Greek domain verification 2022-2023

ICON-GR2.5

IFS-ECMWF

COSMO-GR4 (ceased in Oct 23)

ICON-GR

T2m

➢ In all seasons T2m shows the common diurnal cycle with overestimation at night.

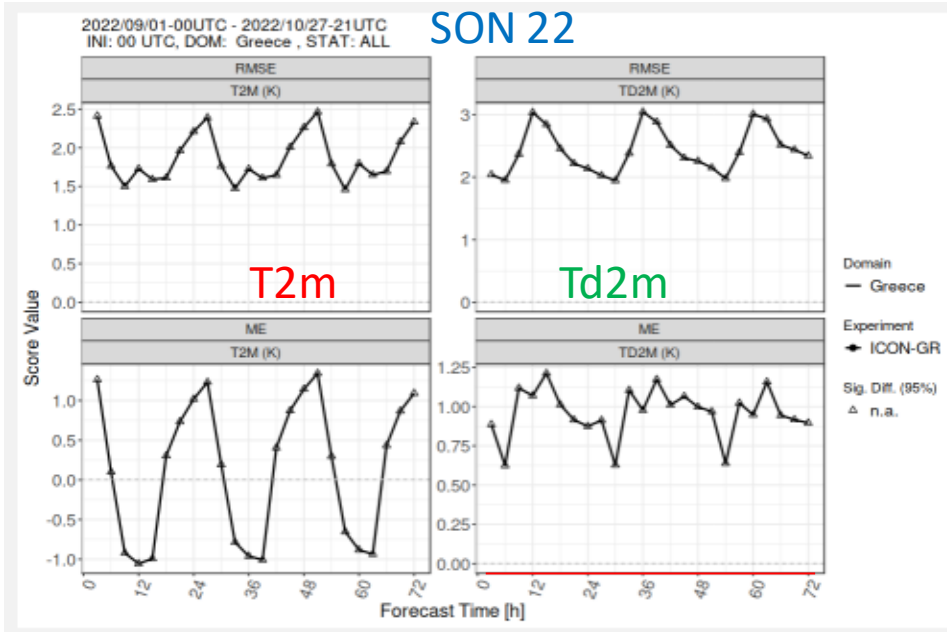➢The nighttime error according to RMSE is bigger and slightly increasing with lead time.

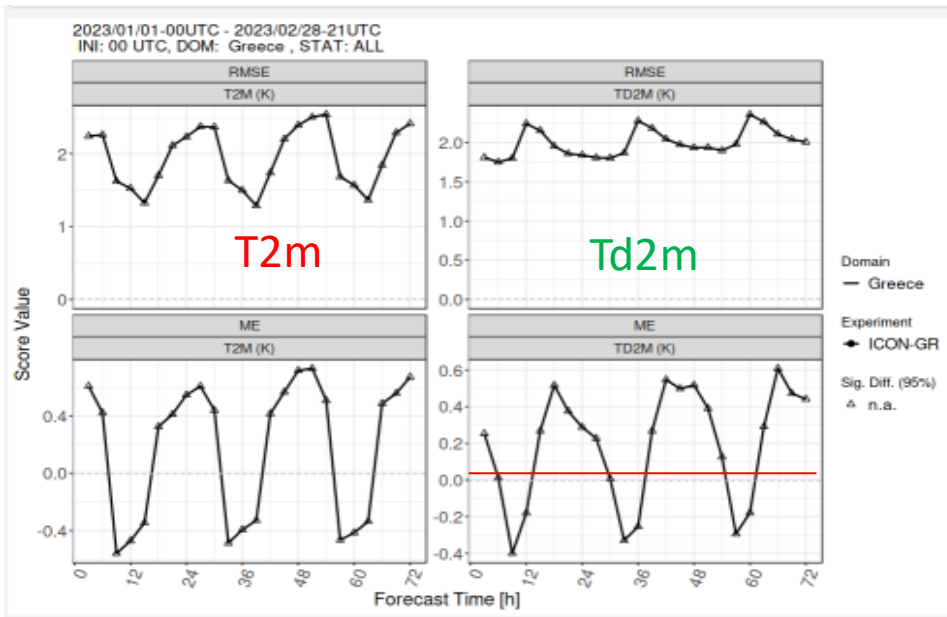➢ **SON** and JJA show the biggest T2m errors.

Td2m

➢ In **SON** and JJA underestimated all day long mainly in warm hours.

➢ in **DJF** and MAM diurnal cycle with underestimation in the morning hours and overestimation in the afternoon.
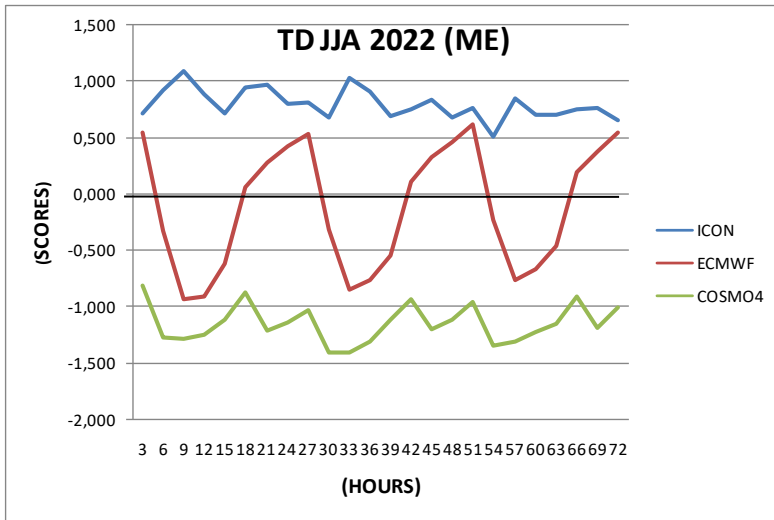
Td2m bias JJA-SON (warm seasons)

IFS-ECMWF
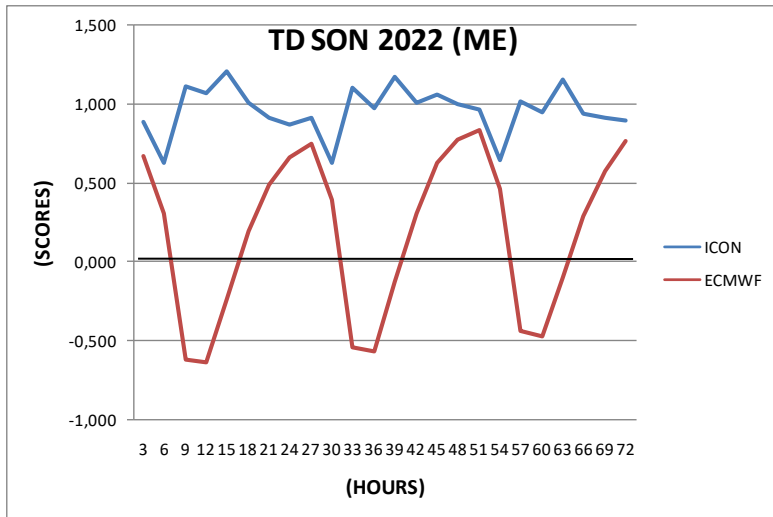**ICON-GR**
COSMO-GR

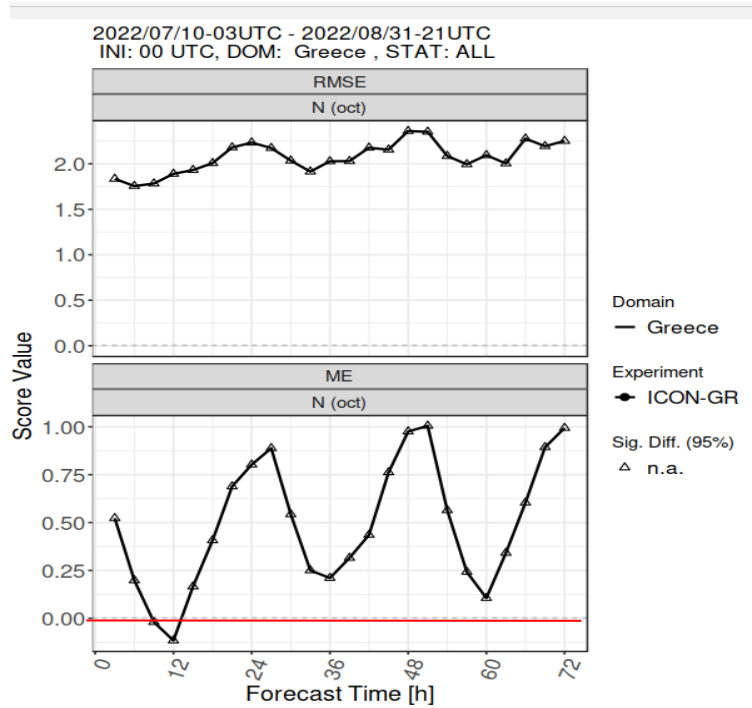➢ In warm seasons (JJA-SON), the difference between ICON- GR/IFS bias is more distinct.

➢ IFS exhibits a diurnal cycle, overestimating only around the afternoon, while ICON-GR overestimates all day long.

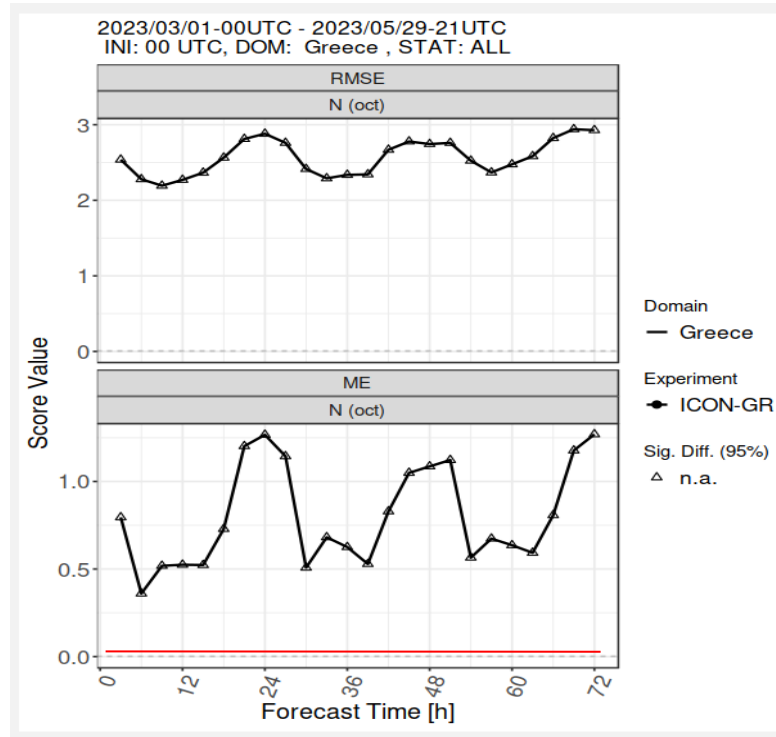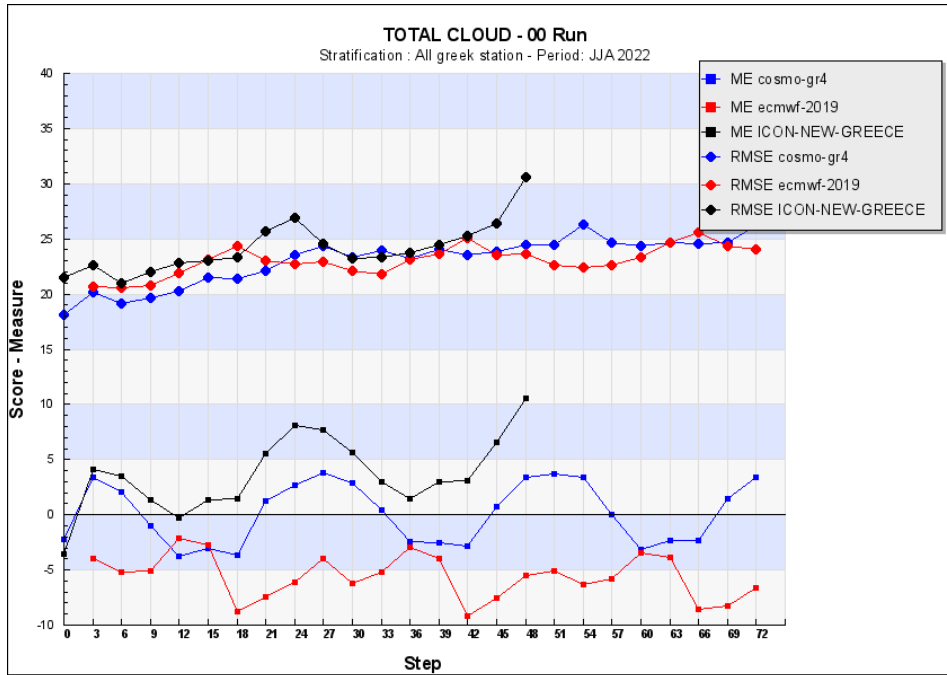➢ On the other side, COSMO-GR constantly underestimates (JJA)

Total Cloud Cover

TCC is <u>overestimated</u> for all seasons, mainly in MAM and DJF with maximum error at night.

TCC JJA models comparison


TOTAL CLOUD - 00 Run
Stratification : All greek station - Period: JJA 2022

Legend:
- ME cosmo-gr4
- ME ecmwf-2019
- ME ICON-NEW-GREECE
- RMSE cosmo-gr4
- RMSE ecmwf-2019
- RMSE ICON-NEW-GREECE

Y-axis: Score - Measure
X-axis: Step

IFS-ECMWF
COSMO-GR
ICON-GR

➢ Bias differences among models are more significant in JJA.

➢ ICON-GR underestimates TCC and error increases with time.

➢ On the other side there is significant difference from IFS which constantly underestimates, and COSMO-GR which shows a diurnal cycle with negative bias at noon.

CONDITIONAL VERIFICATION (TCC, T2m) ICON-GR based on TCC (MAM)

C1 obs >= 6, C2 obs= <2, c3 mod >=6 C4 mod < 2 oct

2023/03/01-00UTC - 2023/05/29-21UTC
INI: 00 UTC, DOM: Greece , STAT: ALL
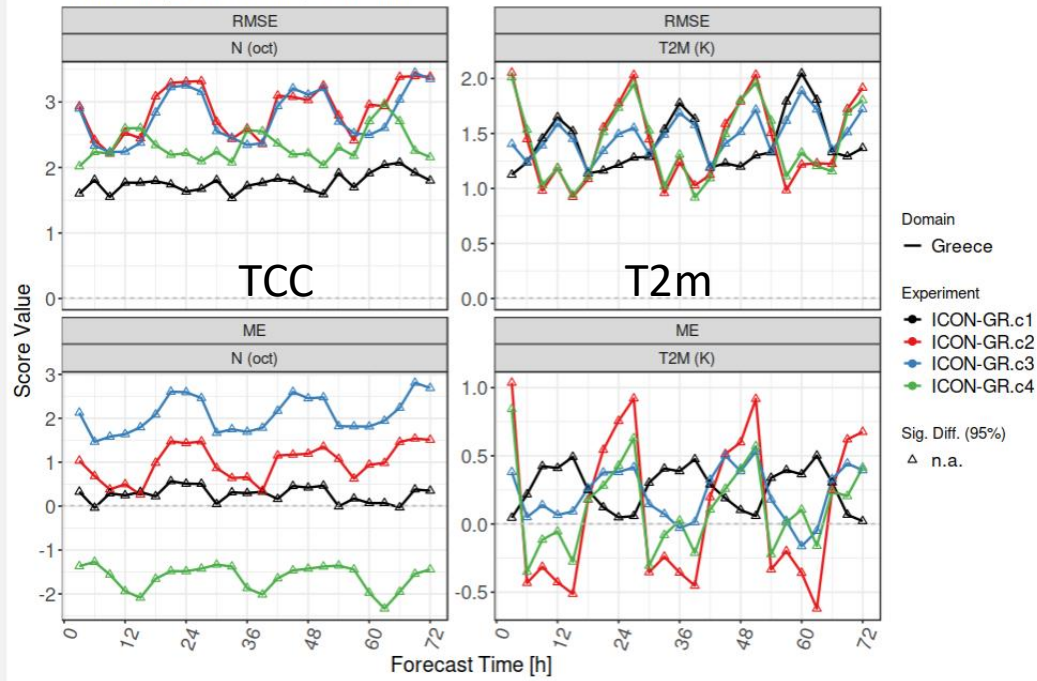
MAM 23

TCC
➤ Biggest error is with the condition **C3 (high cov-mod)**
Lowest with **C1 (high cov-obs) f**or all seasons
Negative bias is for **C4 (low cov-mod).**

T2m
➤The curves of C2 and C4 (low cov) are similar with overestimation at night and underestimation in the daytime.

CONDITIONAL VERIFICATION (TCC, T2m) ICON-GR based on TCC JJA22

C1 obs >= 6, C2 obs= <2, c3 mod >=6, C4 mod < 2.
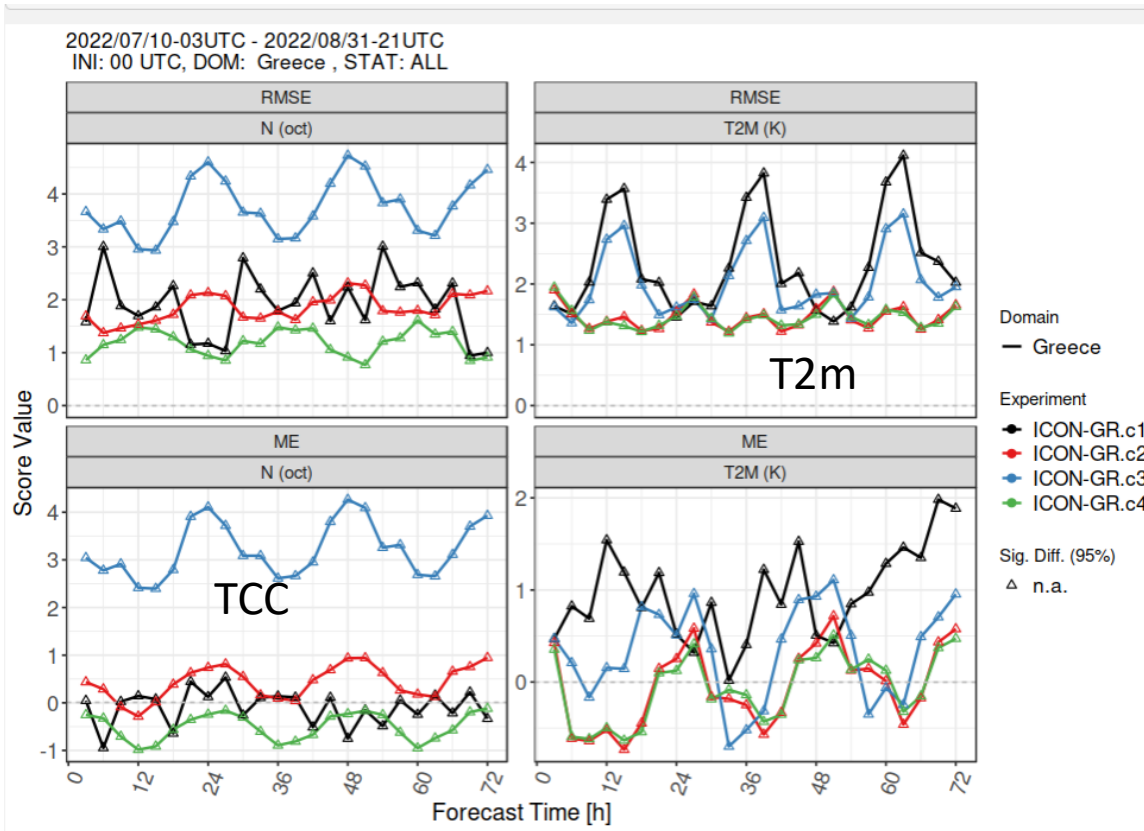
TCC
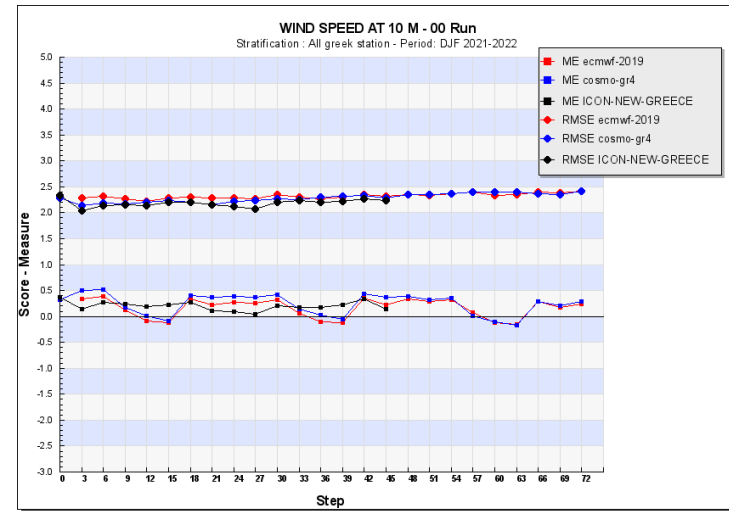➢ The C3 (high cov-mod) condition gives the biggest error.
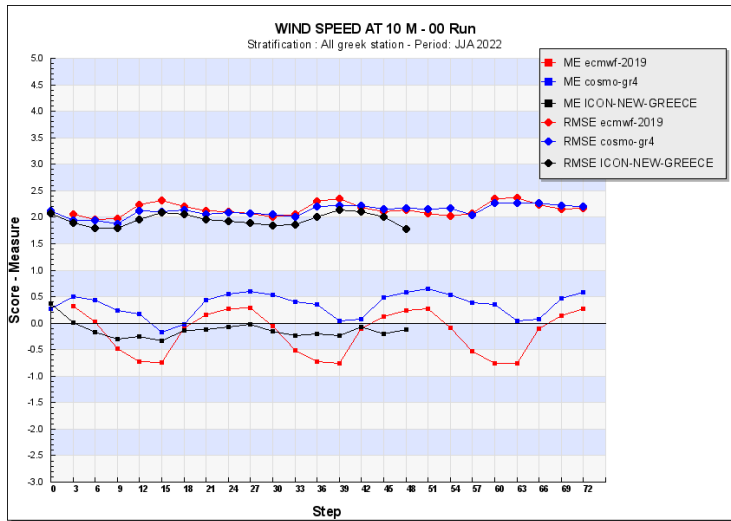
T2m
➢The curves of C1 and C3 (high cov) give the biggest error.

10m Wind speed

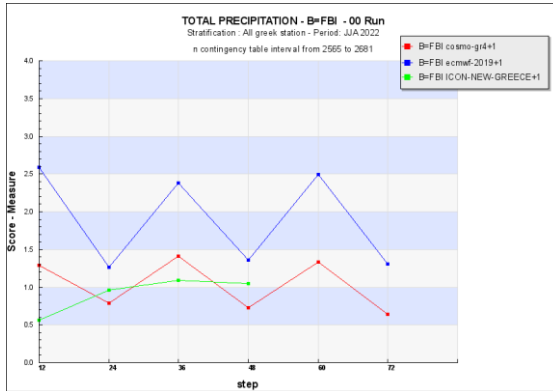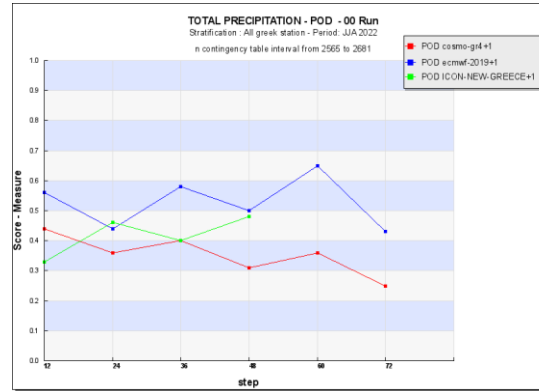IFS-ECMWF
COSMO-GR
ICON-GR

JJA

DJF

> Wind speed is slightly underestimated around noon (ICON-GR) in warm seasons but the diurnal cycle is weaker than other models.

> The differences among models are smaller in DJF when ICON-GR slightly overestimates at night.
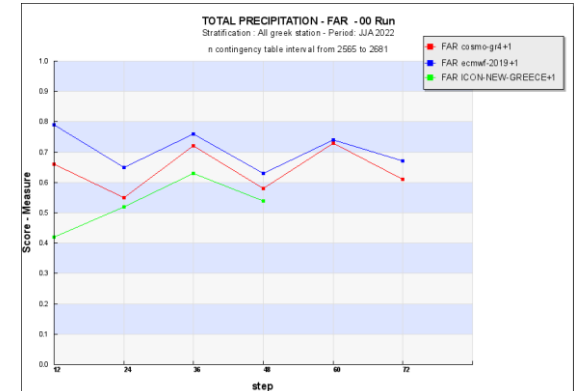
12h JJA Precipitation scores in JJA (<1mm)

COSMO-GR
IFS-ECMWF
ICON-GR

FBI

POD

FAR

FBI : Differences among models more significant in warm seasons with IFS producing a strong diurnal cycle mainly for low thresholds., while ICON-GR remains relatively constant during the day. Similarities among models in DJF season.
POD is better for IFS, but FAR is better for ICON-GR.

Conclusions

✓ Temperature shows the biggest errors in <u>warm months especially at night</u>.

✓ Dew point Temperature is <u>overestimated all day long the warm months</u> and the bias score differs significantly compared to IFS and COSMO.

➢ TCC is <u>overestimated</u> for all seasons, mainly in MAM and DJF with maximum error at night.

➢ Conditional TCC verification shows that the TCC error is higher when the condition is high Cloud coverage based on model.

➢ Conditional T2m verification shows that the T2m error is higher when the condition is high Cloud coverage based on observations/model shown mainly in MAM season.

➢ Wind speed is slightly underestimated around noon in warm seasons.

➢ Precipitation scores show that ICON-GR scores for low thresholds are less variable with time lead and the FAR score is better than the other models.