27th COSMO General Meeting, Bas[illegible]witzerland

Teams link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_OThkYTViM2MtZDY5NS00YzAwLWE5ZDItNzFlOGIyNGJjMDAw%40thread.v2/0?context=%7b%22Tid%22%3a%224dc9a853-049d-4a62-82a8-22f071aaaac5%22%2c%22Oid%22%3a%22c9ef19ca-abf2-4a31-a4e0-7e27a9524e26%22%7d

WGV/A Parallel Sessions: Monday 01 September 2025

WGV/A Verification Activities and Tools **Chair: F.Gofa & A.Mazur**		**Room: Seminarraum 104**
09:00 – 10:40	F.Fundel	Updates on MEC/FFV2
	F.Fundel	Verification activities in DW (AI included)
	A.Pauling	Comparison of NWP and ML verification results
	P.Kaufmann	The significance of averaging interval for the definition of gusts and its impact on verification
	N. Vela	Precipitation FSS for COSMO CP
10:40 – 11:00	***BREAK***	
11:00 – 11:40	S. Gabrian	NMA task report for CP activities
	F. Gofa	Presentation of seasonal CP reports New CP structure
WGV/A PP-APOCS **Chair: Artur Surowiecki**		
11:40 – 12:30	All	PP-APOCS Tasks progress
12:30 – 14:00	***LUNCH***	
WGV/A PP-CARMENS: Joint with WG-EPS **Chair: Stefan Gabrian**		**Room: Seminarraum 104**
14:00 – 15:30	S. Gabrian	Update on PP-CARMENS and its tools (github)
	All	Open Issues - Discussion
	C. Marsigli, all	New EPS project verification tasks
	A.Mazur (for T.Tabalchuk)	Influence of perturbation of surface temperature on temperature inversion at selected SYNOP stations in Poland – intro, preliminary results
15:30 – 16:00	***BREAK***	
WGV/A PT-EGALITE and model applications **Chair: A.Mazur**		**Room: Seminarraum 104**
16:00 – 17:00	A.Mazur, C.Siewert, P.Kaufmann	PT- EGALITE – work completed, final report
	As above, all	Possibilities of continuation, discussion
WGV/A – AOB on verification/application **Chair: F.Gofa & A.Mazur**		**Room: Seminarraum 104**
17:00 –		

WG5 Parallel Sessions: Monday 01 September 2025

https://teams.microsoft.com/l/meetup-join/19%3ameeting_OThkYTViM2MtZDY5NS00YzAwLWE5ZDItNzFlOGIyNGJjMDAw%40thread.v2/0?context=%7b%22Tid%22%3a%224dc9a853-049d-4a62-82a8-22f071aaaac5%22%2c%22Oid%22%3a%22c9ef19ca-abf2-4a31-a4e0-7e27a9524e26%22%7d

ΕΘΝΙΚΗ ΜΕΤΕΩΡΟΛΟΓΙΚΗ ΥΠΗΡΕΣΙΑ

Please keep the allocated time, upload your presentation: https://www.cosmo-model.org/view/content/consortium/generalMeetings/general2025/parallel/wg-va
comments/remarks at the END of presentations (when time allows)

Common Plots Activity

F. Fundel, N. Vela, S. Gabrian, A. Iriza-Burca,
S. Dinicila, M.S.Tesini, F. Batignani, T. Gastaldo, N. Zaccariello, A. Surowiecki, D. Boucouvala, A. Pauling, P. Kaufmann, P. Khain, F.Gofa,….

CP Activities Update

Verification Features:

- **continuous and categorical parameters** (domain average, station average, time series, against SYNOP stations)
- **upper air** (domain average, station average, time series, against SYNOP stations)
- **conditional verification available**. Currently 2mT/Clouds, possibility to use thresdholds on constant files (e.g. Windsp/roughness length)

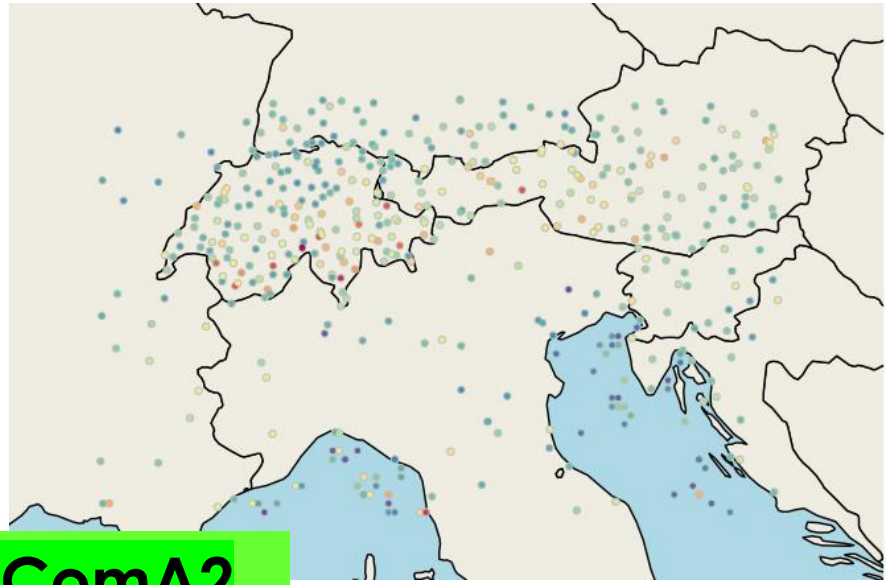
Specifications

- Files submission (seasonal or monthly basis): All files should be uploaded on seasonal or monthly basis on the NMA ftp server: **193.26.129.30**, user: icon (for password contact Stefan Gabrian: stefan.gabrian@meteoromania.ro). In the FTP server, the following directories can be found:
  - OBS_NC: netcdf observations
  - PRECI-GRIB: 3h precipitation GRIB files (for spatial verification)
  - CARMA (Forecast files): MEC derived files
- **Observations** (SYNOP and TEMP) in netcdf format are available on NMA ftp server on a **weekly basis (**icon@193.26.129.30).
- **COSMO-LEPS** control files are processed (MEC) at Atos HPC on a monthly basis
- Nomenclatue for the ScoreFiles has been changed.
- *Cleanup of past years files is necessary done in COSMO shine server (folders but content not visible unless are moved)*

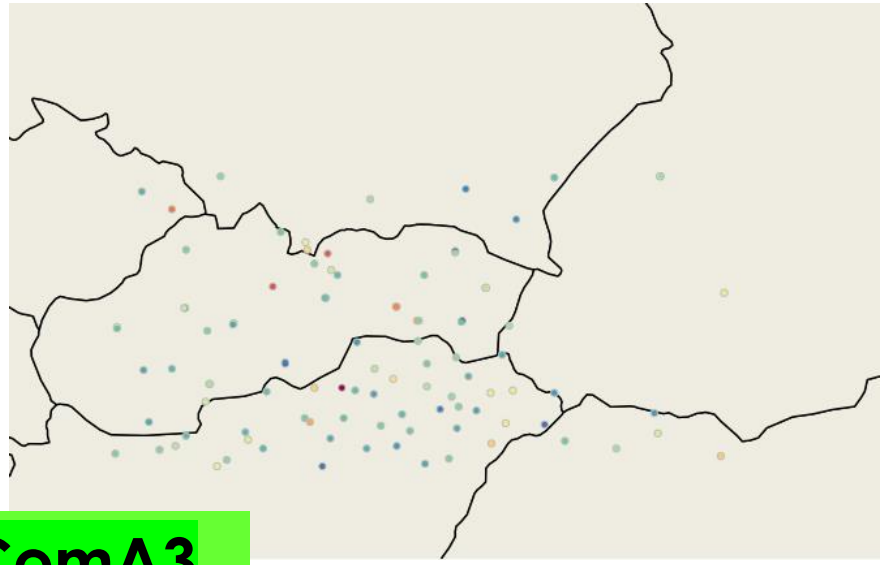
CP activity: operational models

COARSE | FINE | EPS

- **DWD:** ICON-EU (0.0625), ICON-D2 (0.02), ICON-D2-EPS (0.02)
- **COMET:** COSMO-ME (0.045), COSMO-IT (0.02), ICON-IT (0.02), COSMO-ME-EPS (0.0625), COSMOIT-EPS (0.02)
- **IMGW-PIB:** COSMO-PL7 (0.0625), COSMO-CE-PL2k8 (0.025), ICON-PL (0.025), COSMO-PL2.8-eps (0.025)
- **HNMS:** ICON-GR (0.025)
- **MCH:** COSMO-1E (0.01), COSMO-2E (0.02), ICON-1, ICON-2 in testing phase
- **IMS:** ICON-IL (0.025), ICON-IL-EPS (0.025)
- **NMA:** COSMO-RO7 (0.0625), COSMO-RO3 (0.025), ICON-RO2p8 (0.025)
- **ARPAE-SIMC:** COSMO-5M(0.045), COSMO-2I(0.02), COSMO-2I-EPS (0.02), ICON-2I
-

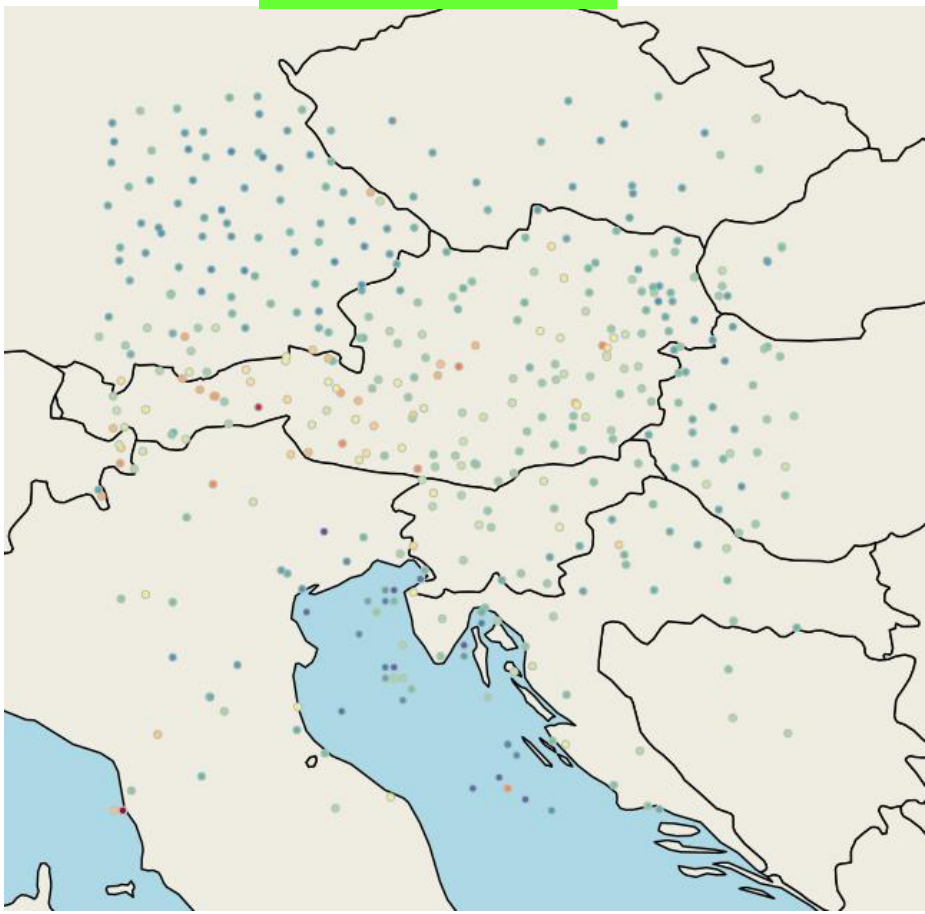


ComA2



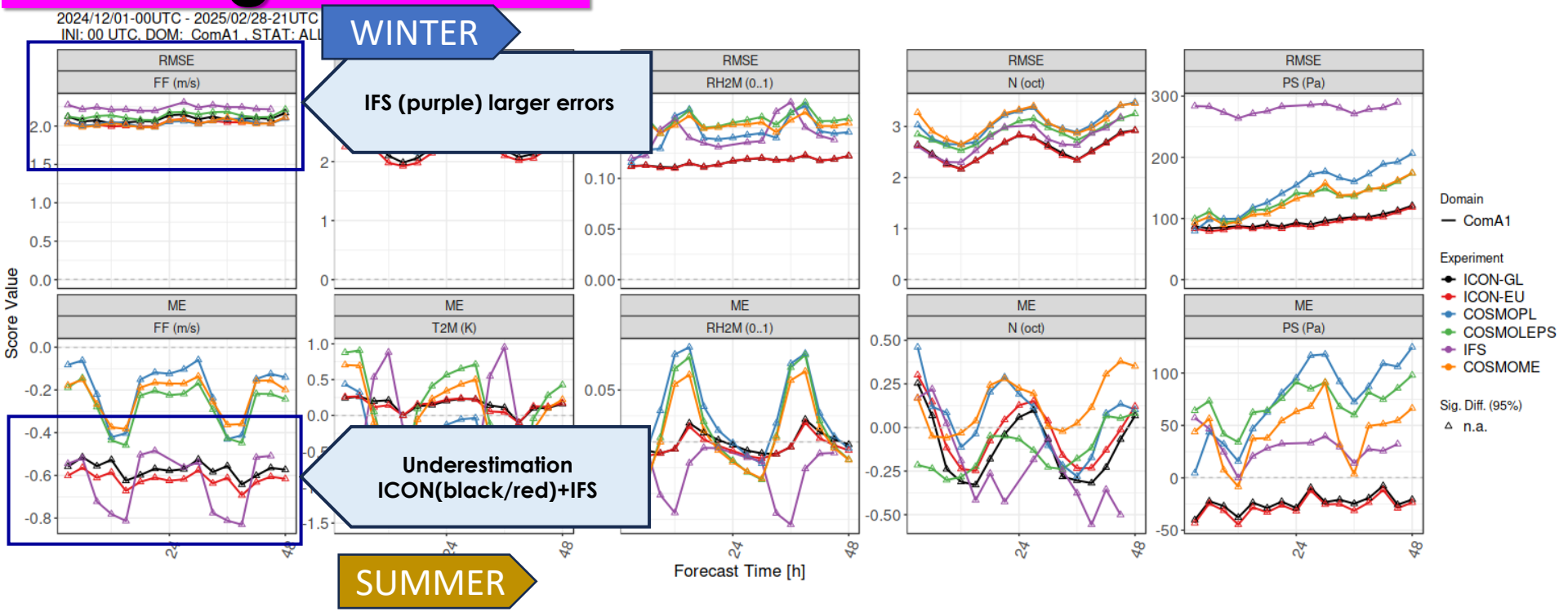
ComA3

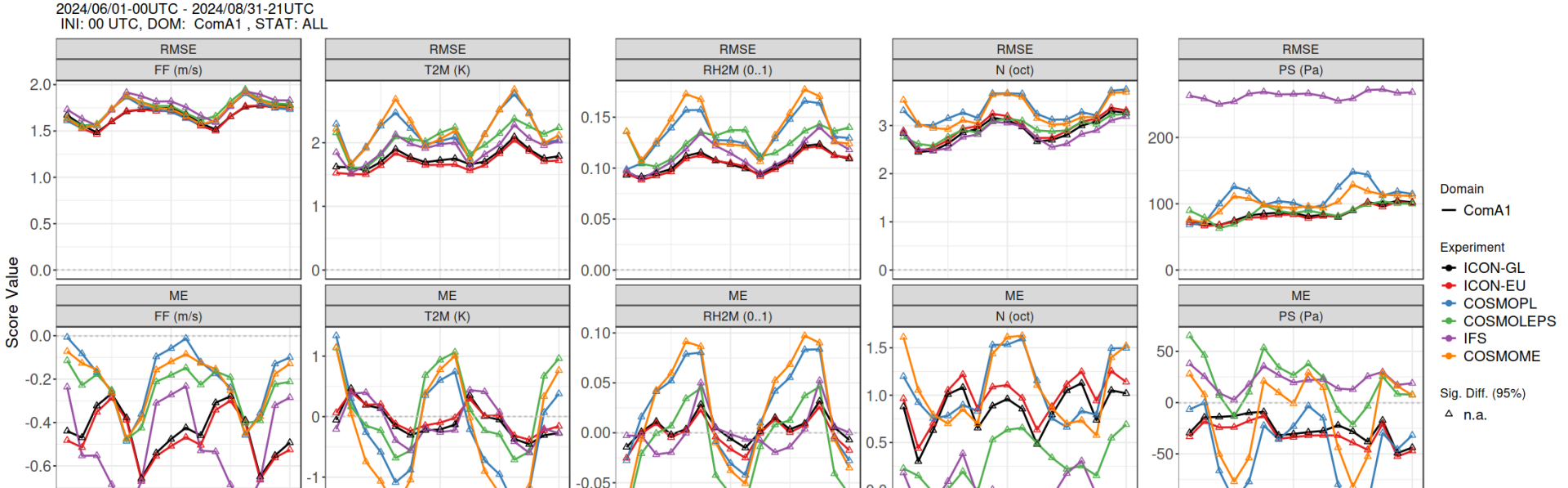
ComA1



Driving Models

ComA1



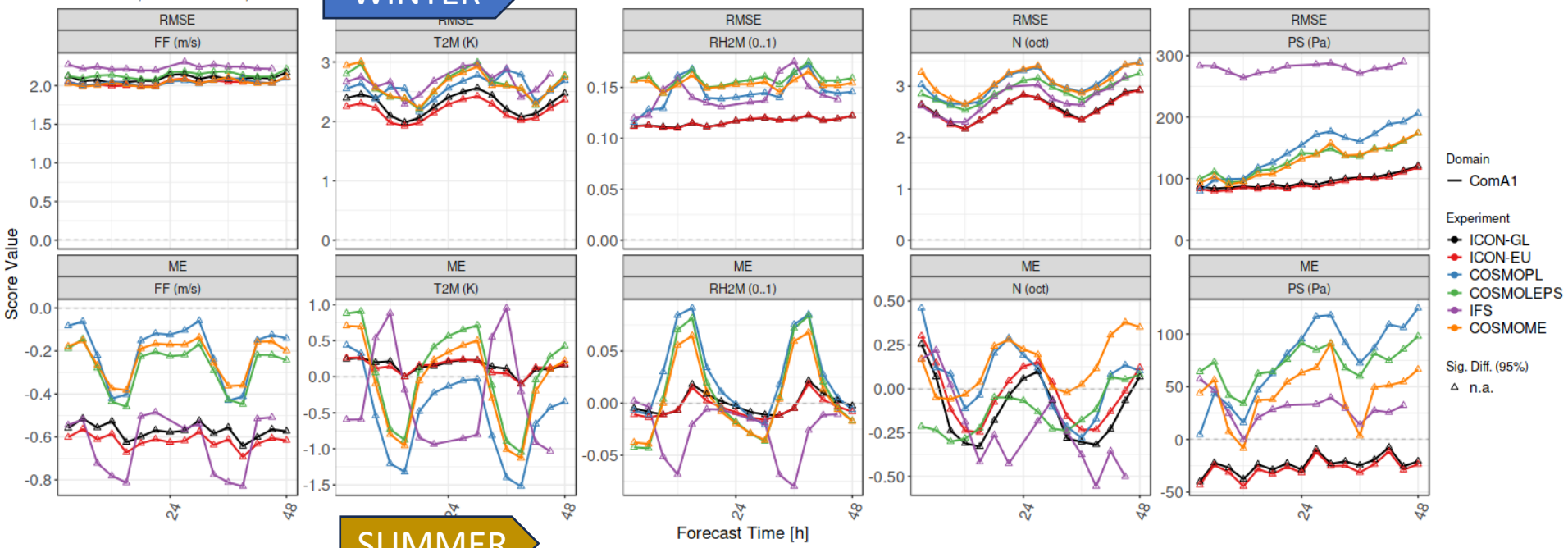


Driving Models

ComA1

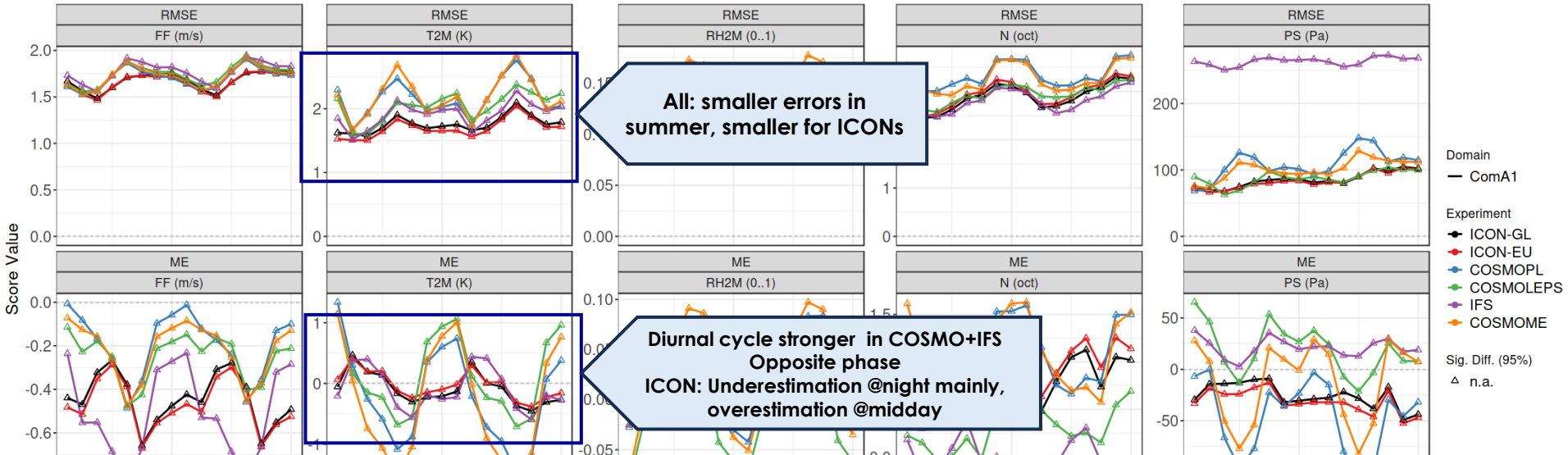
2024/12/01-00UTC - 2025/02/28-21UTC
INI: 00 UTC, DOM: ComA1 , STAT: ALL

WINTER



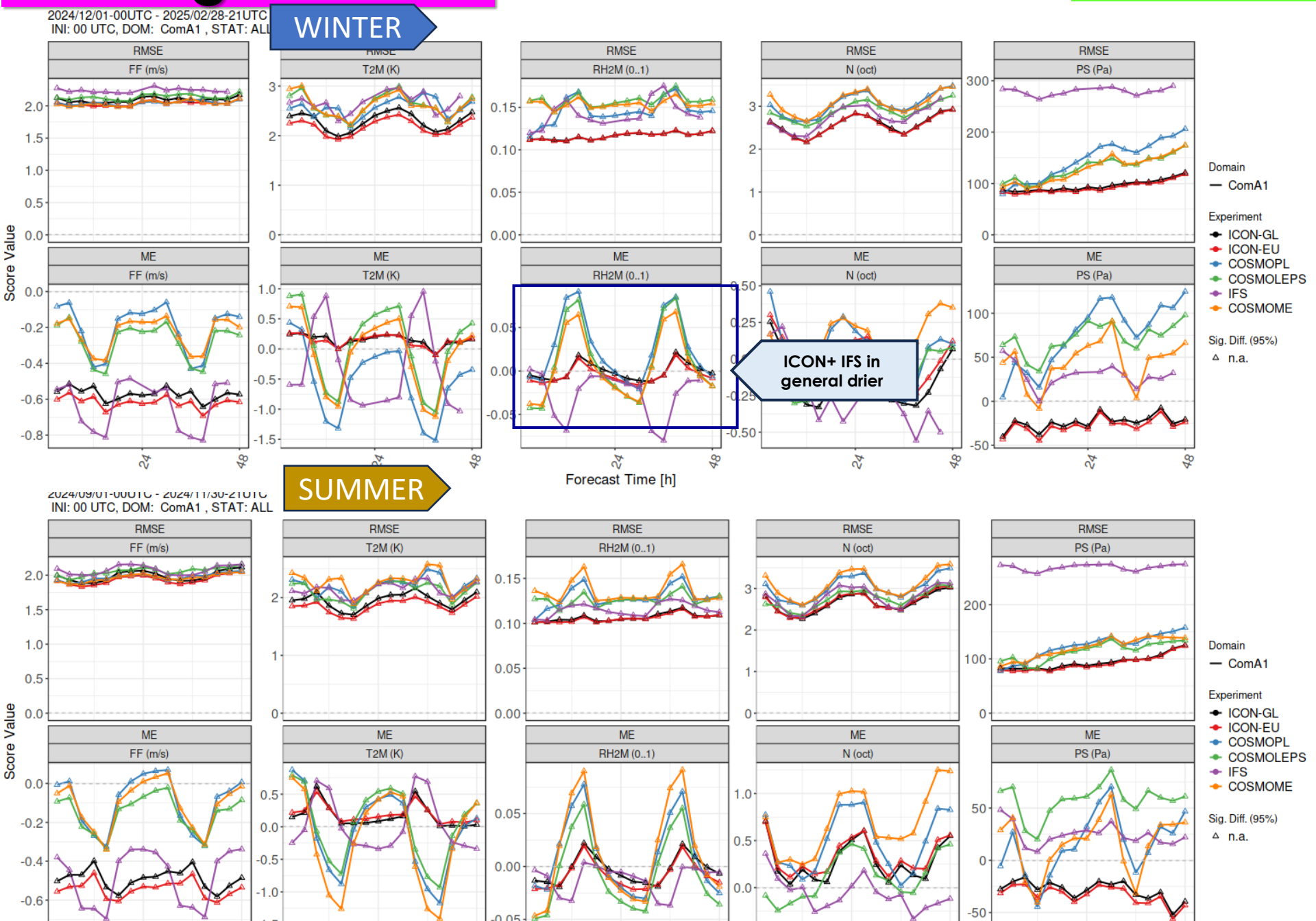
SUMMER

2024/06/01-00UTC - 2024/08/31-21UTC
INI: 00 UTC, DOM: ComA1 , STAT: ALL



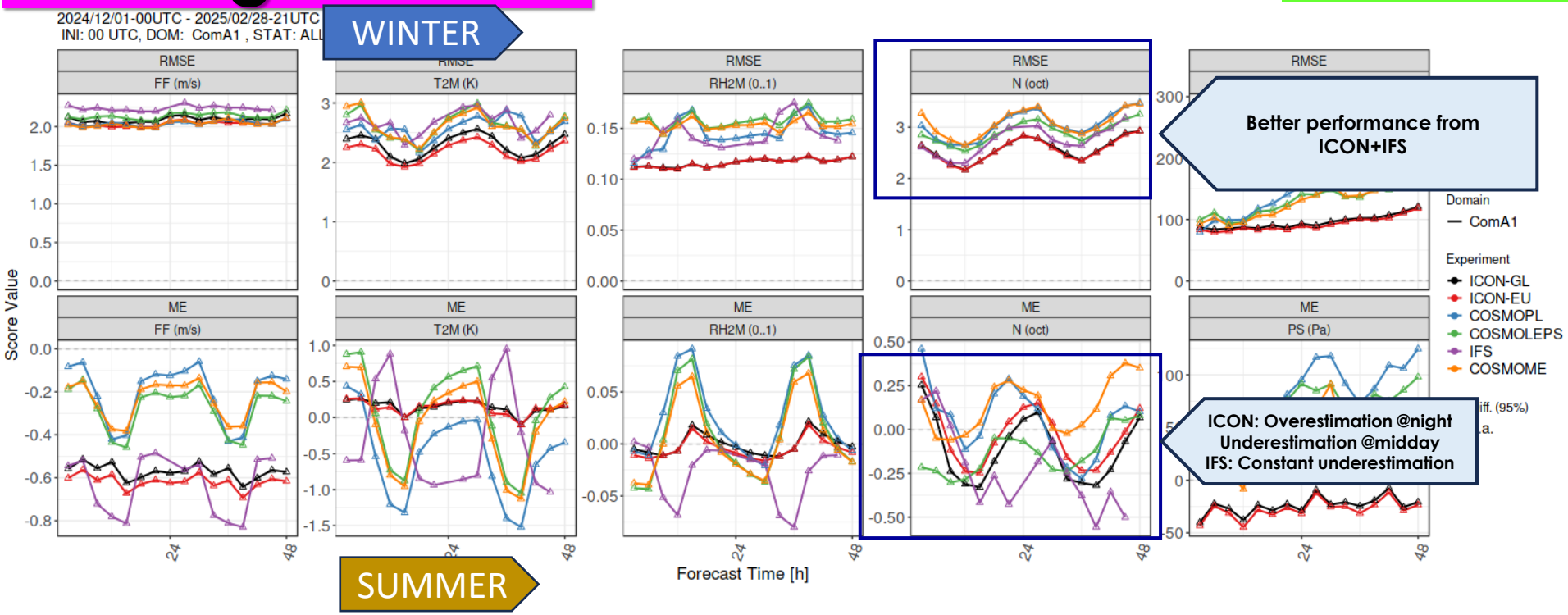
Driving Models

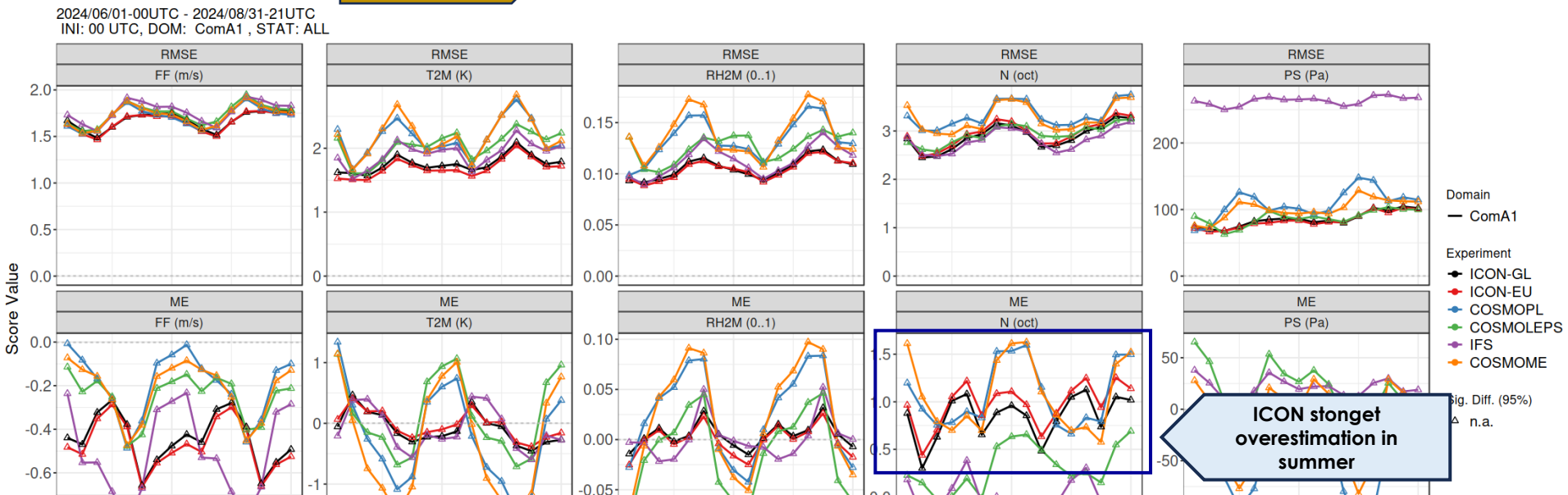
ComA1



Driving Models

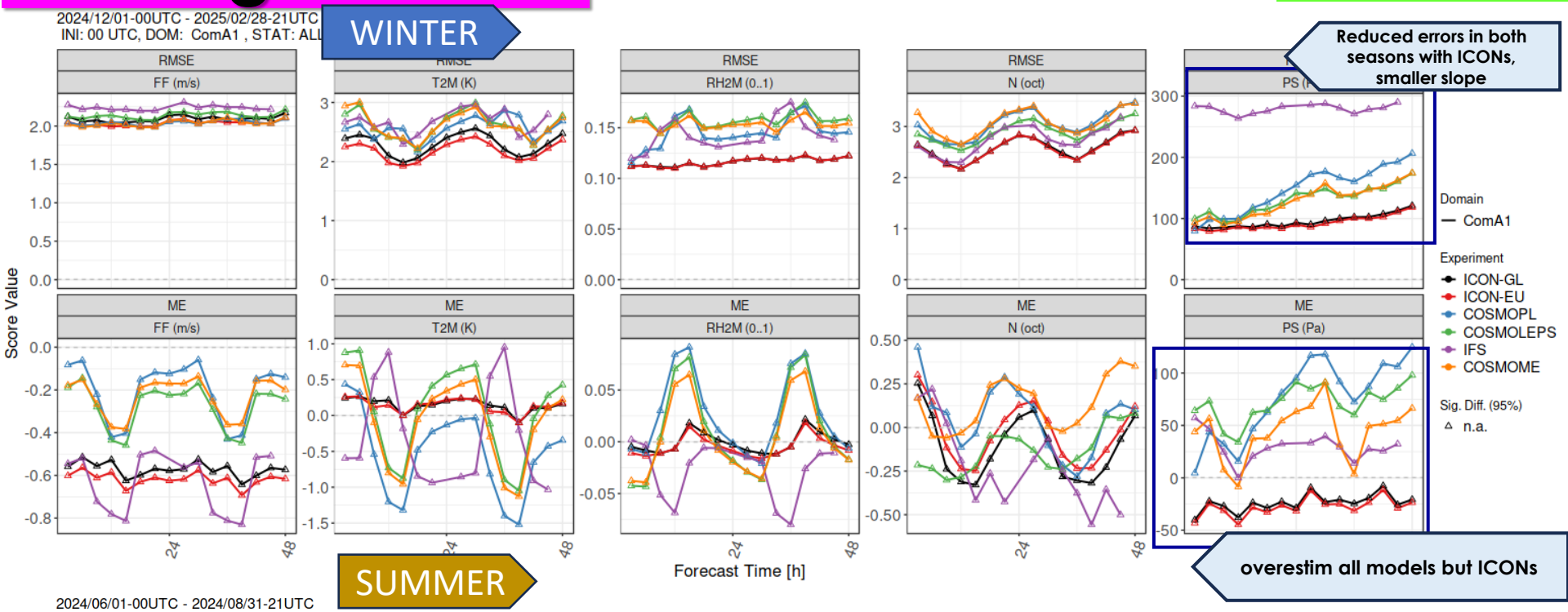
ComA1

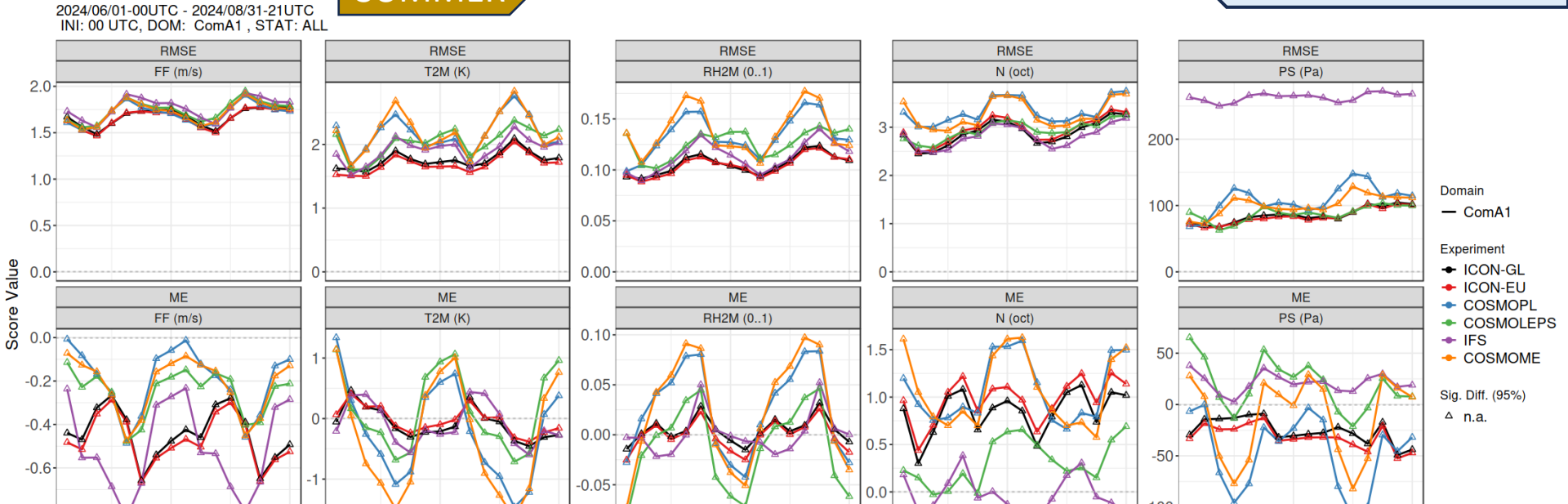




Driving Models

ComA1





2m Temp

Driving models: ICON-Gb performs better than COSMO+IFS.
HighRes LAM: consistency in performance among CA regions

SYS: Diurnal cycle (DC) of **RMSE** is present in all models.
Large Errors from **initialization**

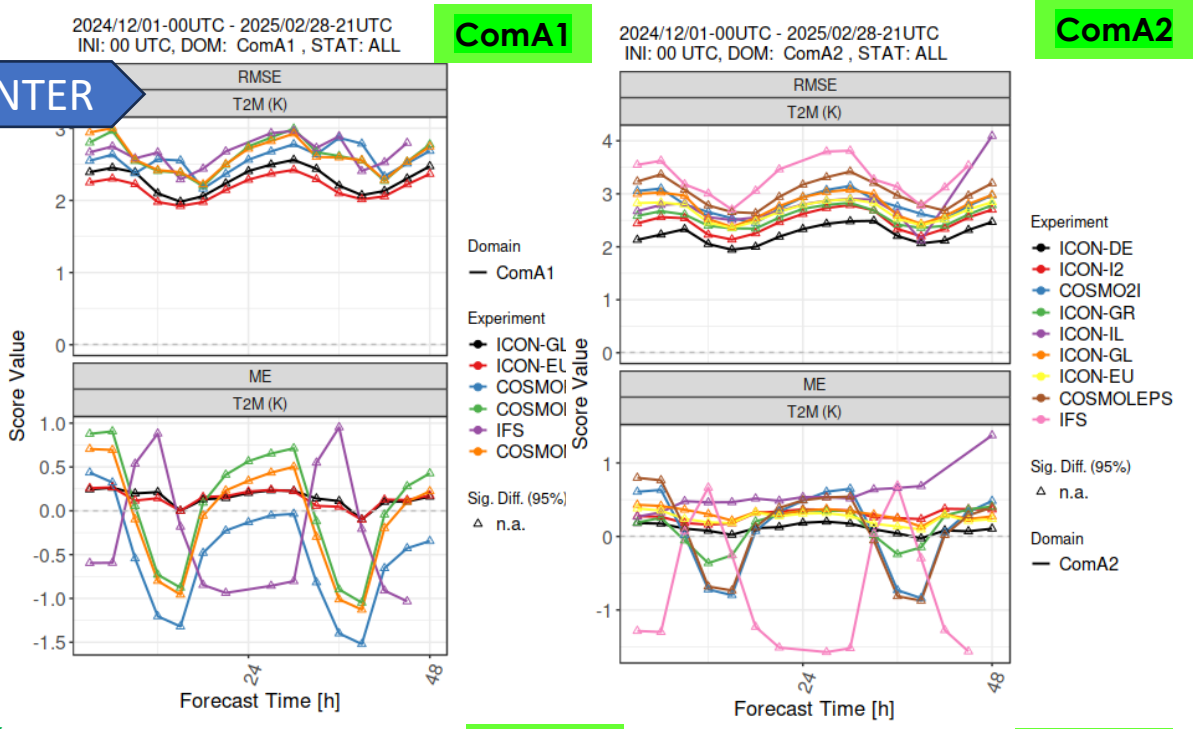
Reduced RMSE DC with ICON models **especially reduction in BIAS DC**

SYS: Larger error of 2mT at **night** and early morning in **winter** and at **midday** in the **summer.**

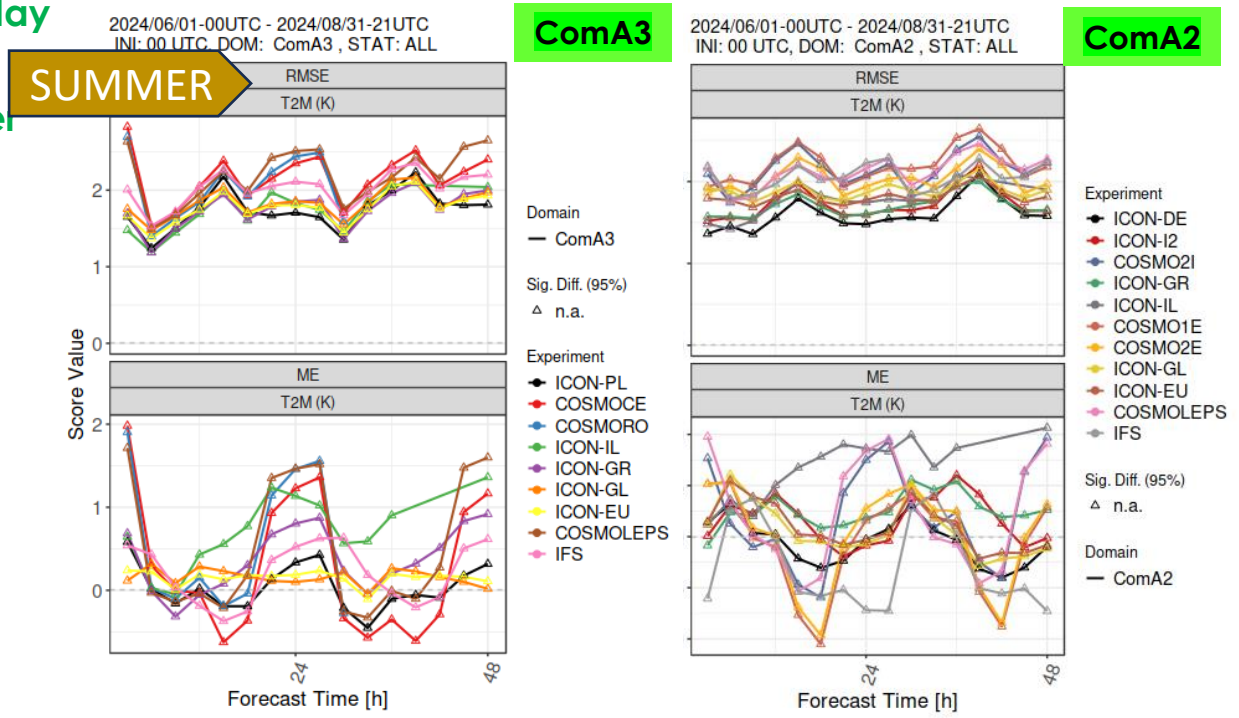
SYS: Underestimation during **summer** warm hours. Overestimation during summer at night hour, but reduced with ICON

SYS : Systematic
MdDp: Model dependant

WINTER



SUMMER



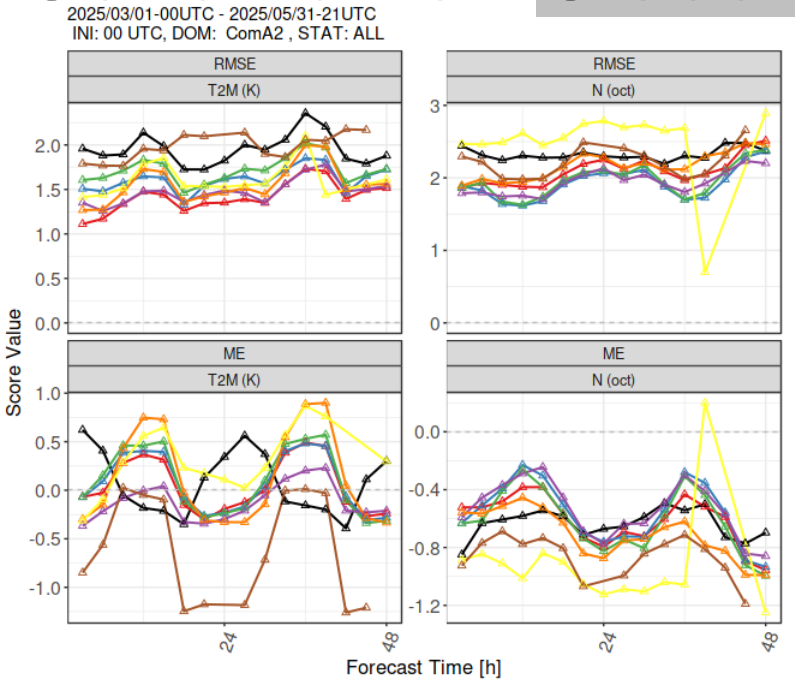
Condition on Cloudiness

C1. *2mT verification when: (condition on obs) Total cloud cover observation>= 75%*
C2 *2mT verification when: (condition on obs) Total cloud cover observation <= 25%*

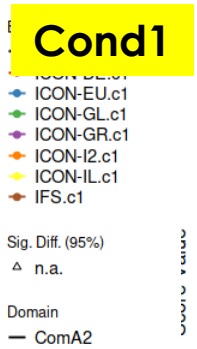
MAM2025

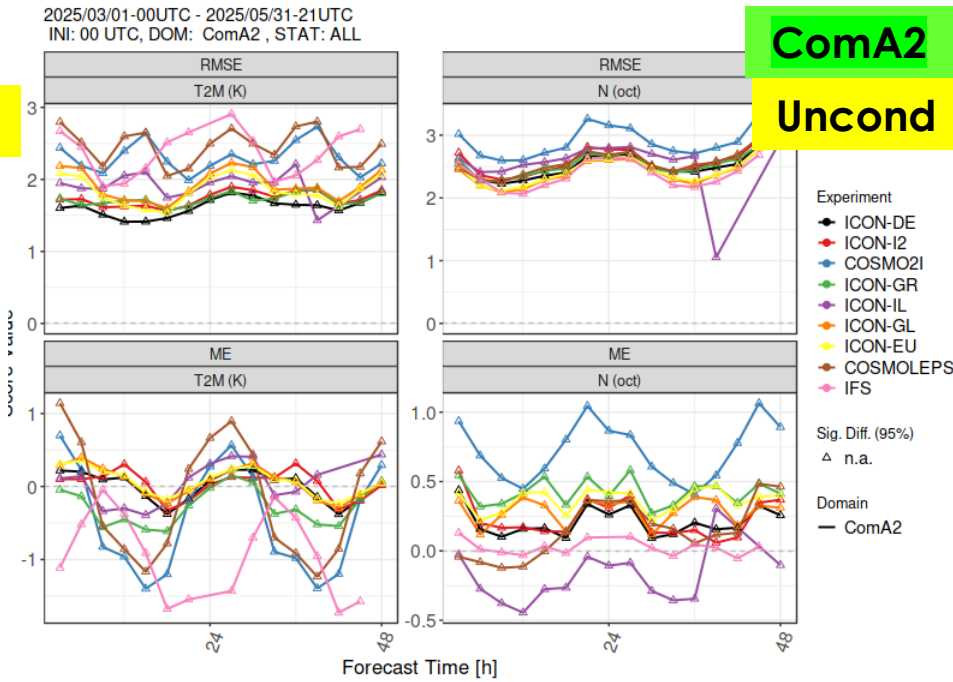
ComA2

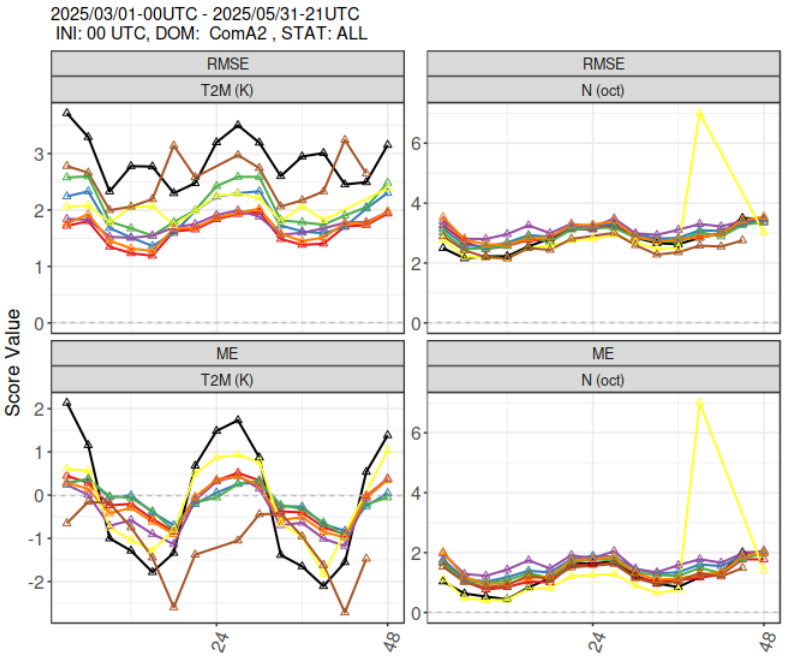
Uncond



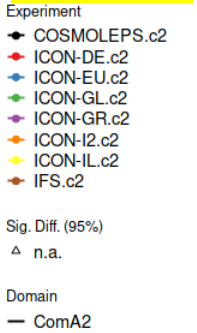
Cond1







Cond2



SYS : Higher **2mT** errors for **low cloudiness**

SYS : Underestimation of 2mT for CS in all models, in the **summer @noon**

SYS : Overestimation of 2mT under cloudy conditions with ICONs **@night**

Cloud Cover

SYS : Diurnal cycle of both **ME/RMSE** for TCC remains strong in all models.

SYS : RMSE (2.5-3oct) **winter** but **larger** in **summer** (up to 4 oct)

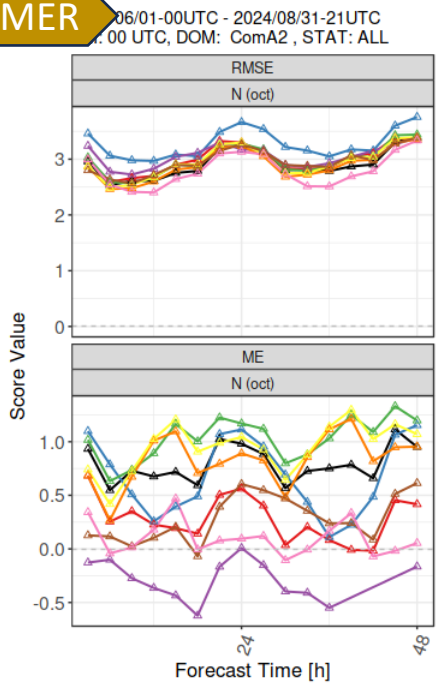
SYS : Higher errors during **nighttime** for all models

SYS : TCC performance in **winter** is similar but improved with ICON overall especially w.r.t. to the **overestimation** at night during summer.

MdDp : Higher **underestimation** for TCC in warm hours of the day with ICON in **winter**

MdDp : In the **summer** larger variability of **ME** and min/max among models

SUMMER

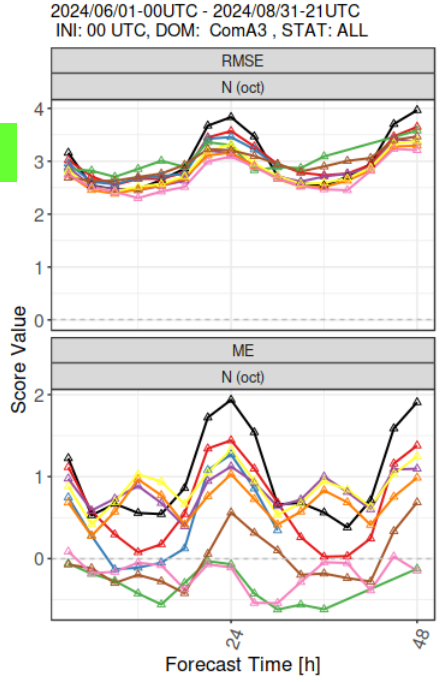


ComA2

Experiment
- ICON-DE
- ICON-I2
- COSMO2I
- ICON-GR
- ICON-IL
- ICON-GL
- ICON-EU
- COSMOLEPS
- IFS

Sig. Diff. (95%)
- n.a.

Domain
- ComA2



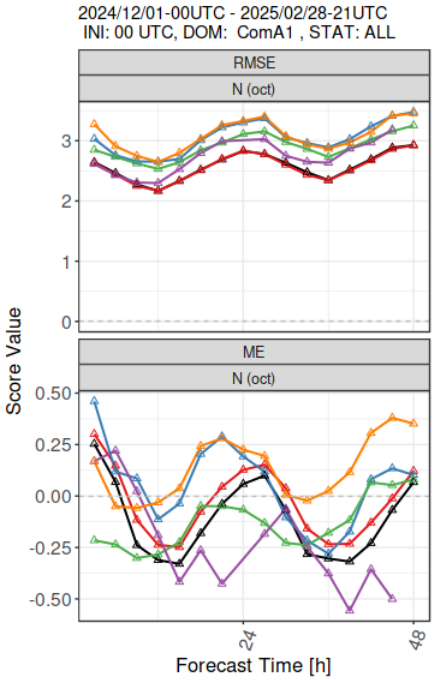
ComA3

Domain
- ComA3

Sig. Diff. (95%)
- n.a.

Experiment
- ICON-PL
- COSMOCE
- COSMORO
- ICON-IL
- ICON-GR
- ICON-GL
- ICON-EU
- COSMOLEPS
- IFS

WINTER

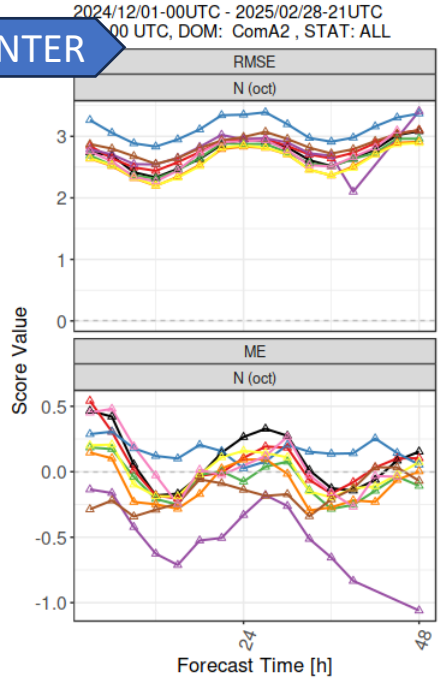


ComA1

Domain
- ComA1

Experiment
- ICON-GL
- ICON-EU
- COSMOPL
- COSMOLEPS
- IFS
- COSMOME

Sig. Diff. (95%)
- n.a.

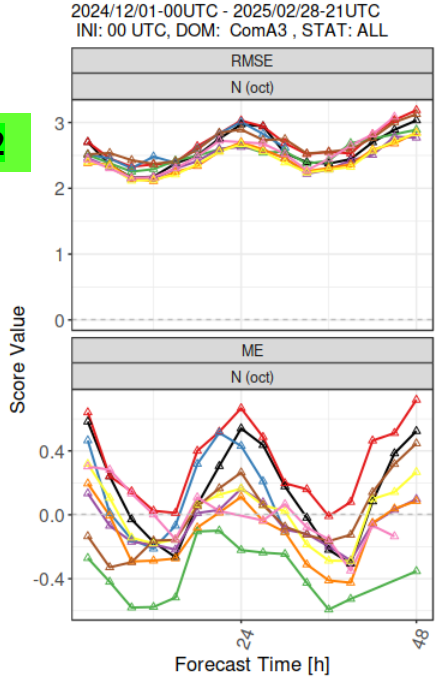


ComA2

Experiment
- ICON-DE
- ICON-I2
- COSMO2I
- ICON-GR
- ICON-IL
- ICON-GL
- ICON-EU
- COSMOLEPS
- IFS

Sig. Diff. (95%)
- n.a.

Domain
- ComA2



ComA3

Domain
- ComA3

Sig. Diff. (95%)
- n.a.

Experiment
- ICON-PL
- COSMOCE
- COSMORO
- ICON-IL
- ICON-GR
- ICON-GL
- ICON-EU
- COSMOLEPS
- IFS

Wind speed

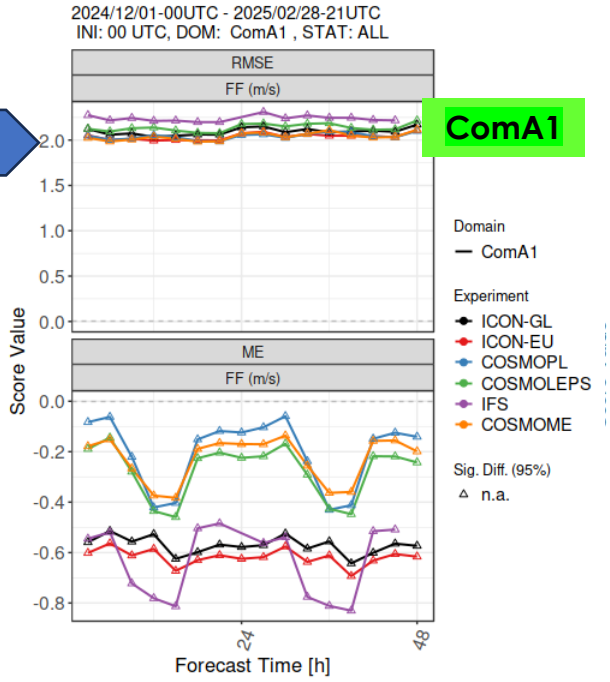
WINTER

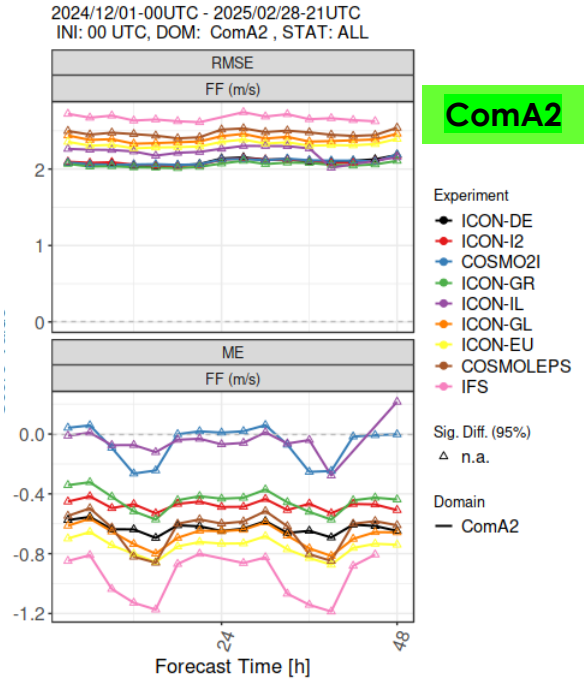
Driving models: No significant differences in RMSE except IFS
HighRes LAM: No differences in RMSE among models mainly in winter

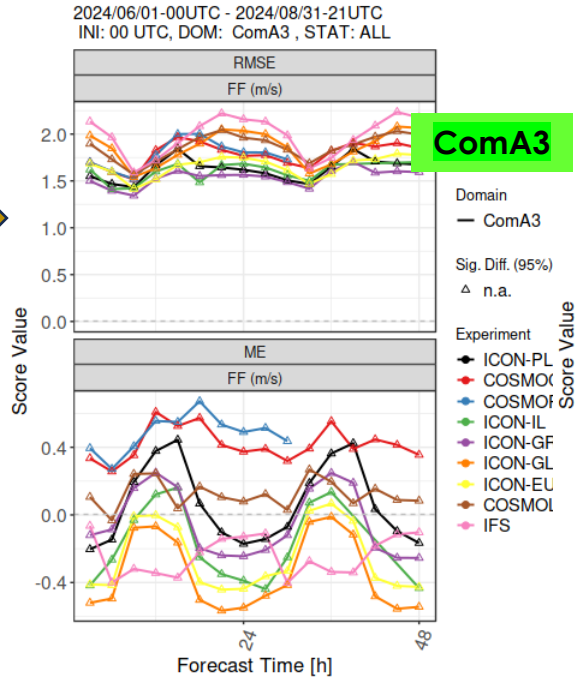
SYS : Larger ME cycle in **summer**

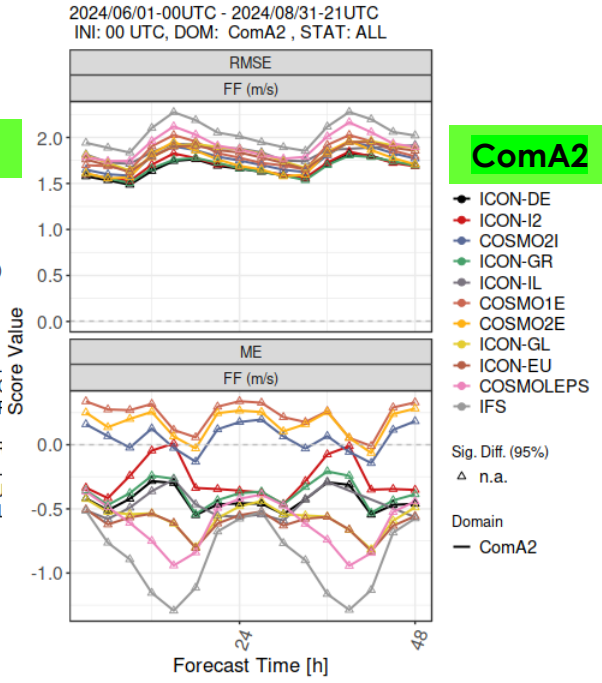
MdDp : negative bias with max during nighttime in **ICON** models for both seasons, positive bias **COSMO** models

SUMMER





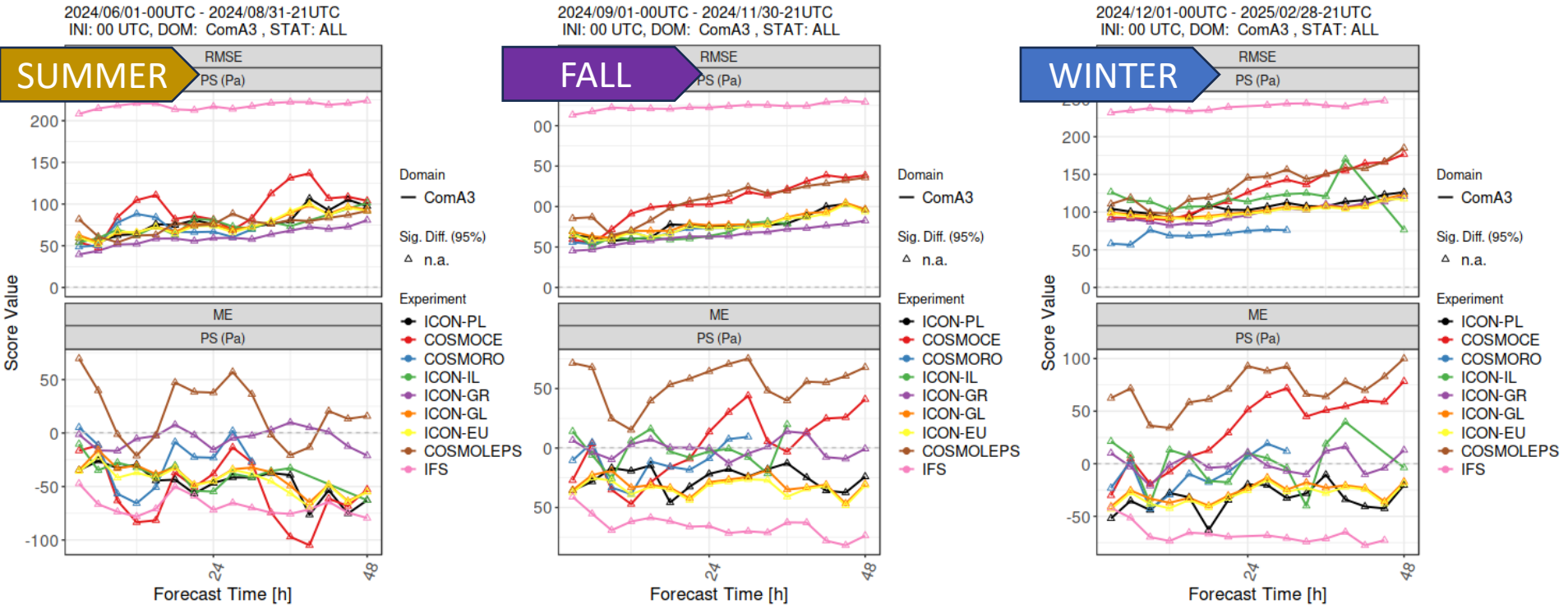




Pressure

SYS : Clear improvement with **ICON** in errors and reduced tendency of ncrease with lead time in esp. in **winter**

MdDp : Underestimation of Pressure with **ICON** during summer+fall

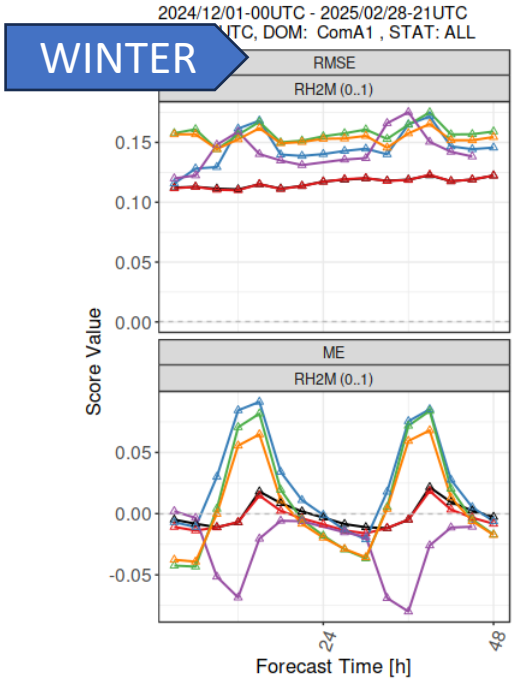


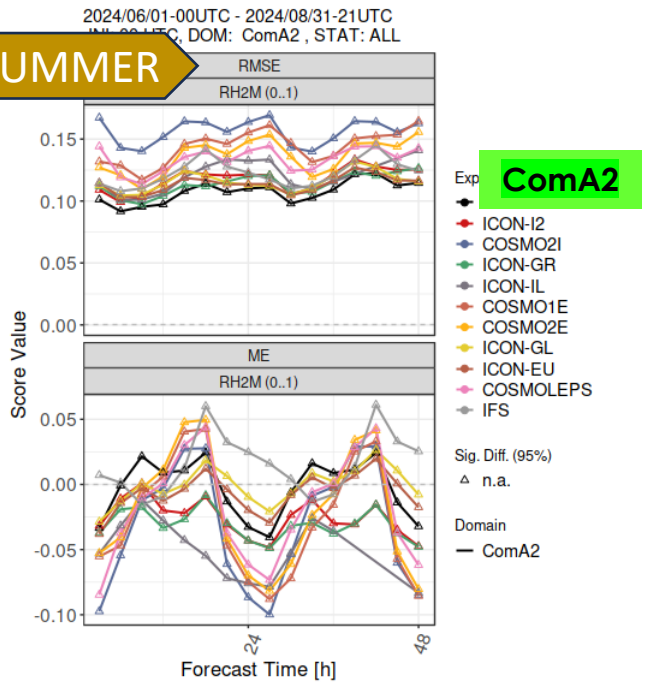
Humidity

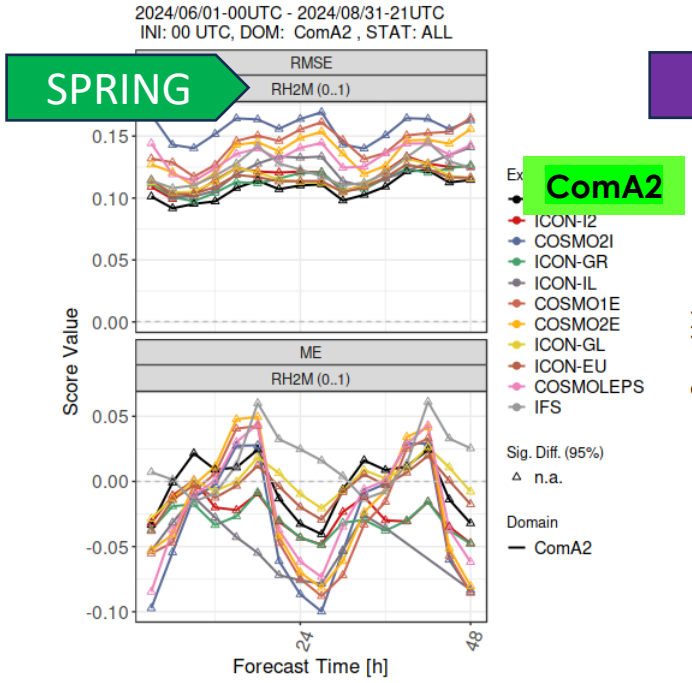
SYS : RelHum and Td **BIAS diurnal cycle**, strongly reduced in ICON models.

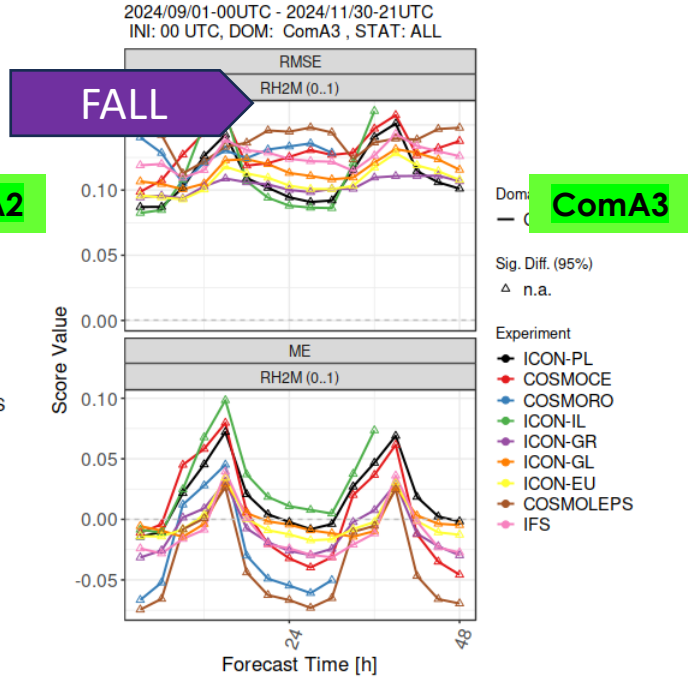
SYS : While RMSE is reduced with **ICON**, errors are attributed to the *overestimation* during daylight hours and the *underestimation* at night in almost <u>all seasons</u>

SYS : ICON models generally **drier**, esp. in winter

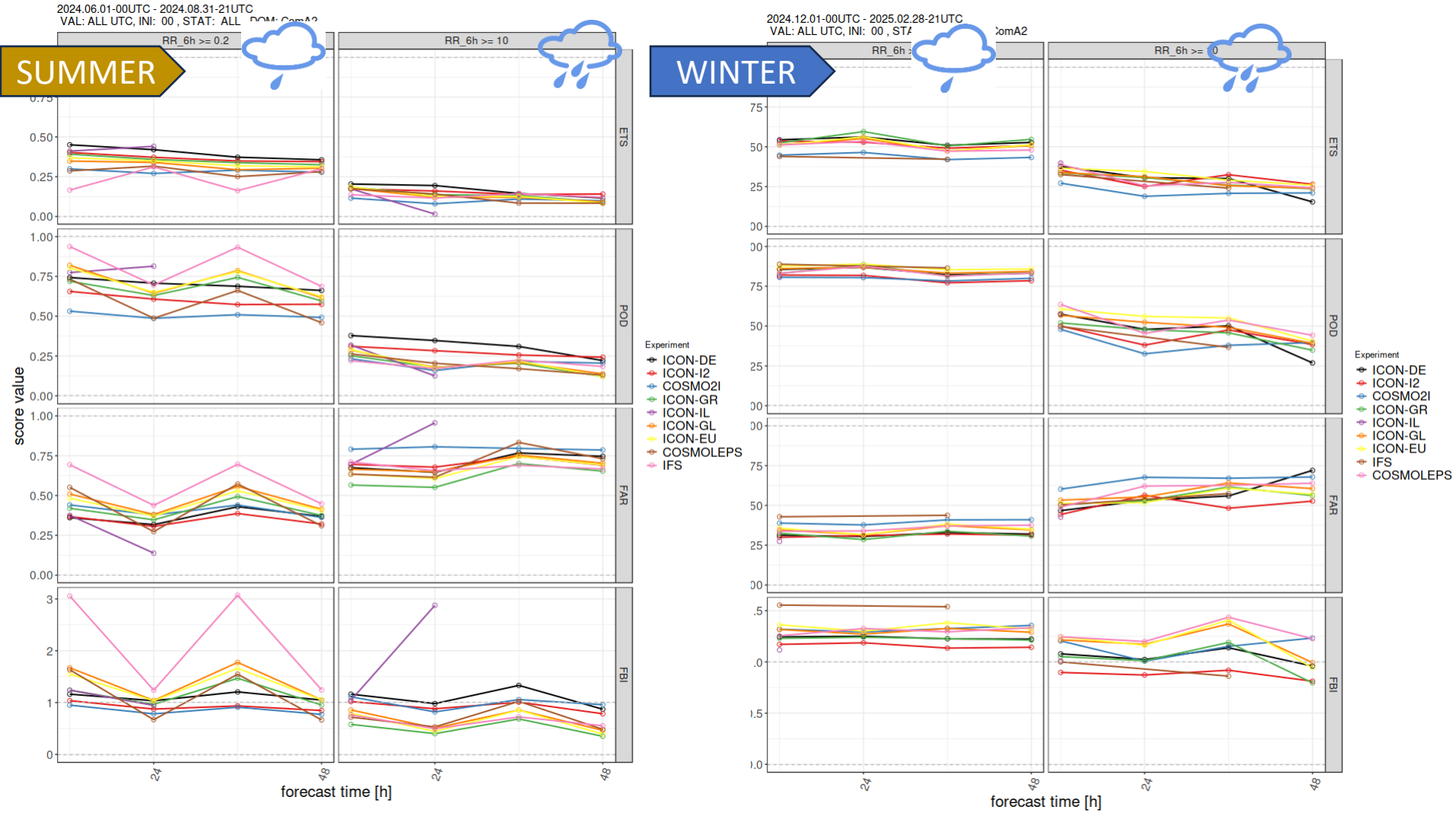








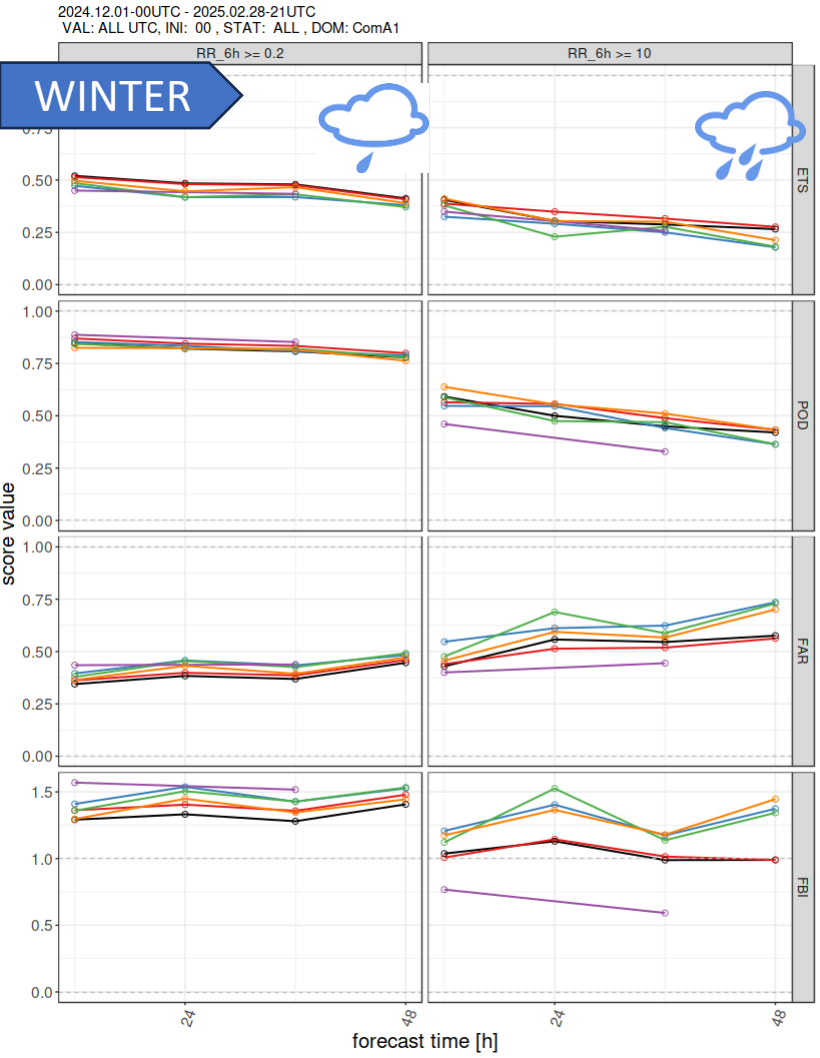
6h Precipitation

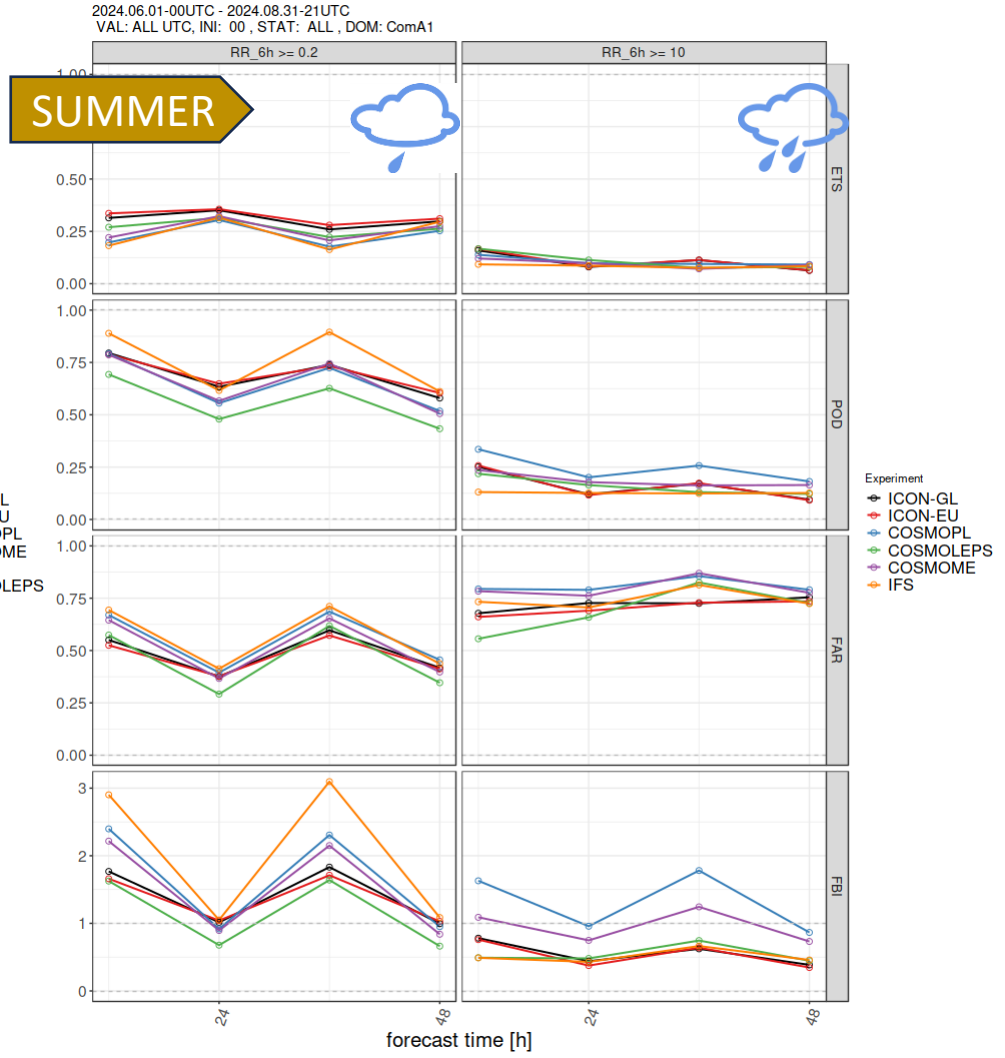


- Clearer differences in performance in higher precipitation amounts
- ETS, FAR are higher for **ICON** but with a tendency to underestimate small preci amounts

Driving models ComA1

6h Precipitation



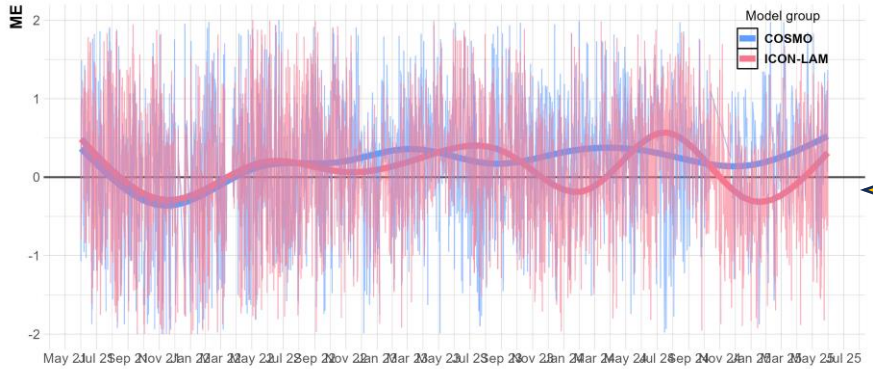


ModDp : Clear overprediction of small precipitation amounts with IFS compared to COSMO models for all seasons, linked also to higher POD and also higher FAR. For hogh precipitation amounts, ICON models overpredict and IFS underpredicts

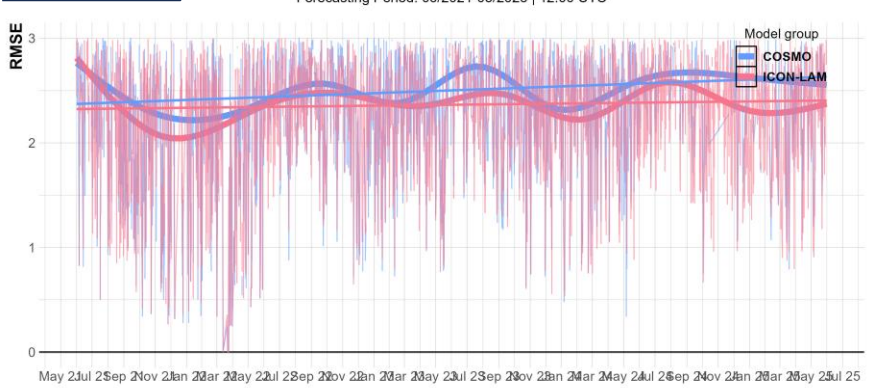
TCC @12+24UTC: HRES COSMO/ICON ComA2, 2021-2025

Factorial timeseries linked to ME and RMSE, thicker lines represent the smoothed average. Used: geom_smooth() that adds a regression line to a plot, and it uses a loess smooth when there are fewer than 1000 observations, and a GAM when there are more.

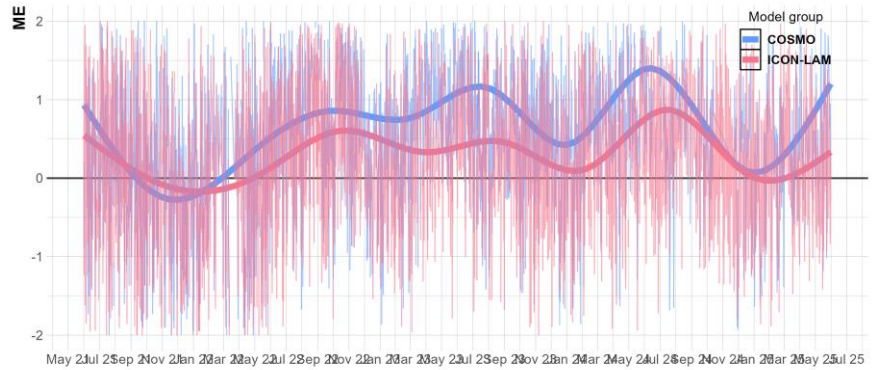
Mean Error



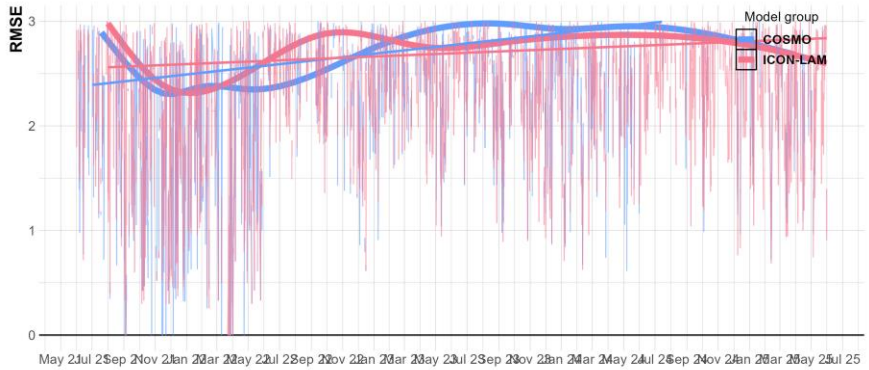
RMSE



Mean Error



RMSE

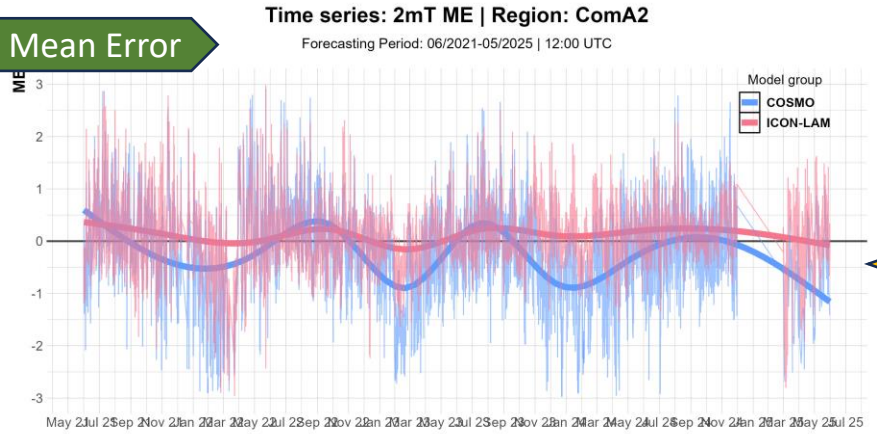


Ambiguous performance in RMSE TS (higher errors at night) with a tendency to overestimation during warm months night hours.

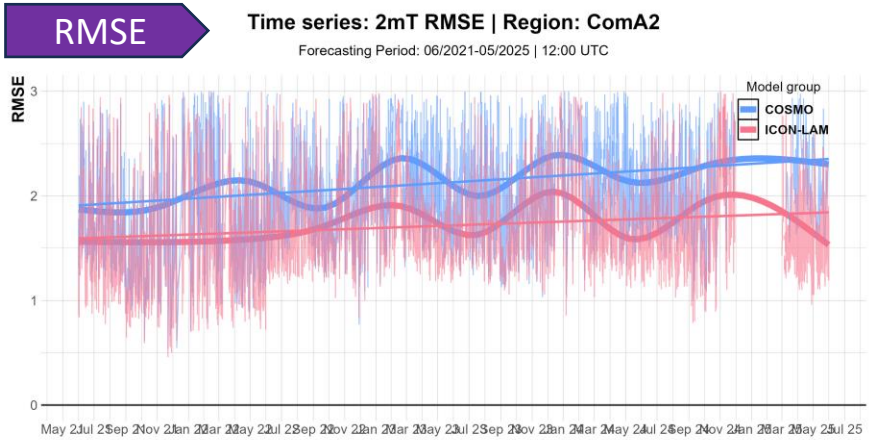
2mT @12+24UTC: HRES COSMO/ICON ComA2. 2021-2025

Factorial timeseries linked to ME and RMSE, thicker lines represent the smoothed average. Used: geom_smooth() that adds a regression line to a plot, and it uses a loess smooth when there are fewer than 1000 observations, and a GAM when there are more.

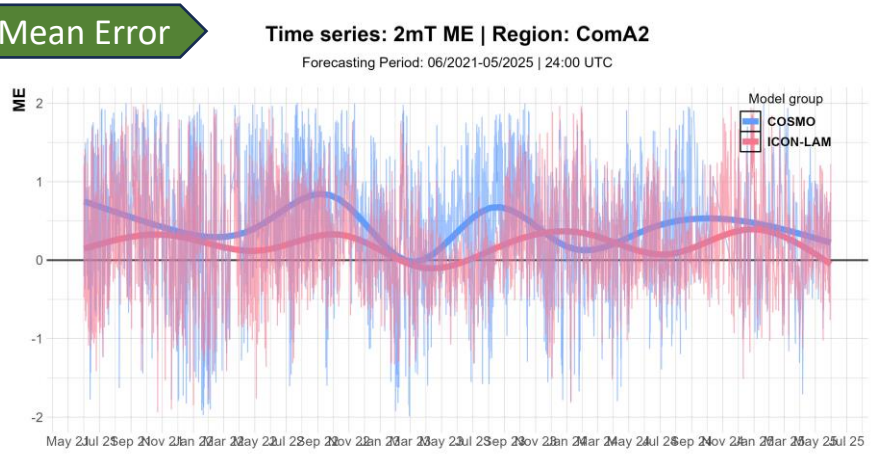
Mean Error



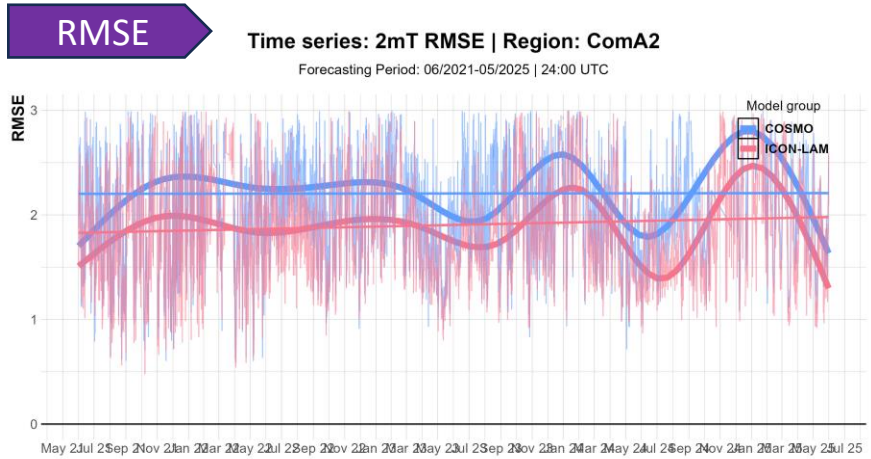
RMSE



Mean Error



RMSE

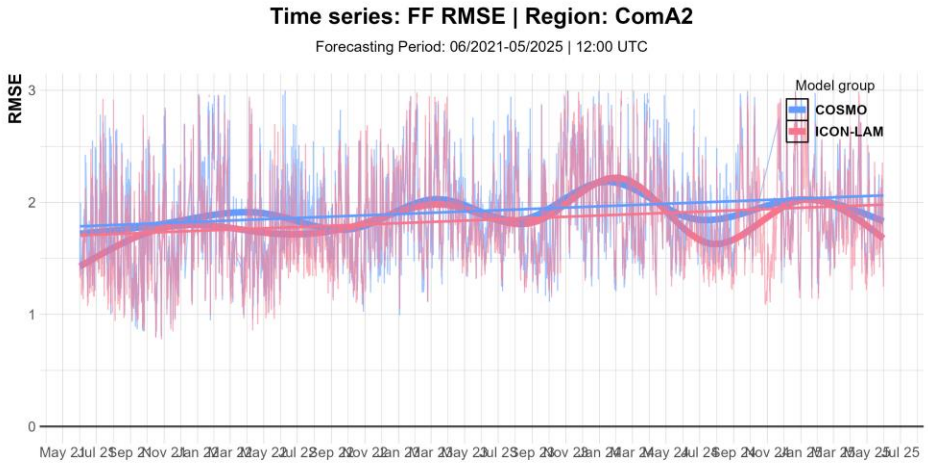


ICON tendency to underestimate mainly in the winter night hours, much less than COSMO that understimates at noon and overestimates at night (diurnal cycle minimized)

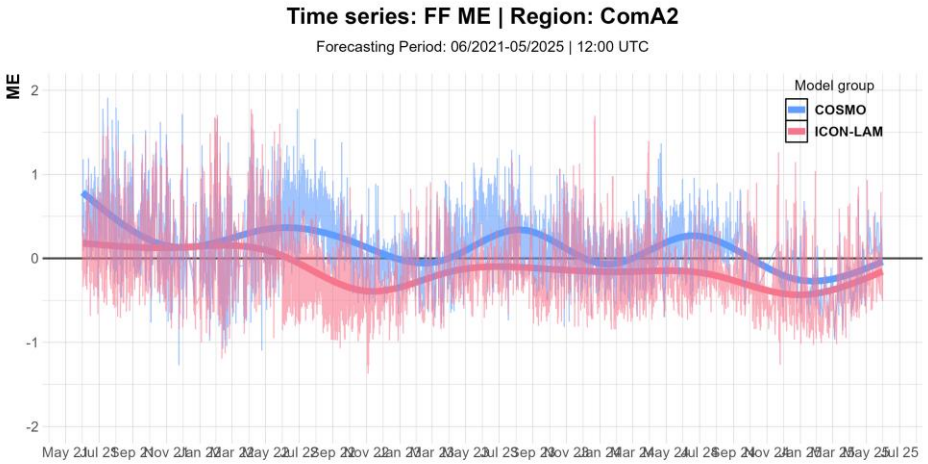
WinsSp @12UTC: HRES COSMO/ICON ComA2, 2021-2025

Factorial timeseries linked to ME and RMSE, thicker lines represent the smoothed average. Used: geom_smooth() that adds a regression line to a plot, and it uses a loess smooth when there are fewer than 1000 observations, and a GAM when there are more.

Mean Error

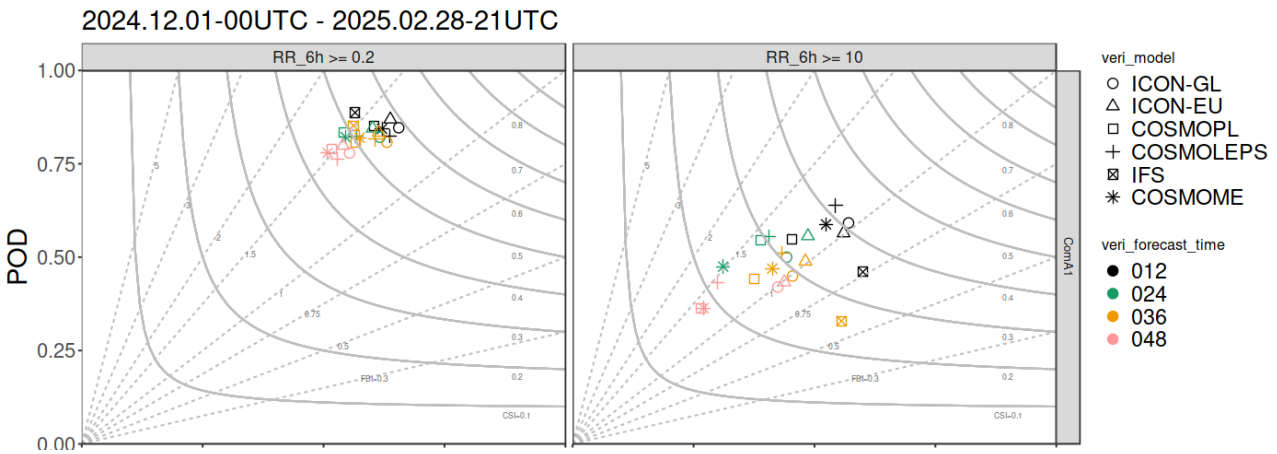


RMSE

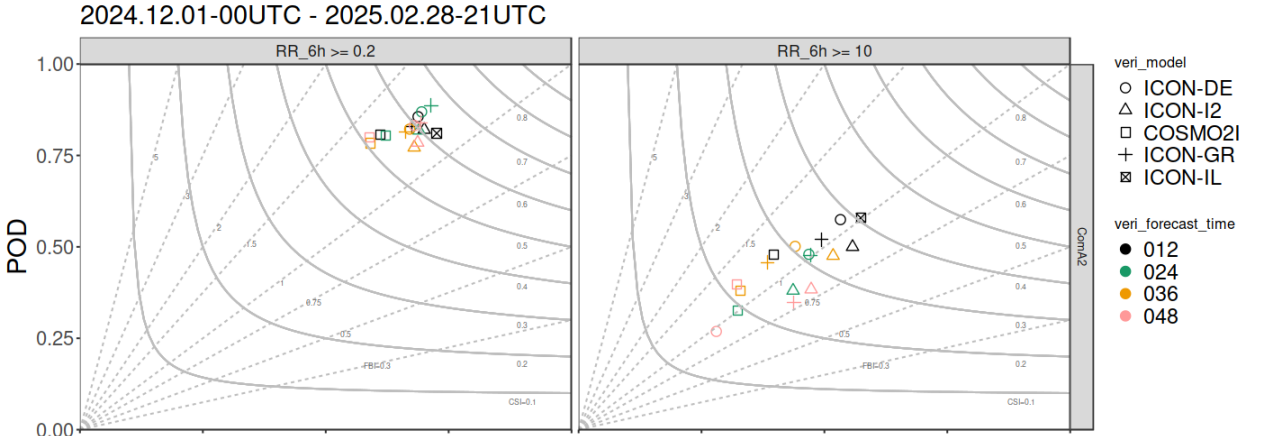


Not clear change in performance with wind speed , tendency to underestimate

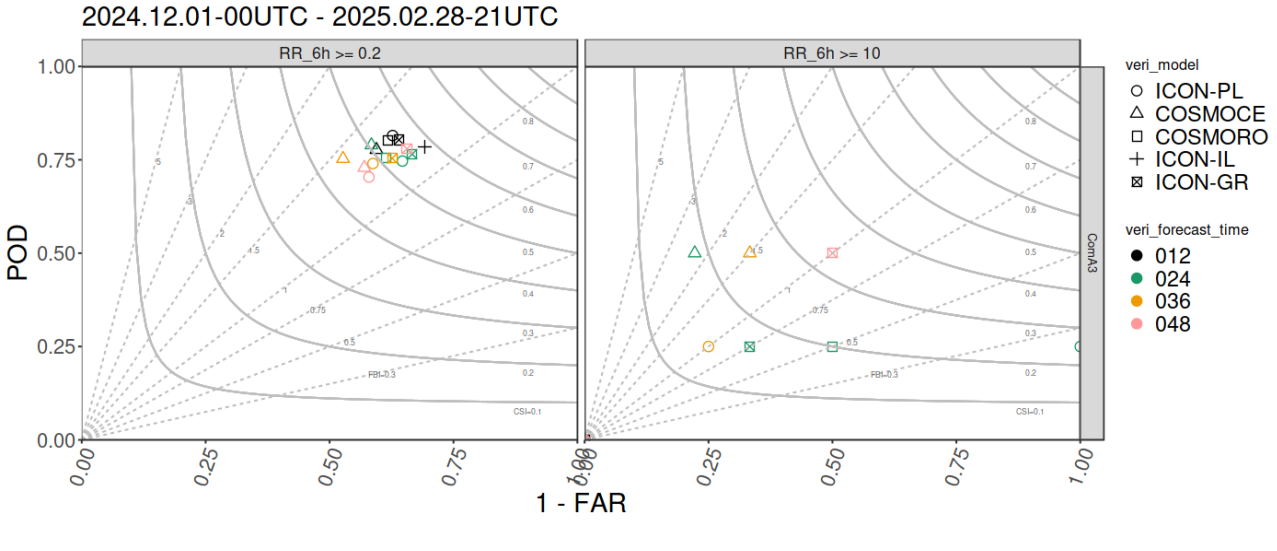
DJF2025



ComA1



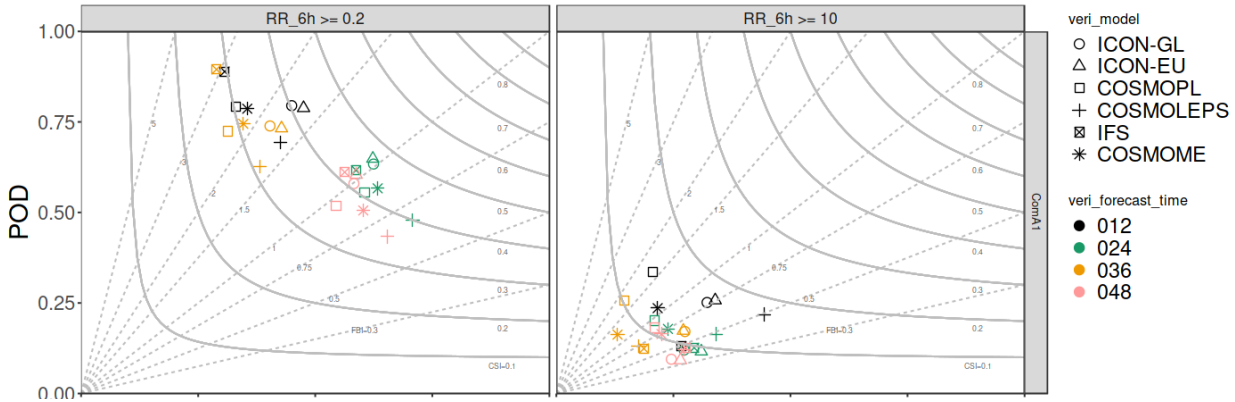
ComA2



ComA3

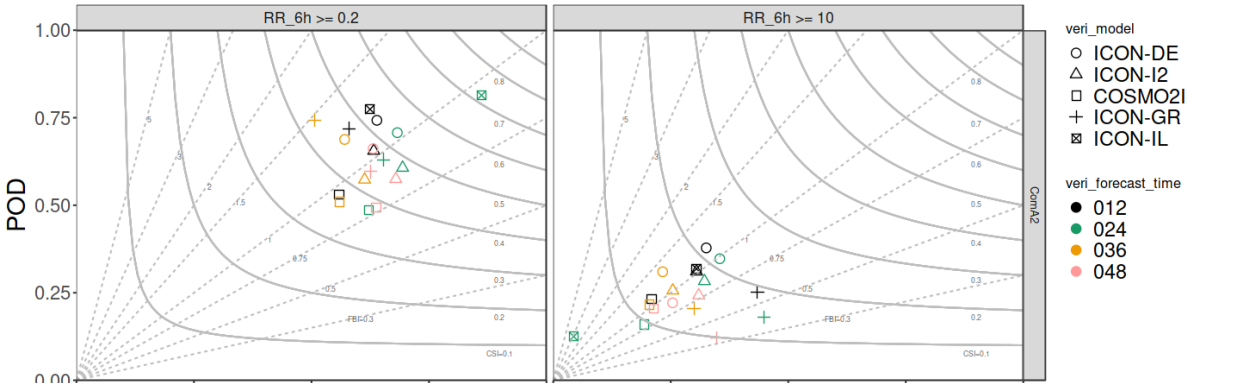
JJA2024

2024.06.01-00UTC - 2024.08.31-21UTC



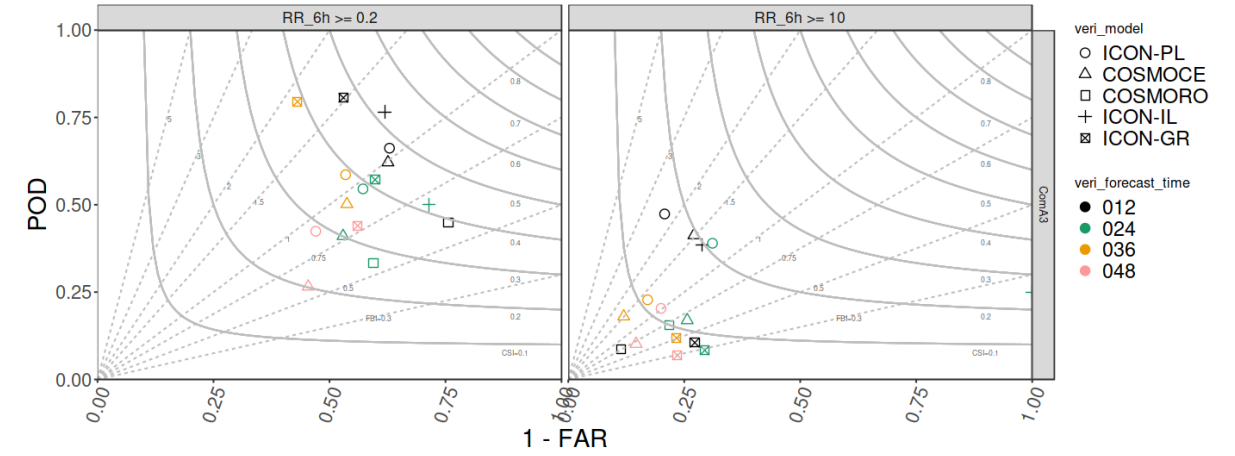
ComA1

2024.06.01-00UTC - 2024.08.31-21UTC



ComA2

2024.06.01-00UTC - 2024.08.31-21UTC



ComA3

Remarks based on CP verification

- **2mT**

Driving models: ICON RMSE smaller than COSMO+IFS, less evident diurnal cycle in ME, overestimation (winter)
SYS: RMSE diurnal cycle present in all models. Large errors in run initialization. Reduced RMSE/Bias DC with ICON
SYS : Larger errors at night and early morning in winter and at midday in the summer.
SYS : Underestimation during summer warm hours. Overestimation during summer at night
SYS : ICON tendency to underestimate mainly in the winter night hours

Possible Model Error attributes: issues in the surface energy budget, representation of land-atmosphere interactions, errors in cloud cover or radiation schemes, incorrect representation of soil moisture or boundary Layer parameterization.

- **WindSp**

Driving models: Underestimation in ALL models (winter) more evident with ICON/IFS
HighRes LAM: No differences in RMSE variability among models. Underestimation mainly from ICON-LAMs
SYS: Larger error cycle in summer
ModDep: negative bias in all seasons with max during nighttime in some ICON-LAMs for winter

Possible Model Error attributes: errors in the momentum fluxes or frictional effects in the boundary layer, inaccuracies in the pressure field, particularly in the simulation of high and low-pressure systems (wind direction)

Remarks based on CP verification

- **TCC**

Overestimation both seasons stronger @night
SYS : Diurnal cycle of both ME/RMSE for TCC remains strong
SYS : Large errors in winter, larger errors in summer
SYS : Higher errors during nighttime for all models (overestimation)
ModDp: Higher underestimation in warm hours of the day with ICON in winter
ModDp: Ambiguous performance in RMSE (higher errors at night) with a tendency to overestimation during warm months night hours.

Model Error attributes: shortcomings in cloud parameterization, radiation errors

- **Humidity**

Driving models: ICON is general drier
SYS : RelHum and Td BIAS diurnal cycle, strongly reduced in ICON models.
SYS : While RMSE is reduced with ICON, errors are attributed to the overestimation during daylight hours and the underestimation at night during almost all seasons
SYS : ICON models generally drier, esp. in winter
limitations in the moisture transport and cloud microphysics parameterizations.

Model Error attributes: issues with cloud formation, representation of boundary layer processes, while underestimations could be linked to the model's inability to capture subtle moisture sources

Remarks based on CP verification

- **Precipitation**

Clearer differences in performance in higher precipitation amounts
MOD: ETS, FAR are higher for ICON but with a tendency to underestimate small preci amounts

Possible Model Error attributes: convective parameterization, small-scale convective or orographic precipitation processes (moisture transport, cloud formation, etc,)

- **General Remarks**

Same model, different errors extent and performance characteristics in different geographical area

Addressing Systematic Errors

Model Tuning/Calibration
Higher-Resolution Runs/update version
Improved Parameterizations

- Early preparation of plots will allow for a timely analysis
- **CP analysis requires further attention to identify systematic errors**
- **National domain** analysis can be supplementary to CA analysis
- **Driving models** performance is indicative to for ICs choice
- More **features** of MEC/FFV2 can be tested (e.g. conditional verif on surface characteristics)
- **Restructure of activity** and more resources can improve the activity
- **EPS** in CP will provide additional insights (to be discussed in joint meeting with WG7 @2pm (PP-CARMENS session)