Common Plots Activity
…model errors

Meeting 24.01.2024

F. Gofa, S. Gabrian, S. Dinicila, N. Vela, F. Fundel, J. Linkowka, P. Khain, P. Kaufman, F. Sudati, D. Boucouvala, M.S.Tesini…..

Meeting on: MODEL ERRORs

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

Summary to be included in COSMO newsletter: verification report

Schedule (2h)

1. F. Gofa+Intro 15'
2. N. Vela 10'
3. J. Linkowska 10'
4. F. Fundel 10'
5. M.S. Tesini 10'
6. F. Sudati 10'
7. D. Boucouvala 10'
8. short discussion

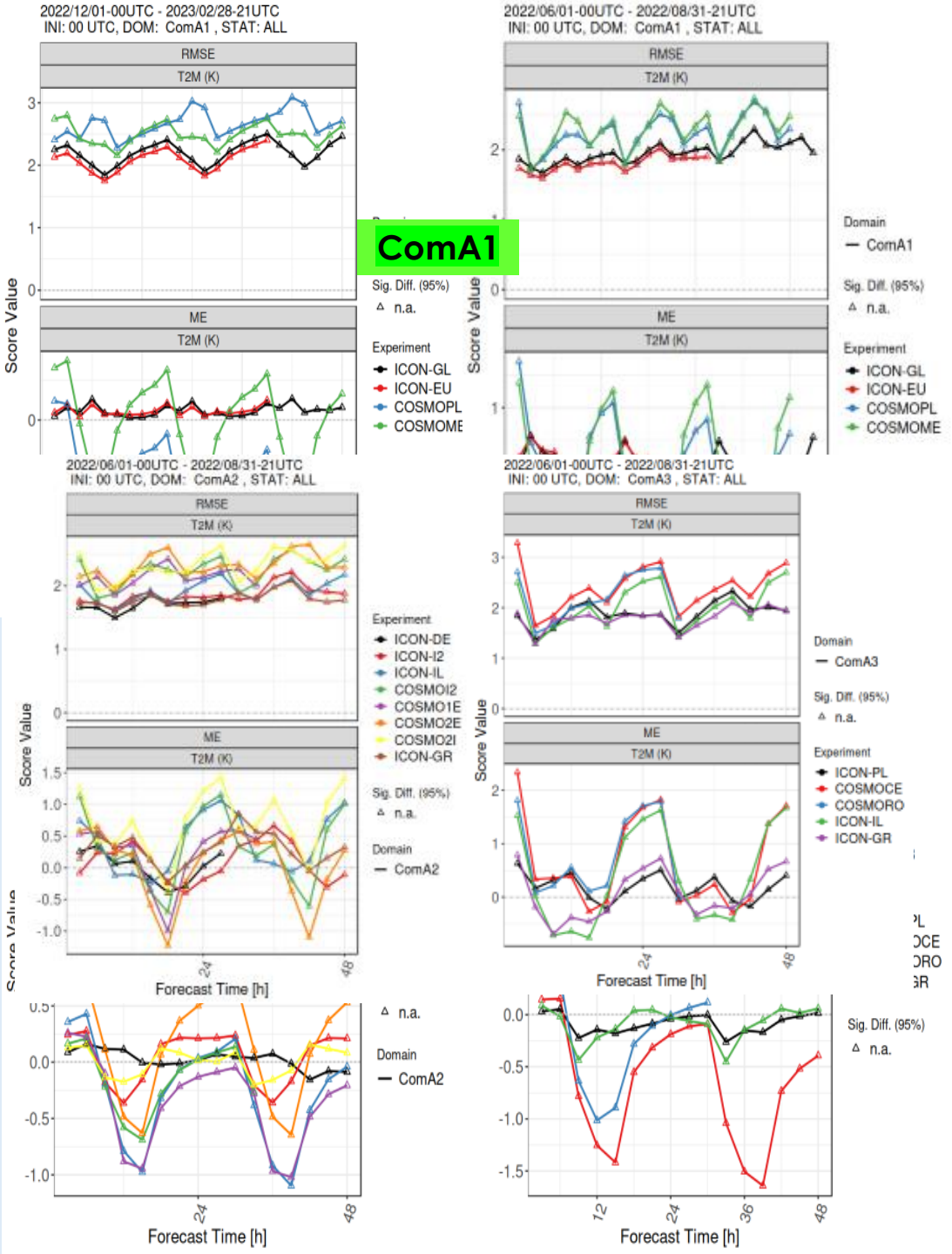
Please keep your comments/remarks for the discussion at the END of all presentations

2m Temperature

Coarser models: ICON-Global performs better than COSMO coarse limited area models and similarly to ICON-EU.
Higher res models: Better performance over ComA3 region for 2mT

SYS: Diurnal cycle (DC) of **RMSE** is present in all models. Errors from initialization of run. 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 hours
SYS: different phase for BIAS in ICON models

SYS: Systematic
MOD: Model dependant

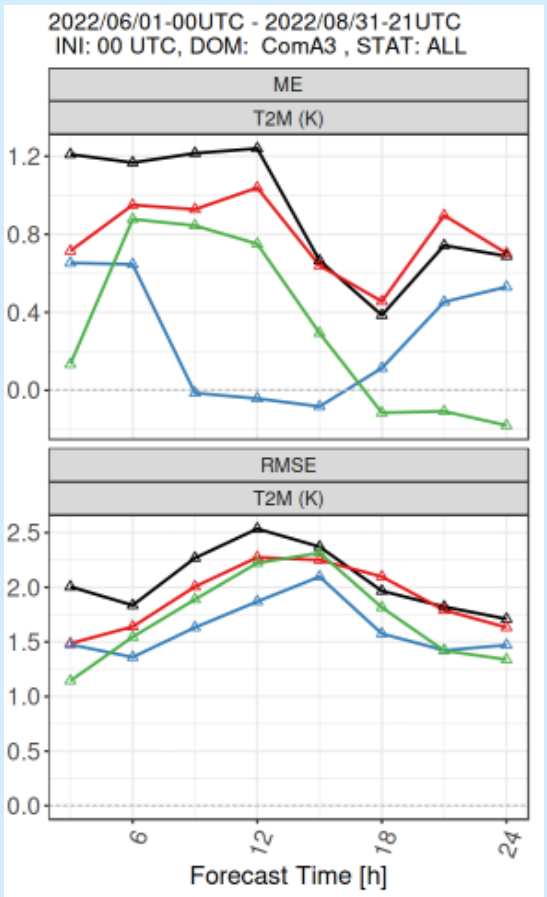


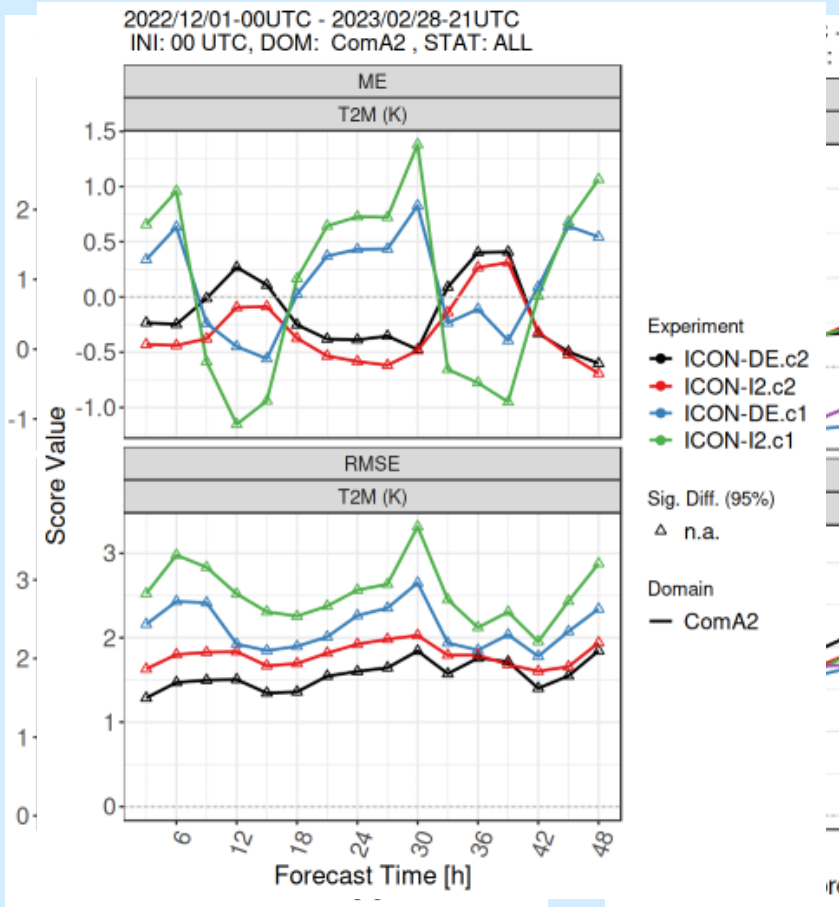
Temperature w.r.t. Cloudiness

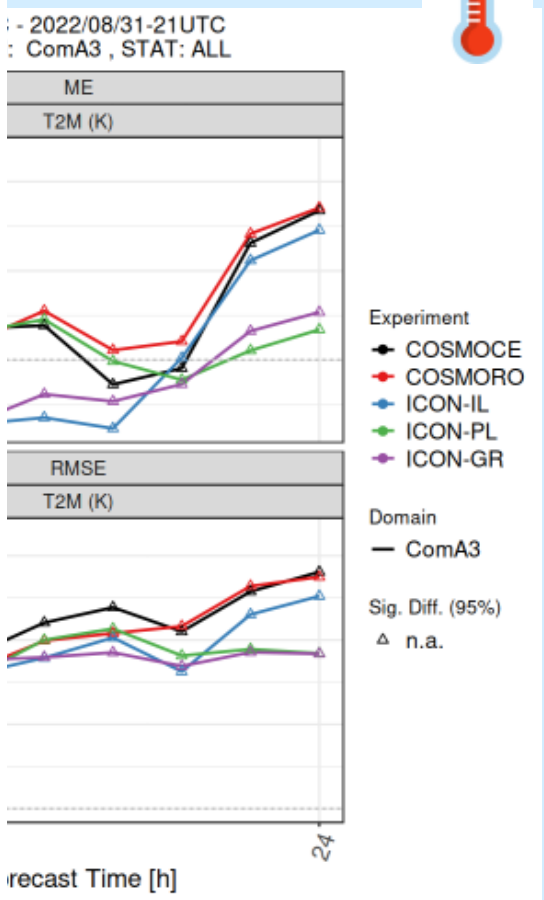
JJA2022

ComA3

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







Cond1 **Cond2** **ALL**

SYS: Underestimation of 2mT for clear sky conditions in all models, **noon**
SYS: Overestimation of 2mT under cloudy conditions in all models, **night**

Cloud Cover

SYS: Diurnal cycle of RMSE for TCC remains strong in all models.

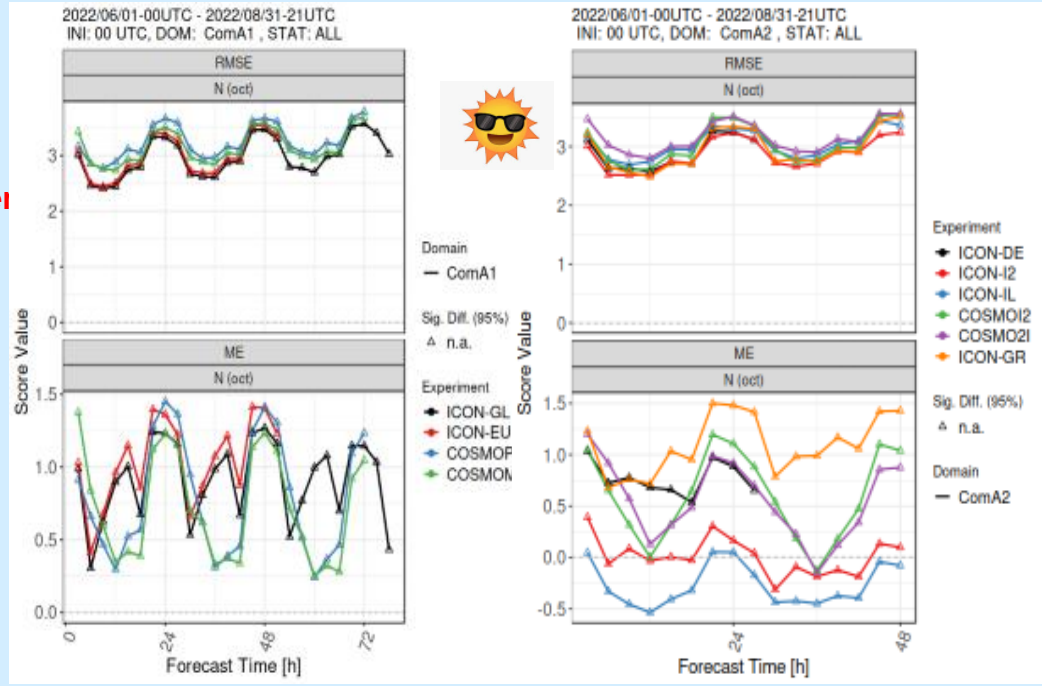
SYS: Large errors (2.5-3oct) **winter**, larger errors in **summer** (up to 4 oct)

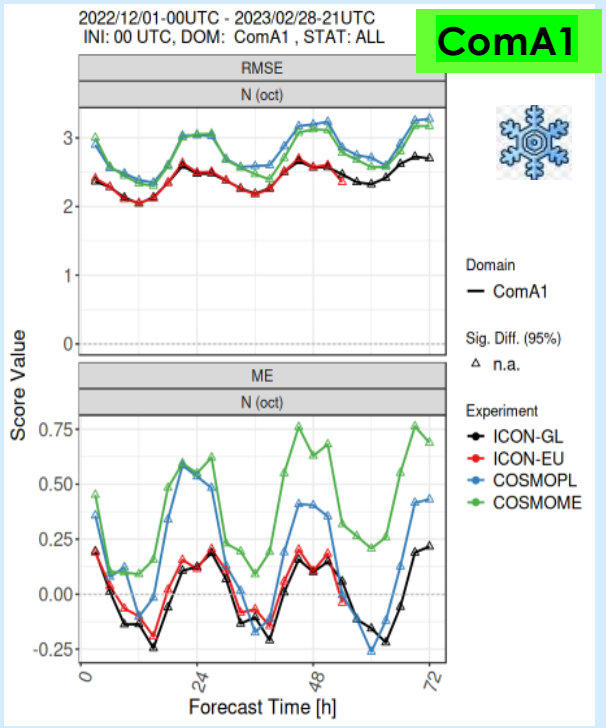
SYS: Higher errors during **nighttime** for all models

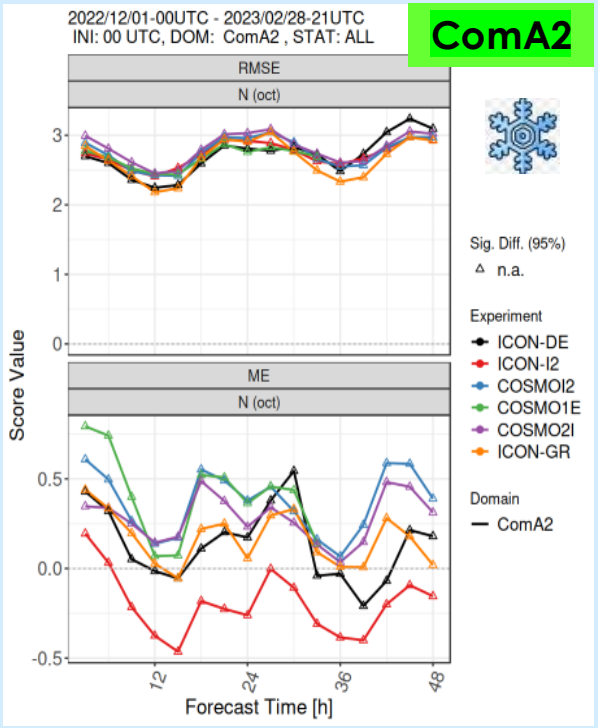
MOD: Higher **underestimation** for TCC in warm hours of the day with ICON in **winter**

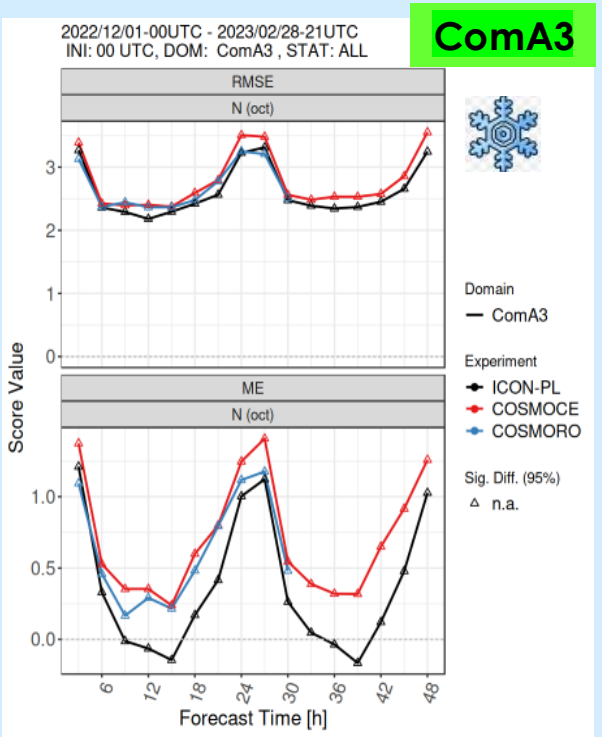
SYS: TCC performance in **winter** is similar but improved with ICON overall especially w.r.t. to the **overestimation** at night.

MOD: In the **summer** **overestimation** of clouds in warm hours (ICON) while COSMO model shows <u>opposite behavior</u>







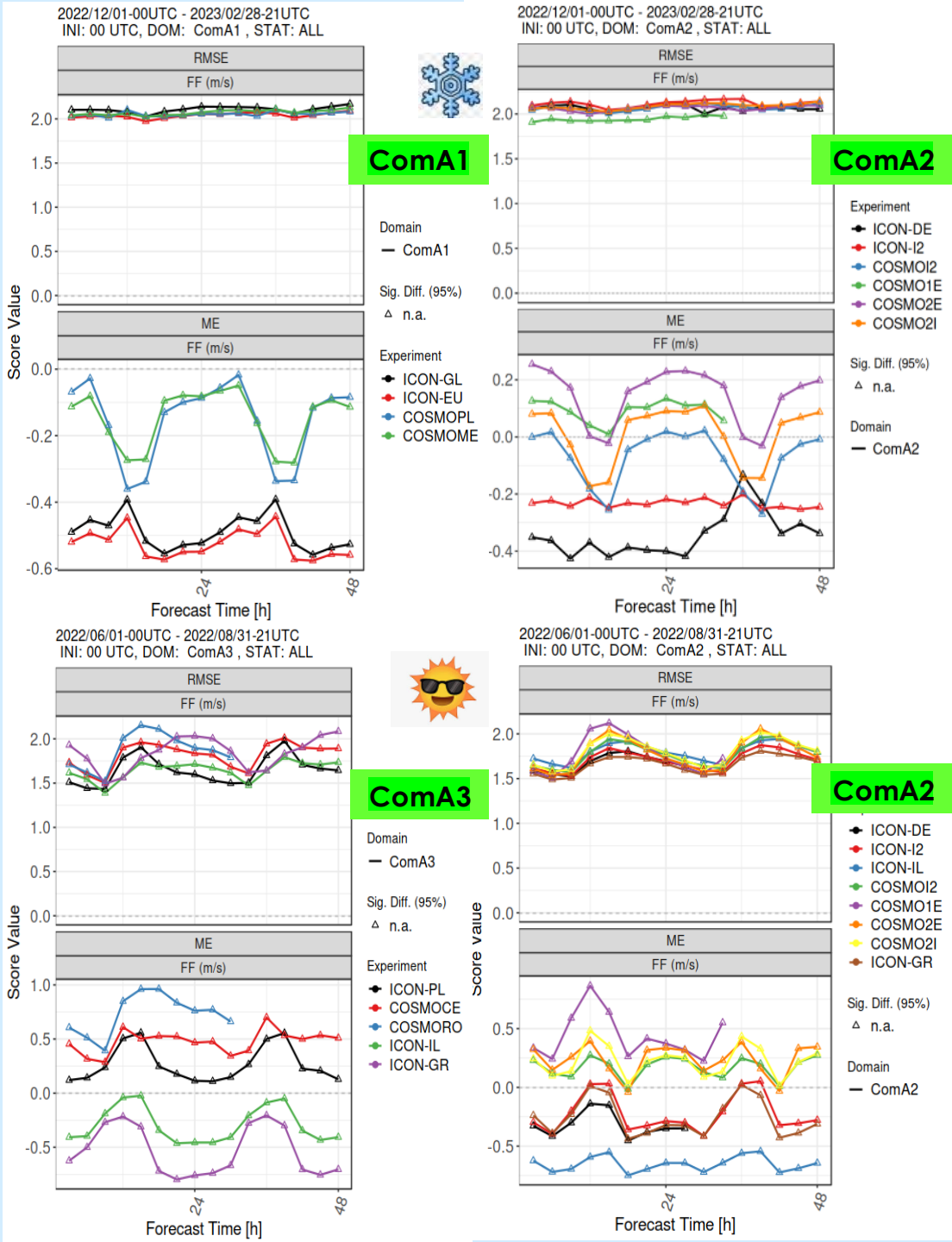


Wind speed

Coarser models: No significant differences in RMSE among models
Higher Res models: No differences in RMSE among models only in winter

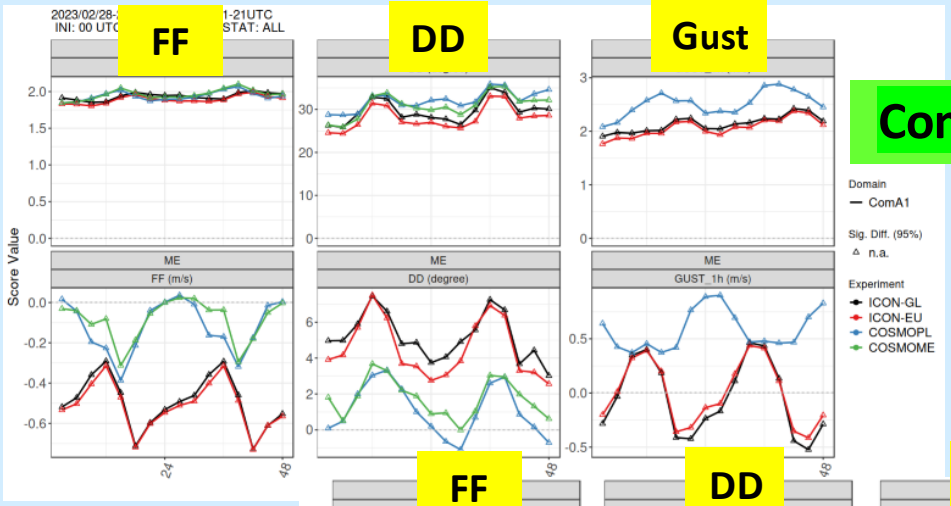
SYS: Larger error cycle in **summer**

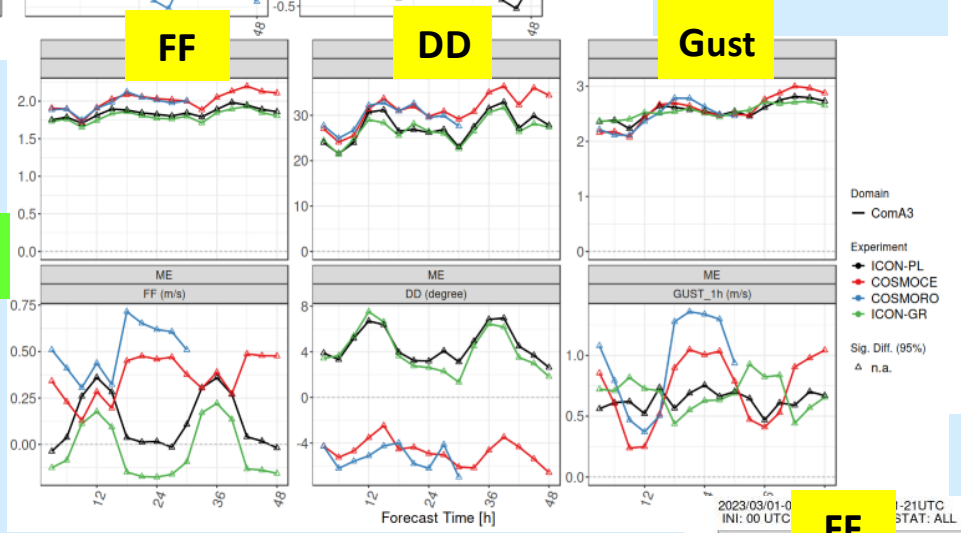
MOD: **Strong negative bias** in all seasons with max during nighttime in **ICON** models



WIND Properties

MAM2023



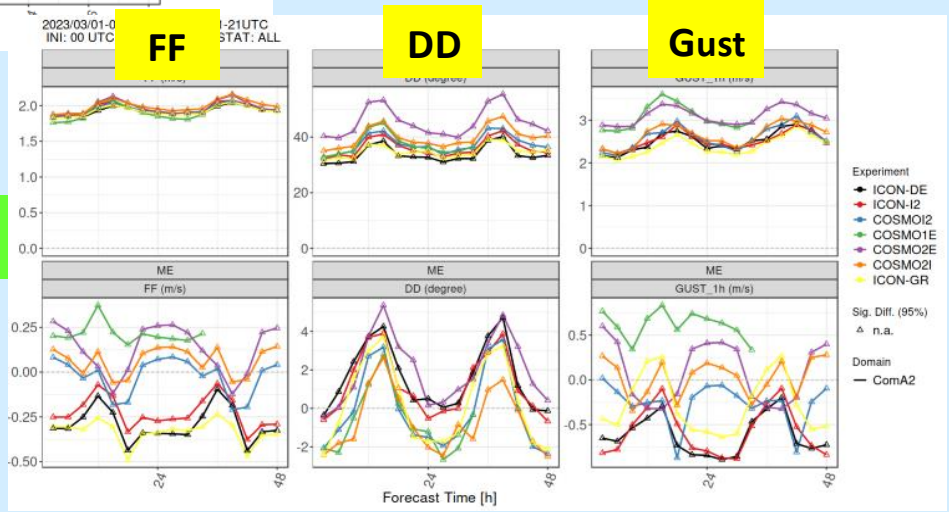


SYS: Resolution-dependence and model improvement effect in wind properties

- For Gust, resolution effect is small but **improvement with ICON** more clear - A3

MOD: At **higher resolution** tendency **ICON** to **underestimate** wind more, opposite from COSMO

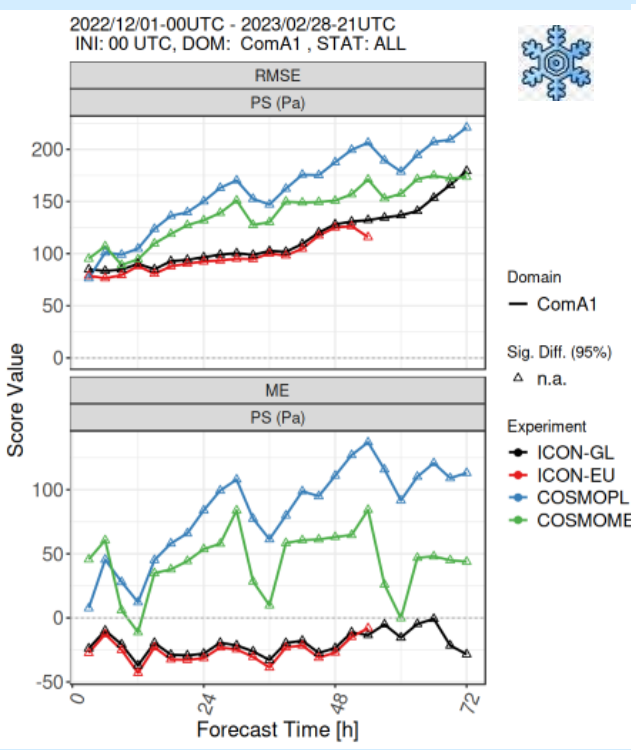
SYS/MOD: Large diurnal cycle with differences in phase among COSMO/ICON for FF/Gust

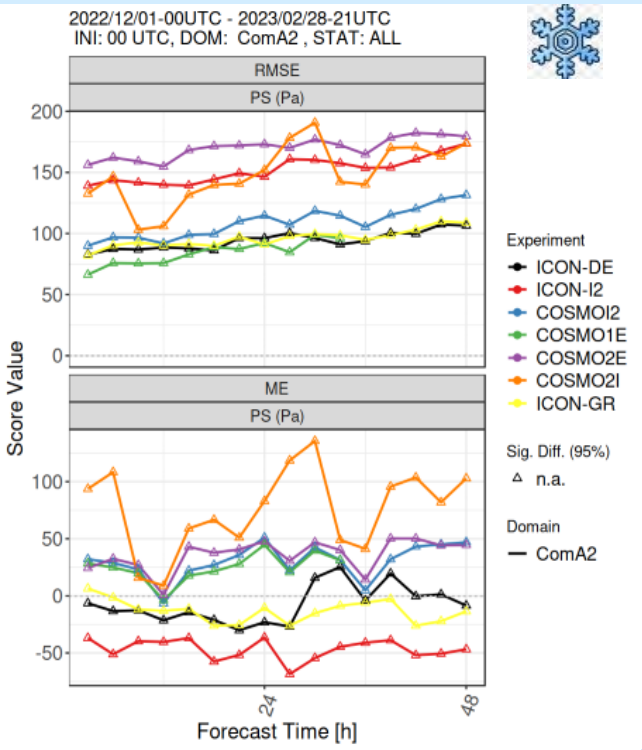


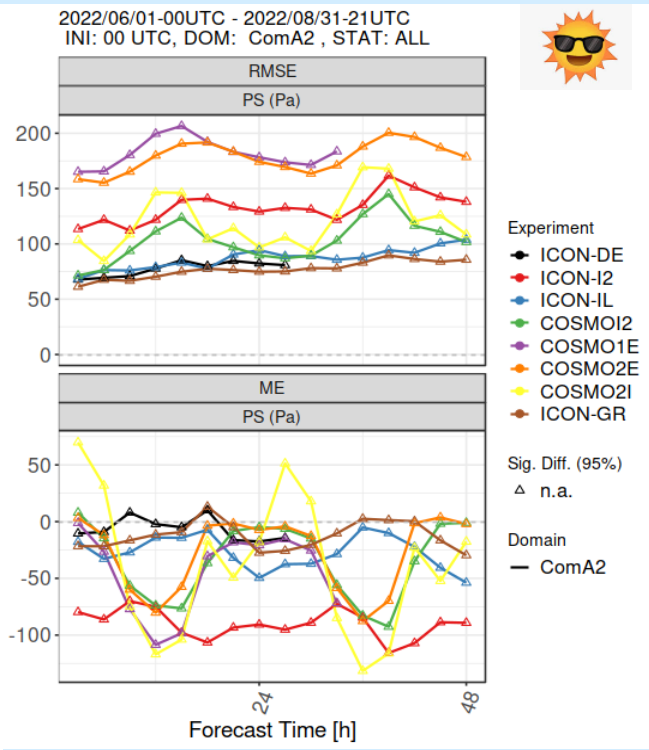
Pressure

SYS: Clear improvement with **ICON** in errors and increasing tendency with lead time in **winter**

MOD: **Underestimation** of Pressure with **ICON** during all seasons



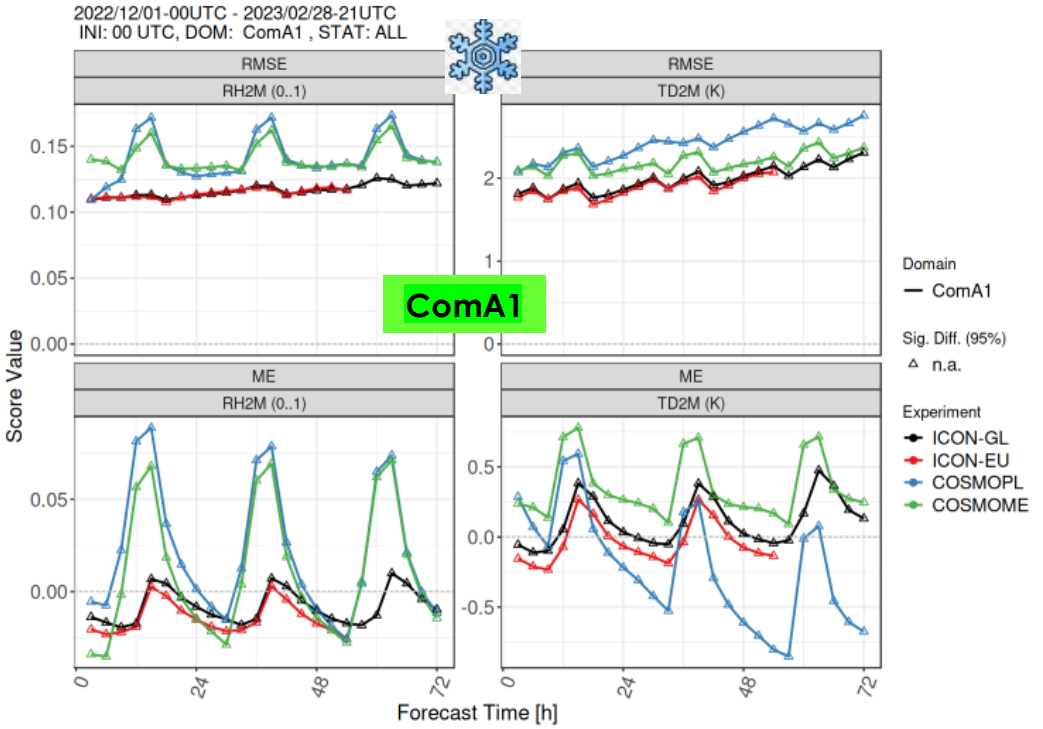


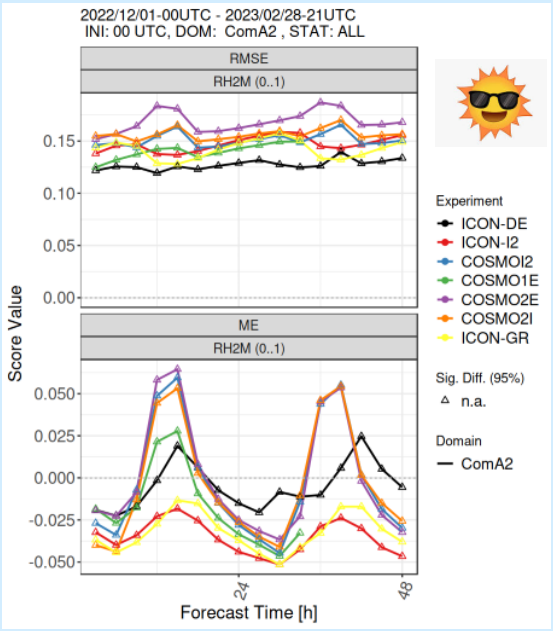


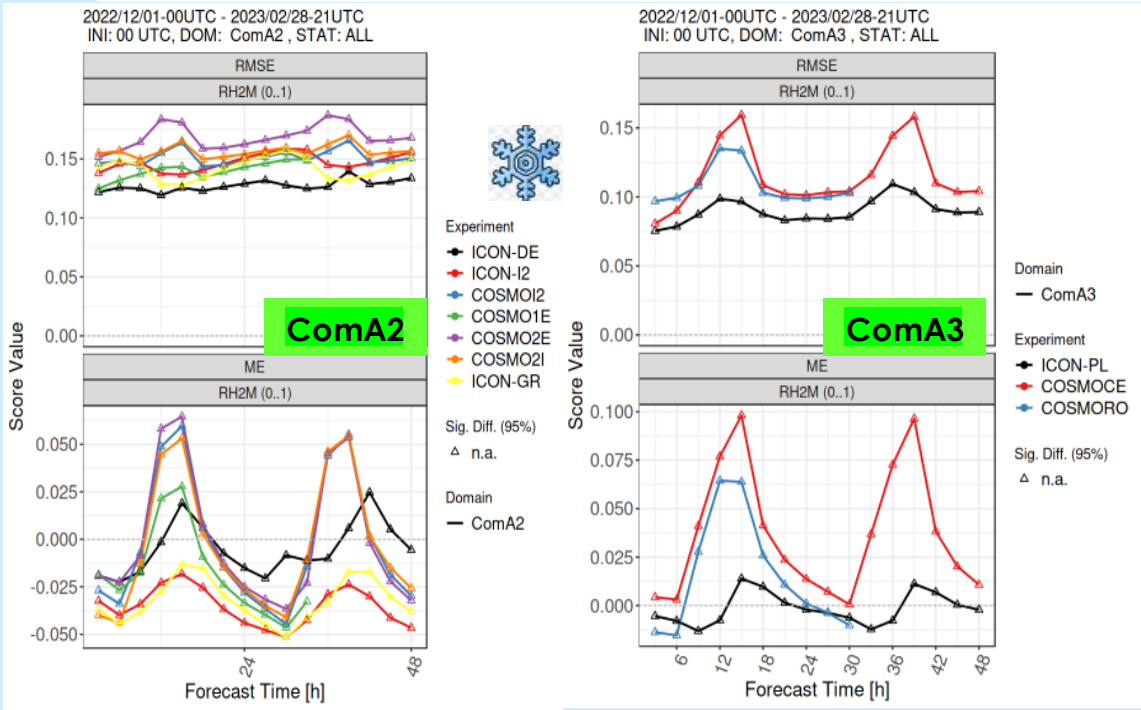
Humidity

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 during almost <u>all seasons</u>



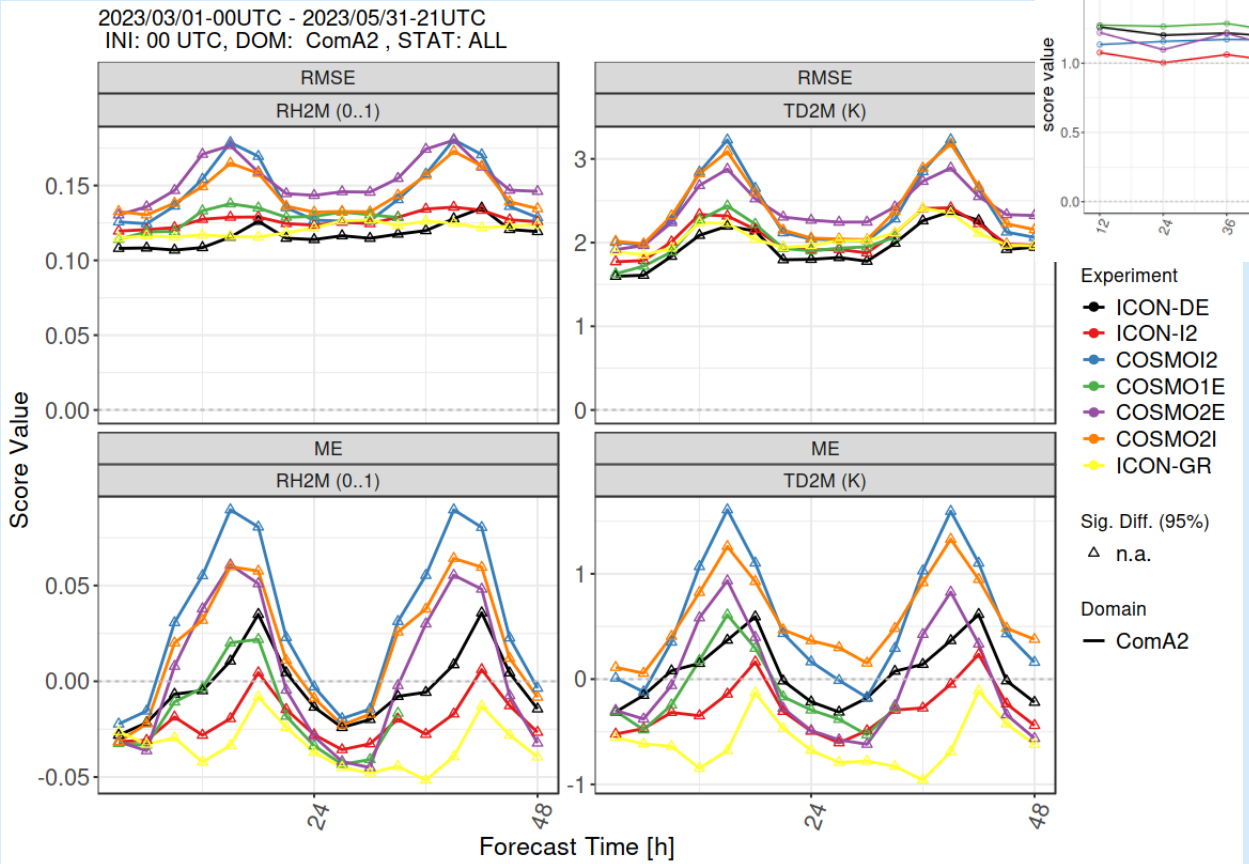


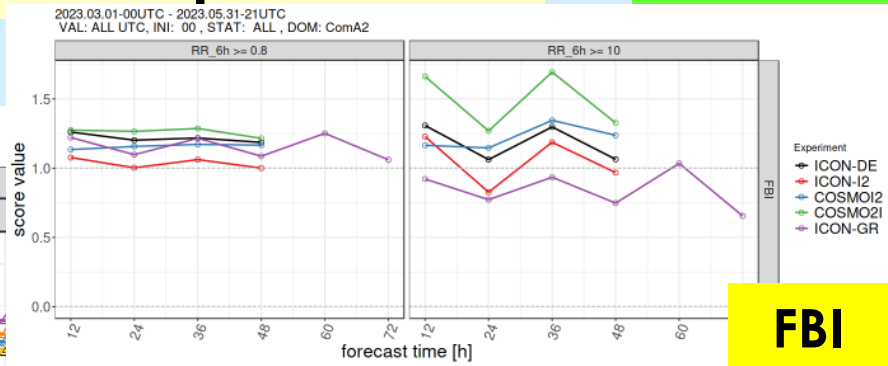


MAM2023

Humidity Properties

ComA2





FBI

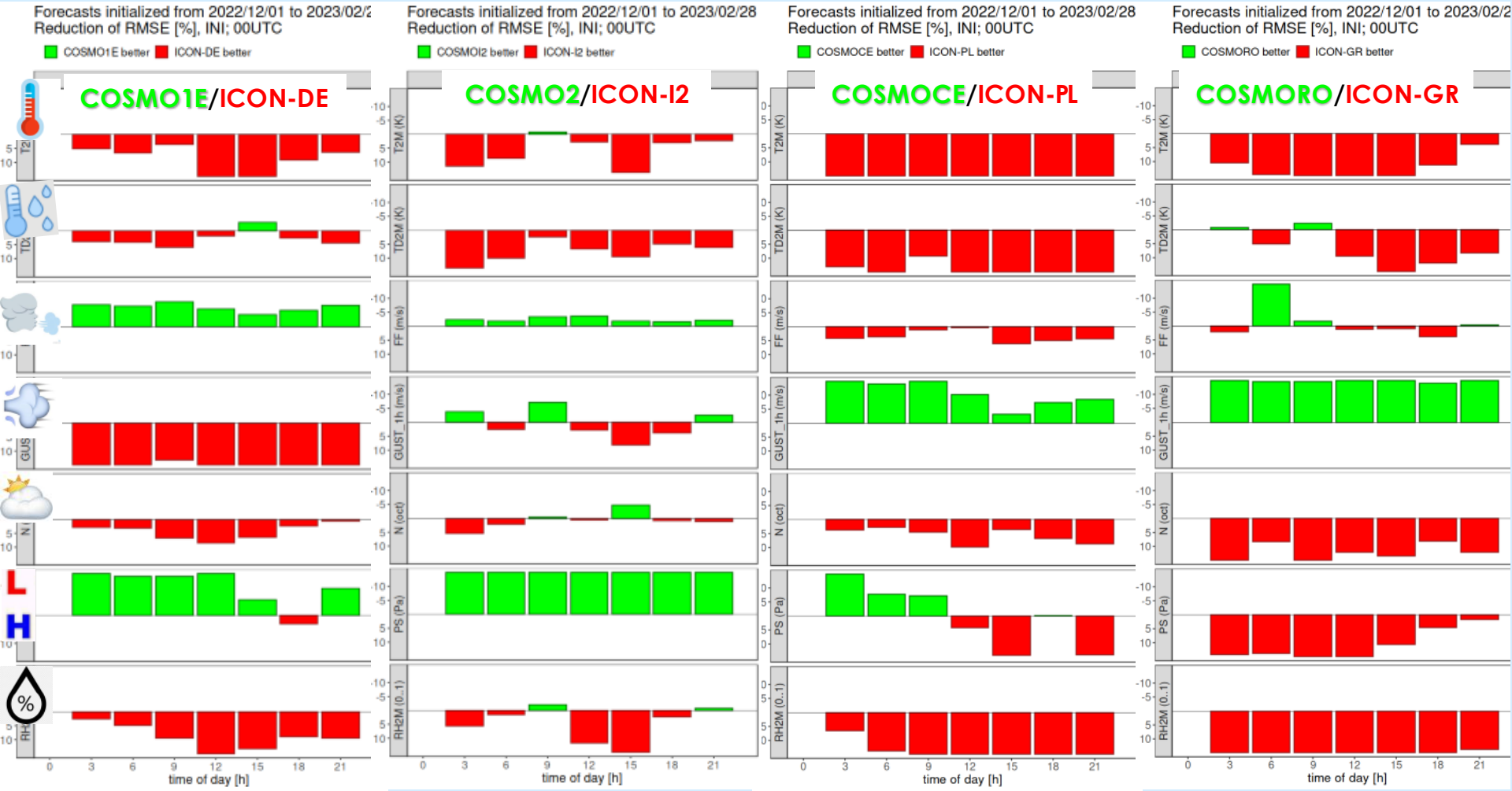
RH and Td can be used interchangeable

MOD: larger errors with COSMO models during the warm hours of the day (overestimation)

MOD: ICON models are **generally drier**.

CONSORTIUM FOR SMALL SCALE MODELING COSMO

ΕΘΝΙΚΗ ΜΕΤΕΩΡΟΛΟΓΙΚΗ ΥΠΗΡΕΣΙΑ



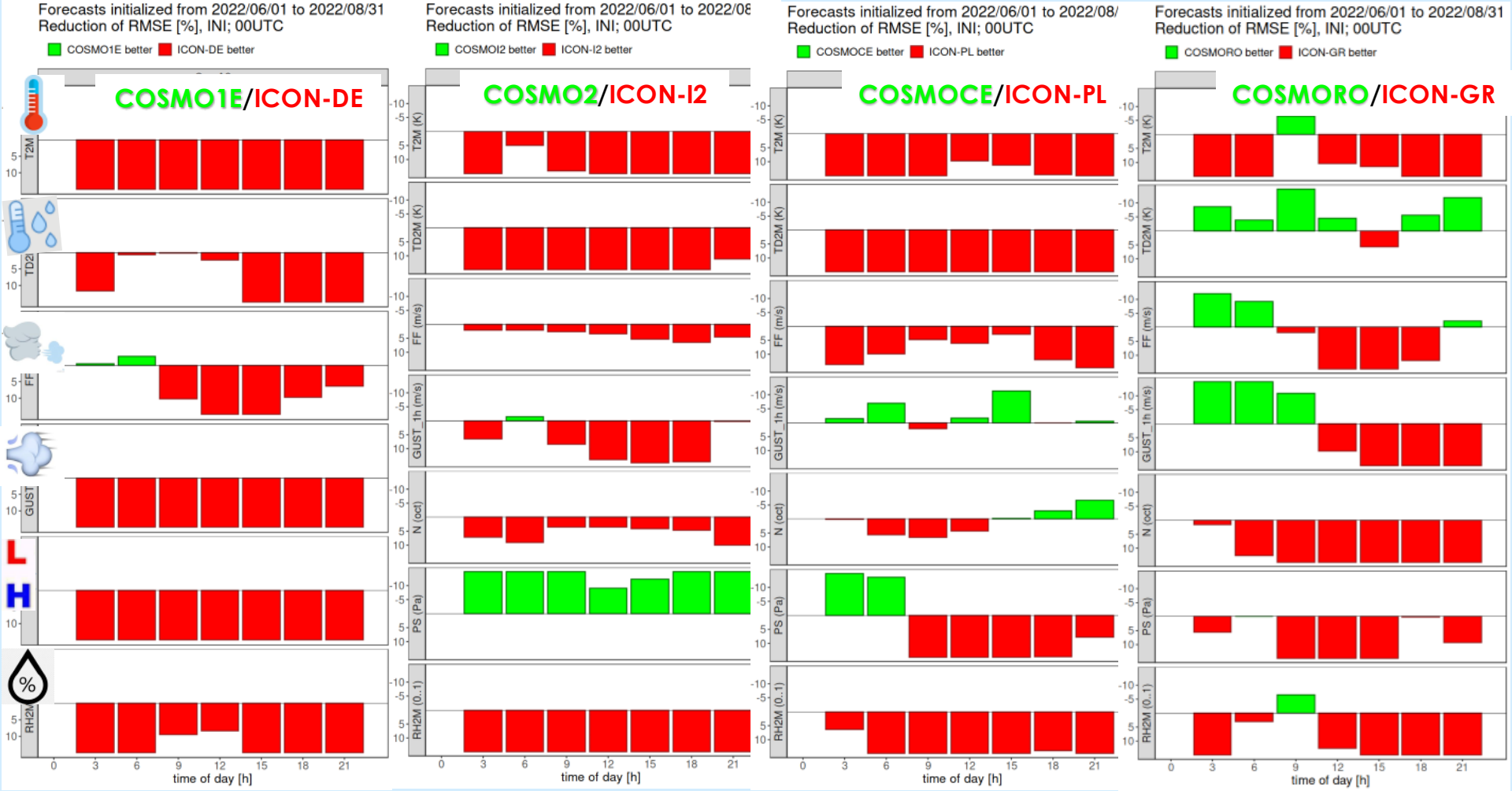
DJF2023
RMSE%

Comparison of models in both CA2 and CA3

MOD: Wind speed RMSE is a pending problem with ICON for models with similar resolutions

CONSORTIUM FOR SMALL SCALE MODELING
COSMO

ΕΘΝΙΚΗ ΜΕΤΕΩΡΟΛΟΓΙΚΗ ΥΠΗΡΕΣΙΑ



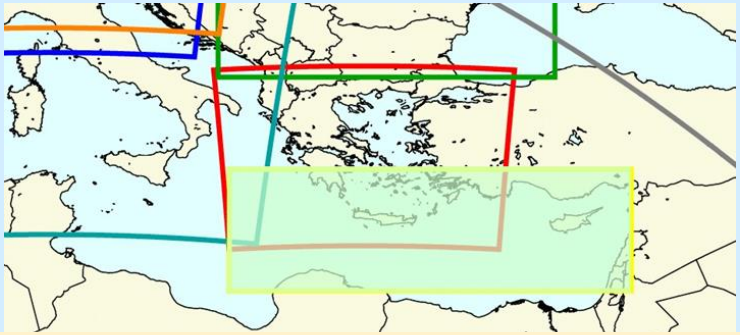
Comparison of models in both CA2 and CA3

JJA2023
RMSE%

CONSORTIUM FOR SMALL SCALE MODELING
COSMO

ΕΘΝΙΚΗ ΜΕΤΕΩΡΟΛΟΓΙΚΗ ΥΠΗΡΕΣΙΑ

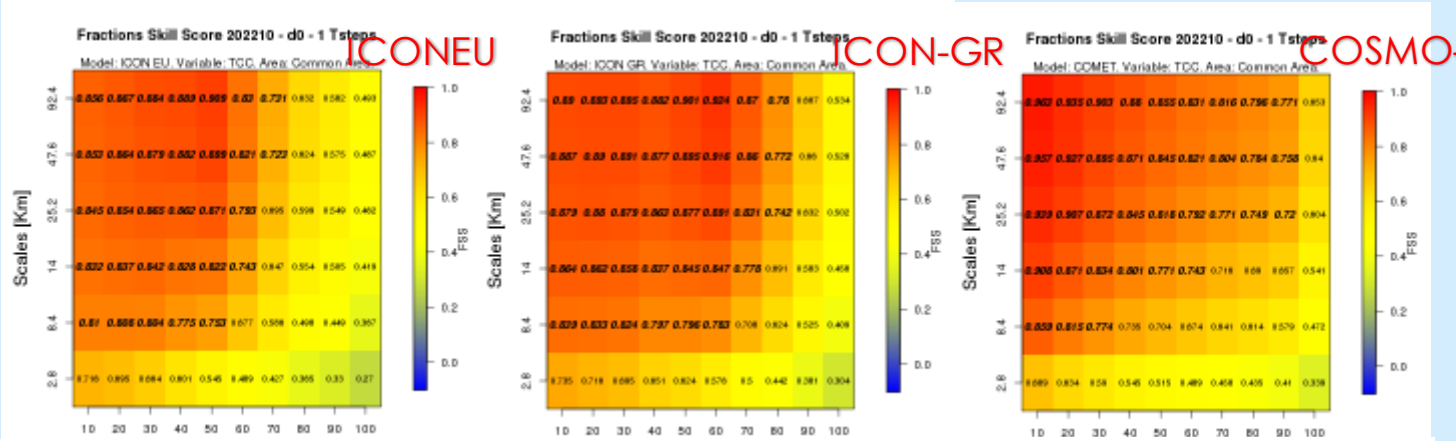
NWC-saf based verif

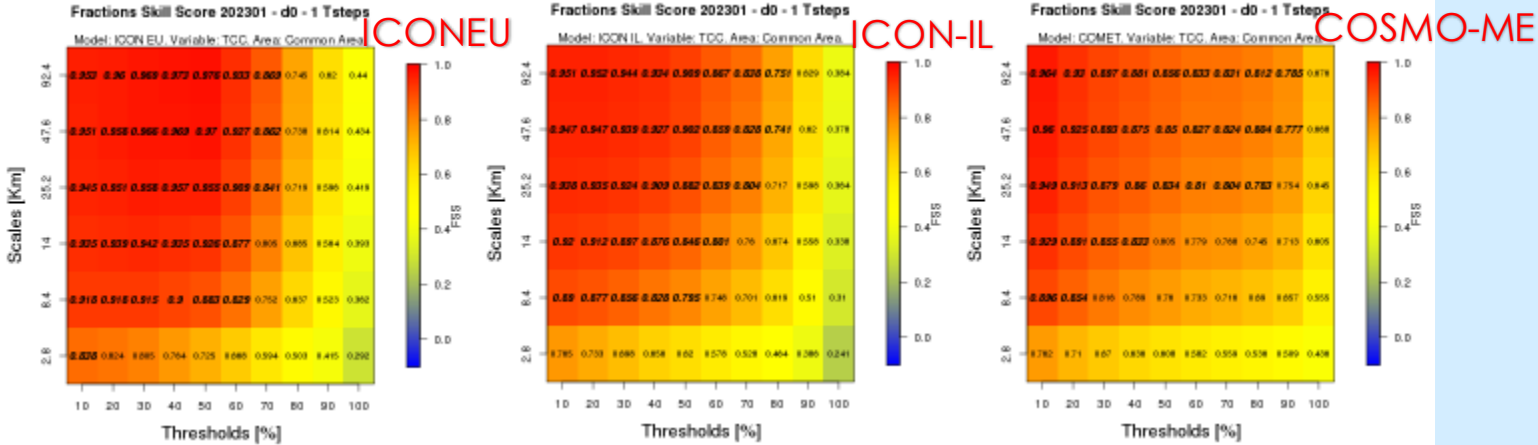


Domain: lon1=-12; lon2=39; lat1=26; lat2=55
Interpolated resolution: 0.025 degrees

SYS: For scale higher than 8km and for lower thresholds, performance seems very good for all models

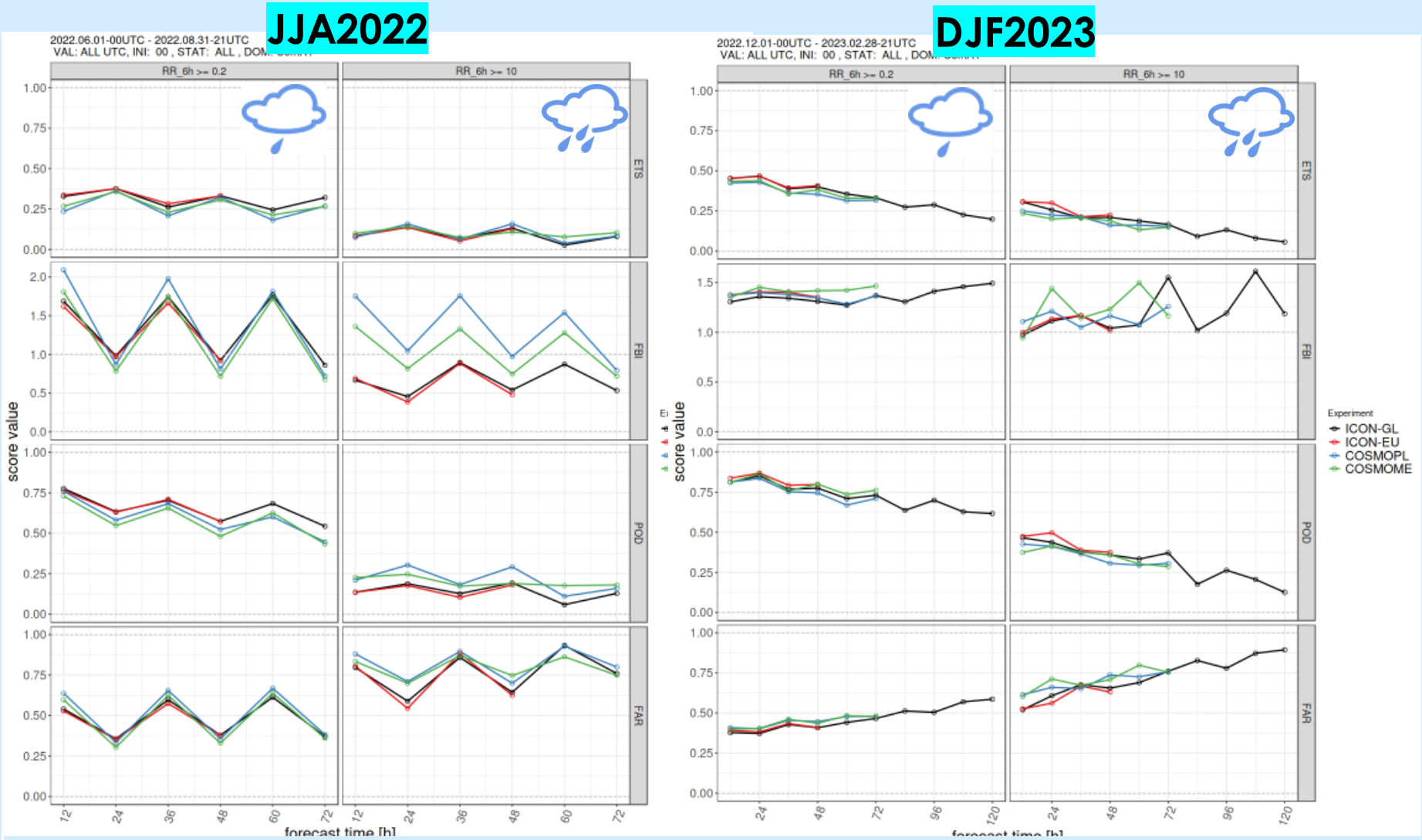
MOD: For higher cloudiness cases (obs) ICON tends to be less useful





6h Precipitation

COSMO / ICON coarse



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

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

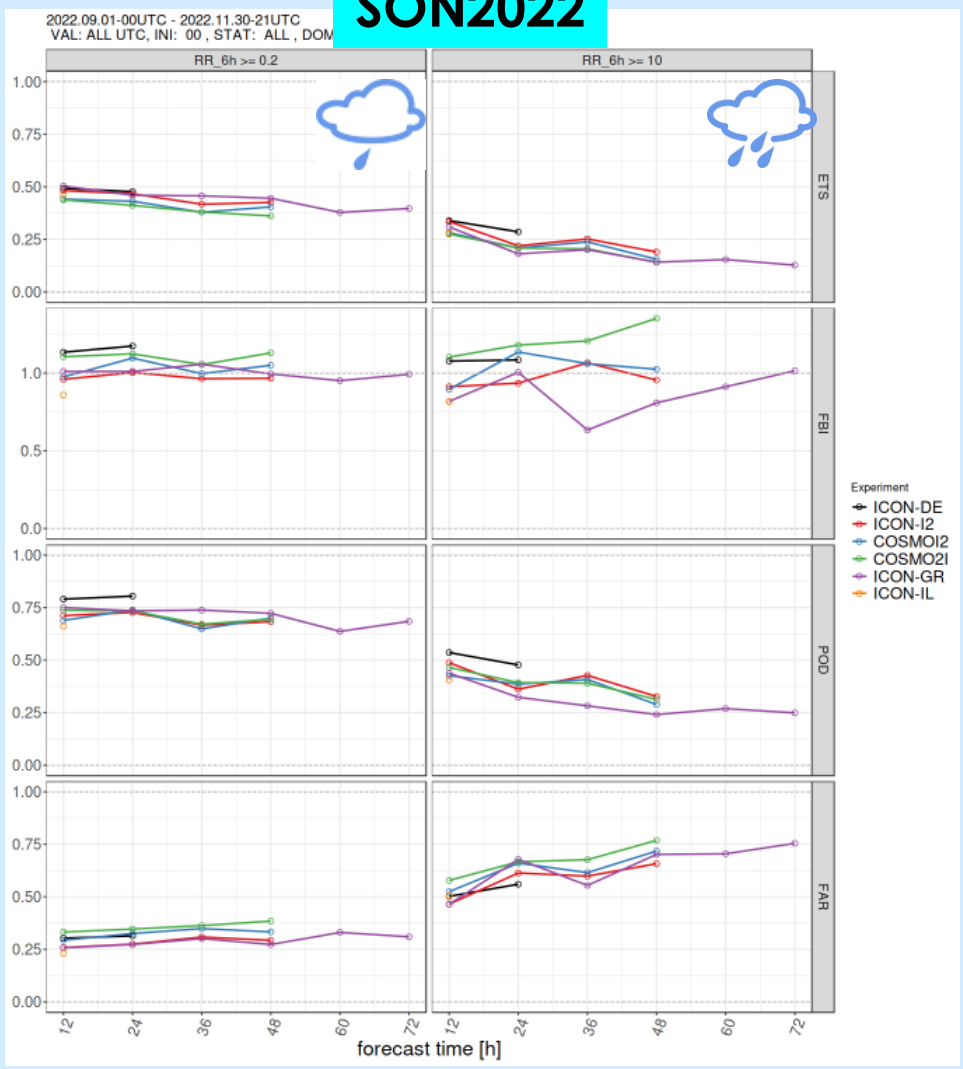
MOD: Smaller POD but also smaller FAR in higher precipitation amounts

6h Precipitation

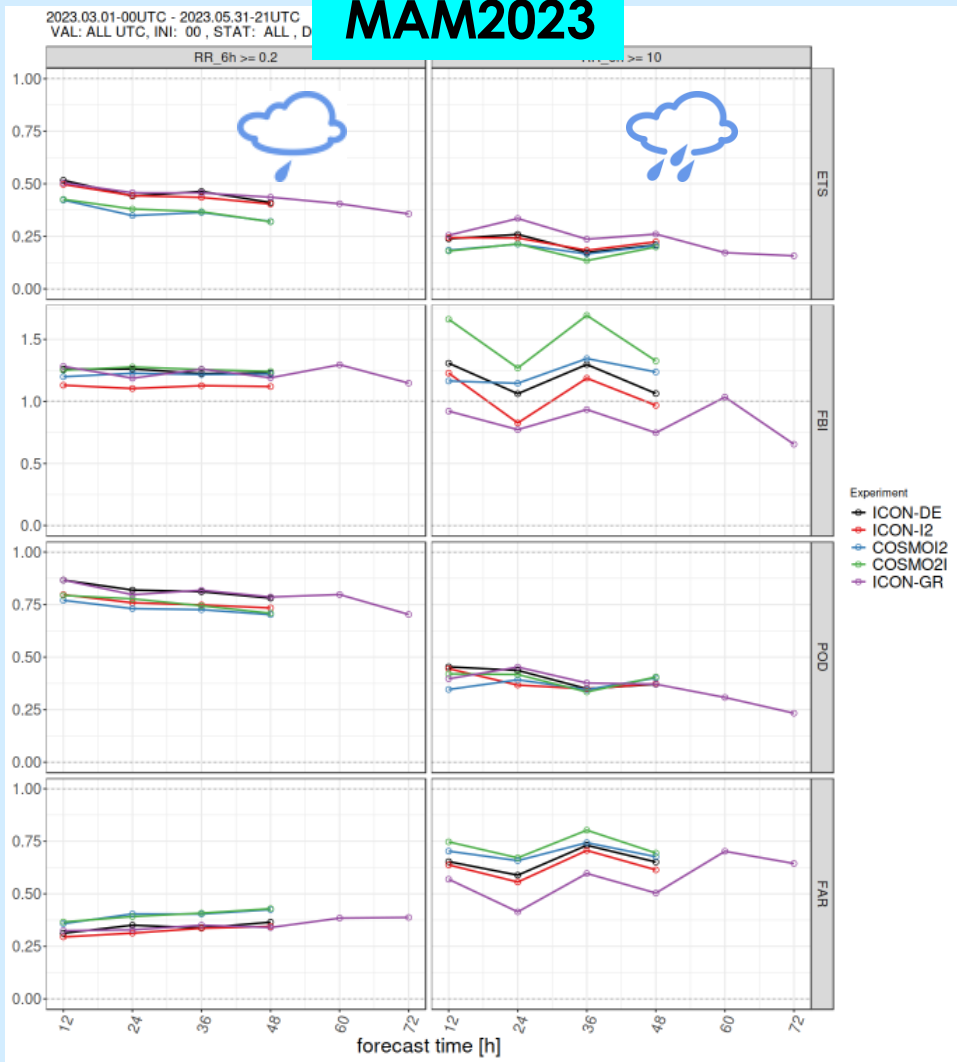
ComA2

COSMO / ICON high

SON2022

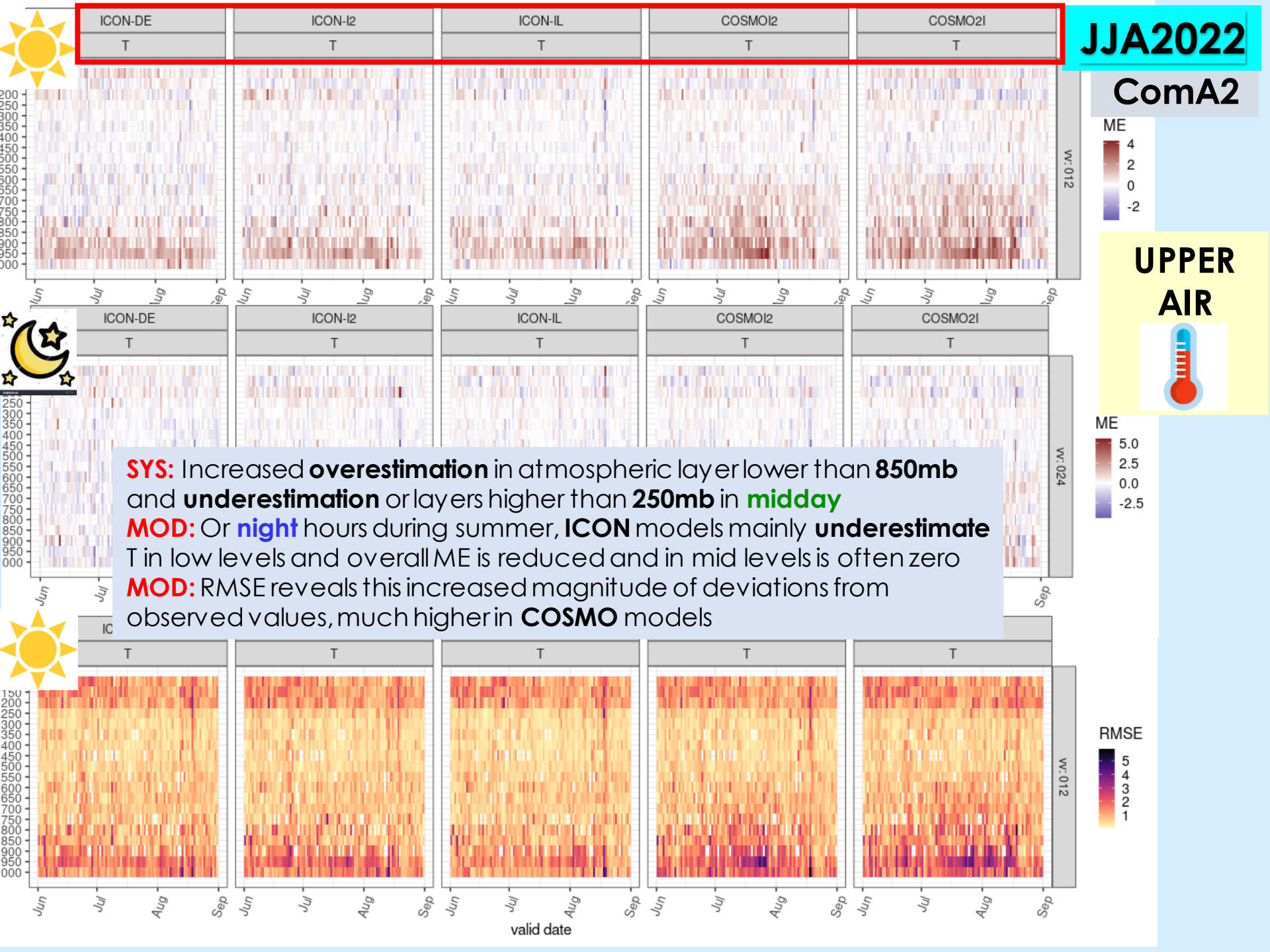


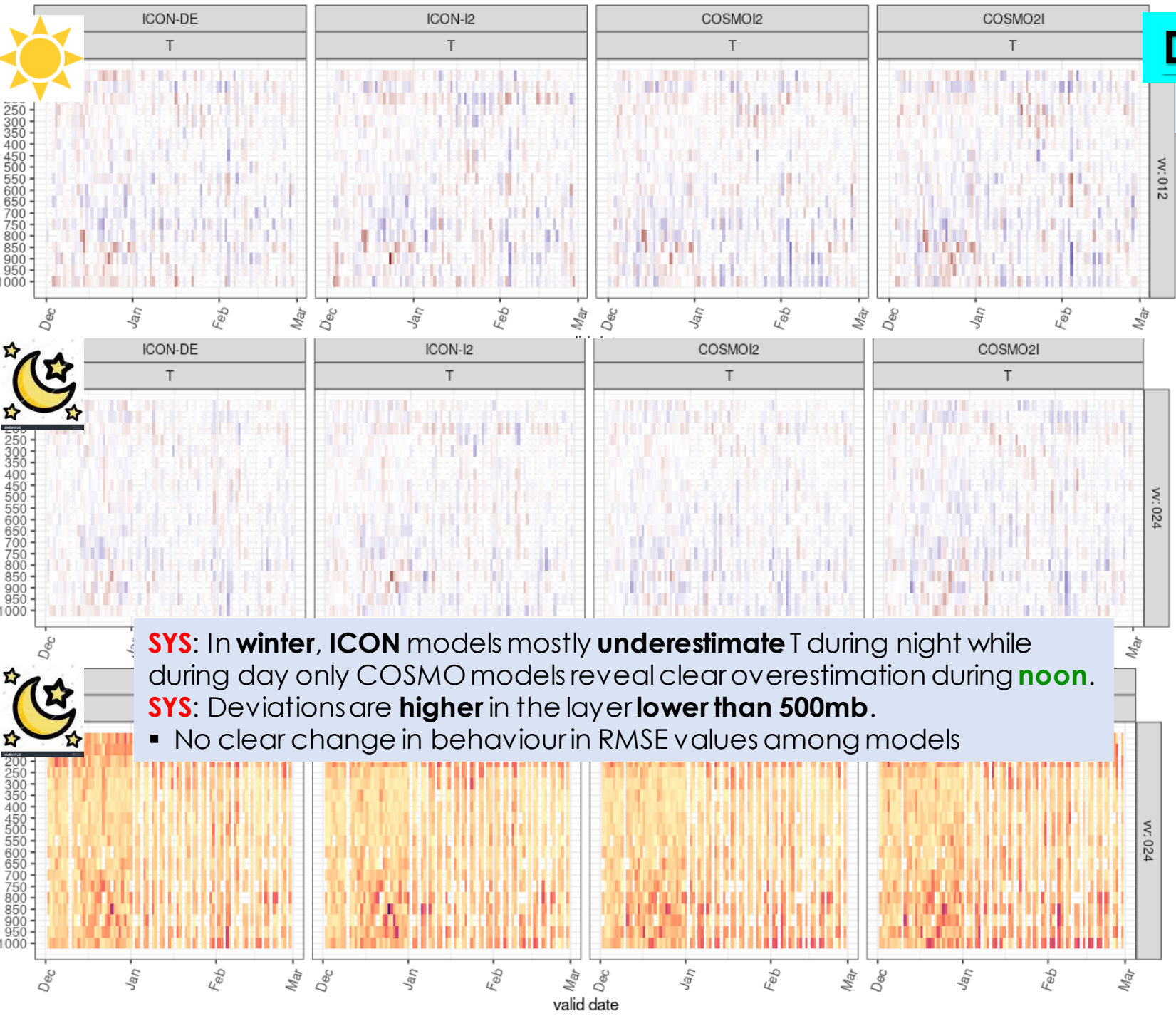
MAM2023



- Clearer differences in performance in higher precipitation amounts

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

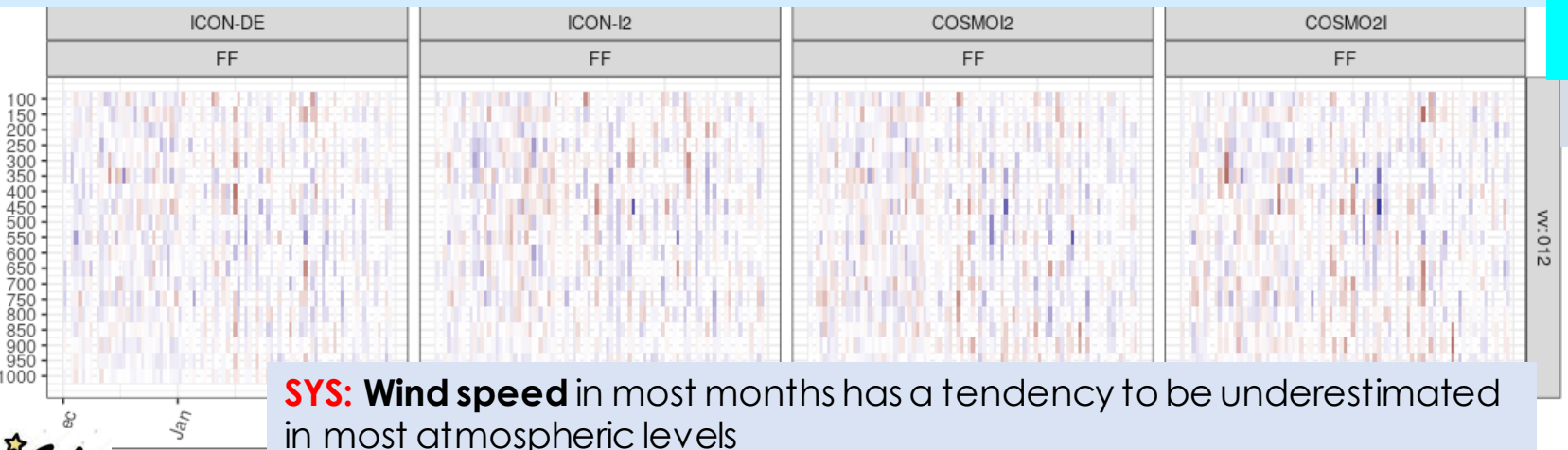

JJA2022
ComA2
UPPER AIR
ICON-DE
ICON-I2
ICON-IL
COSMOI2
COSMO2I
T
ME
RMSE
vv:012
vv:024
valid date
Jun
Jul
Aug
Sep
SYS: Increased overestimation in atmospheric layer lower than 850mb and underestimation or layers higher than 250mb in midday
MOD: Or night hours during summer, ICON models mainly underestimate T in low levels and overall ME is reduced and in mid levels is often zero
MOD: RMSE reveals this increased magnitude of deviations from observed values, much higher in COSMO models



SYS: In **winter**, **ICON** models mostly **underestimate** T during night while during day only COSMO models reveal clear overestimation during **noon**.

SYS: Deviations are **higher** in the layer **lower than 500mb**.

- No clear change in behaviour in RMSE values among models



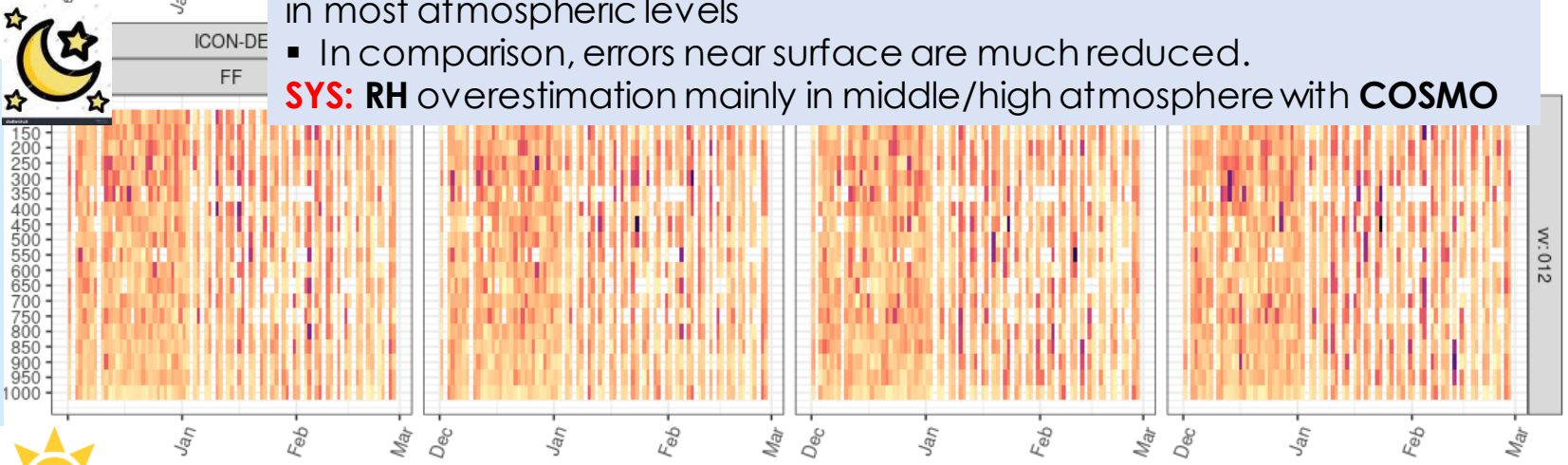
DJF2023

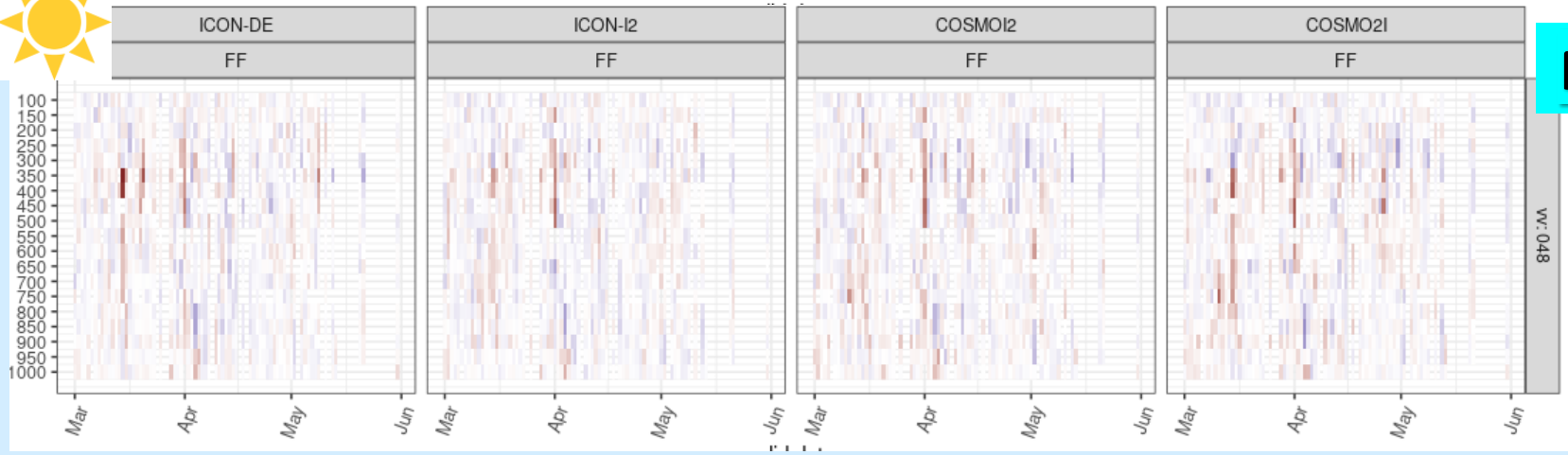
ComA2

SYS: Wind speed in most months has a tendency to be underestimated in most atmospheric levels

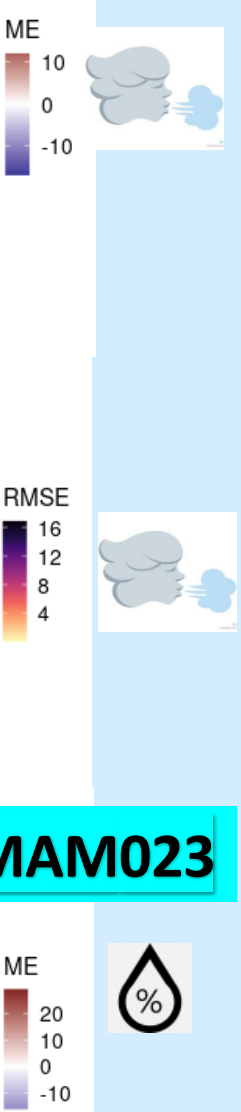
- In comparison, errors near surface are much reduced.

SYS: RH overestimation mainly in middle/high atmosphere with **COSMO**

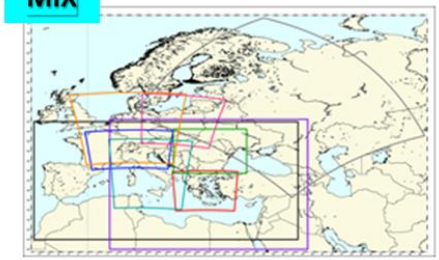
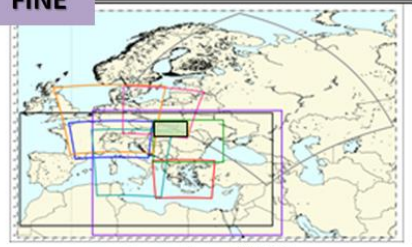
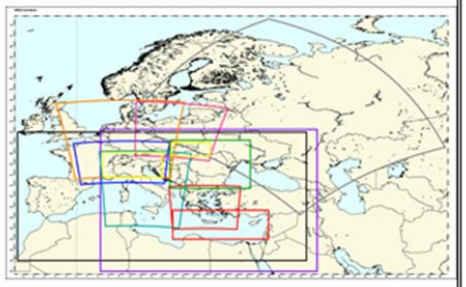




MAM023



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 (control), 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, ICON-EU	**Area and LAMs, Specs based on specific experiment**