# WG5 Parallel Sessions: Monday 02 September 2024

| | | |
|---|---|---|
| **WG5 Activities** **Room: Schlauch** **Chair: Flora Gofa** | | |
| **09:00 – 10:40** | F. Fundel (20') | FFV2 updates including AI model verification |
| | F. Fundel (20') | News on AI front verification |
| | N. Vela (15') | VAST updated version |
| | P. Kaufmann (15') | Cloud and precipitation verification in ICON-CH models |
| | F. Fundel (10') | Verification of the ICON weather-interpretation |
| | D. Boucouvala (10') | Verification feedback over Greece |
| ***10:40 – 11:00*** | ***BREAK*** | |
| **11:00 – 12:30** | S. Gabrian (15') | Verification activities in NMA |
| | Artur Surowiecki (10') | Verification activities in IMGW-PIB |
| | N. Vela (15') | Precipitation FSS for COSMO CP |
| | S. Gabrian (25') | NMA task report for CP activities |
| | F. Gofa (25') | Presentation of seasonal CP reports |
| ***12:30 – 14:00*** | ***LUNCH*** | |
| **WG5 PP-CARMENS: Joint with WG7** **Room: Schlauch** **Chair: Stefan Gabrian** | | |
| **14:00 – 15:30** | S. Gabrian | Status of PP-CARMENS |
| | All | Short presentations from all PP participants |
| | All | Open Issues - Discussion |
| ***18:00 – ….*** | ***ICE BREAKER*** | |

**Last entries**

***F. Batignani: Italian Verification results**

****E. Minguzzi: Problem with ICON-LAM performance during convective events**

**[lease keep the allocated time**
**upload your presentation:** https://www.cosmo-model.org/view/repository/GM-2024/wg5
**comments/remarks at the END of presentations (when time allows)**

# Common Plots Activity

*F. Fundel, J. Linkowska, N. Vela, S. Gabrian,*
*S. Dinicila, M.S.Tesini, F. Sudati, F. Batignani, D. Boucouvala, P. Kaufmann,*
*M. Zosicz, P. Khain, F.Gofa,….*

# Common Plots Highlights: 2023-24

ΕΘΝΙΚΗ ΜΕΤΕΩΡΟΛΟΓΙΚΗ ΥΠΗΡΕΣΙΑ

## A. FF verification

- ✓ Migration to FFV2 – documentation
- ✓ MEC for IFS: included since SON2024 for all parameters in ComA1
- ✓ Include COSMO-LEPS control run with det models (started in August 2023)
- ✓ New Time series and HeatMap plots for long term trends

**Additional**: restrict forecast horizon, uniform length in model name for legend, added more parameters: 2mRH, 3h&6h Preci (all intervals)

**Critical:** Driving models (IFS, ICON, LEPScntr) currently only in A1 only

## B. Conditional verification

- ✓ 2mT verification with thresholds on TCC (condition based on obs)
- ✓ Elevation stratification

**Critical:** Conditioning based on external information (constant fields) necessary – performed by Felix previous years

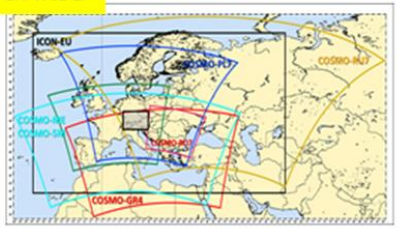
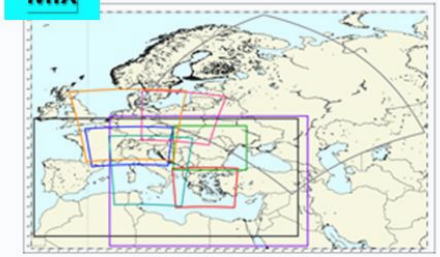
## C. Fuzzy verification

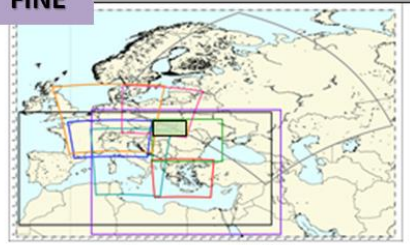
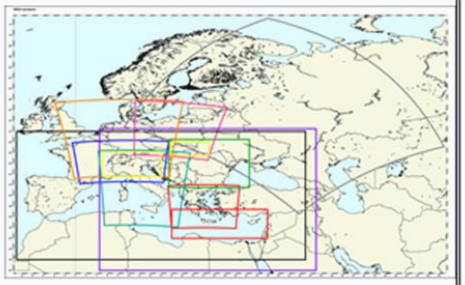
- ✓ include **FBI** and **TS** indices
- ✓ new software version with additional features – to be disseminated after GM2024

## D. General Information

- ✓ FTP Platform for data exchange – NMA provided server with increased autonomy for WG5
- ✓ Guidelines for current year were adapted to new requirements and sent to users: necessary?
- ✓ **Constant delay in data exchange, incomplete data series, extra work load for NMA, not enough time to analyze before the GM**
- ✓ Annual Verif Report is prepared for new Newsletter format with trends from previous years

## Common Plots: redefined areas

| | ComA-1 | ComA-2 | NoComA (National Domains) |
|---|---|---|---|
| Specs | COARSE   **Forecast run:** 00UTC **Forecast Horizon:** 48h **Seasons:** JJA22, SON22, DJF23, MAM23 | FINE **Forecast run:** 00UTC **Forecast Horizon:** 48h **Seasons:** JJA22, SON22, DJF23, MAM23 **Area: 43.5/5.0/48.2/16.0** | MIX  **Area:** national domains **Forecast Horizon:** variable **Seasons:** JJA22, SON22, DJF23, MAM23 |
| Models | **Global**: ICON, IFS **LAMS**: DWD: ICON-EU, COMET: COSMO-ME IMGW-PIB: COSMO-PL7 | **Driving models**: ICON-EU, IFS, ICON **LAMs:** DWD: ICON-D2, MCH: COSMO-1E (contro , COSMO-2E, HNMS: ICON-GR COMET: COSMO-I2, ICON-I2, ARPA-E: COSMO-2I IMS: ICON_IL2p5 | **COSMO and ICON-LAM** DWD, MCH, COMET, HNMS, IMGW-PIB, NMA, RHM, IMS, ARPA-E |

| | ComA-3 | ComA-TCC | ComA-OnDemand |
|---|---|---|---|
| Specs | FINE  **Forecast run:** 00UTC **Forecast Horizon:** 48h **Seasons:** JJA22, SON22, DJF23, MAM23 **Area: 47.5/17.7/50.0/25.0** | MIX **Forecast run:** 00UTC **Forecast Horizon:** 48h **Period:** June2022, Dec2022, Apr2023 **Area: 31.0/18.0/37.4/32.0** | Optional  |
| Models | **Driving models**: ICON-EU, IFS, ICON **LAMs:** HNMS: ICONGR2.5, NMA: COSMO-NMA/ICON-NMA. IMGW-PIB: ICON-PL, IMS: ICON–IL2.5 | **Driving models**: IFS, ICON **LAMs:** HNMS: ICONGR2.5, IMS: ICON_IL2p5, ICO - EU | **Area and LAMs, Specs based on specific experiment** |

Large potential with FFV2 software and Shiny web server that is not yet exhausted

| Common Plots: verification specifications | |
|---|---|
| **Parameters** | **Surface: Continuous**<br>T2m, SurfPressure, Td, WSpeed, TCC<br>**Surface: Dichotomic**<br>6h Precip (Thresholds):0.2,0.8,1,5,8,10,15,20 mm<br>TCC (Intervals): [0,25), (25,75), [75,100]<br>Wind gust(thresholds):12.5,15,20 m/sec<br>**Upper Air**: Temperature, RH, Wind Speed<br>**Areas:** ComA-1, ComA-2, ComA-3, NoComA |
| **Stratification** | **-100m, 100m-300m, 300m-800m and >800m**<br>**Areas:** ComA-1, ComA-2, ComA-3, NoComA |
| **PointVerif Indices** | **Surface - Continuous/UpperAir**: ME, RMSE, StdDv<br>**Surface – Dichotomic**: Contingency table attributes: FBI, ETS, CSI<br>**Areas:** ComA-1, ComA-2, ComA-3, NoComA |
| **SpatialVerif Precipitation** | **Obs:** OPERA composite<br>**Indices:** FSS, POD, FAR, FBI, TS<br>**Spatial windows:** 2.8, 8.4, 14, 25.2, 47.6, 92.4km<br>**Areas:** ComA-2, ComA-3<br>**Resolution:** 0.025 |
| **SpatialVerif Total Cloud Cover** | **Obs:** NWC-SAF Cloud Mask<br>**Indices:** FSS, FBI, TS<br>**Spatial windows:** 2.8, 8.4, 14, 25.2, 47.6, 92.4km<br>**Thresholds:** 0, 20, 40, 60, 80, 100%<br>**Areas:** ComA-TCC<br>**Resolution:** 0.025 |
| **Conditional** | **Critical Choices: conditions imposed on the observations, alignment is ON**<br>**A.2mT verification when:**<br>Total cloud cover >= 75%<br>Total cloud cover <= 25%<br>**B. Wind Speed when:** *(roughness length as constant field)*<br>Roughness length<0.2m<br>Roughness length>1m<br>**Areas:** ComA-2, ComA-3 |

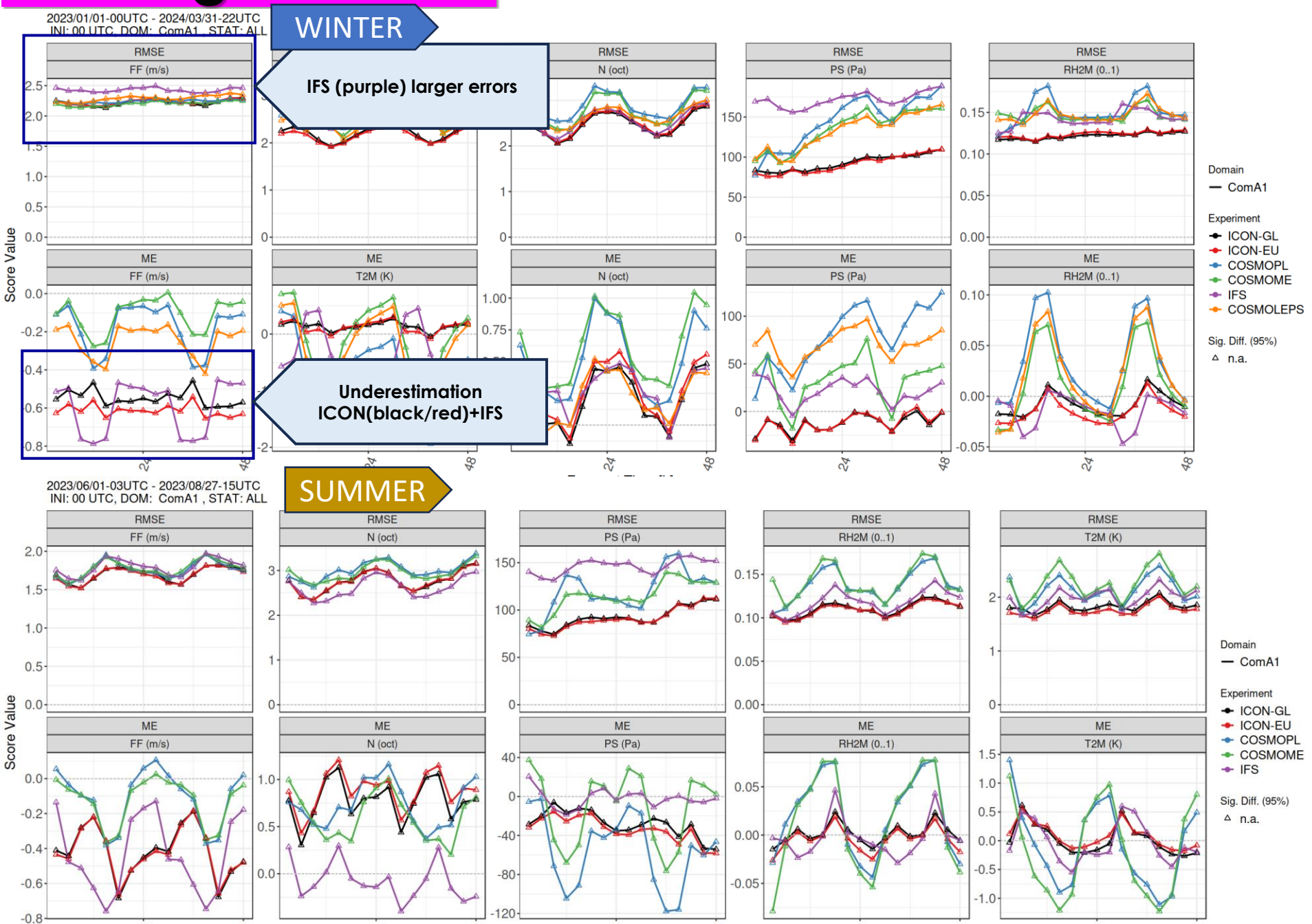
# CP activity: operational models

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), COSMO-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

# …overview of Stats

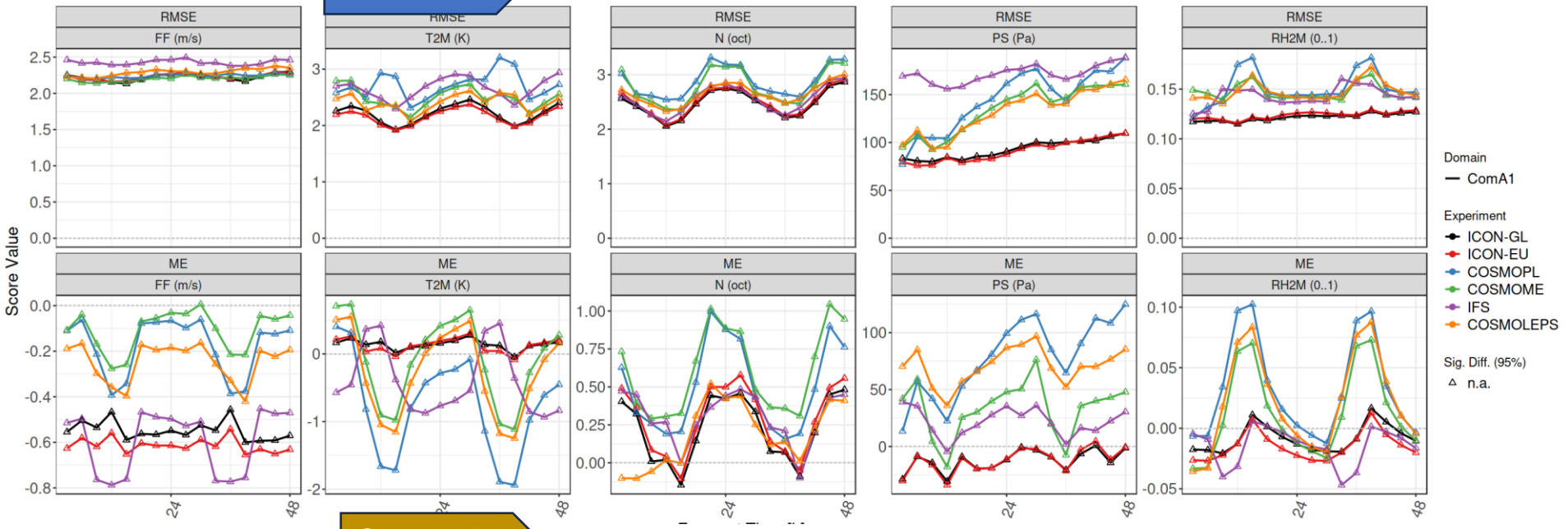
# Driving Models



# Driving Models

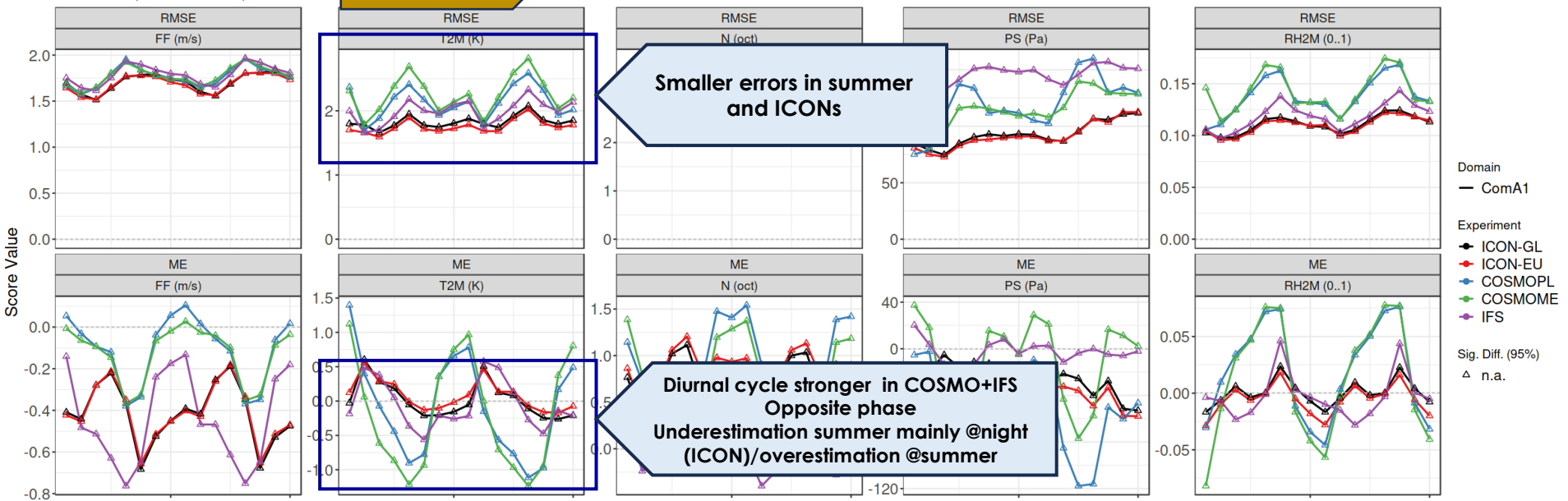
2023/01/01-00UTC - 2024/03/31-22UTC
INI: 00 UTC, DOM: ComA1 , STAT: ALL

WINTER




2023/06/01-00UTC - 2023/09/15-21UTC
INI: 00 UTC, DOM: ComA1 , STAT: ALL

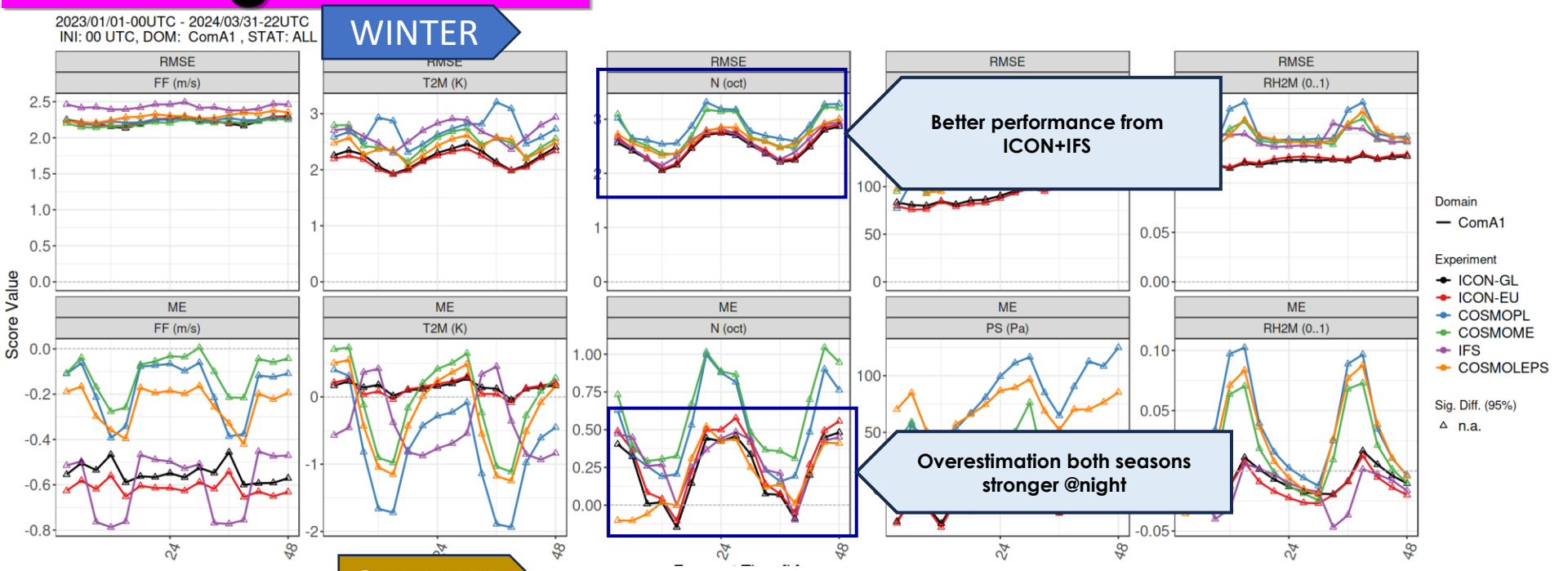
SUMMER

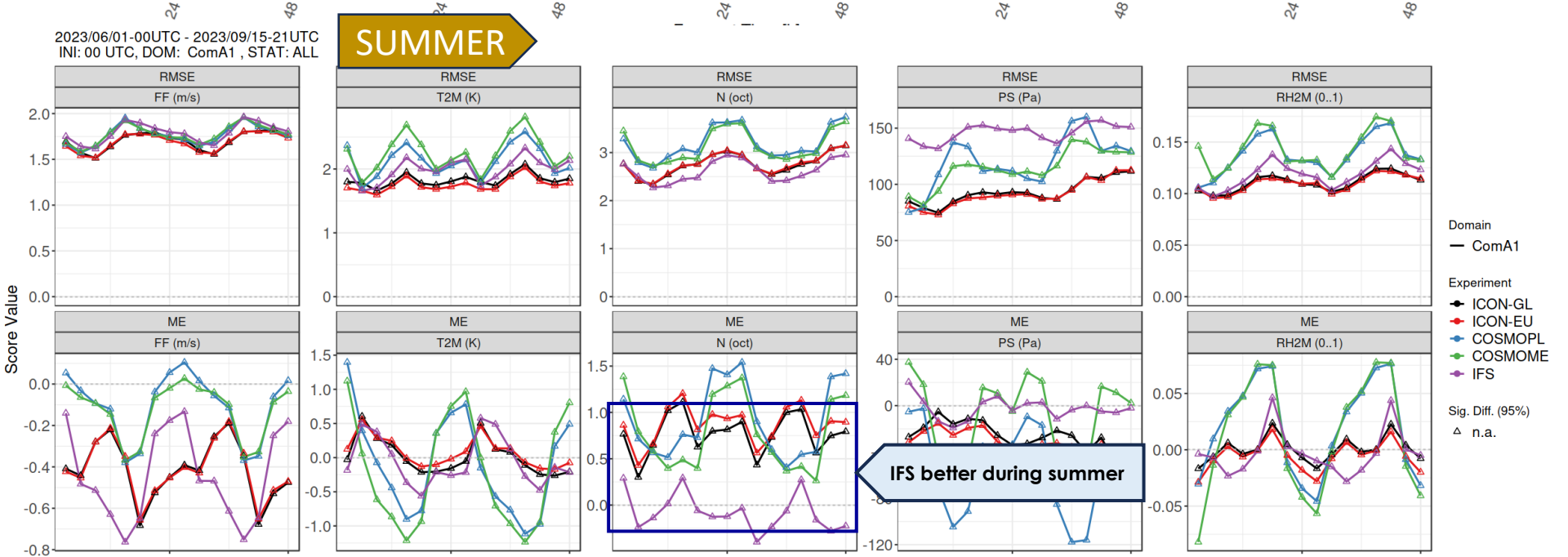



**Smaller errors in summer and ICONs**

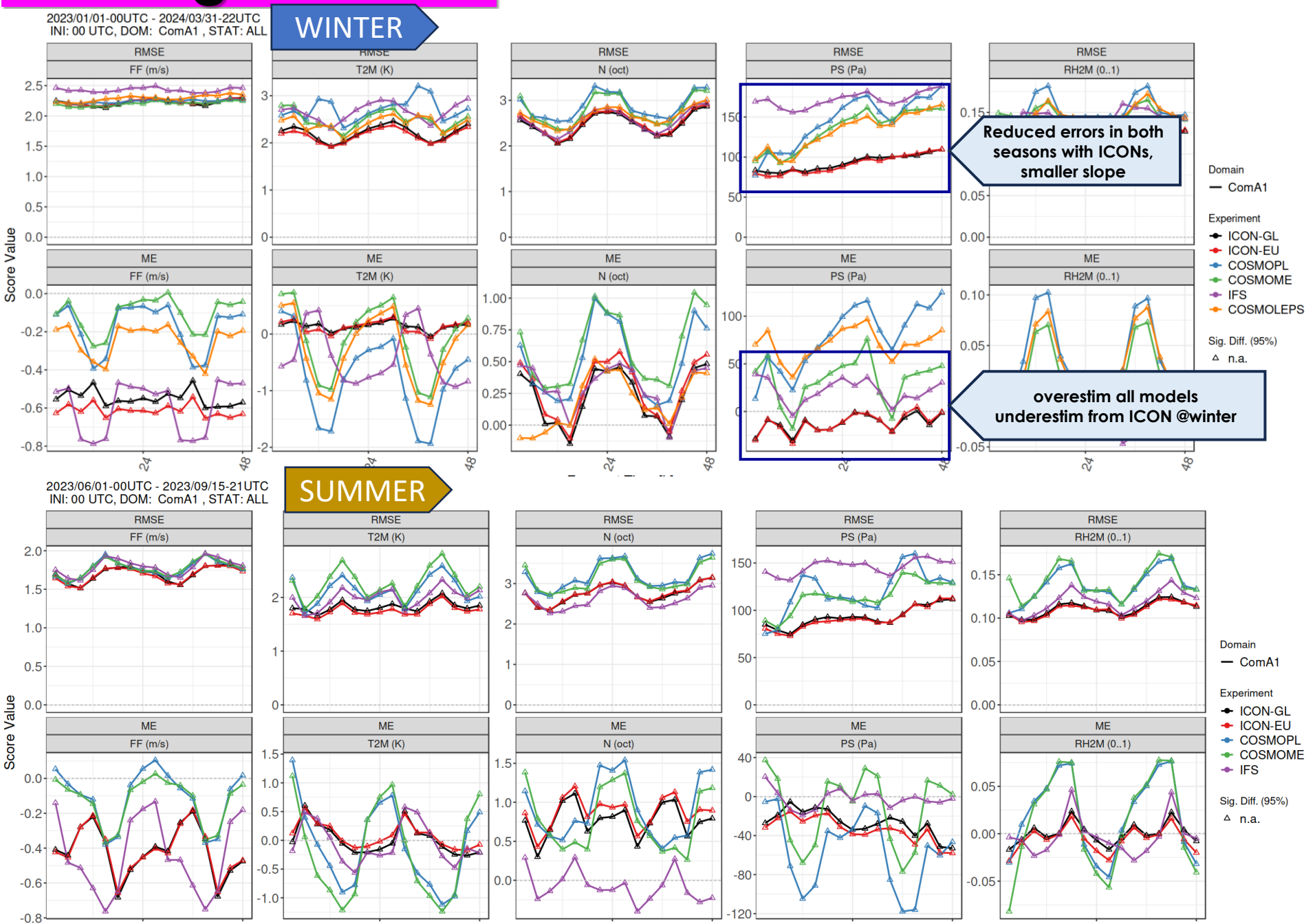
**Diurnal cycle stronger in COSMO+IFS**
**Opposite phase**
**Underestimation summer mainly @night (ICON)/overestimation @summer**

# Driving Models

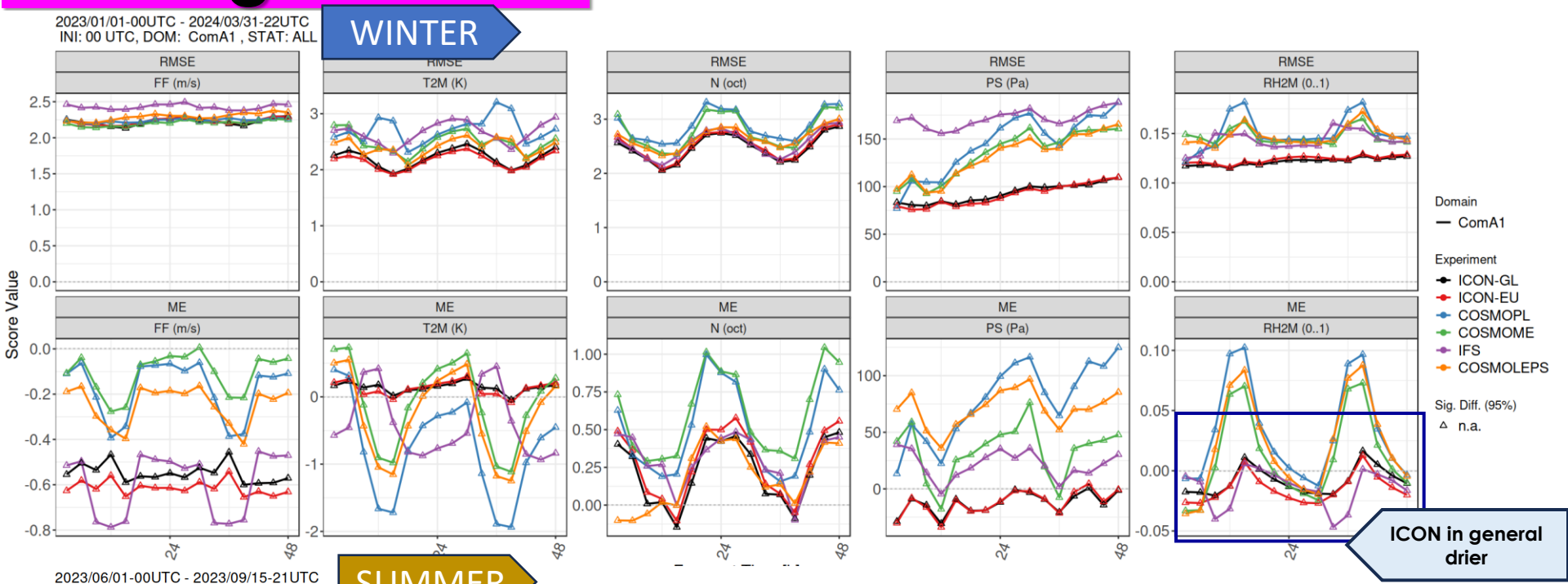


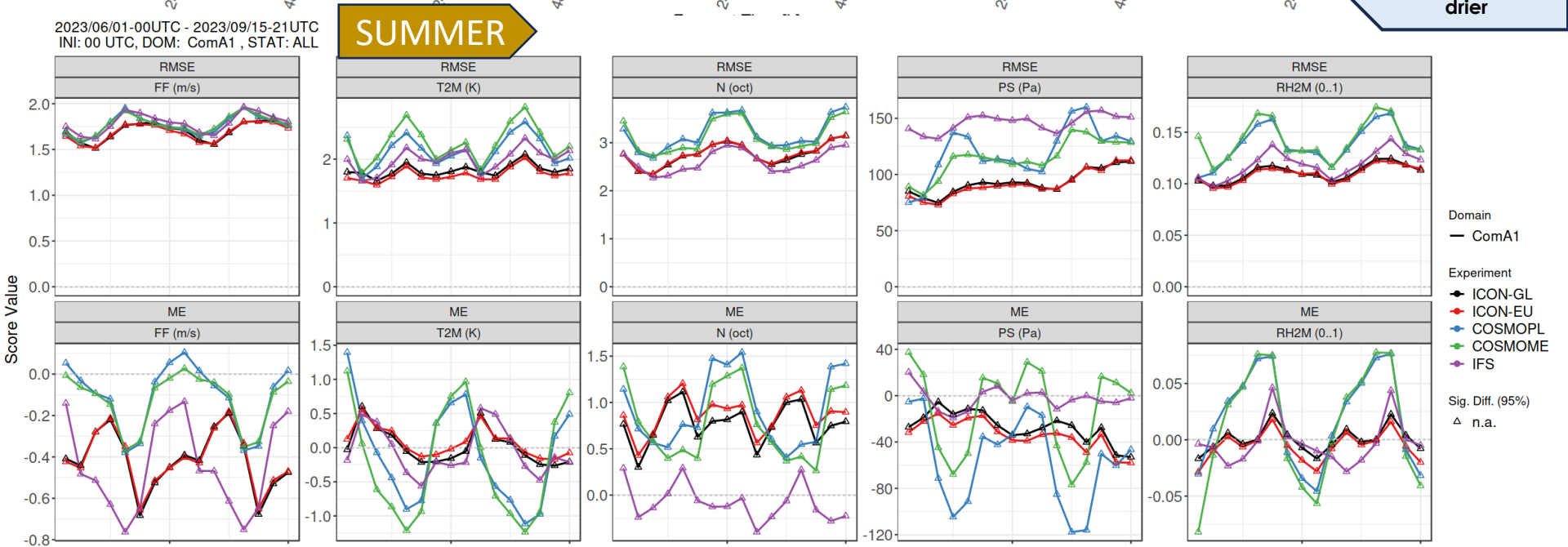



# Driving Models



# Driving Models



# 2m Temp

WINTER

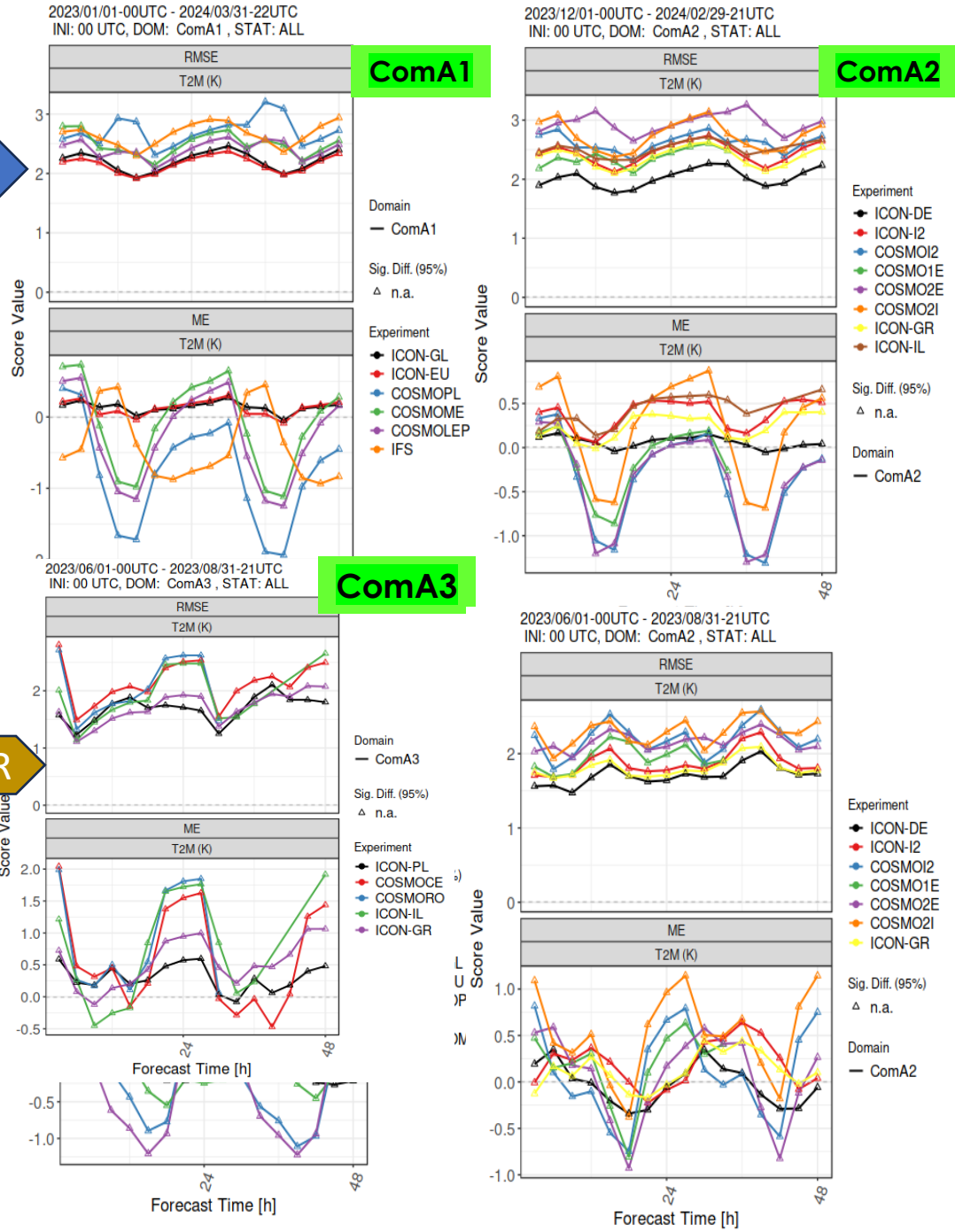
**Driving models:** ICON-Global performs better than COSMO+IFS.
**HighRes LAM:** consistency in performance among CA regions

**SysEr:** Diurnal cycle (DC) of **RMSE** is present in <u>all models.</u>
<u>Large</u> Errors from **initialization** of run.
Reduced RMSE DC with ICON models **especially reduction in BIAS DC (black+red+yellow).**

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

SUMMER

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




**SysEr : Systematic**
**ModDp: Model dependant**

# Condition on Cloudiness

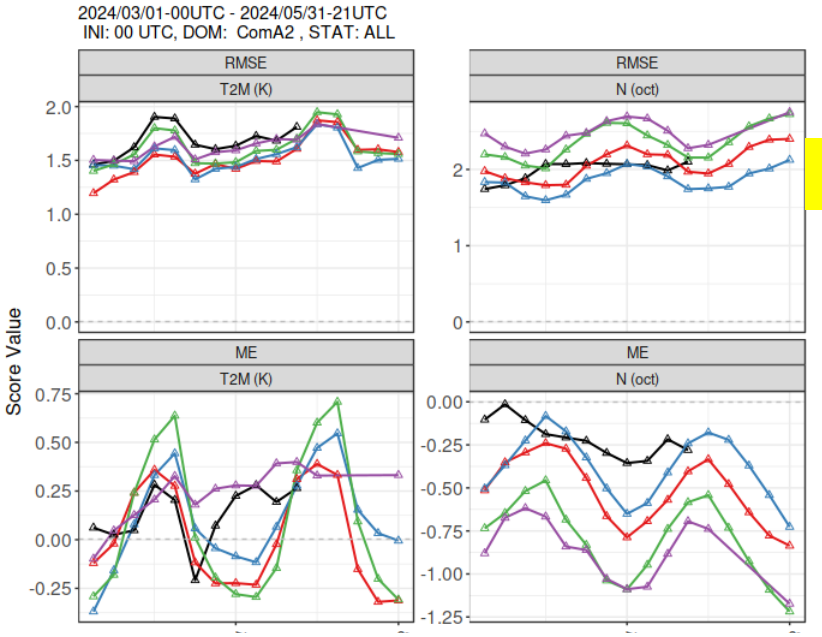
***C1.*** *2mT verification when: (condition on obs) Total cloud cover observation>= 75%*
***C2*** *2mT verification when: (condition on obs) Total cloud cover observation <= 25%*

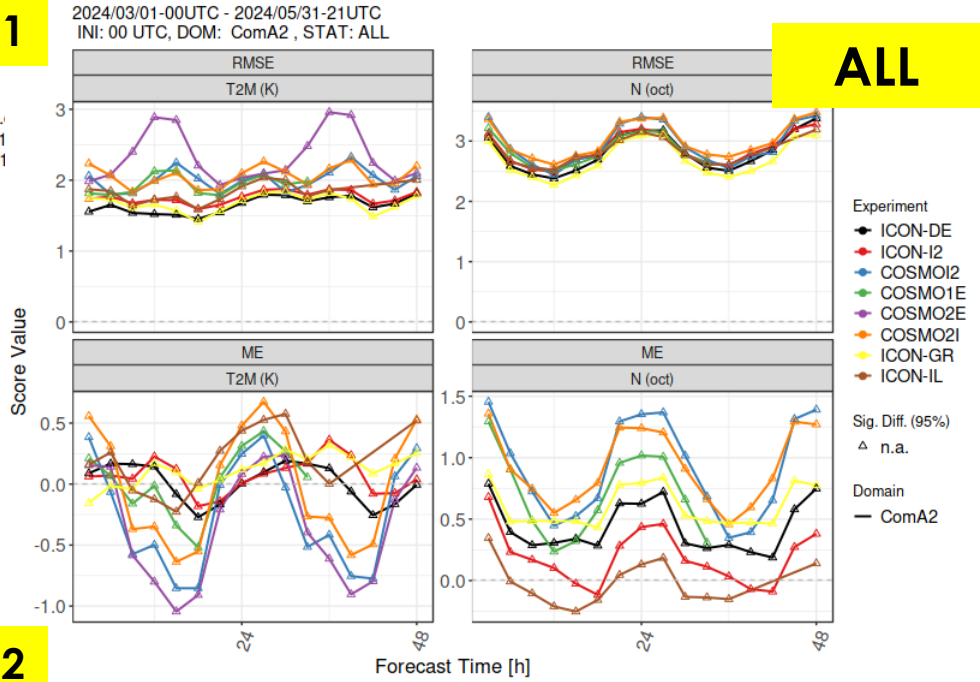
**MAM2024**

**ComA2**

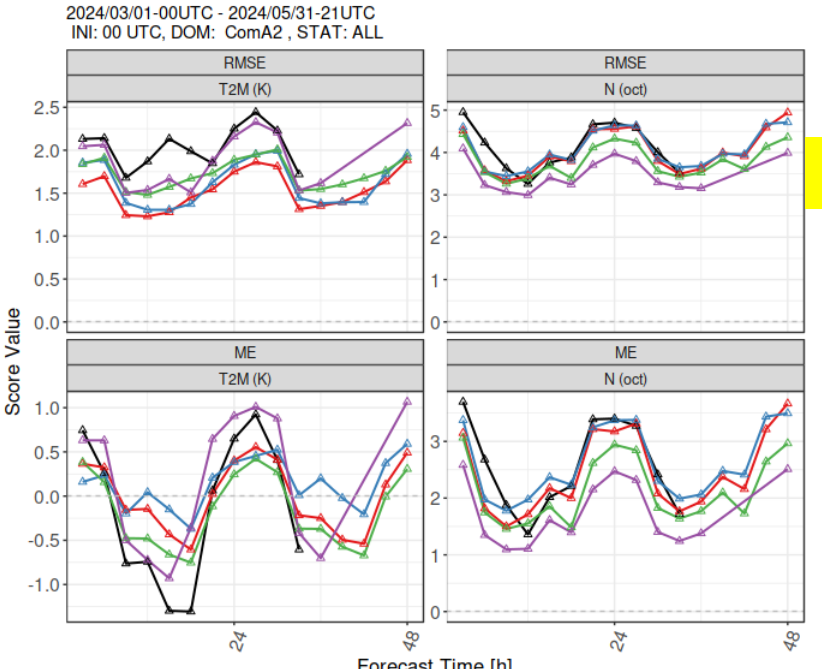
**Cond1**

**ALL**




**Cond2**




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

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

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

# Cloud Cover

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

**SysEr :** Large errors (2.5-3oct) **winter**, **larger** errors in **summer** (up to 4 oct)

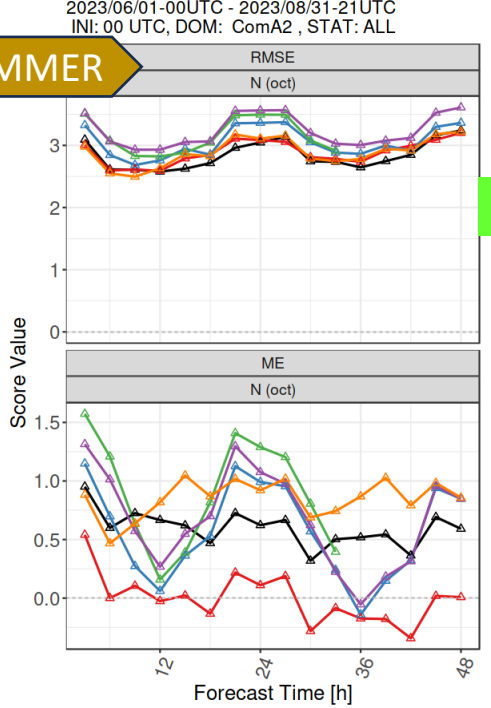
**SysEr :** Higher errors during **nighttime** for all models

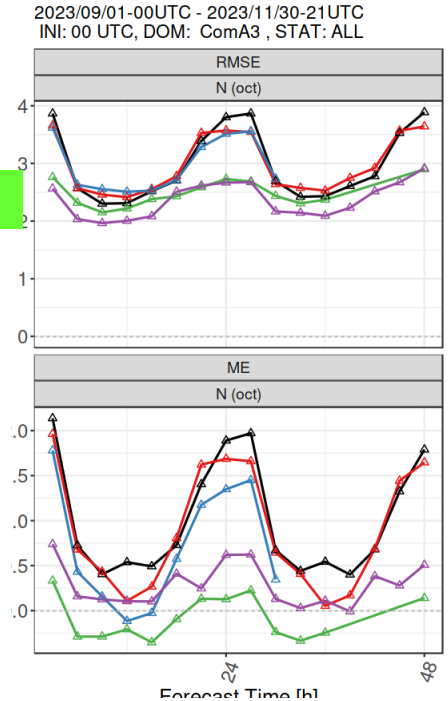
**SysEr :** TCC performance in **winter** is similar but improved with ICON overall especially w.r.t. to the **overestimation** at night.

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

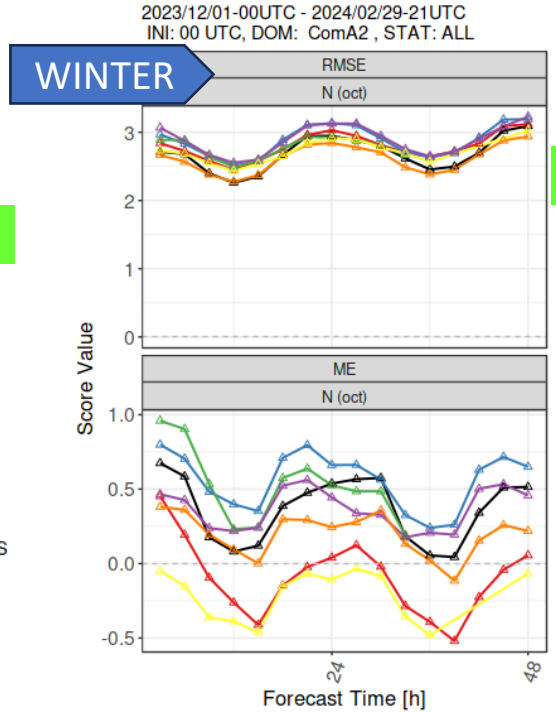
**ModDp :** In the **summer** larger variability of ME and min/max among models

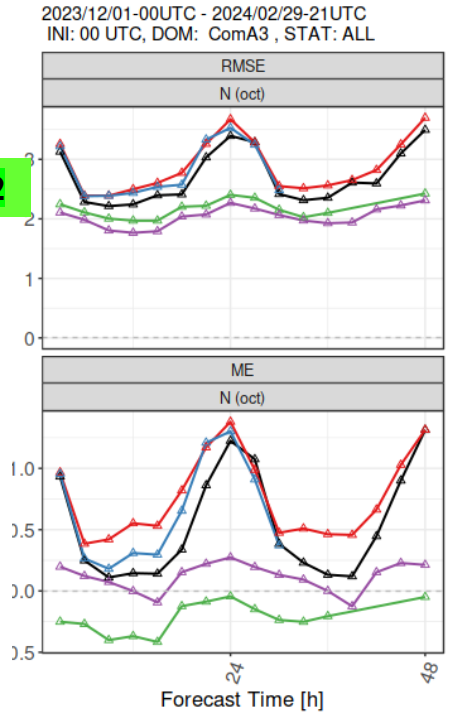
SUMMER

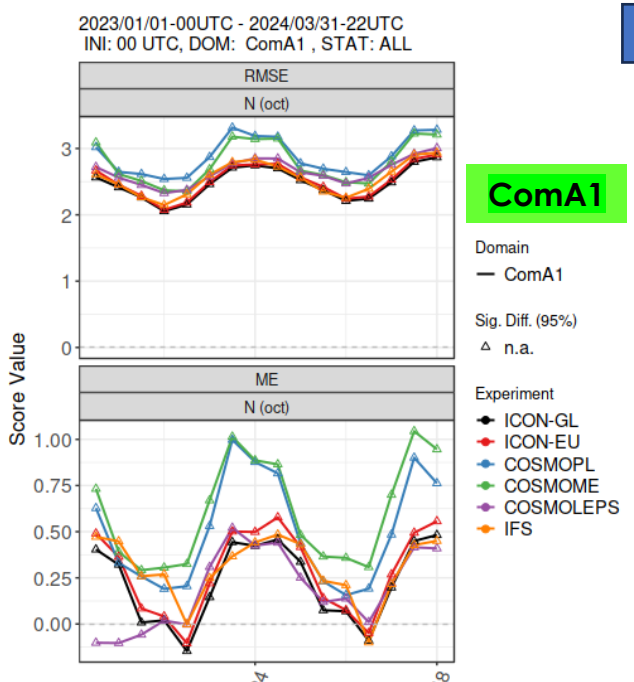



WINTER



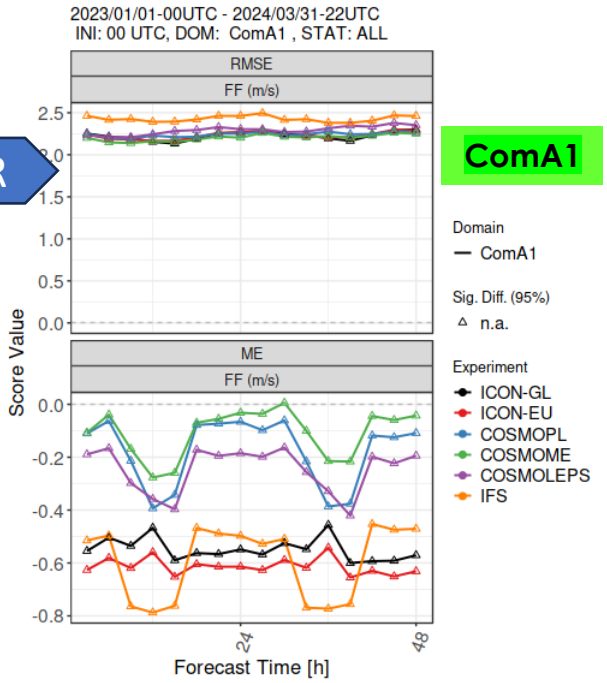



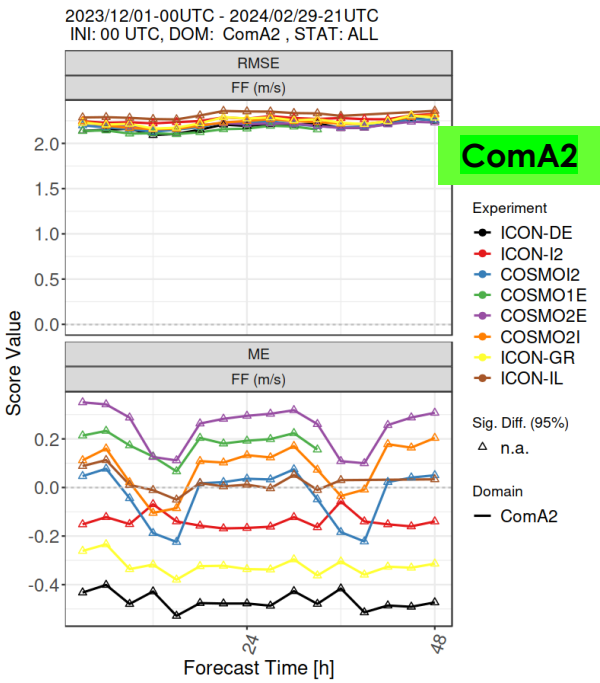



# Wind speed

WINTER

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

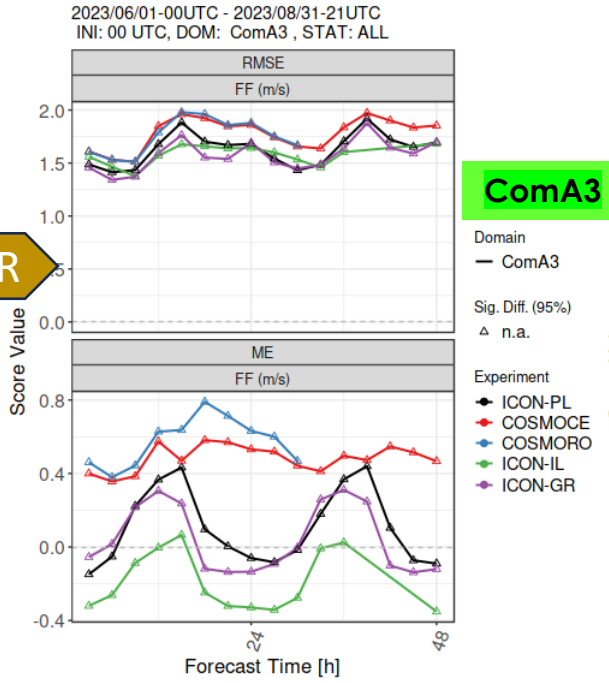


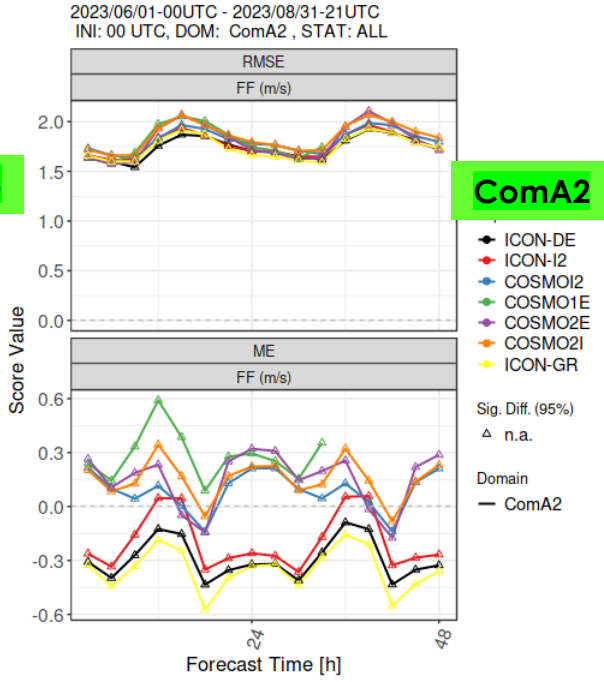




**SysEr :** Larger error cycle in **summer**

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

SUMMER

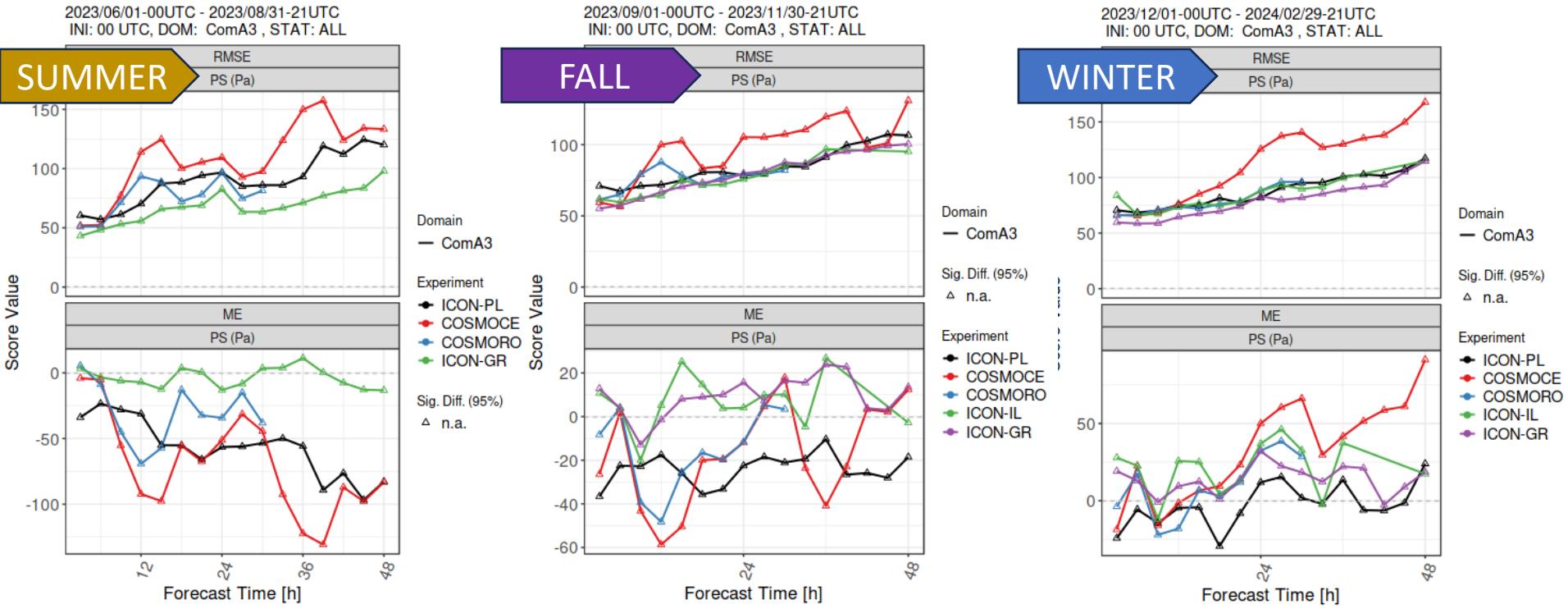


# Pressure

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

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

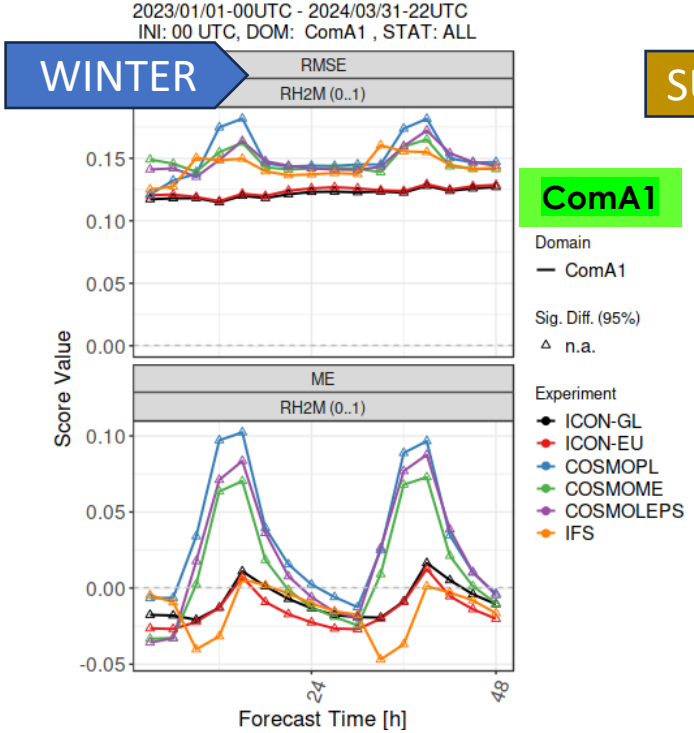


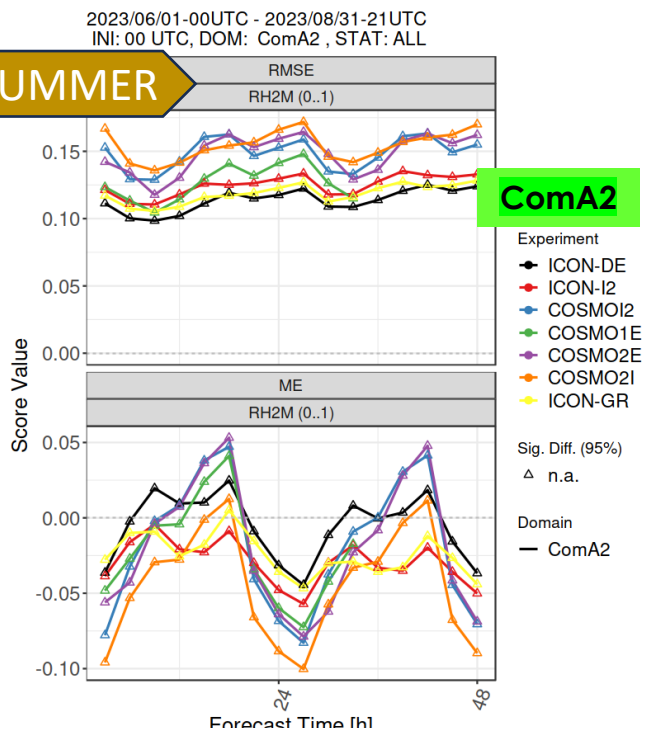
# Humidity

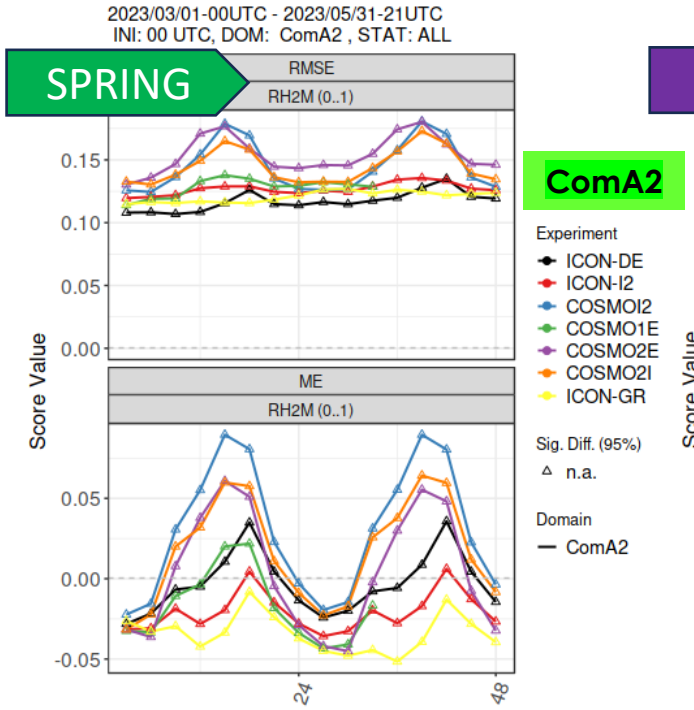
**SysEr :** RelHum and Td **BIAS diurnal cycle**, strongly reduced in ICON models.

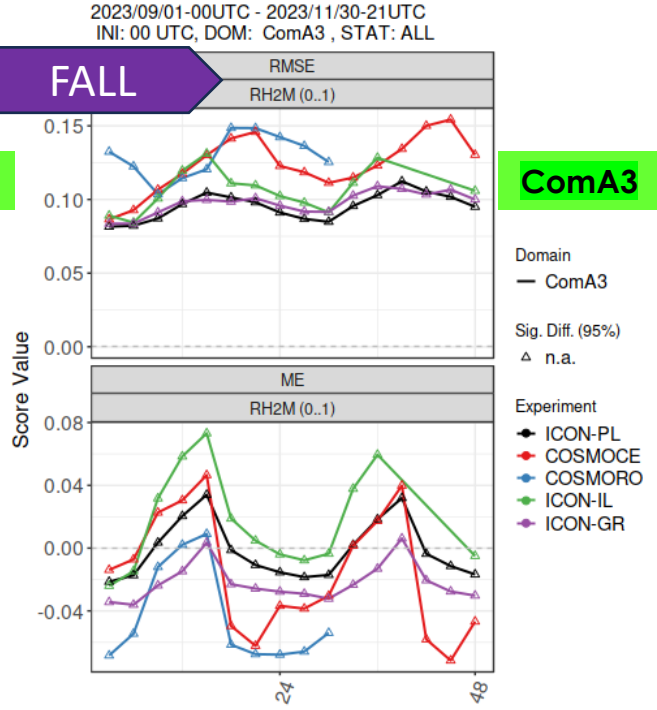
**SysEr :** While RMSE is reduced with **ICON**, errors are attributed to the *overestimation* during daylight hours and the *underestimation* at night during almost <u>all seasons</u>

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

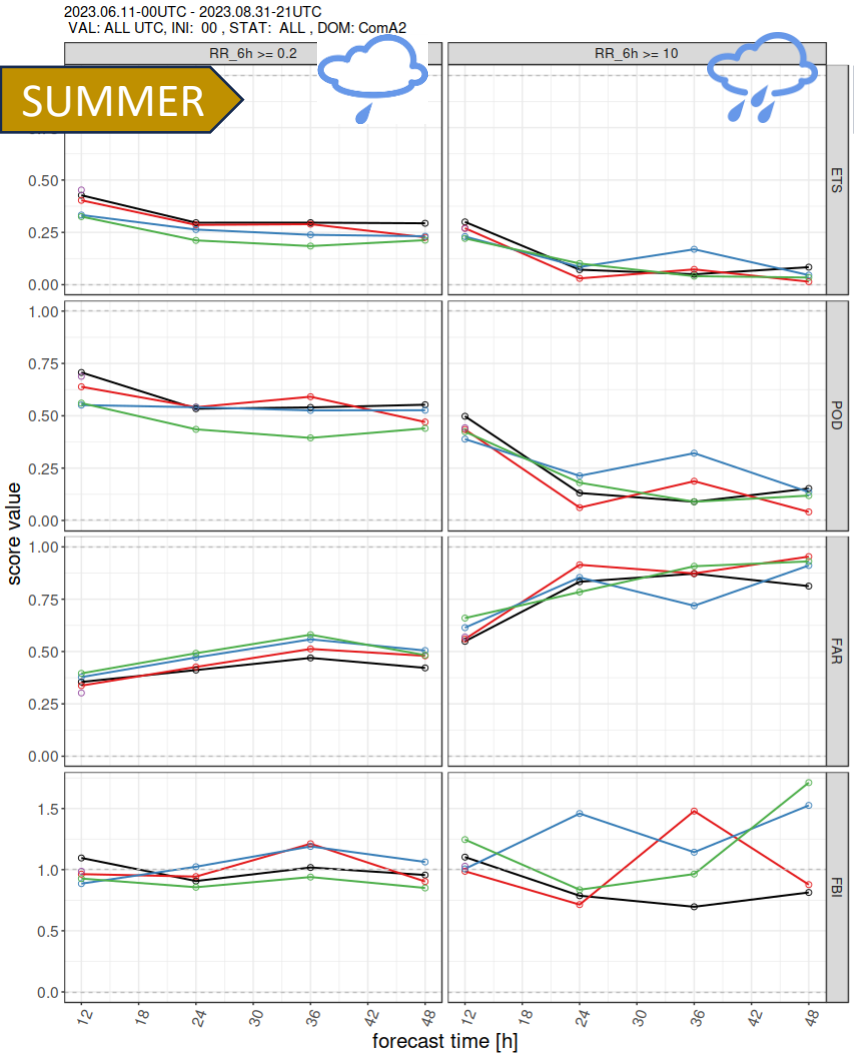


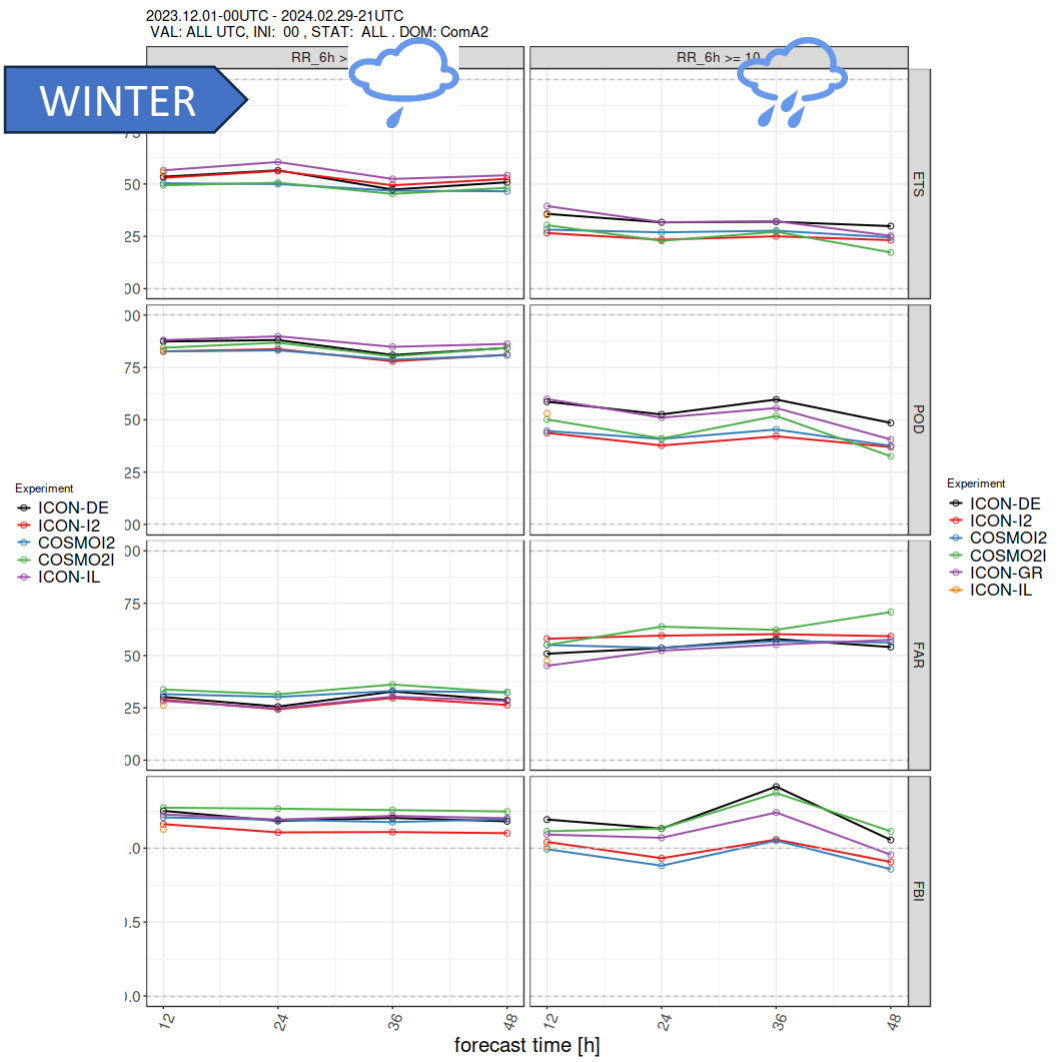



# 6h Precipitation



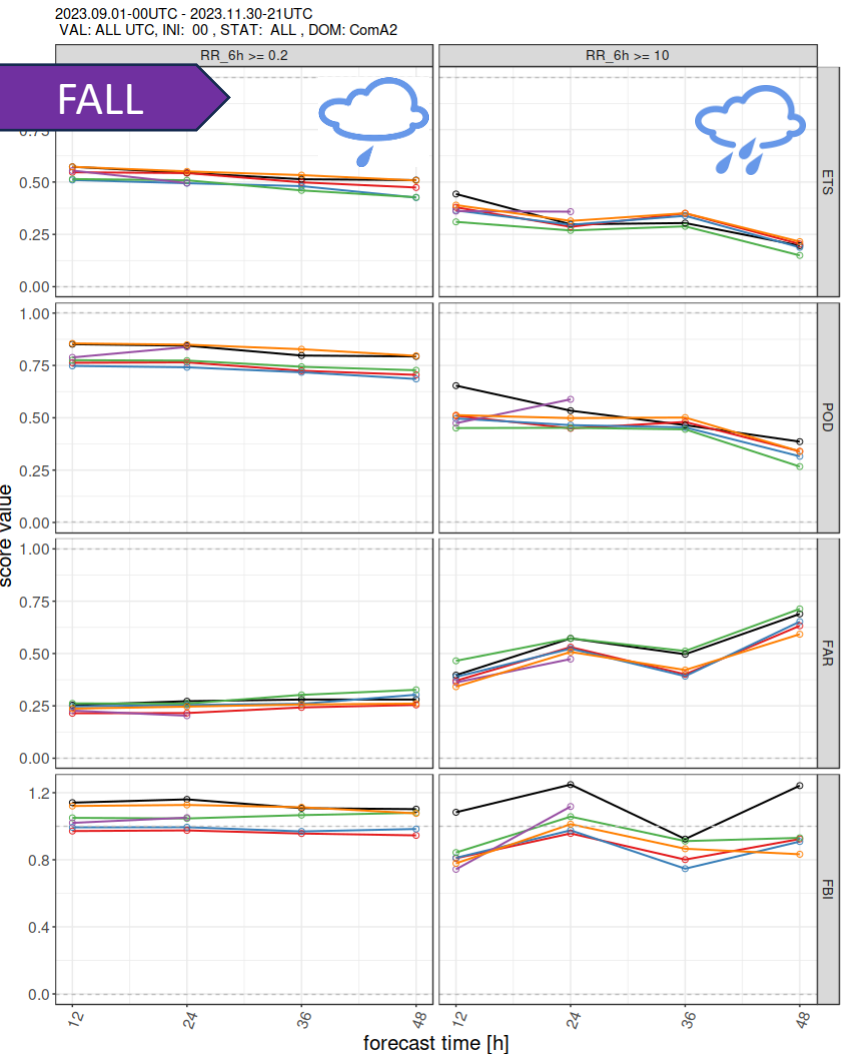



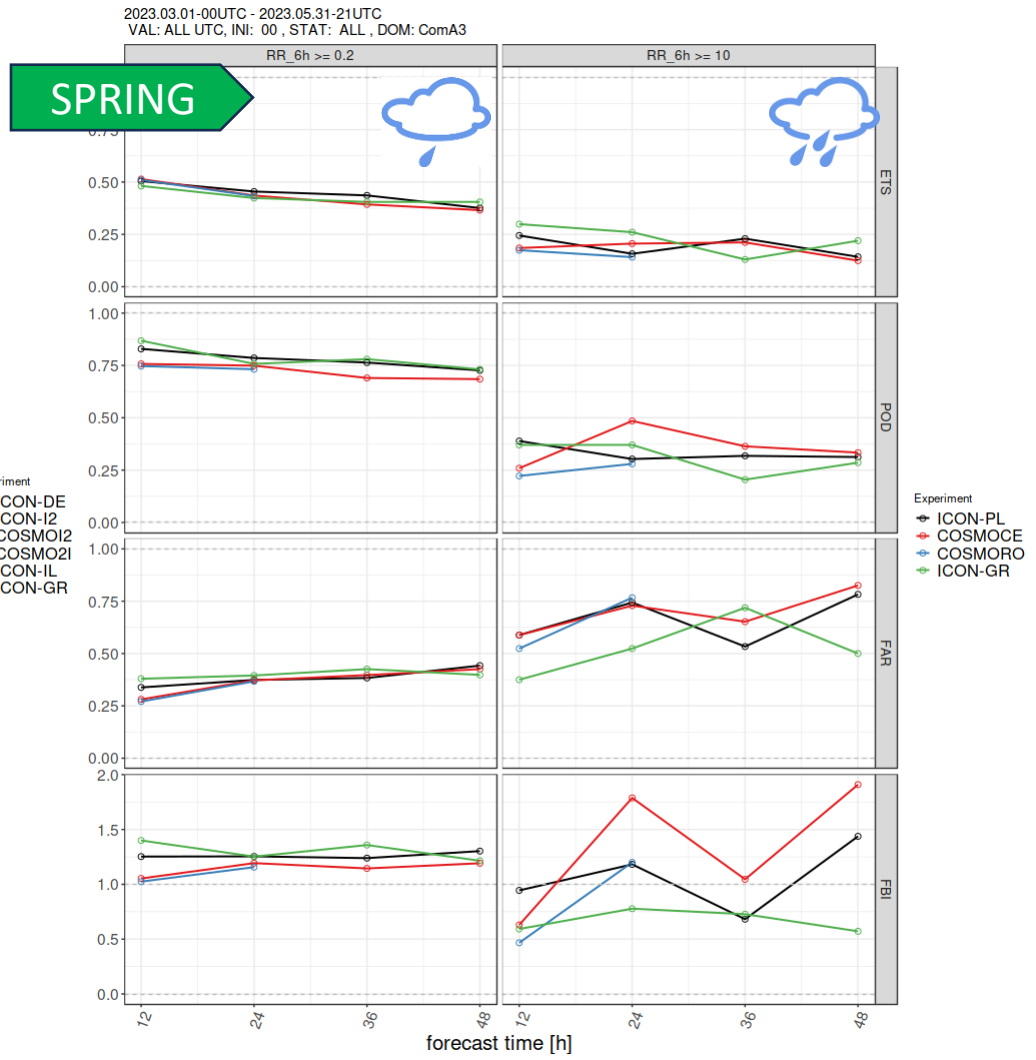

- Clearer differences in performance in higher precipitation amounts

**MOD:** ETS, FAR are higher for **ICON** but with a tendency to underestimate small preci amounts

# COSMO/ICON ComA2

## 6h Precipitation



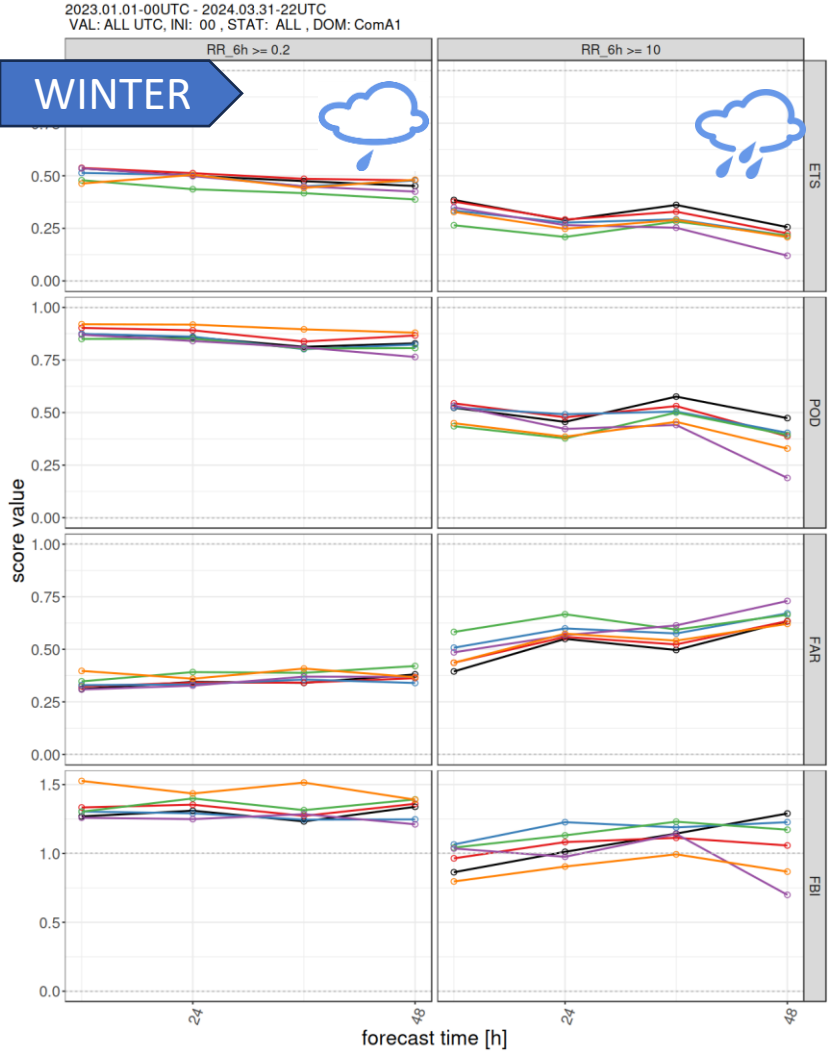

- Similar performance of all models for both seasons for small thresholds

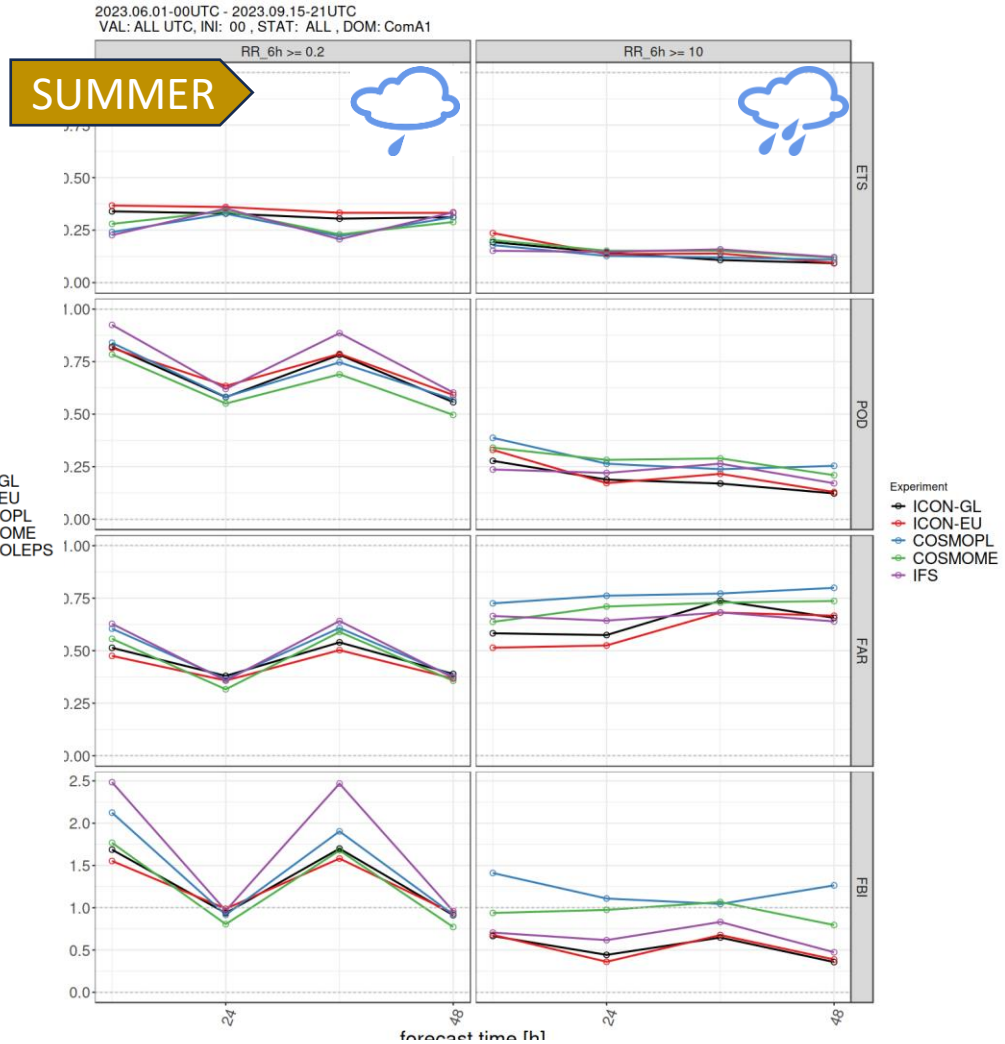
**SysEr:** For higher amounts of preci, **ICON models seem drier with a tendency to underestimate mainly in summer.**

**ModDp :** Smaller POD but also smaller FAR in higher precipitation amounts

# Driving models ComA1

## 6h Precipitation

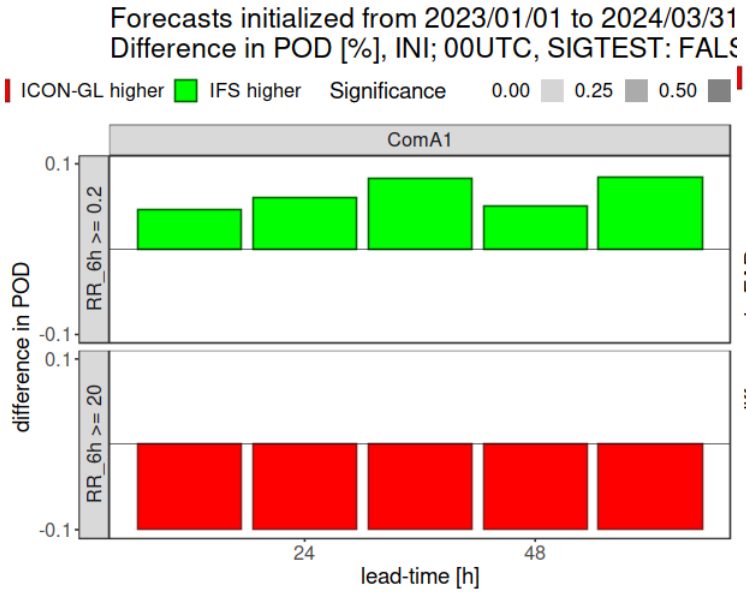


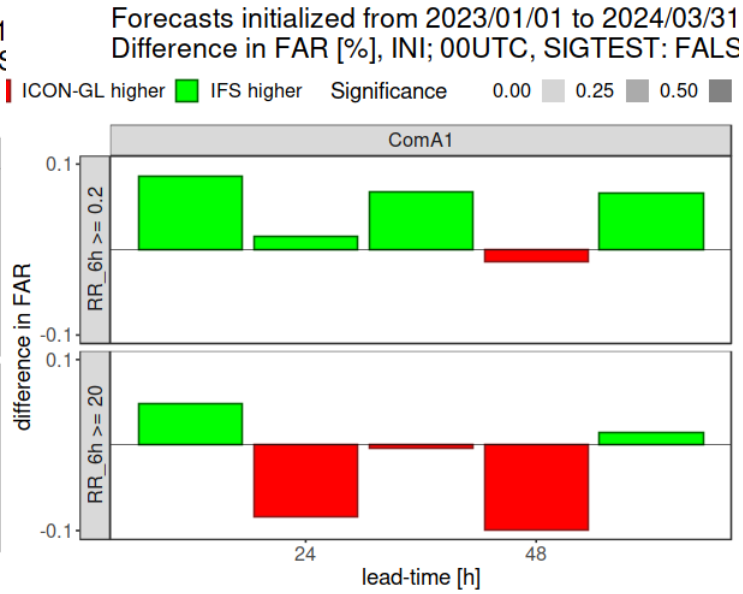



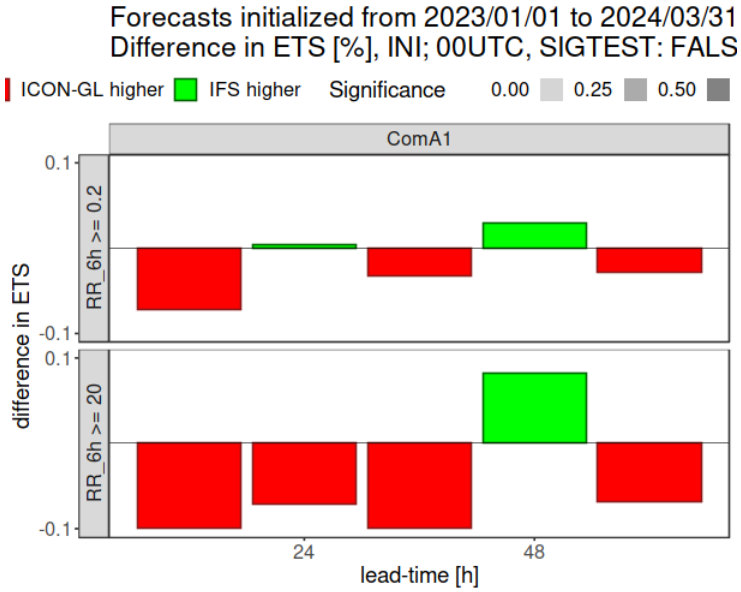

**ModDp :** Clear overprediction of small precipitation amounts with IFS compared to COSMO models for all seasons, linked also to higher POD and also higher FAR. For hogh precipitation amounts, ICON models overpredict and IFS underpredicts

# Driving models IFS vs. ICON

WINTER



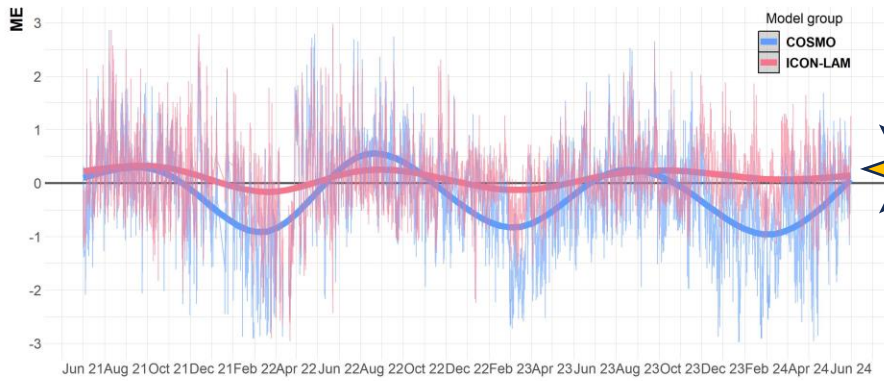



# Time Series

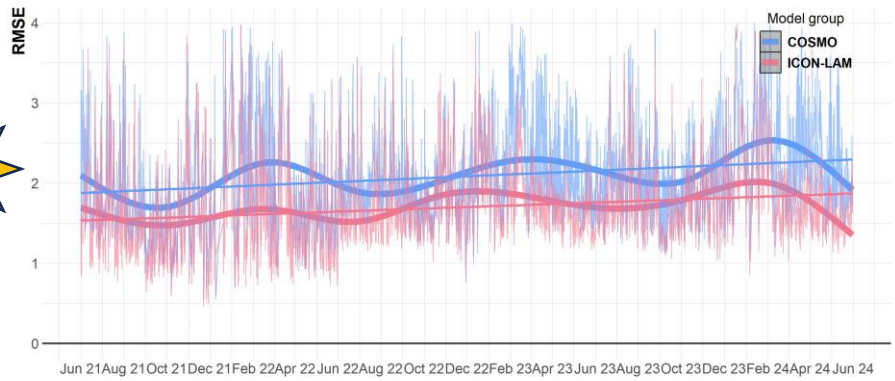
# 2mT @12+24UTC: all COSMO/ICON ComA2. 2021-2024

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.

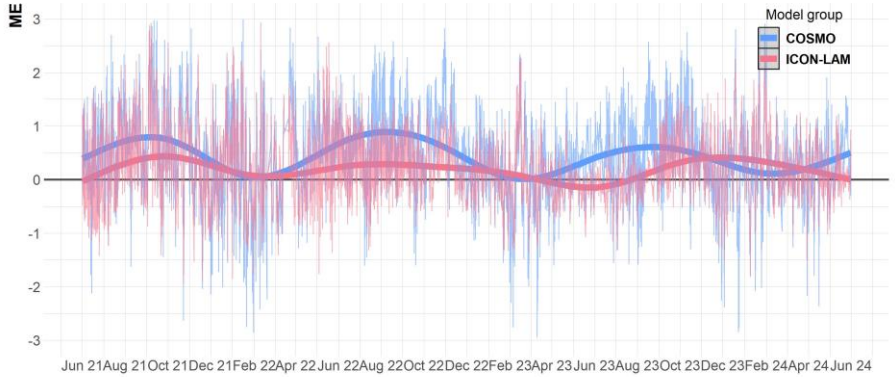
Mean Error



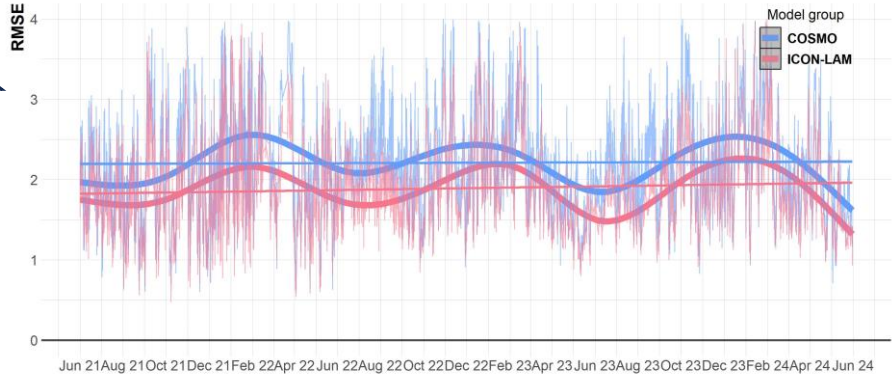

RMSE




Mean Error




RMSE

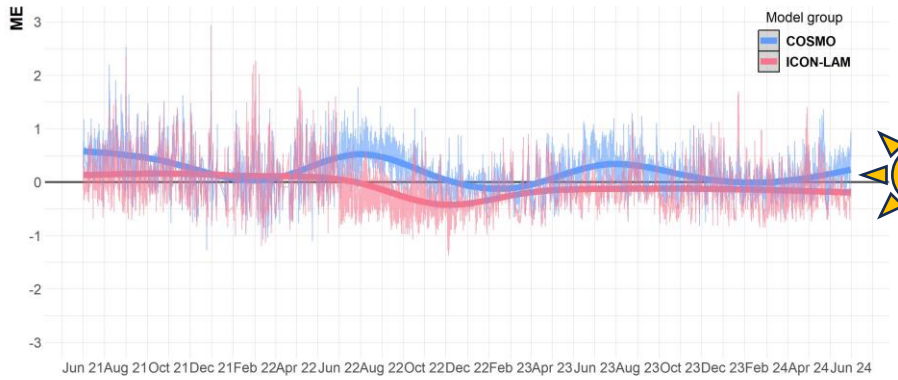



ICON tendency to underestimate mainly in the winter night hours, much less than COSMO that understimates at noon and overestimates at night (diurnal cycle minimized)

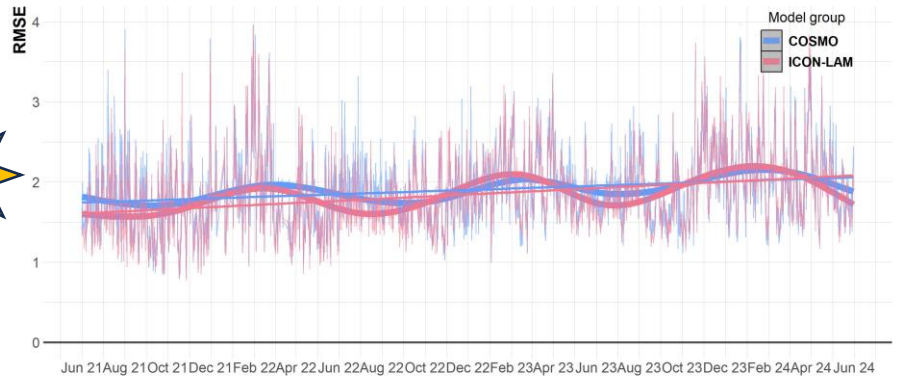
# WinsSp @12+24UTC: all COSMO/ICON ComA2, 2021-2024

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.

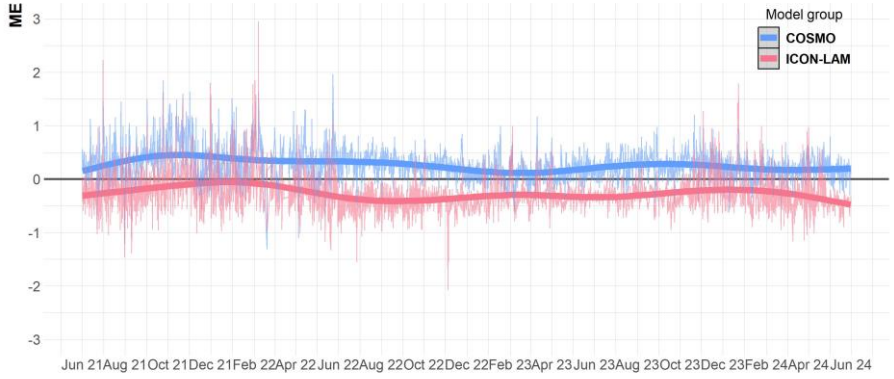
Mean Error



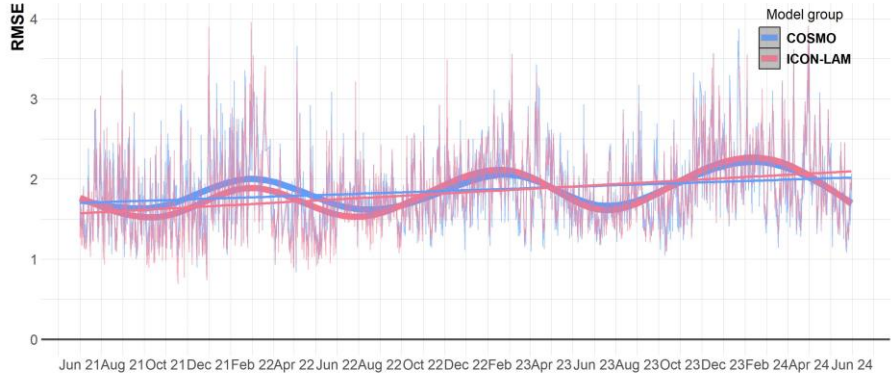

RMSE




Mean Error




RMSE

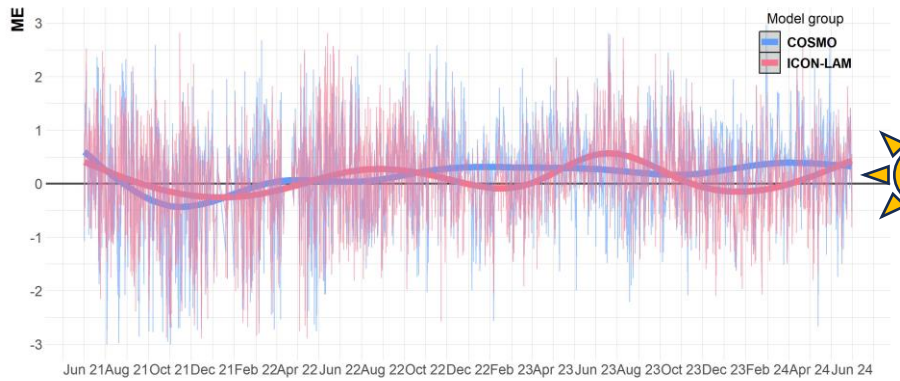



Not clear change in performance with wind speed , tendency to underestimate mainly at night

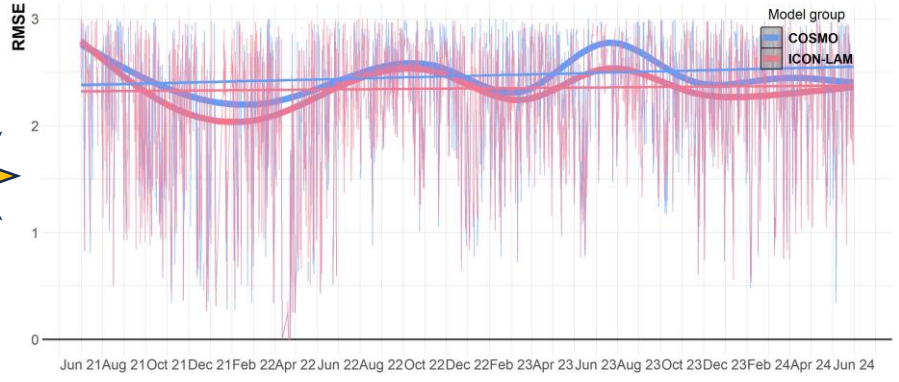
# TCC @12+24UTC: all COSMO/ICON ComA2, 2021-2024

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.

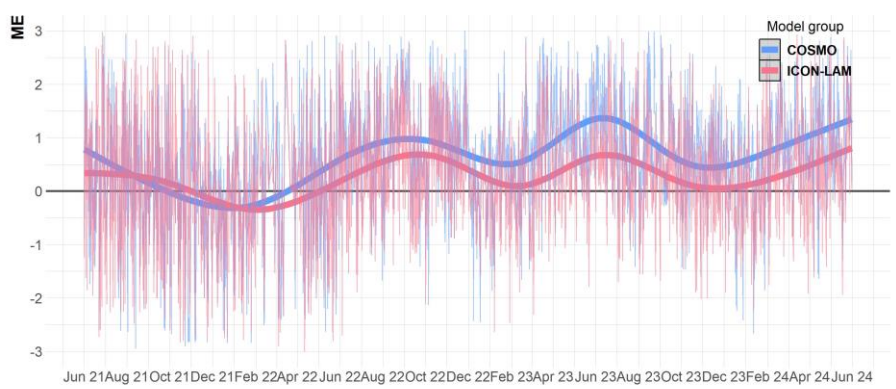
Mean Error




RMSE




Mean Error



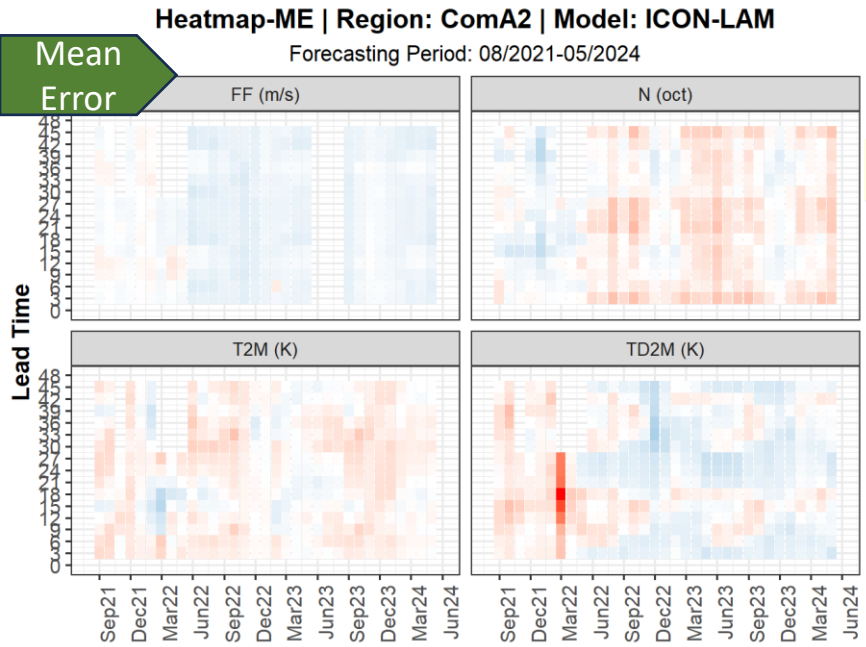

RMSE

Ambiguous performance from RMSE, both models with a tendency to overestimate during warm months night hours.

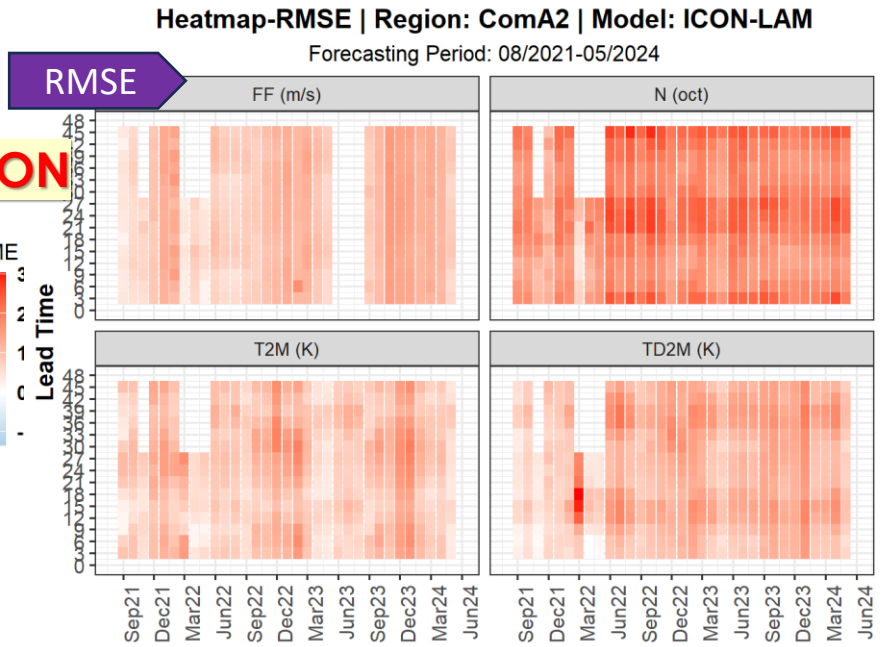
# Long-Term Trends

# HeatMaps all COSMO/ICON ComA2, 2021-2024

Mean Error



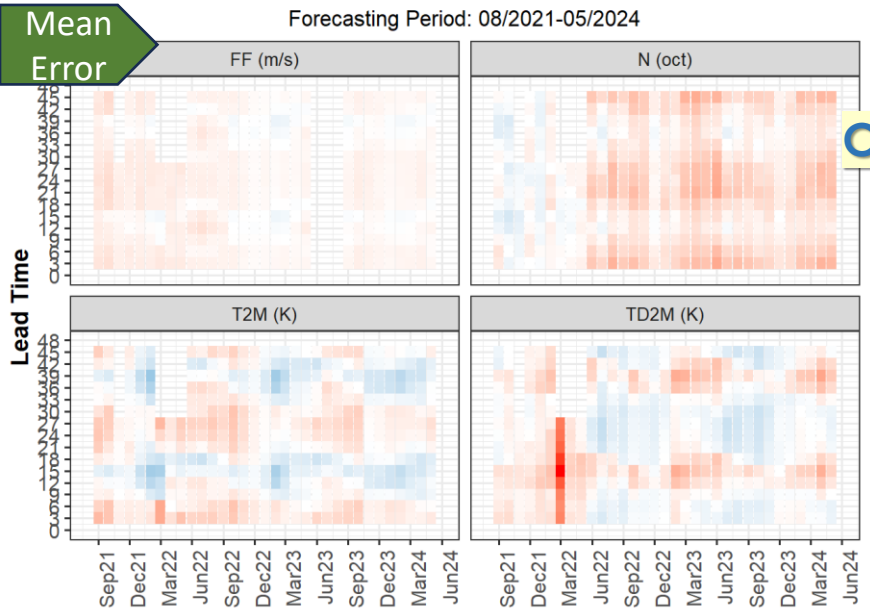

RMSE



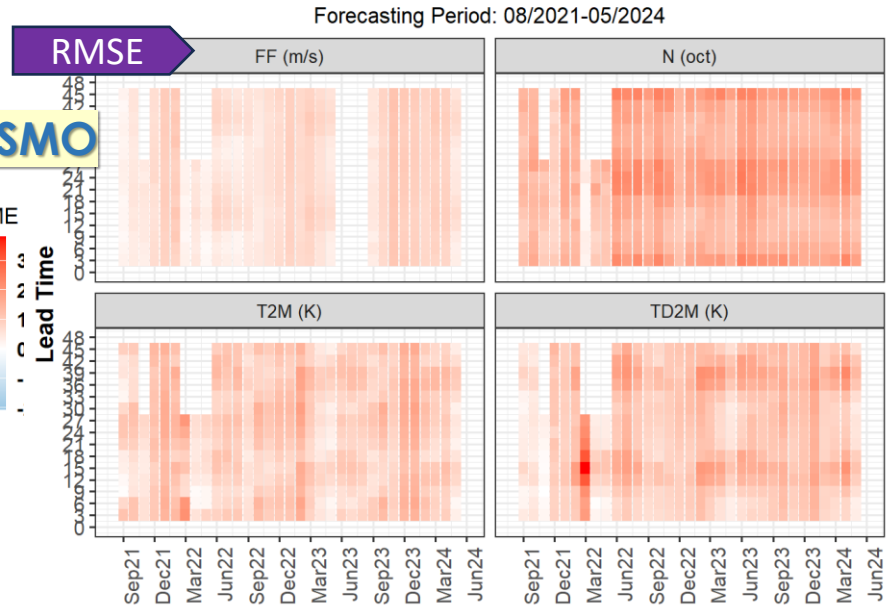

ICON

ME

Mean Error




RMSE

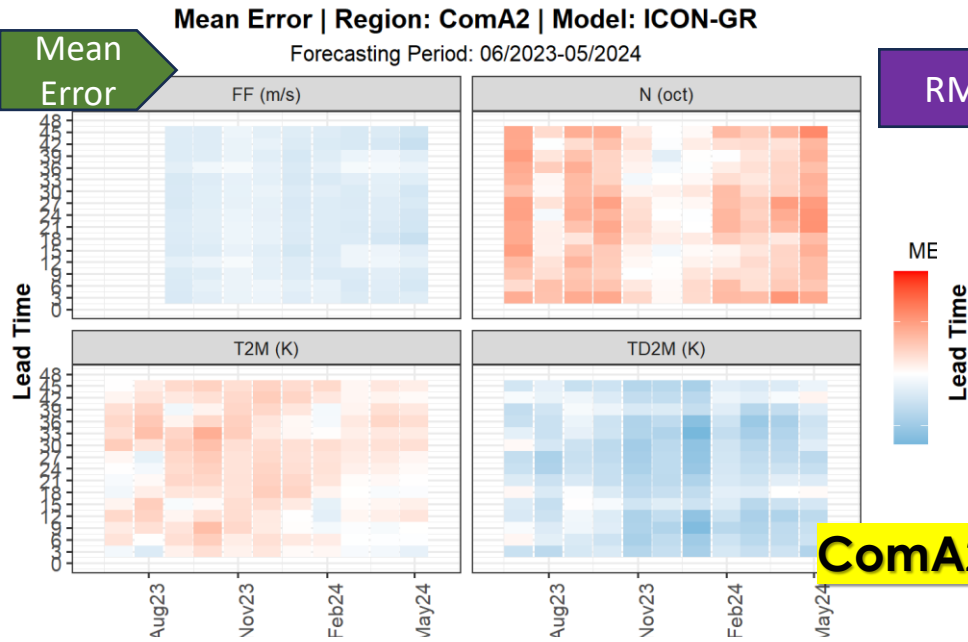



COSMO

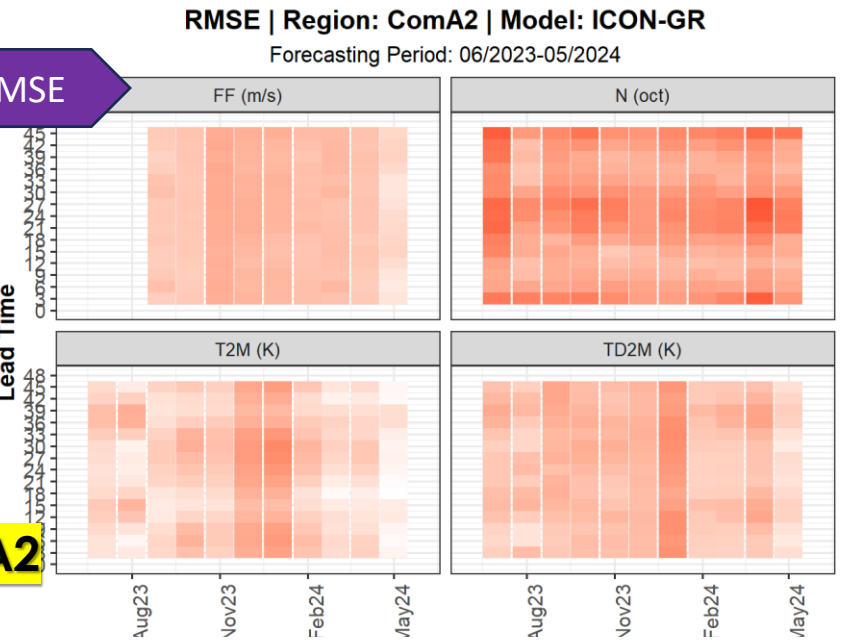
ME

# HeatMaps ICONGR ComA2#ComA3, 2023-2024

Mean Error




RMSE



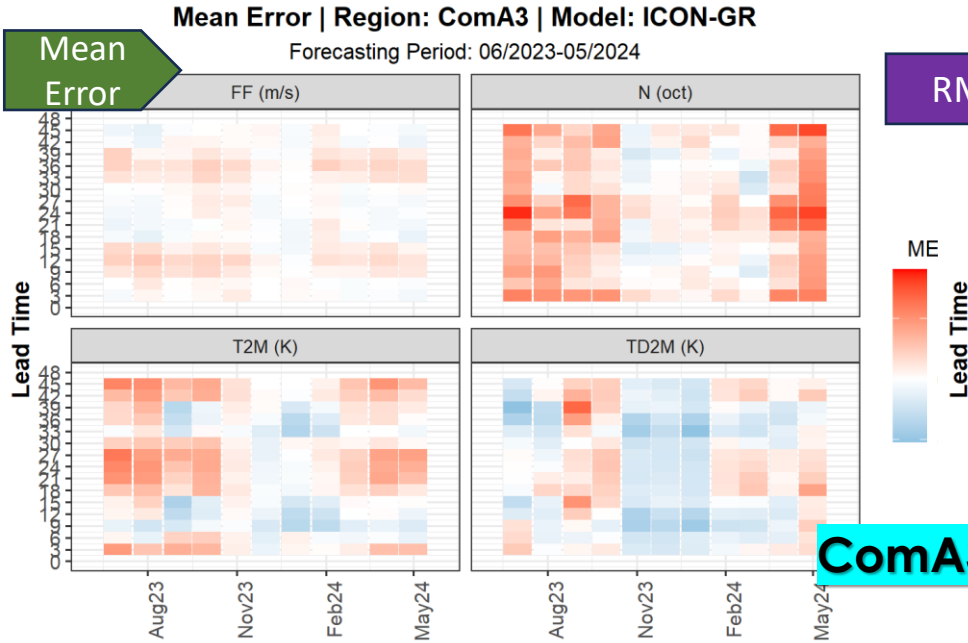

ME

RMSE

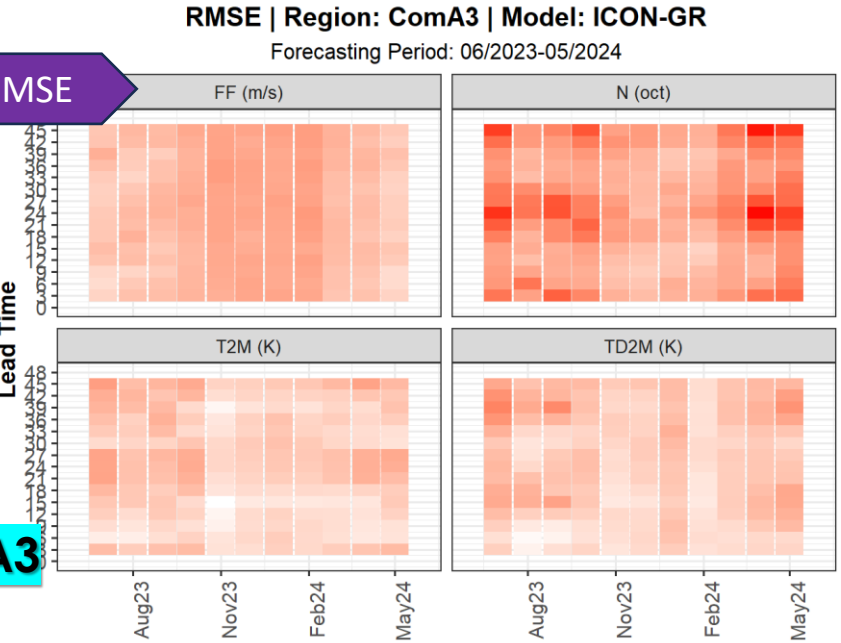
3.5
3.0
2.5
2.0
1.5

ComA2

Mean Error




RMSE




ME

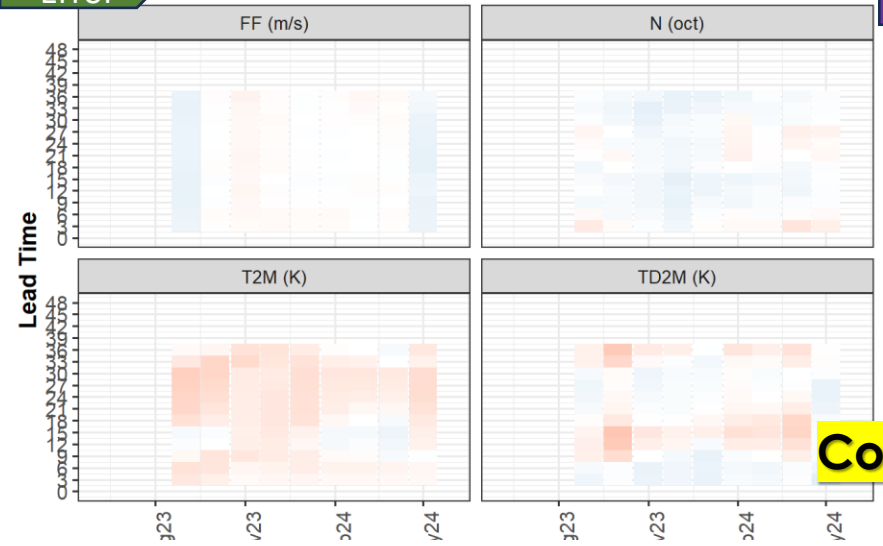
RMSE

3.0
2.5
2.0
1.5
1.0

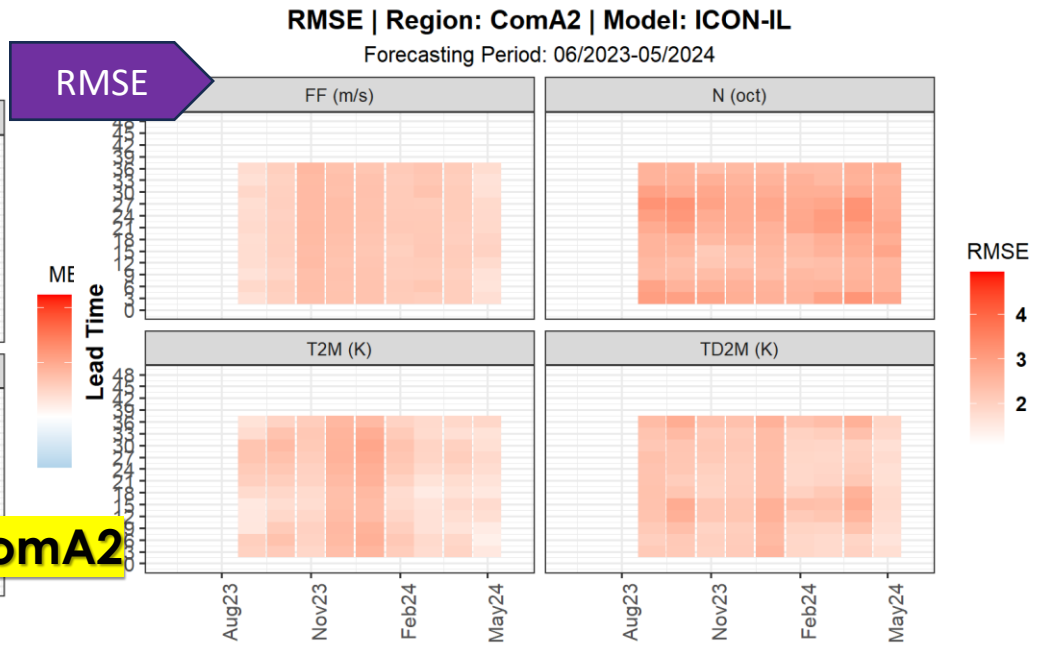
ComA3

# HeatMaps ICON-IL ComA2#ComA3, 2023-2024

Mean Error

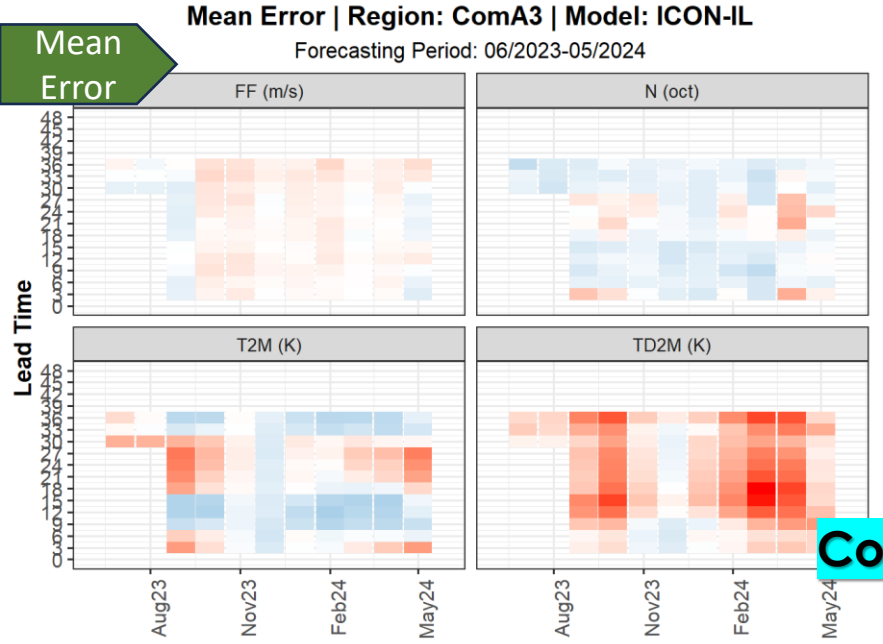



RMSE

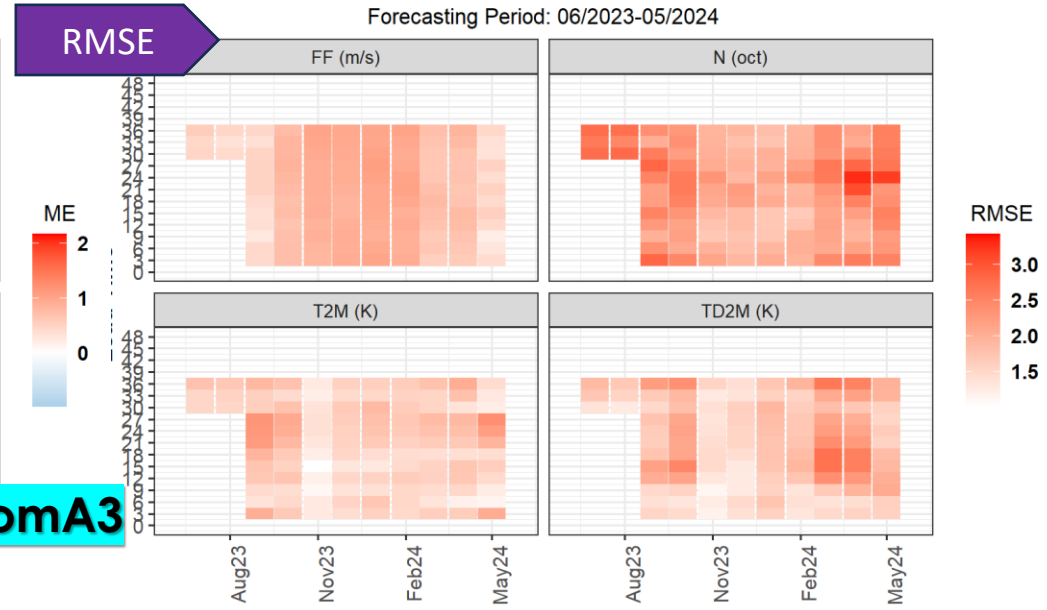



ComA2

Mean Error



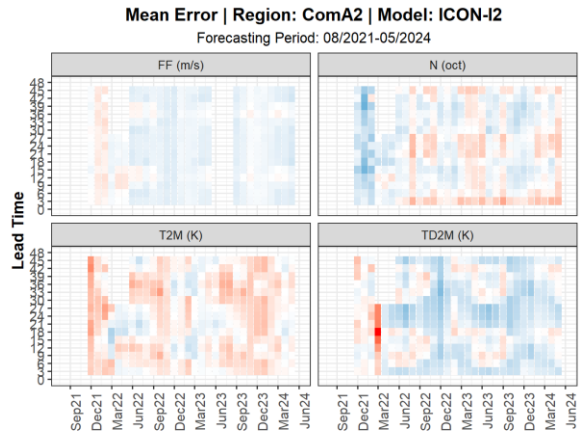

RMSE

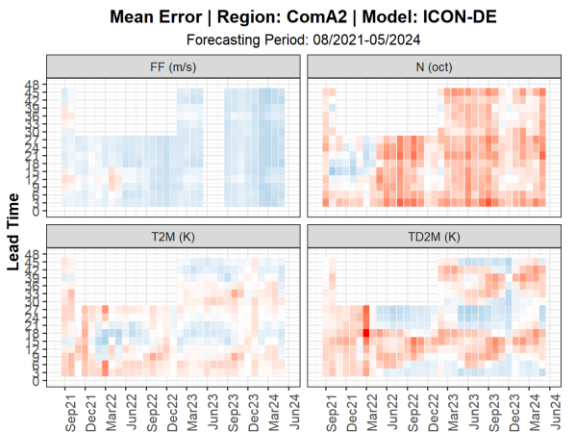


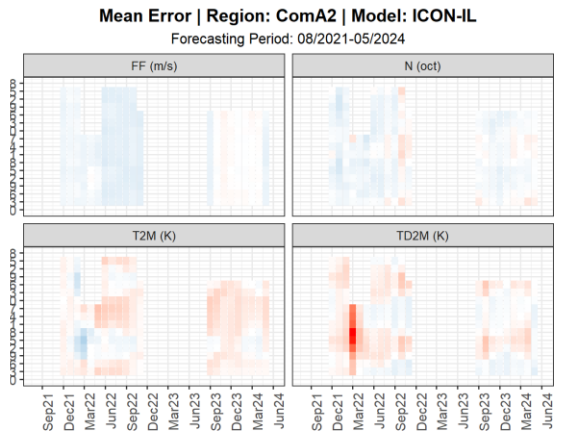

ComA3

# HeatMaps all models ComA2, 2021-2024

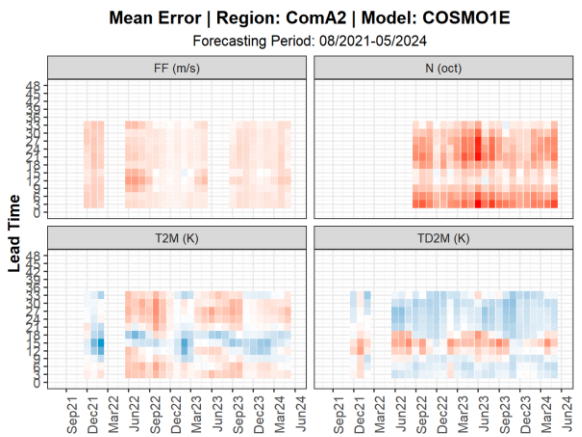
## ICON

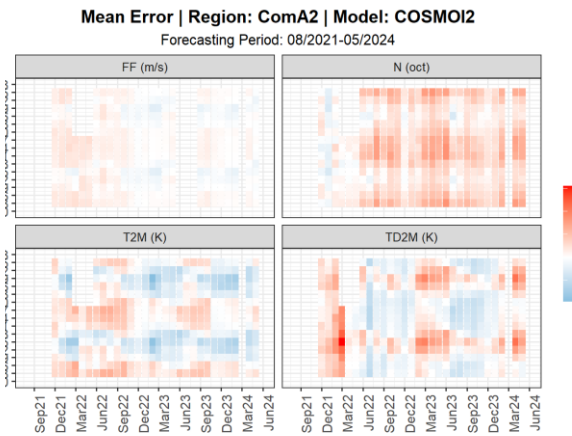


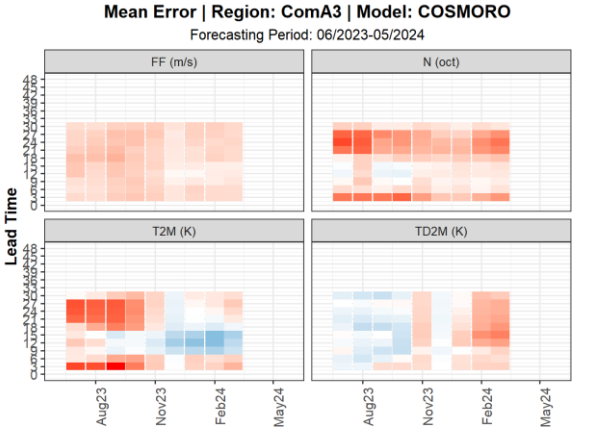




## COSMO



# Discussion on MODEL ERRORs

***1st Meeting (Videoconference) 24.01.2024***

Based on Common Area and National Domain verification results
Standard and Conditional Verification
Fuzzy on precipitation and TCC

**Focus:**

- Relative performance of COSMO/ICON implementations
- Reporting of systematic errors of ICON-LAMs (dependence on: season, hour, geographical location, weather, other parameters)
- Tuning on systematic model errors

**Necessary to repeat such meetings on annual basis as the GM does not allow to focus on Common Plots extensively**

**IDEAS for Content and Participants (other WGs)?**
**Timing?**

- **Common Plots analysis requires further attention to identify systematic errors and to be USEFUL**
- National domain analysis can be supplementary
- Necessary to tidy up CDSMO verification server for easier access
- Early preparation of plots will allow for a timely preparation before the GM
- New features of MEC/FFV2 can be tested (e.g. conditional verif on surface characteristics)
- Heatmaps and Time series plots can help identify gaps and errors easier but need effort to be utilized for the big number of models
- Possibility to add Performance diagrams in precipitation analysis
- EPS in common plots (can be discussed in joint meeting with WG7 @2pm (PP-CARMENS session)

…END