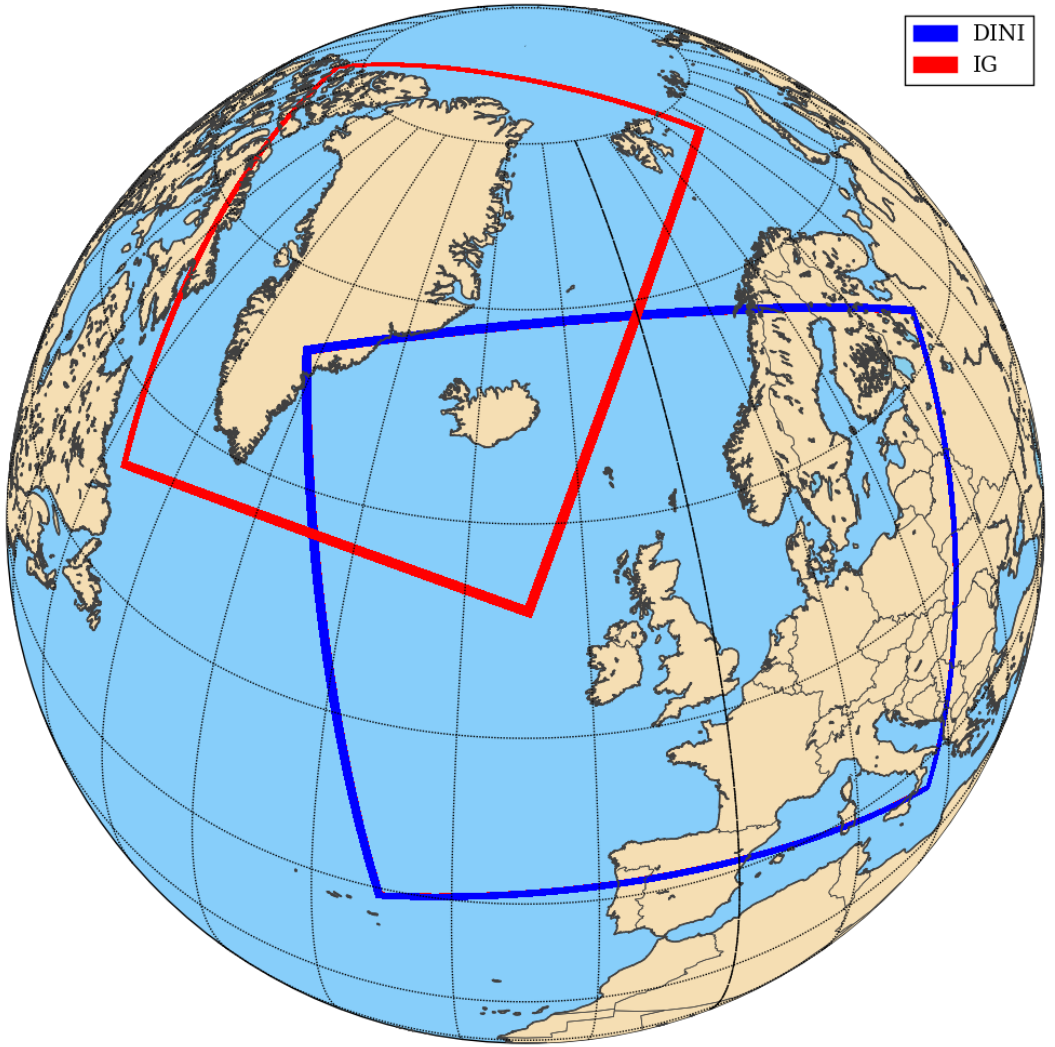
Eoin Whelan
With lots and lots of input from James Fannon, Sander Tijm & many more

Overview

- Operational suites
- Model verification

Operational suites

- Two common domains
- Harmonie-43h2.2 with SP forecasts
- DINI-EPS
  - Staggered 1+30 (54 h) EPS
  - 60 h forecast for control member
  - 2.0 km grid with 90 vertical levels
  - Updated each hour (1+5)
- IG-Det
  - 72 h forecast
  - 2.0 km grid with 90 vertical levels
  - Updated every three hours

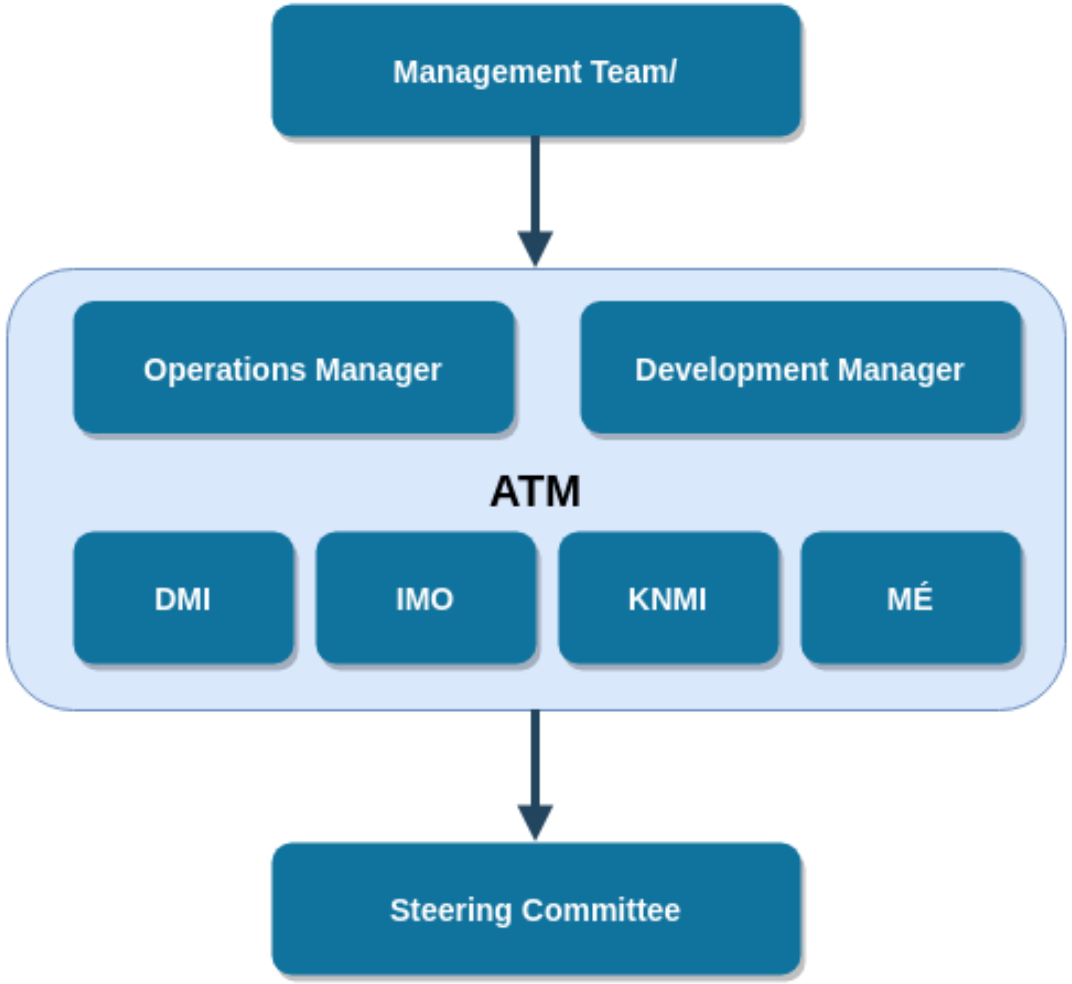


Operational suites

Operations							
	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
	IG			IG			IG
	DINI EPS00	DINI EPS00	DINI EPS00	DINI EPS00	DINI EPS00	DINI EPS00	DINI EPS00
	DINI EPS01	DINI EPS06	DINI EPS11	DINI EPS16	DINI EPS21	DINI EPS26	DINI EPS01
	DINI EPS02	DINI EPS07	DINI EPS12	DINI EPS17	DINI EPS22	DINI EPS27	DINI EPS02
	DINI EPS03	DINI EPS08	DINI EPS13	DINI EPS18	DINI EPS23	DINI EPS28	DINI EPS03
	DINI EPS04	DINI EPS09	DINI EPS14	DINI EPS19	DINI EPS24	DINI EPS29	DINI EPS04
	DINI EPS05	DINI EPS10	DINI EPS15	DINI EPS20	DINI EPS25	DINI EPS30	DINI EPS05
	0000	0100	0200	0300	0400	0500	0600

Getting to operational status

- Advisory Team for Model Cycles
  - UWC-W OM/DM plus representatives for the four member services
  - Advise the DT on the main focal points for model improvement
  - Consider the feasibility of the model changes/updates of the e-suite and advise the MT and SC on implementing the e-suite as the new o-suite



Model verification: What we have now

- harpVis & harp-verif
  - James Fannon with Kasper Hintz, Carlos Peralta & Guðrún Nína Petersen
- Comparisons with IFS and existing operational forecasts
- Known issues & Forecaster feedback
  - Sander Tijm

Harp & visapp

- Harp version v0.2.2 (with develop version of harpPoint)
- Data processing handled by a *harp_sqlite* suite
  - BUFR → vobs → sqlite
  - vfld → sqlite
- Point verification handled by *harp_verif* suite
- Dedicated harp server hosts
  - harpVis, harp's built-in shiny app
  - harp-verif, for serving a "standard" set of point verification results

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Go to the harpVis app | Go to the harp-verif app

harp is a set of R packages developed within the ACCORD consortium for analysis and verifcation of NWP data.

This is the operational harp server. Please see the documentation at https://pages.srv.uwcw.net/documentation/ for further details.

harp : : Point Verification

Select Verification Directory

Model combination

Waiting for valid directory

Dates

Waiting for valid directory

Parameter

Waiting for valid directory

Load

Dashboard | Interactive

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Point Verification

Monthly | **Rolling** | **Seasonal**

Experiment

Prd: DINImbr000 vs HRES

Year

2024

Date

2024/03/01 00Z - 2024/03/31 18Z

Surface | **Temp** | **Scorecards**

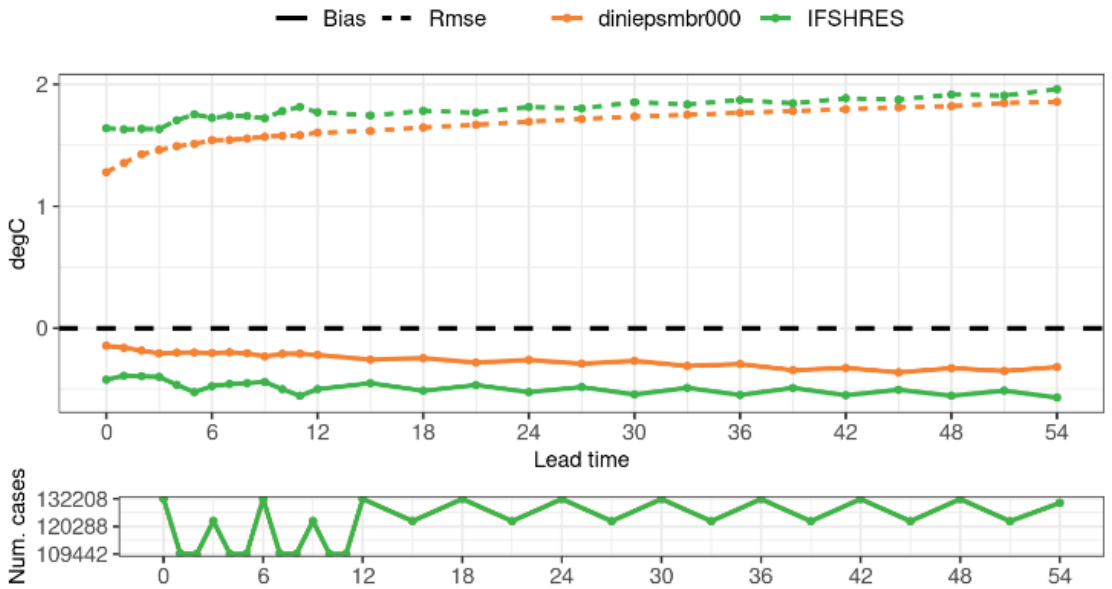
Summary | **Skill** | **Map** | **Signif**

Station selection

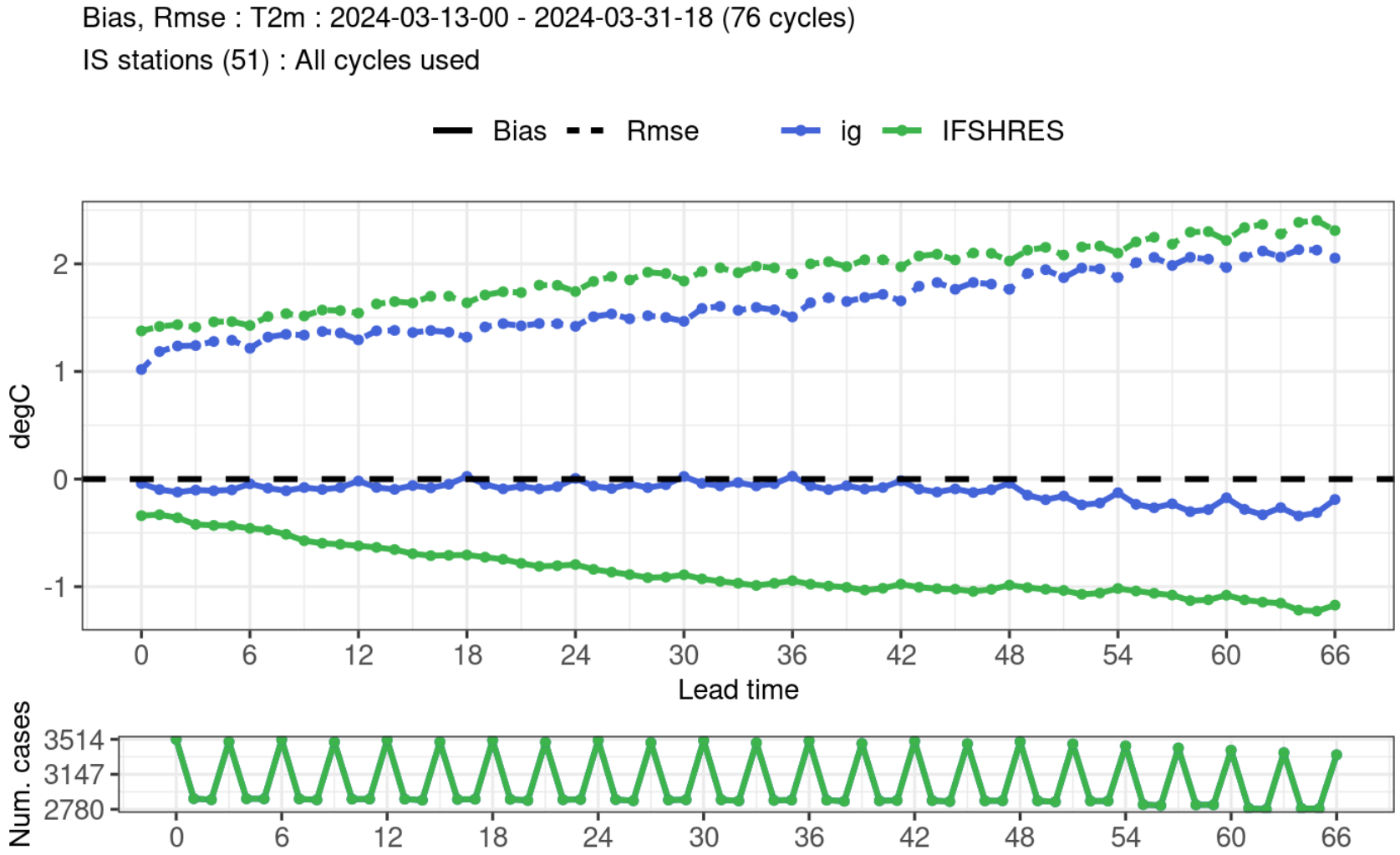
- (●) All stations
- ( ) Denmark
- ( ) Netherlands Oper
- ( ) Iceland
- ( ) Ireland
- ( ) Ireland+UK
- ( ) Scandinavia
- ( ) France
- ( ) North Sea
- ( ) Germany
- ( ) Alps

Parameter: T2m | **Score**: Bias RMSE | **Cycle**: All | **Valid time**: NA | **Threshold**: NA

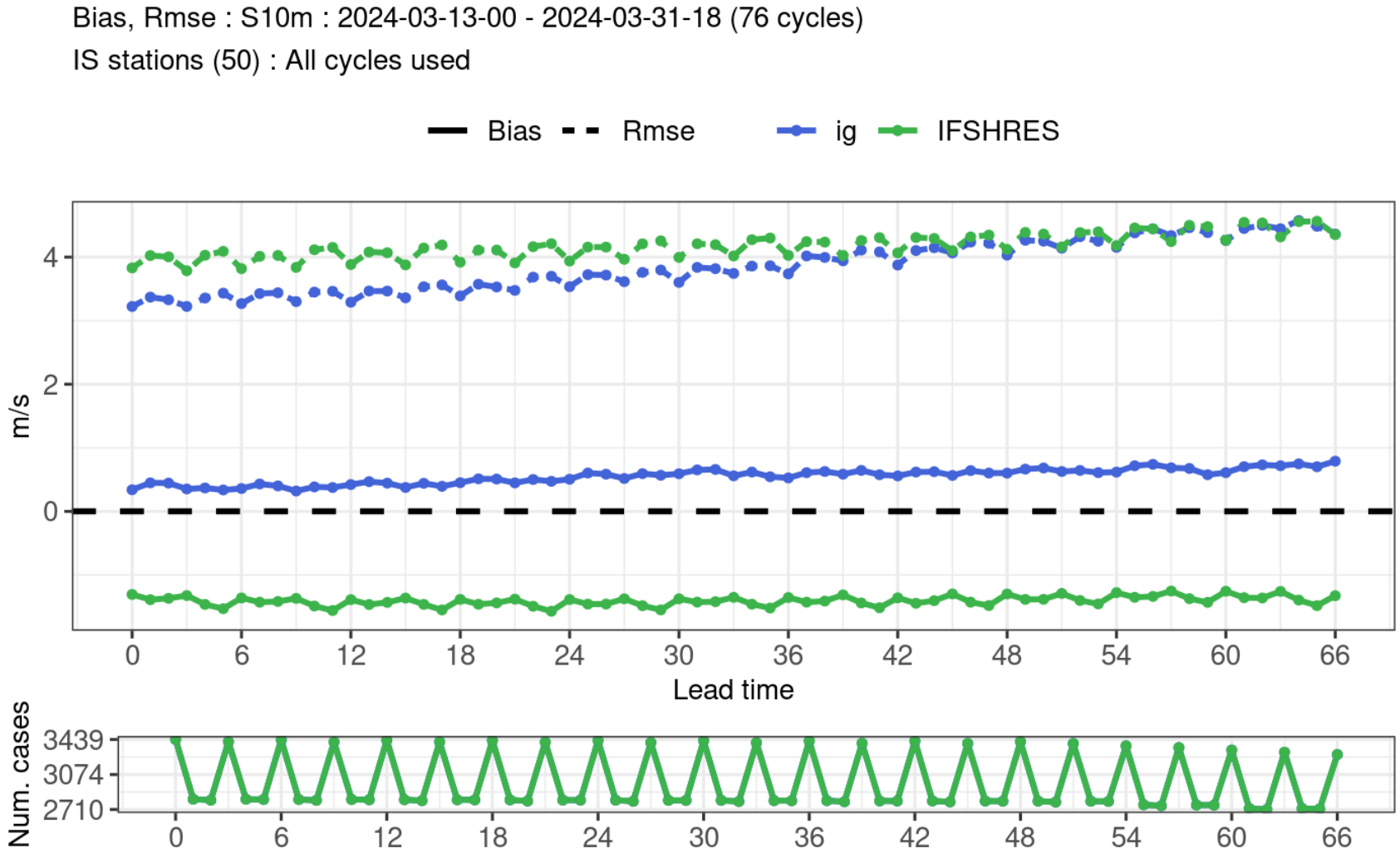
Bias, Rmse : T2m : 2024-03-13-00 - 2024-03-31-18 (76 cycles)
All stations (1786) : All cycles used



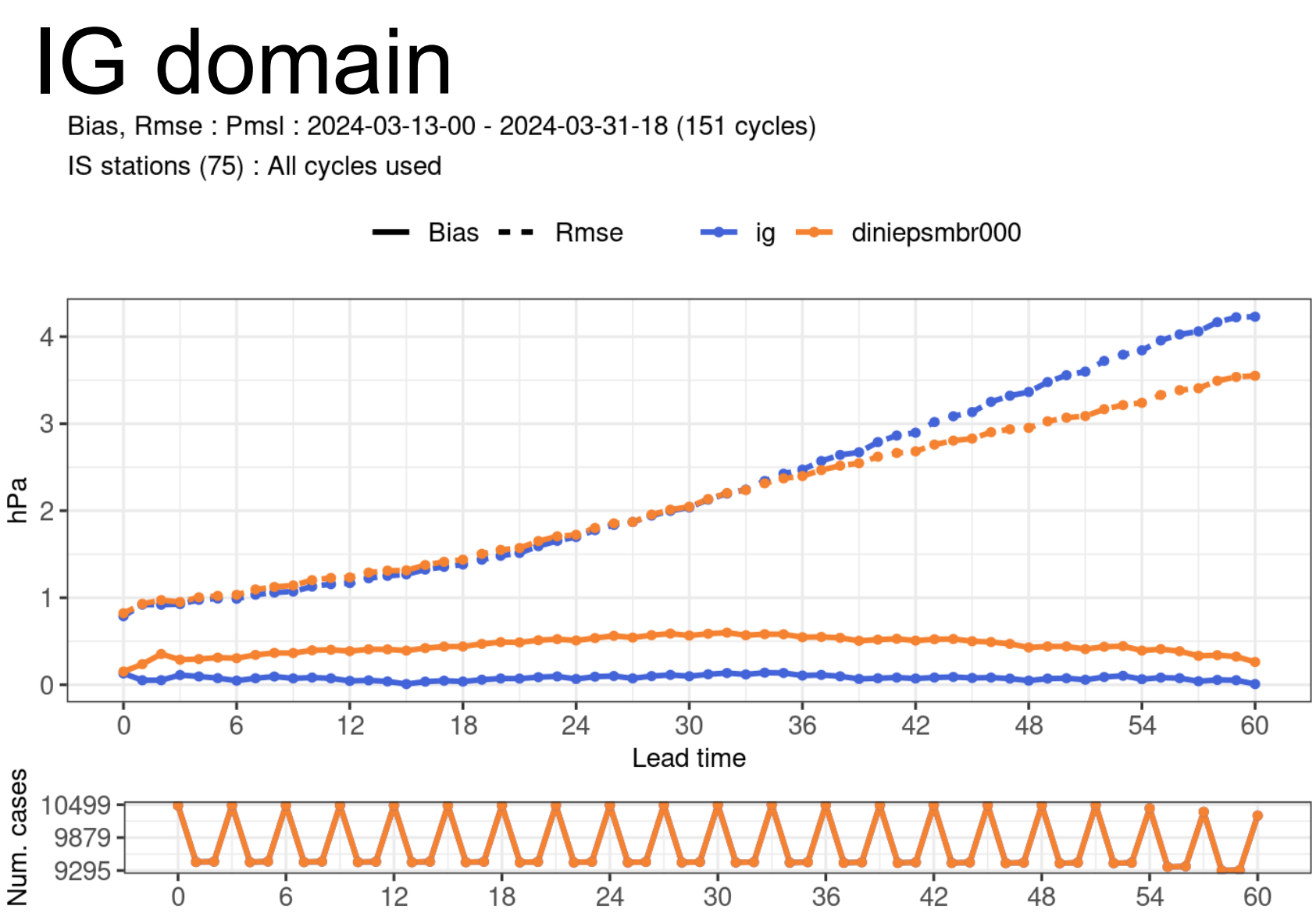
IG domain

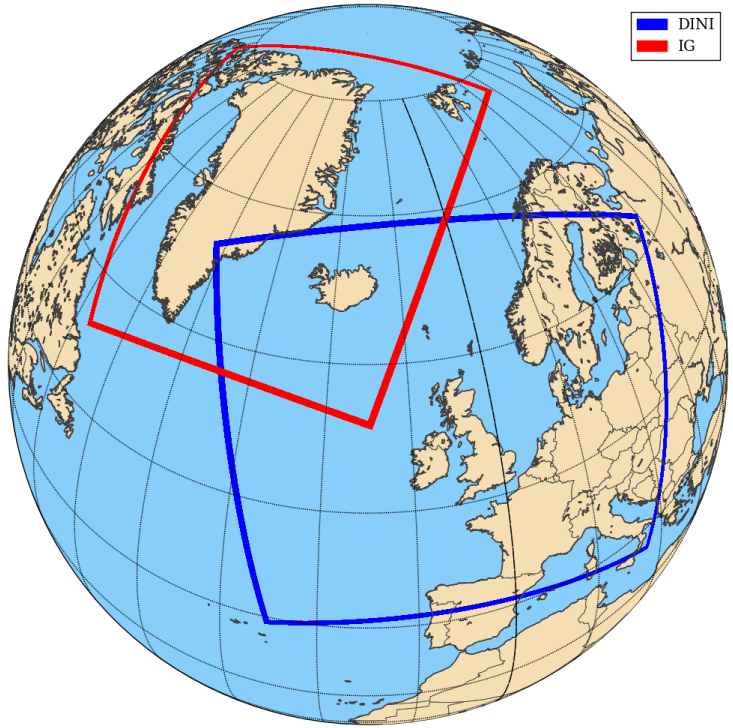

Bias, Rmse : T2m : 2024-03-13-00 - 2024-03-31-18 (76 cycles)
IS stations (51) : All cycles used
Bias
Rmse
ig
IFSHRES
degC
2
1
0
-1
0
6
12
18
24
30
36
42
48
54
60
66
Lead time
Num. cases
3514
3147
2780

IG domain

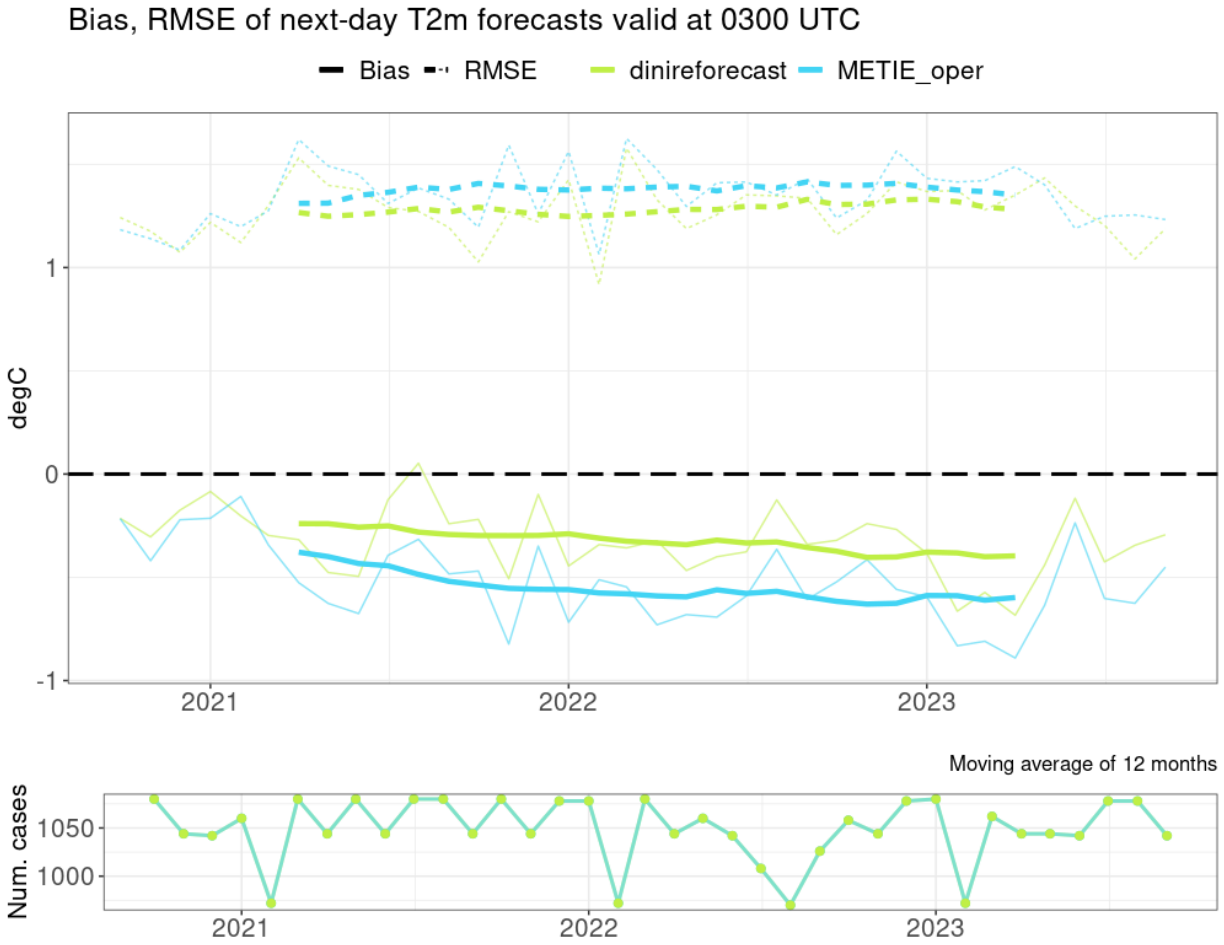

Bias, Rmse : S10m : 2024-03-13-00 - 2024-03-31-18 (76 cycles)
IS stations (50) : All cycles used
Bias
Rmse
ig
IFSHRES
m/s
4
2
0
0
6
12
18
24
30
36
42
48
54
60
66
Lead time
Num. cases
3439
3074
2710
0
6
12
18
24
30
36
42
48
54
60
66

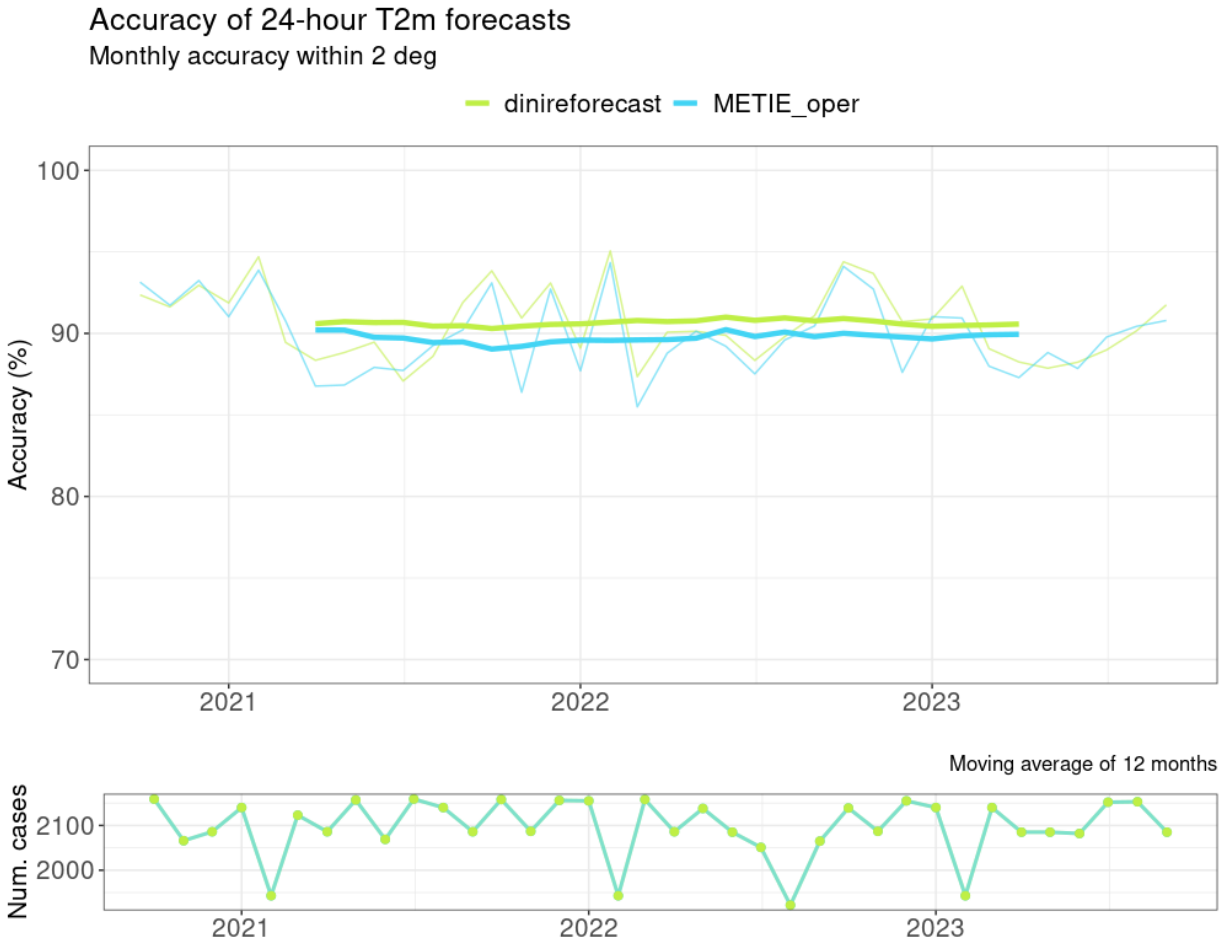
IG domain


Bias, Rmse : Pmsl : 2024-03-13-00 - 2024-03-31-18 (151 cycles)
IS stations (75) : All cycles used
Bias
Rmse
ig
diniepsmbr000
hPa
0
1
2
3
4
0
6
12
18
24
30
36
42
48
54
60
Lead time
Num. cases
10499
9879
9295
0
6
12
18
24
30
36
42
48
54
60

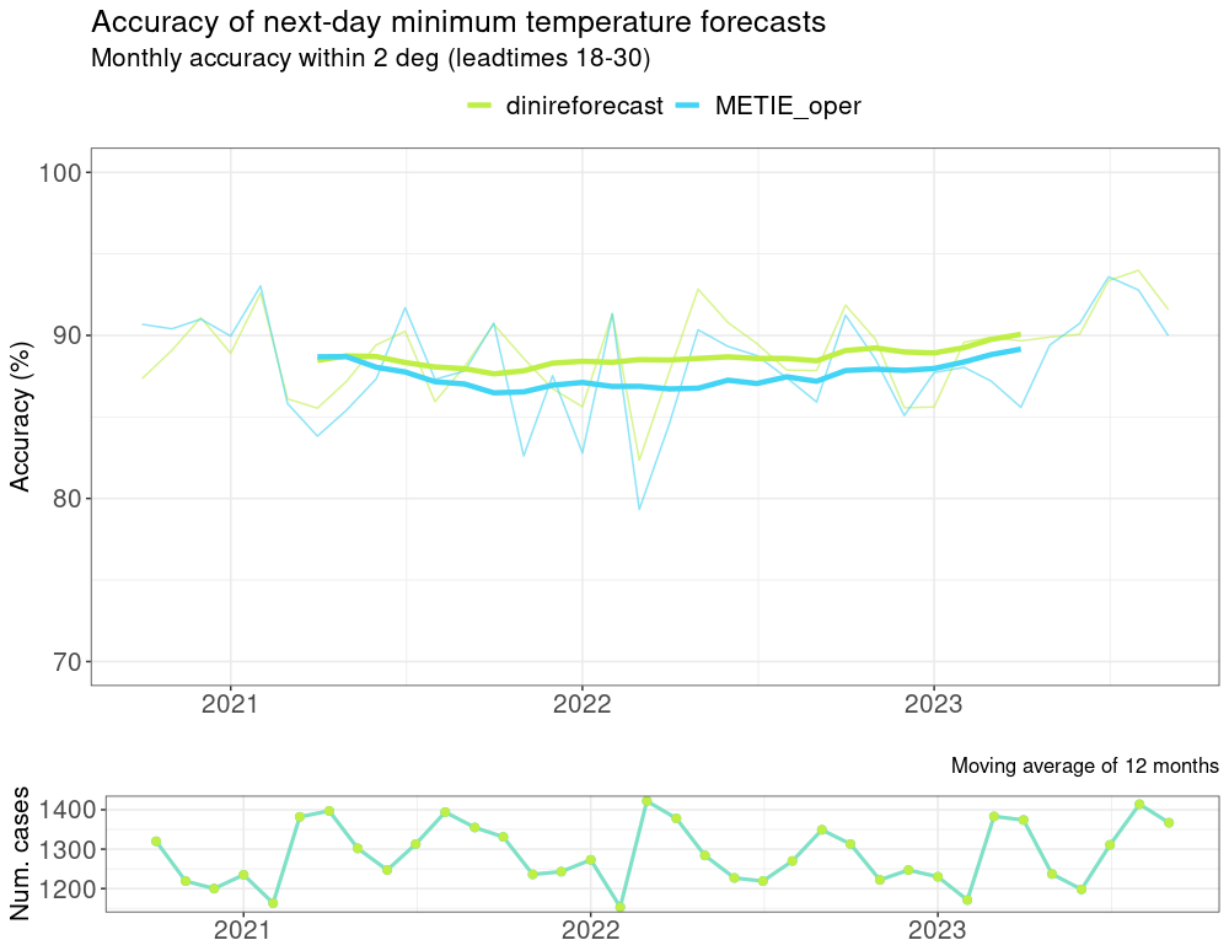

DINI
IG

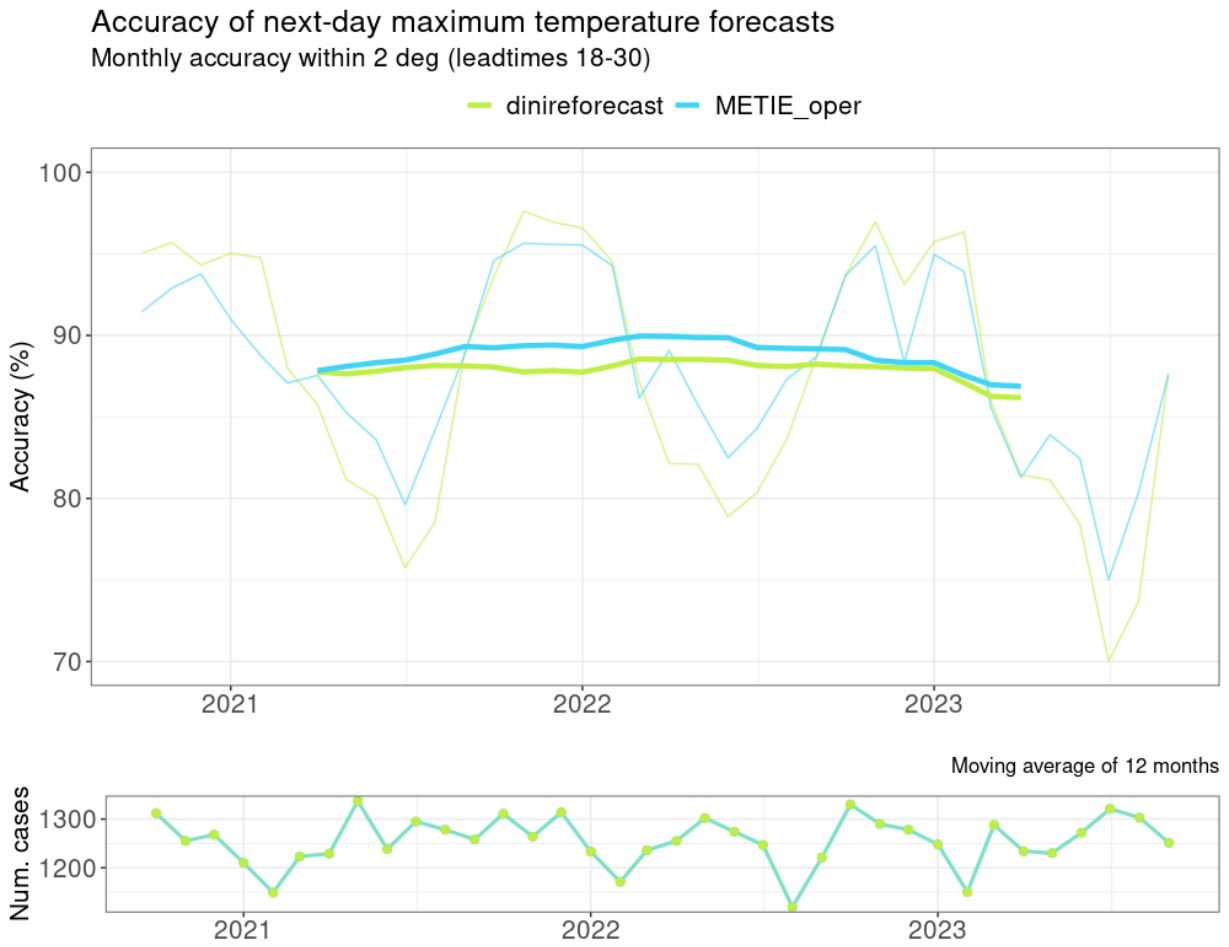
Reforecast verification



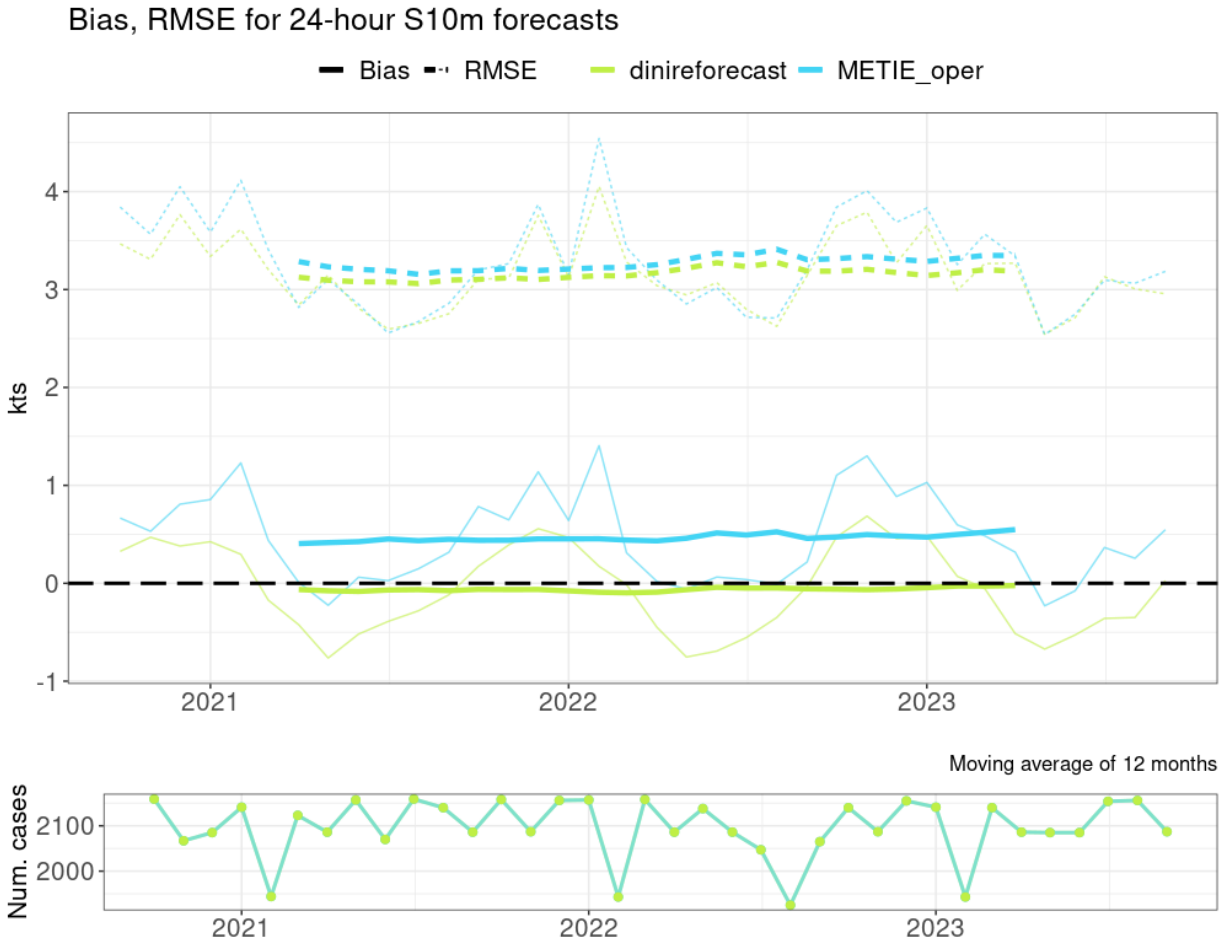


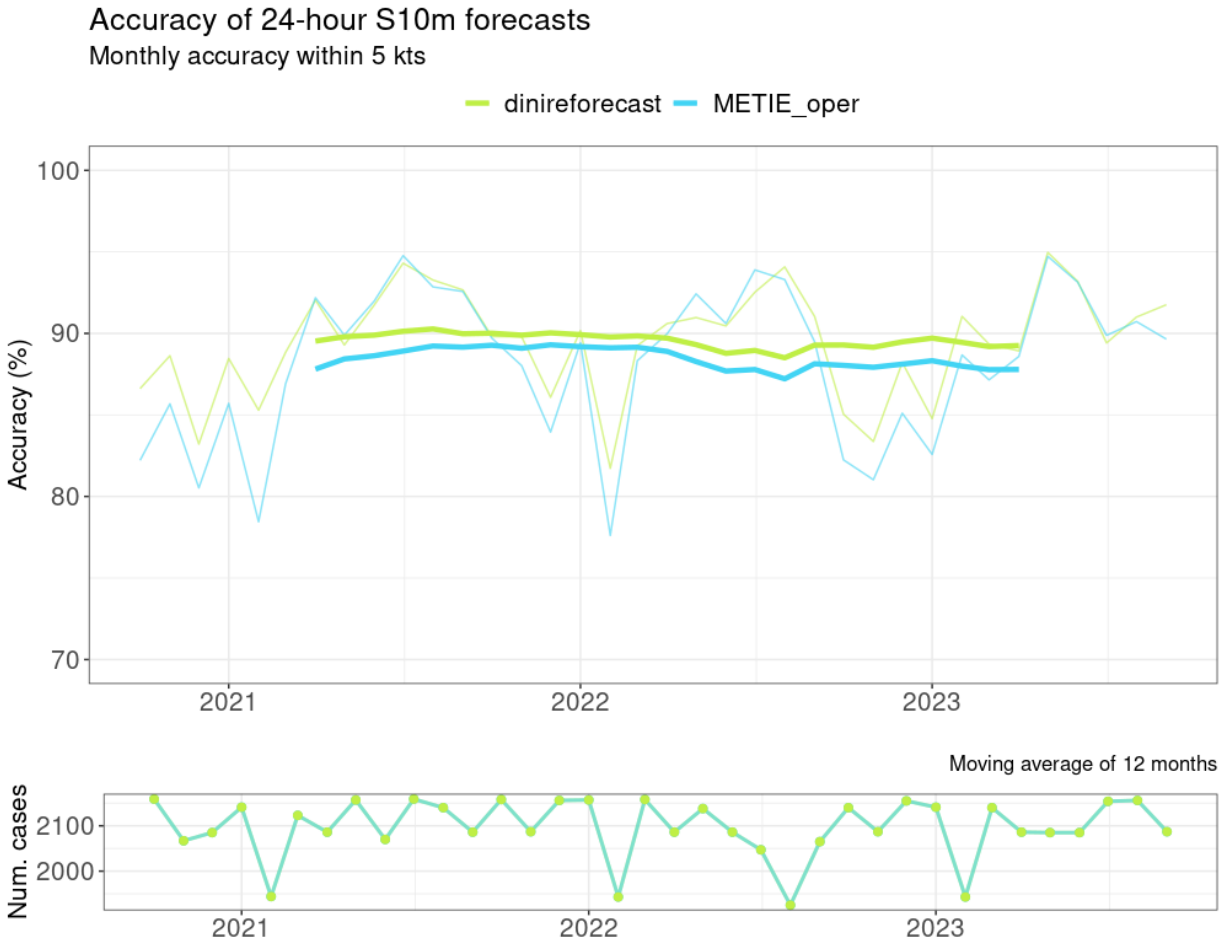
Reforecast verification





Reforecast verification

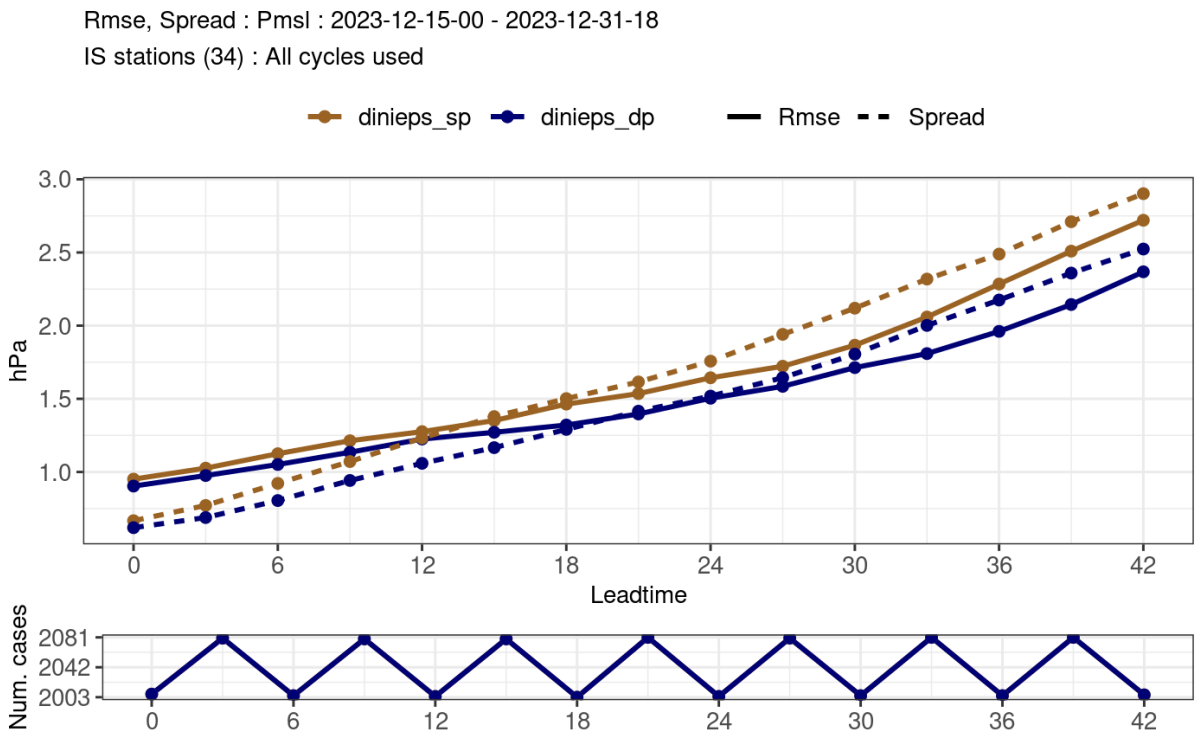


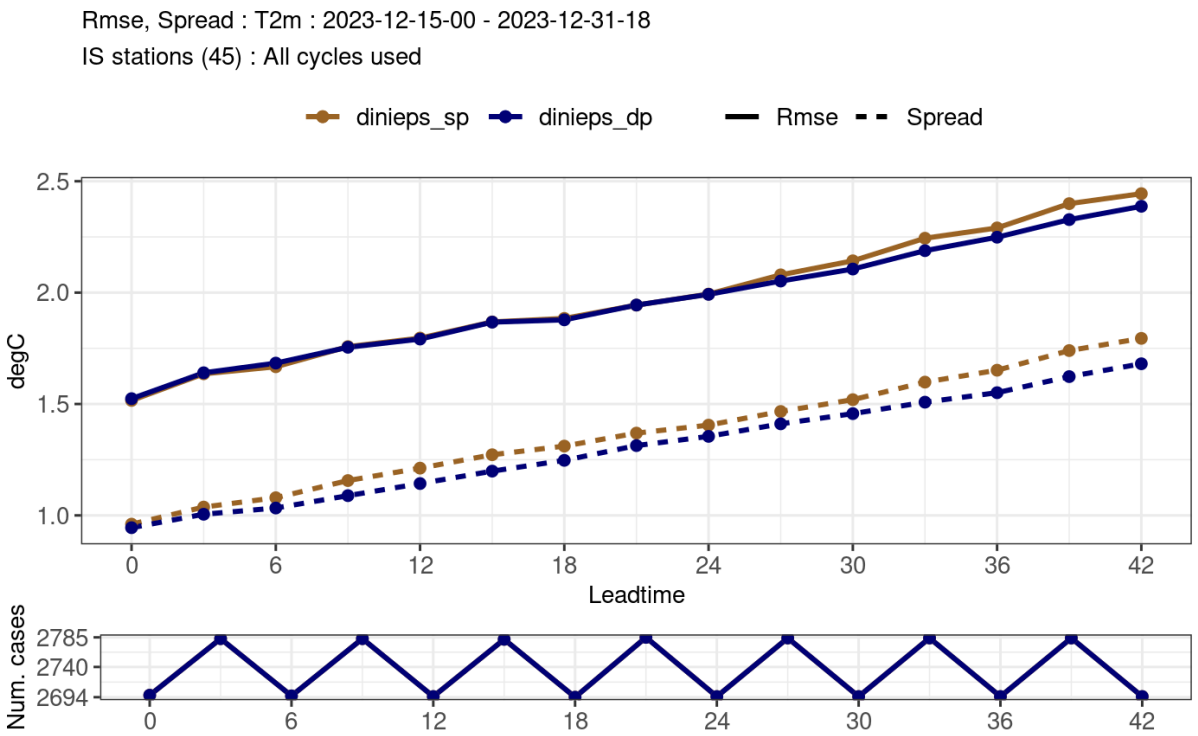


EPS verification

- Comparison of SP and DP – is SPP in SP OK?
- Comparison with IREPS which uses SLAF
- Relatively short period considered by ATM
- Results and conclusions still valid for operations

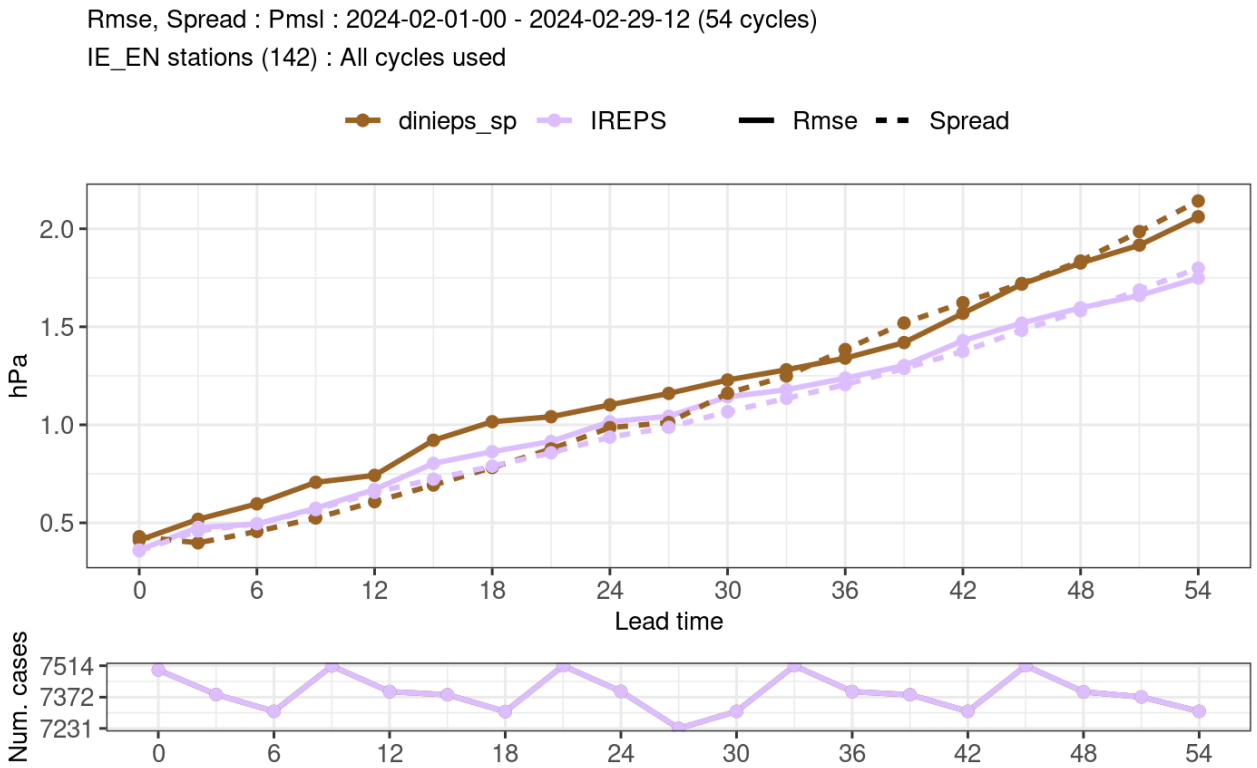
EPS verification – SP vs DP

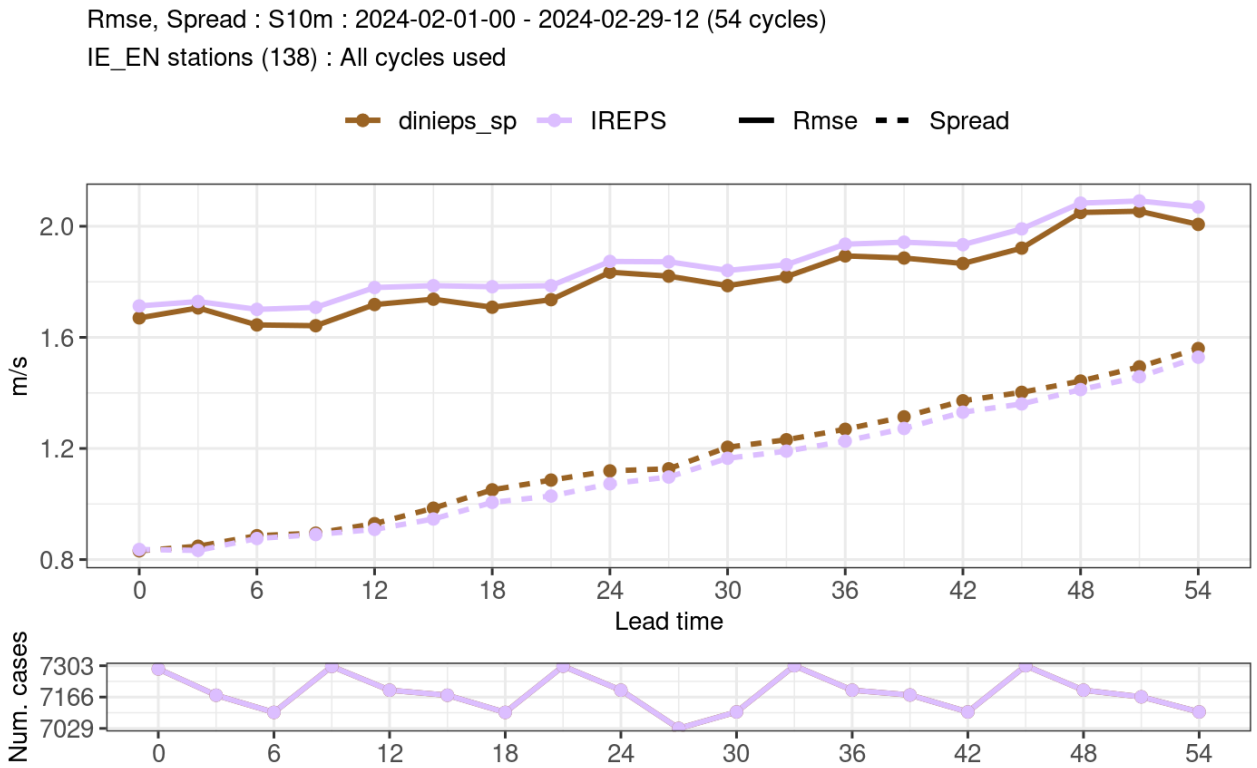




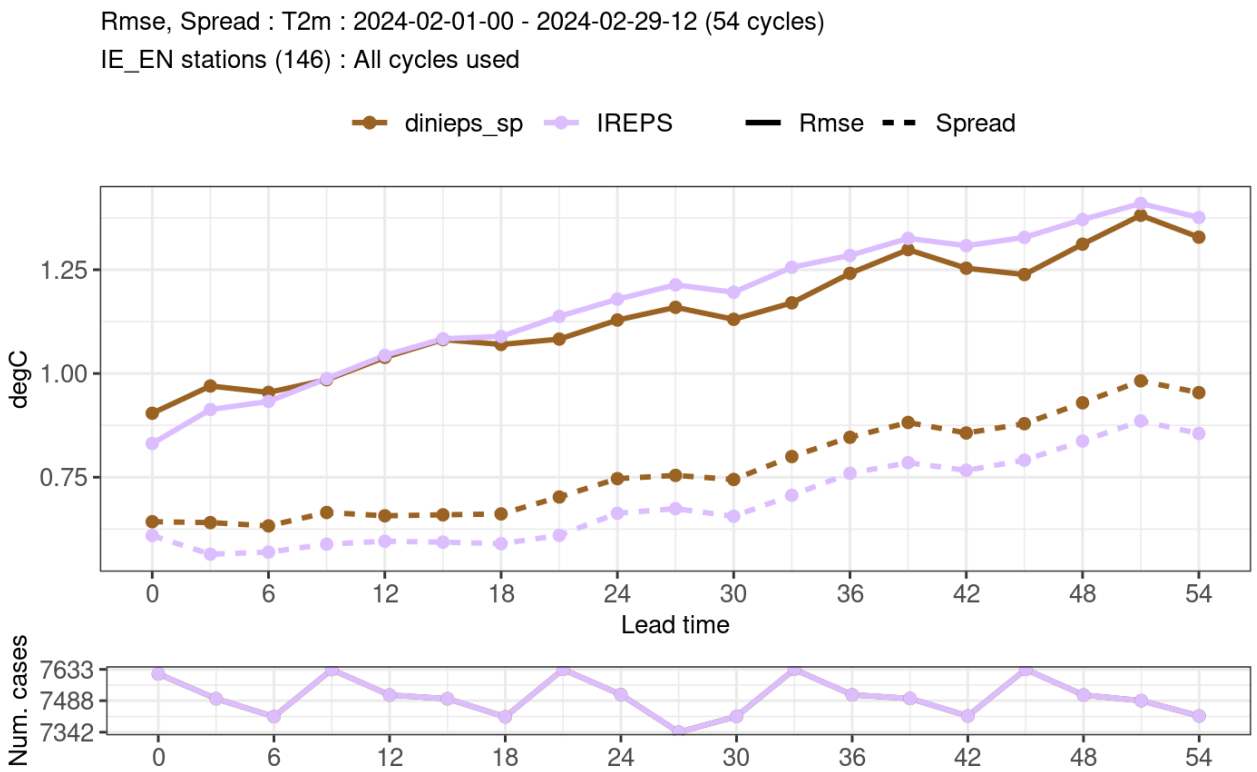
Larger spread and RMSE caused by use of older LBCs

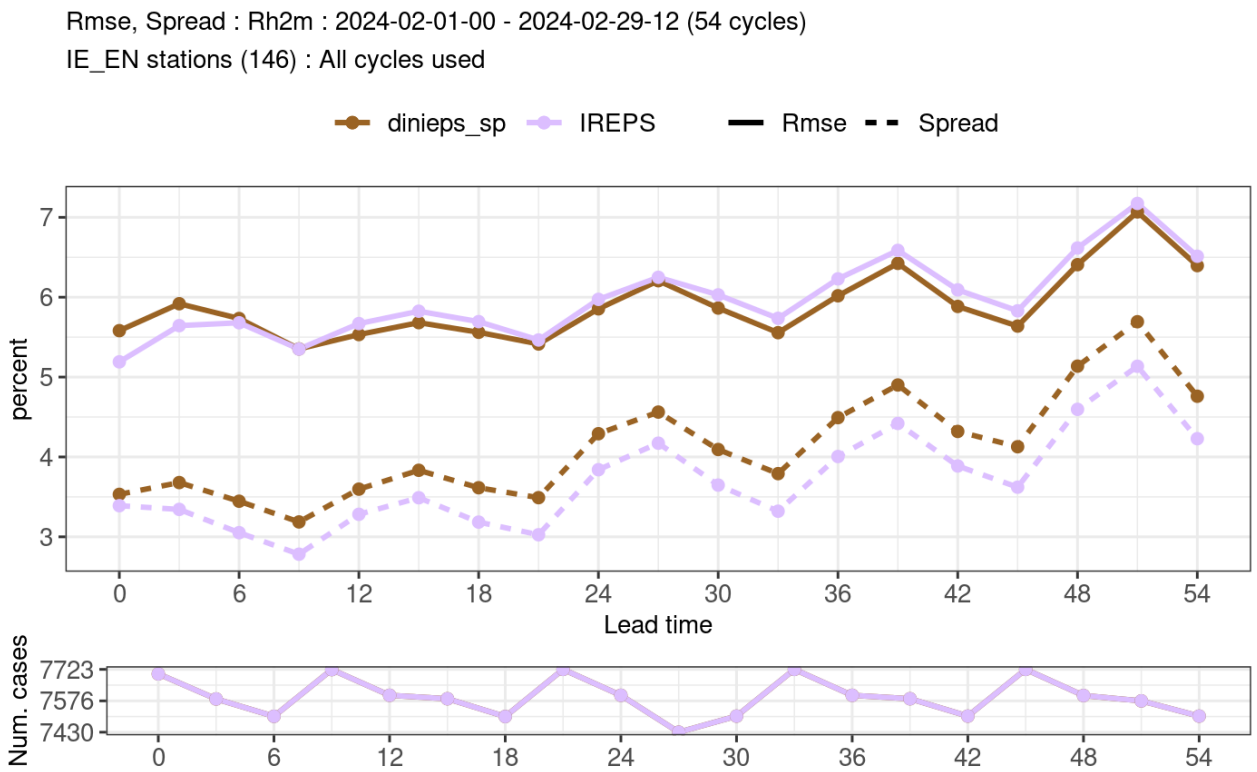
EPS verification





EPS verification





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Known issues

Type/#	Issue	Description
C2	Frontal clouds optically too thick	Not enough short wave radiation reaches the surface in the case of thick frontal clouds. This probably causes a negative bias in temperature and in critical cases it means that the (road) surface will remain below or very close to 0°C where it is significantly warmer in reality.
C3	Underestimation of Sc cloud cover	Some Sc cases are strongly underestimated. This causes too much short wave radiation to reach the surface (solar energy overestimation) and nights to become too cold or too foggy (see the presentation on 2023-03-16: 2023 Forecasters feedback).
C4	Overestimation of Sc cloud cover	Some Sc cases are strongly overestimated. These are primarily the cases where over the sea there is an open cell type of convection that is not resolved by HARMONIE. Over cold land surfaces this open cell convection clouds usually dissolve, in the model the Sc type of cloud remain causing too high nighttime temperatures and too little fog to develop.
P2	Shadowing effect mountains on precipitation too strong	Too little precipitation is forecasted over Reykjavik in case of winds coming from the Southeast, East and Northeast.
P3	Missing showers	Already since the introduction of HARMONIE CY40 there is an underestimation of especially the smaller showers. They do not develop or develop too late, giving a false hope for dry conditions in some areas. Especially when the clouds have temperatures of between 0°C and -15°C, and are not too deep, 1-4 km, they are missing quite often. See also the feedback given by Met Eireann on 2022-06-30 on Forecasters feedback

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Resolved issues

Type/#	Issue	Description	Solved
C1	Overestimation of cloud cover	Climate experiments show a significant underestimation of the short wave radiation reaching the sea surface. In addition there is also an overestimation of the cloud cover over land (SYNOP verification) and probably also over the sea (subjective comparison of (pseudo) satellite images). This overestimation is caused by tuning to solve the overestimation of fog in addition to an overestimation of heating in Summer over land due to too few and transparent clouds, when using the solutions for the fog overestimation (standard profile of CCN over land and sea (too high there), increase in VSIGQSAT)	This is improved in ECDS v2, implemented on 2022-12-12, 12 UTC. After many tests during the summer of 2022 improvements have been found and tested over 4 seasons, showing mostly improvements over all periods and all areas. For a description, see presentation 17 on Overview of presentations during ASM Nov/Dec 2022
P1	Too much drizzle	In warm sectors and with shallow convective clouds often there was too much light precipitation forecasted. This was caused by an erroneous setting in the model (LTOTPREC).	In ECDS v1, implemented 2022-05-03, 12 UTC
S1	Snow cover disappears when T_{surf}>0°C	Due to an erroneous namelist setting (LCRITSNOW in NAMFPC) in the snow cover diagnostics the snow cover disappears when the surface temperature gets above 0°C. When the surface temperature drops below 0°C the snow magically reappears again.	Was fixed in May 2022. Set LCRITSNOWTEMP to .FALSE. did the trick.

Resolved issues

Type/#	Issue	Description	Solved
S2	Thin snow cover melts too slowly	Thin snow stays present in the model too long. This is caused by snow having its own tile in the surface scheme. In case of a lowest model level having a T>0°C this means a stable situation, with only a low sensible heat flux and little energy being available for melting the snow, except in very strong winds or strong radiative forcing. It is also the reason why precipitation with a solid fraction gives a snow cover too quickly.	This is solved in ECDS v2, implemented on 2022-12-12, 12 UTC. The snow melt was a function of the snow fraction, which is a function of roughness and snow depth. At small snow depth the snow fraction and with that the melt became very small. The snow fraction impact on the melt is now limited to a minimum threshold of 25%. For a description, see presentation 17 on Overview of presentations during ASM Nov/Dec 2022
W1	Large scale wind gusts too weak?	Winds are generally a little bit weaker in the 90 levels ECDS than the KNMI 65 levels CY43 run. This also causes the wind gusts to be weaker. This caused the wind gusts to be too weak for large scale wind storms (e.g. storm Eunice, 2022-02-18). The wind storms where convection caused the strongest gusts were forecasted better by the 90 levels HARMONIE, HARMONIE 65 levels over forecasted these wind gusts.	Verification of wind gusts does not show an underestimation of the wind gusts on average (for the hourly wind gusts). A local maximum wind gust may not be resolved by the model, or may not be representative due to observation errors. The question therefore is if this is really an issue. The underestimation for the Netherlands can be attributed to the reporting of 3- and 6-hour gusts in the 03/09/15/21 and 00/06/12/18 GTS observations for the Netherlands.

Melting the last few cm of snow

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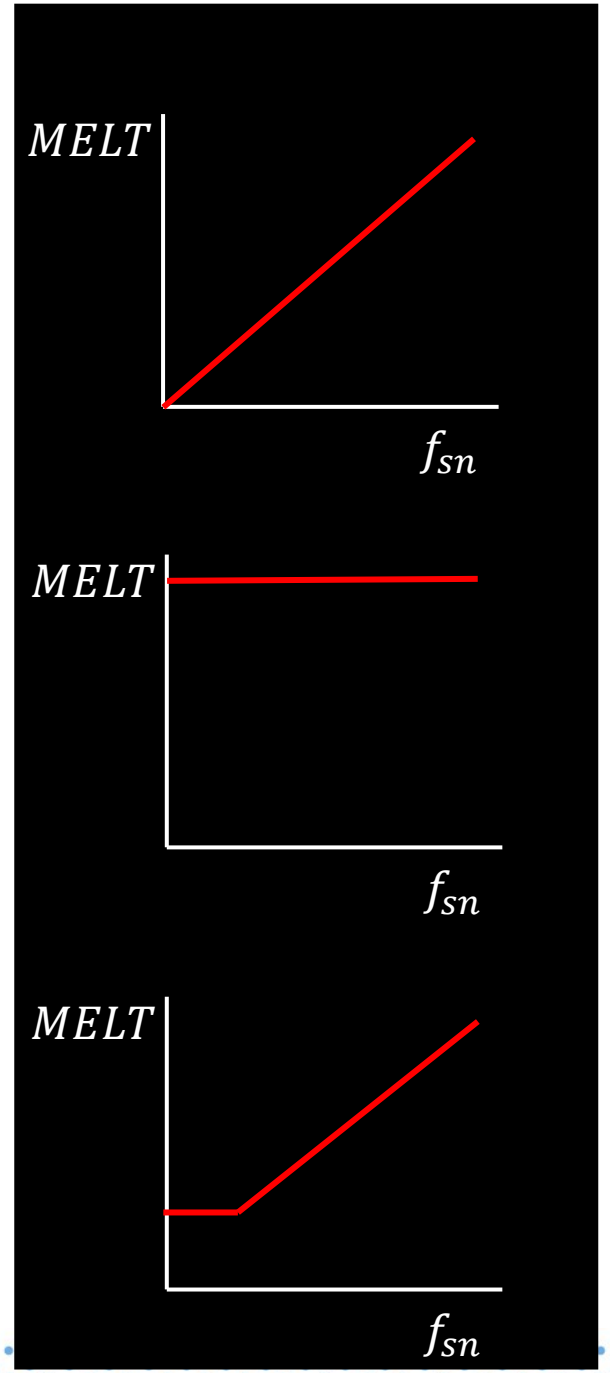
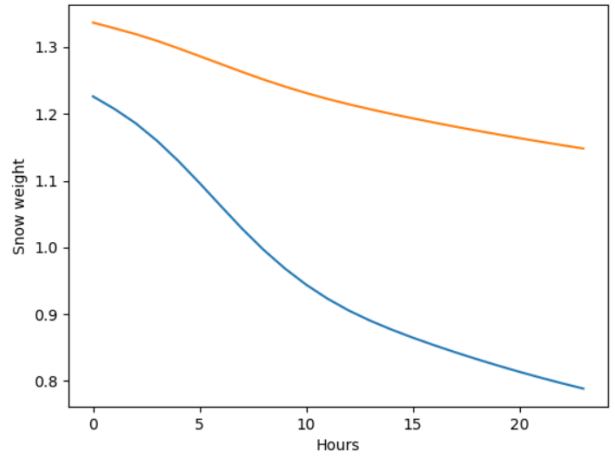
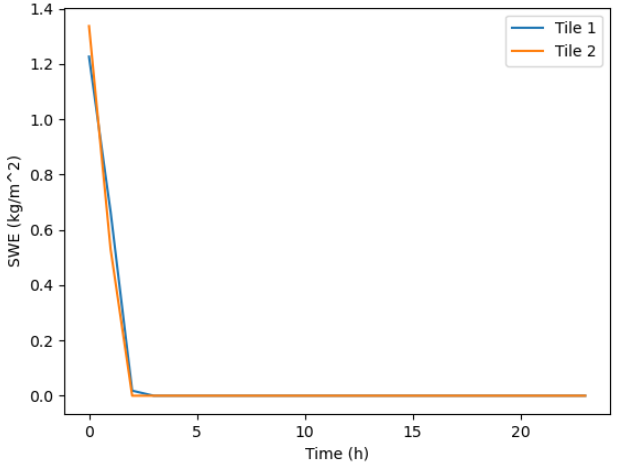
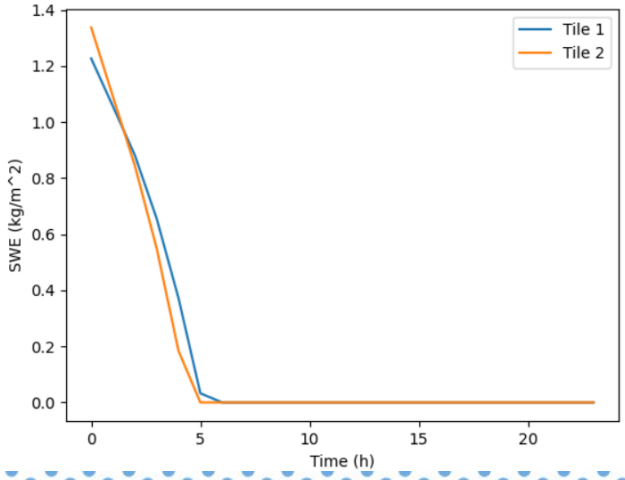
Work carried out by Michael Adriaens & Sander Tijm

$$MELT = f_{sn} * \frac{\Delta T}{C_p * c_m * \Delta t}$$









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Snow Depth Water Equivalent

Run: Wed 07 Feb 06Z

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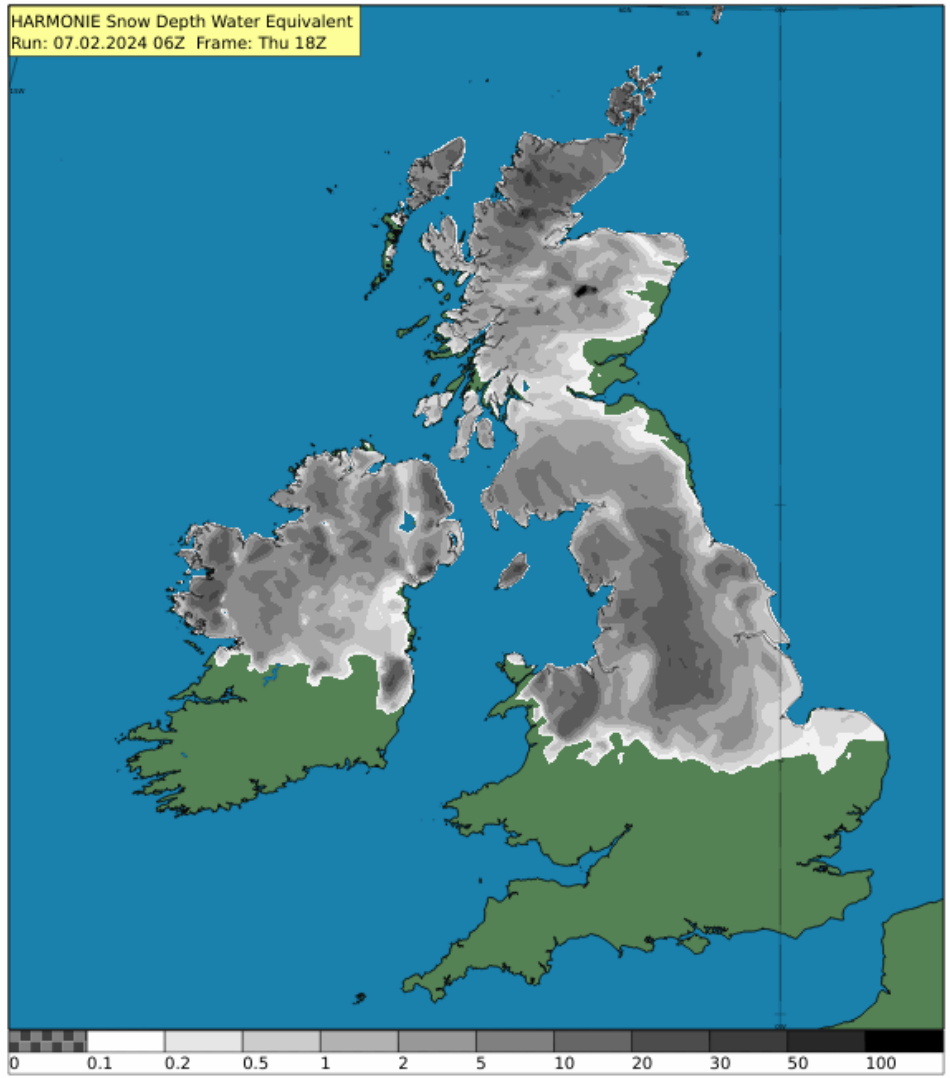
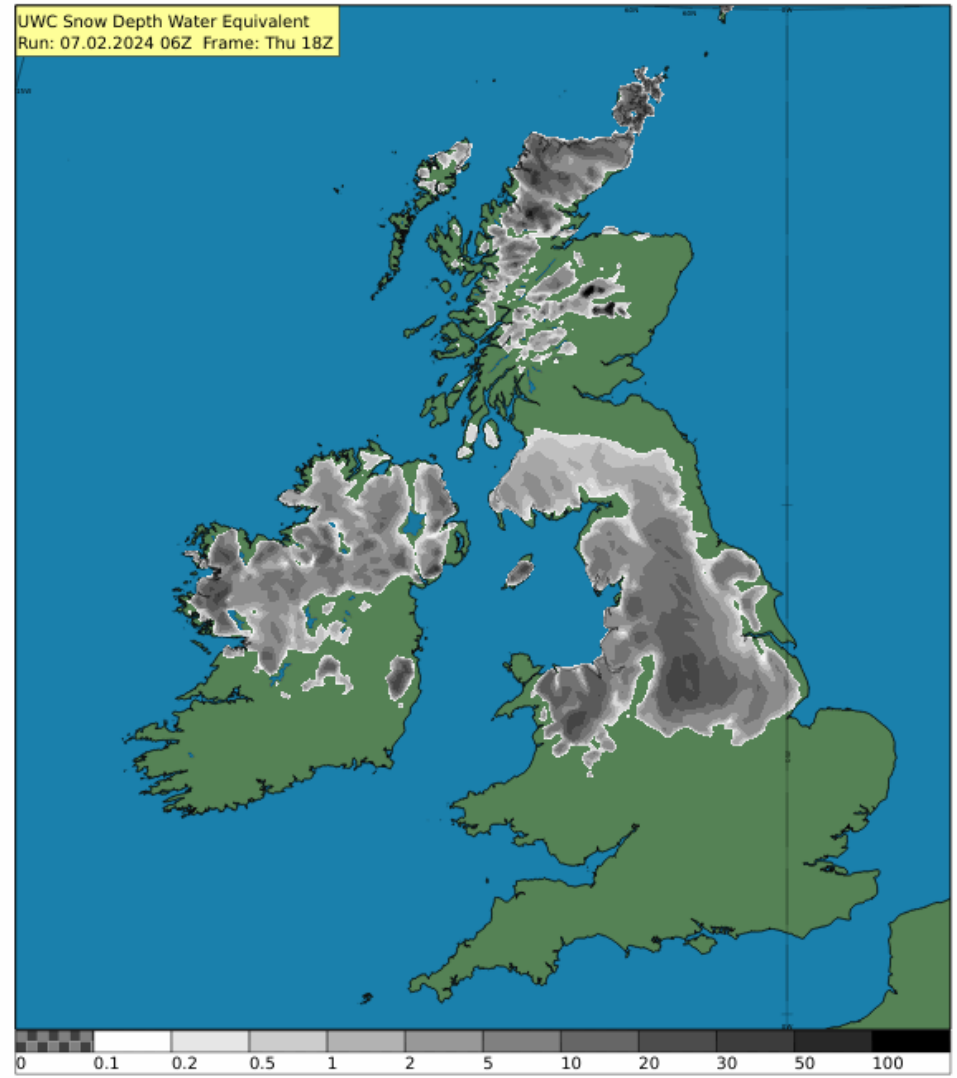
entres

Frame: Thu 08 Feb 18Z





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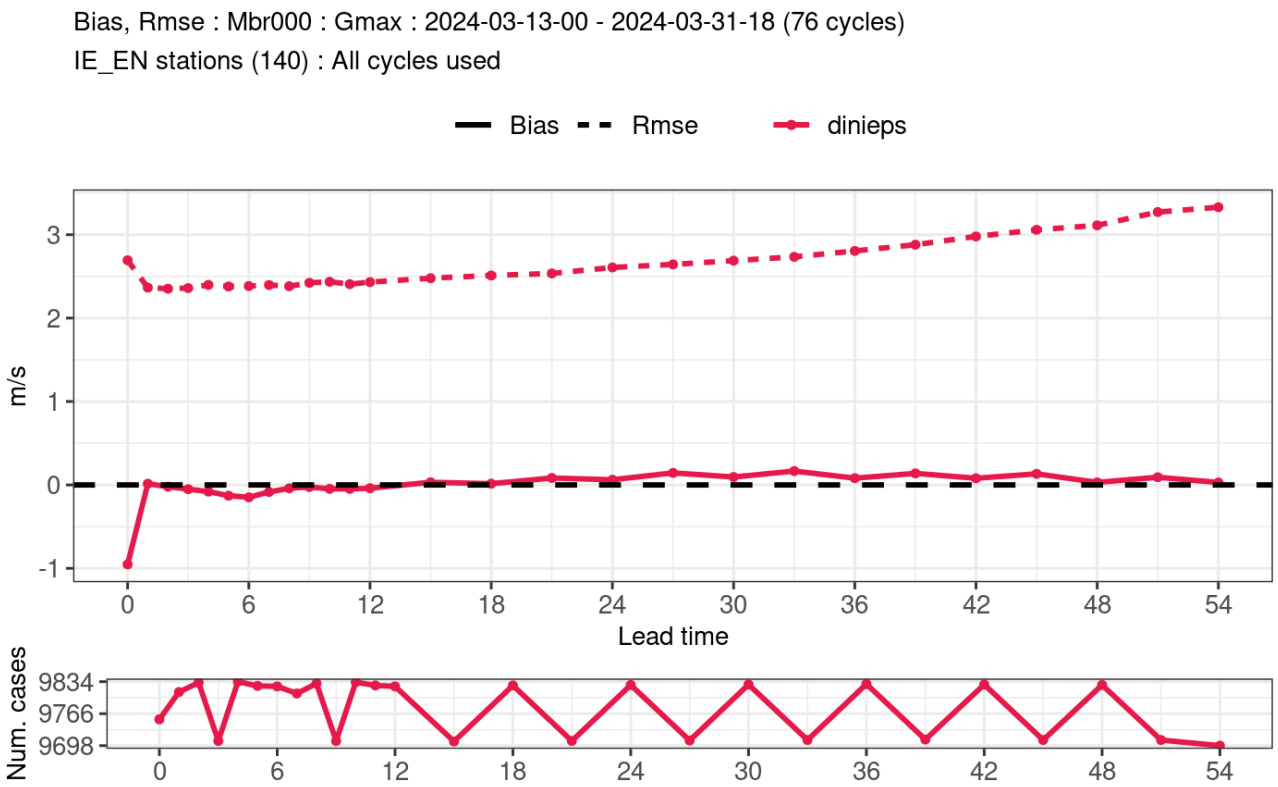
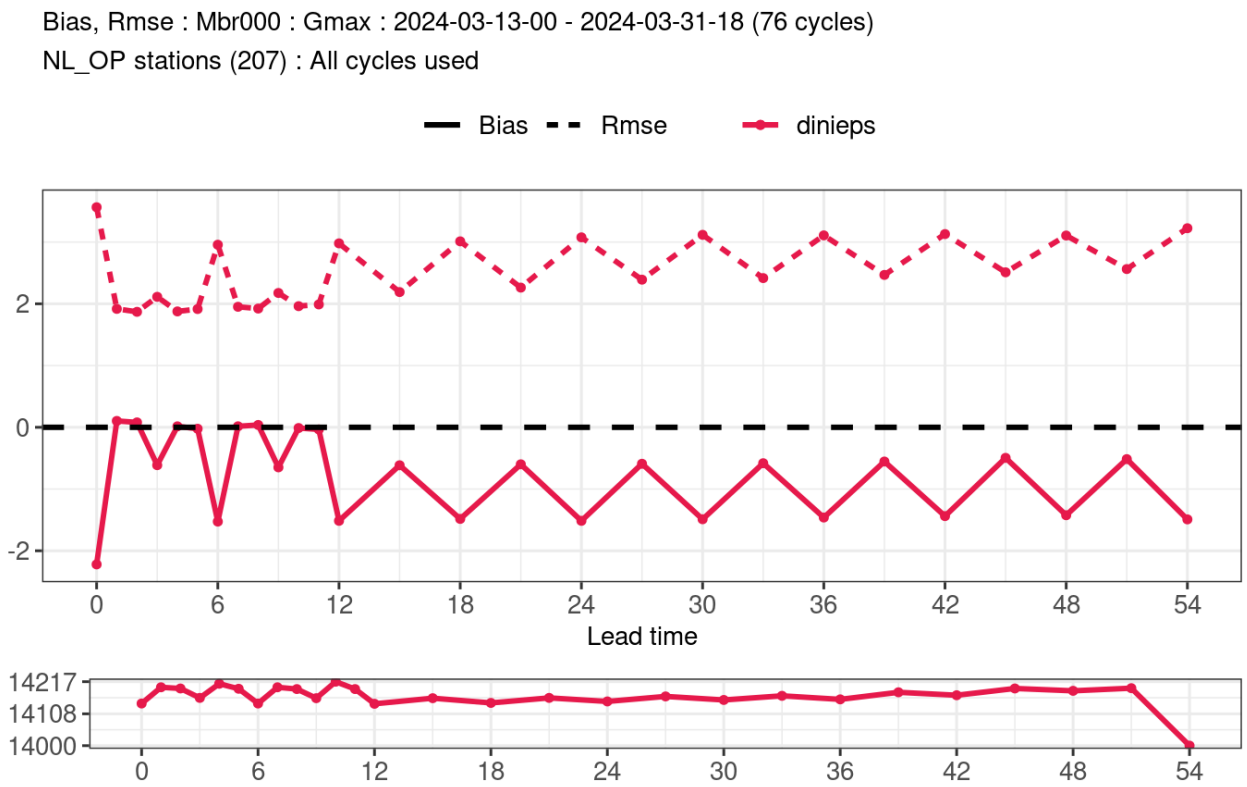
Gust verification





Some beautiful BUFR …

timeSignificance	missing	CODE TABLE
timePeriod: -10		
timePeriod	-10	min
maximumWindGustDirection	110	deg
maximumWindGustSpeed	14.7	m/s
timePeriod: -60		
timePeriod	-60	min
maximumWindGustDirection	110	deg
maximumWindGustSpeed	16.9	m/s

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