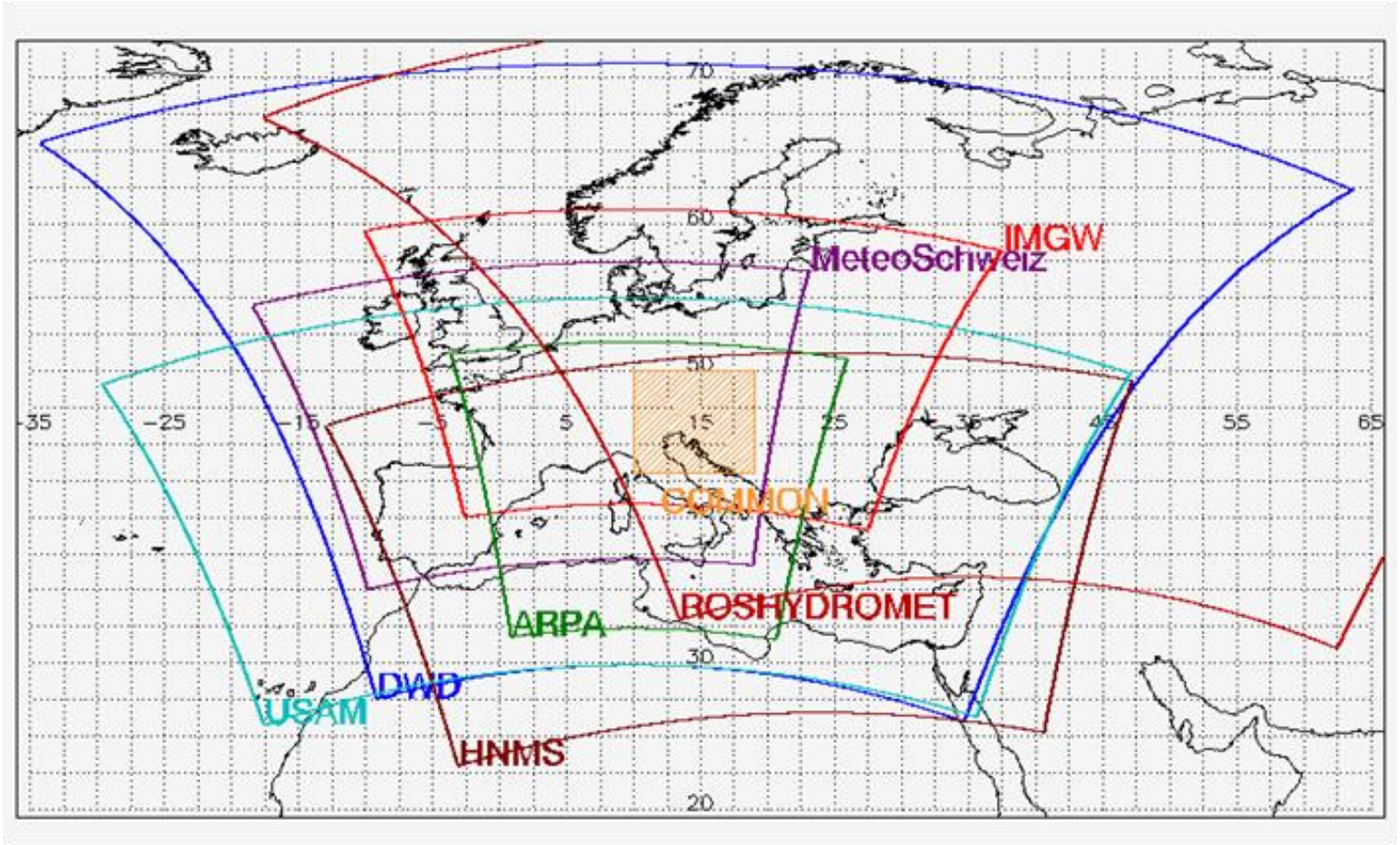
Verification Overview
(based on CP activity: JJA2018-MAM2019)

Alexander Kirsanov & WG5

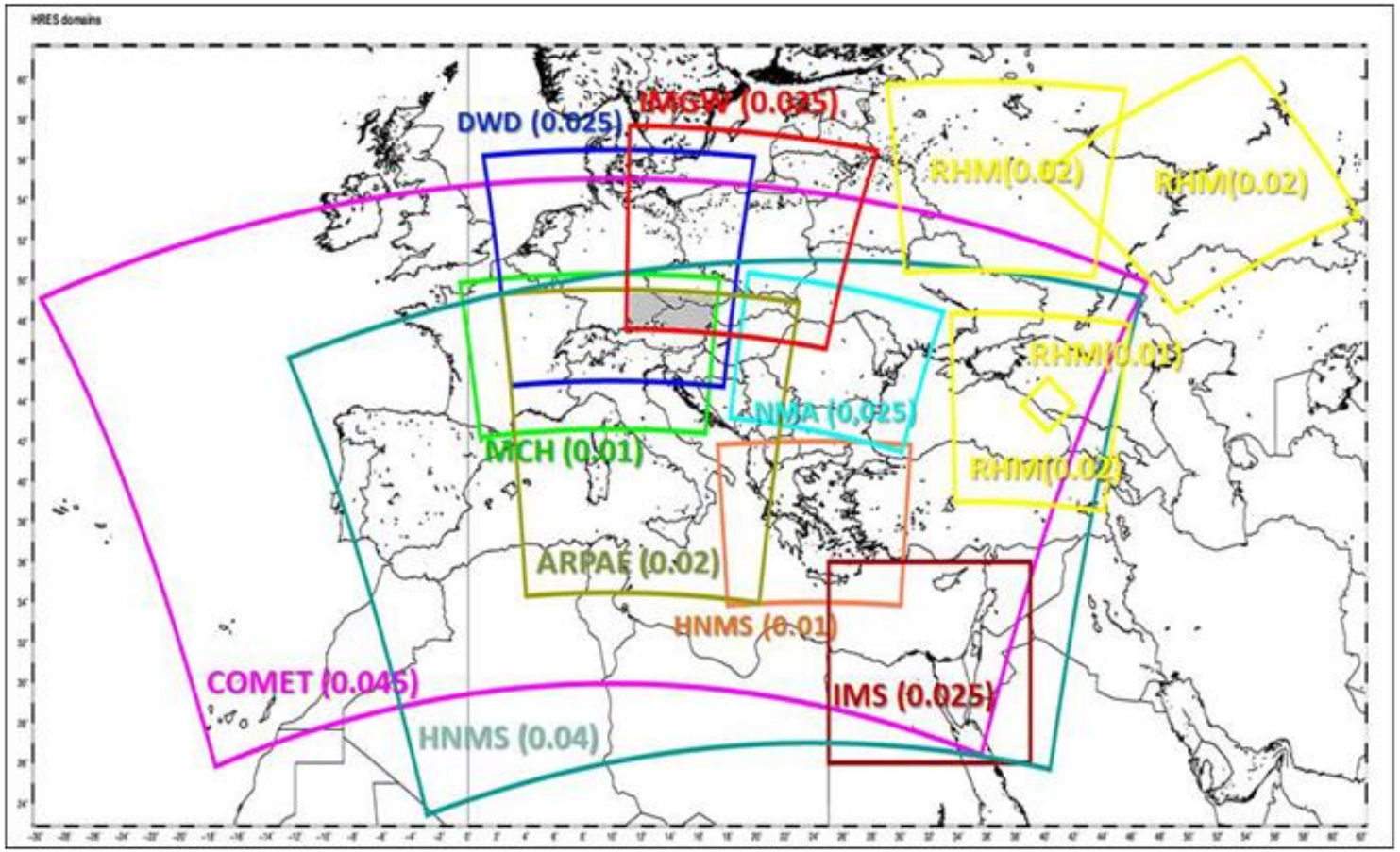
VERIFICATION OVER THE COMMON AREA



COSMO-GR4, **COSMO-5M**, **ICON-EU**, **IFS**, **ICON**, **COSMO-ME**, **COSMO-PL**, **COSMO-RU7**

Annual reports and Seasonal analytics are located at the website:
http://cosmo-model.org/content/tasks/verification.priv/

VERIFICATION OVER THE COMMON AREA 2: FINE RESOLUTION



COSMO-D2, IFS, ICON, COSMO-IT, COSMO-PL

Annual reports and Seasonal analytics are located at the website:
http://cosmo-model.org/content/tasks/verification.priv/

General Information on Scores

Continuous parameters

Temperature at 2 m
Dew point temperature at 2 m
Pressure reduced to Mean Sea Level
Wind speed at 10 m
Total cloud cover

$$ME = \frac{1}{n}\sum_{k=1}^{n}(f_k - o_k) \qquad RMSE = \sqrt{\frac{\sum_{k=1}^{n}(f_k - o_k)^2}{n}}$$

Dichotomic parameters

Total Precipitation
Total cloud cover
Wind gust at 10 m

$$FBI = \frac{a+b}{a+c} \qquad TS = \frac{a}{(a+b+c)}$$

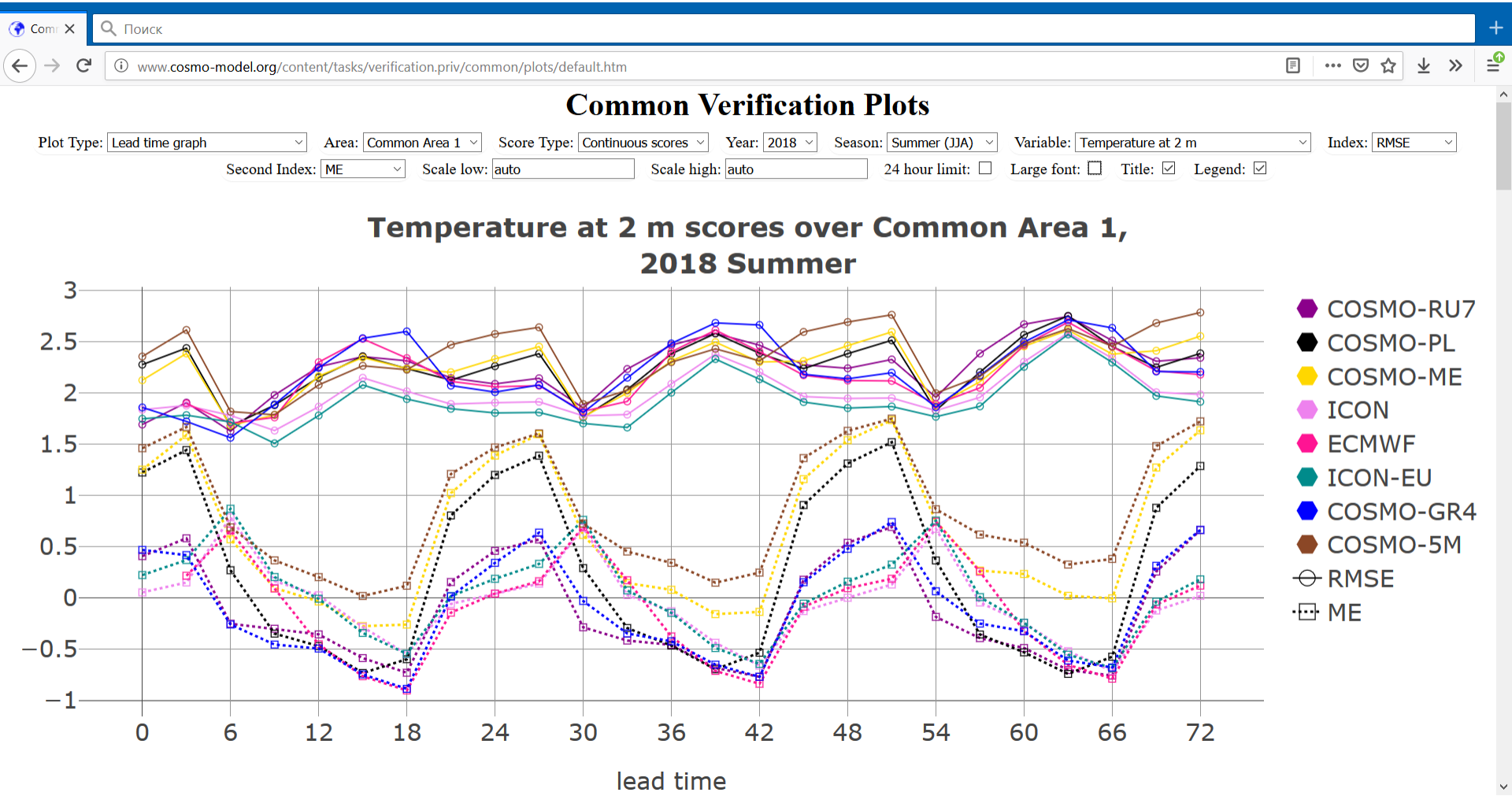
$$ETS = \frac{a-a_r}{a+b+c-a_r}, \quad where \quad a_r = \frac{(a+b)(a+c)}{a+b+c+d}$$

		OBSERVATIONS	
FORECASTS	Hit (**a**)	False Alarm (**b**)	Forecasted
	Miss (**c**)	Correct Rejection (**d**)	Not Forecasted
	Observed	Not Observed	

All the scores you can view at the website:
http://cosmo-model.org/content/tasks/verification.priv/common/plots/default.htm

Common Plots Interactive view

http://www.cosmo-model.org/ -> COSMO Tasks -> Verification

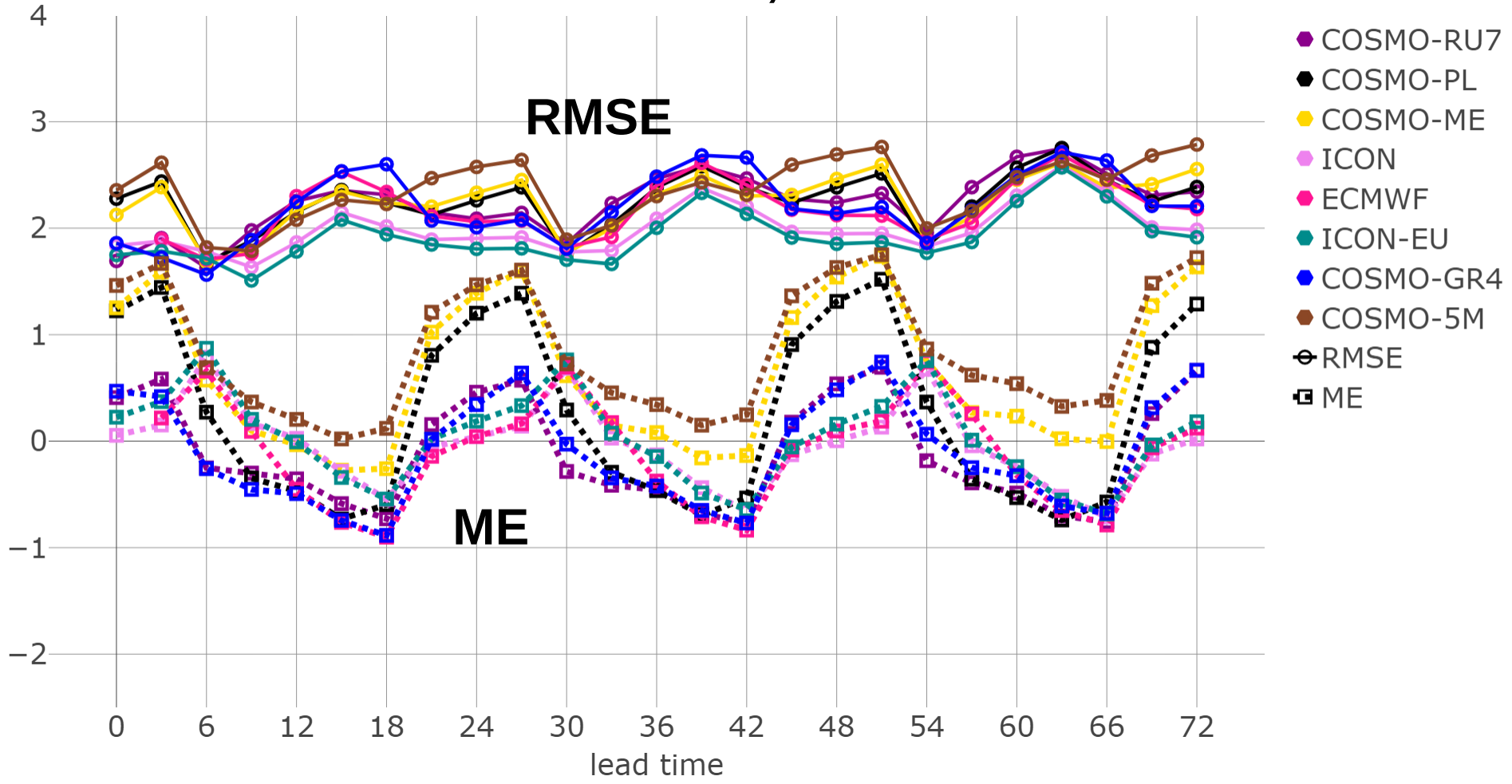


JavaScript required

All the scores you can view at the website:

http://cosmo-model.org/content/tasks/verification.priv/common/plots/default.htm

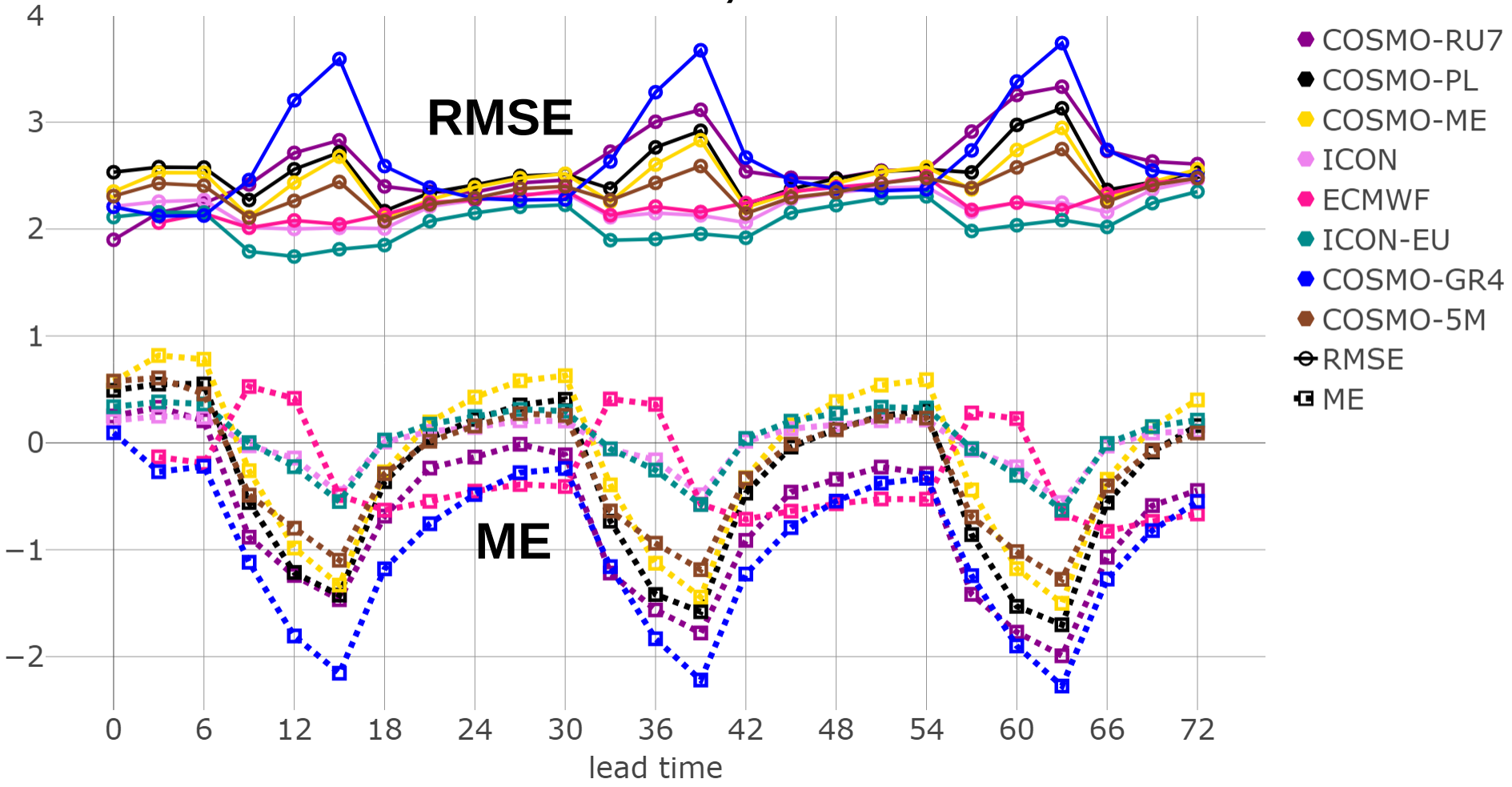
Temperature at 2 m scores
Common Area 1, Summer 2018



Diurnal variability underestimation persists

ICON-EU has the lowest RMSE after 6 hour lead time

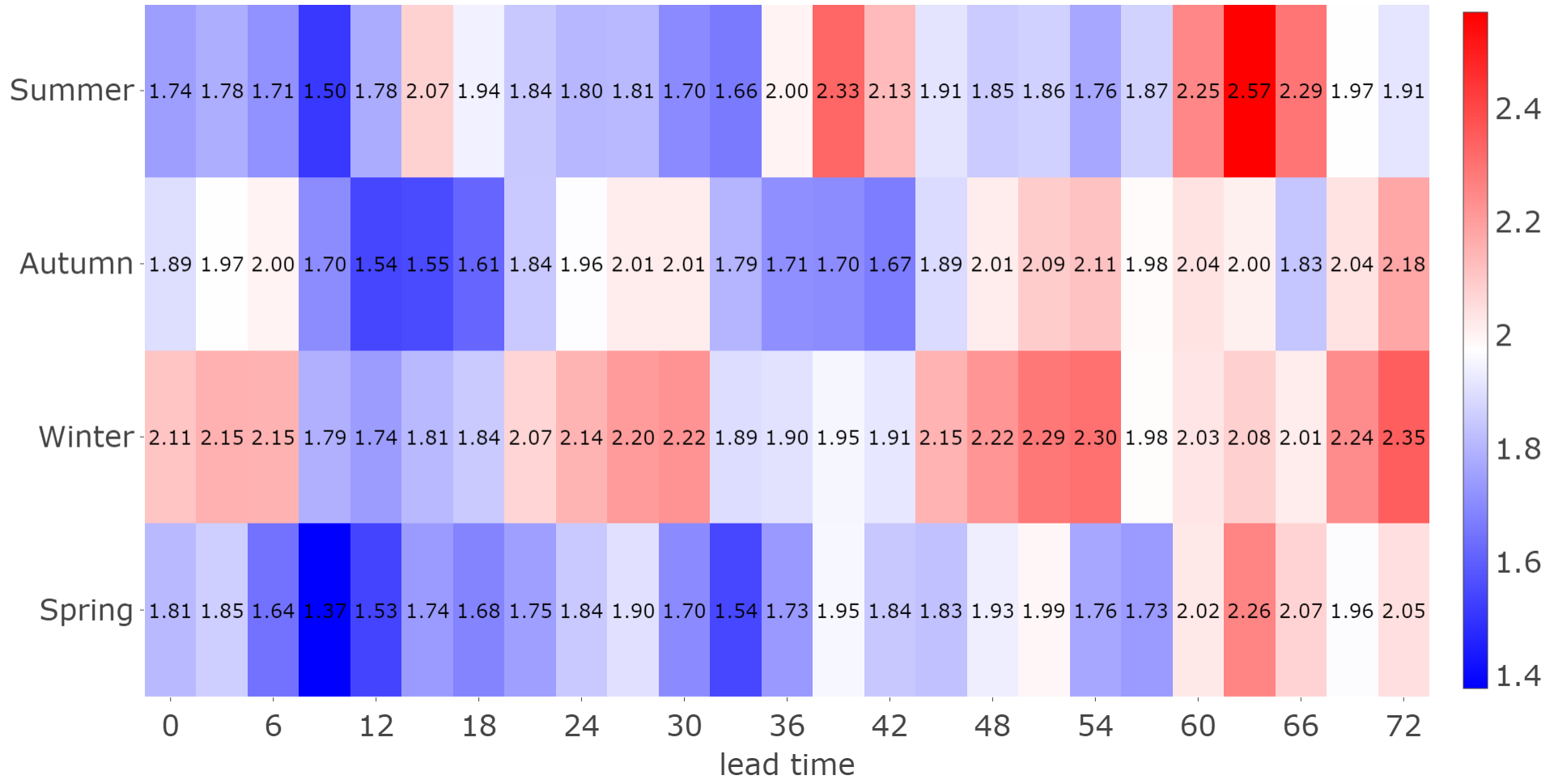
Temperature at 2 m scores
Common Area 1, Winter 2018-2019



Diurnal variability underestimation persists

ICON-EU has the lowest RMSE after 6 hour lead time

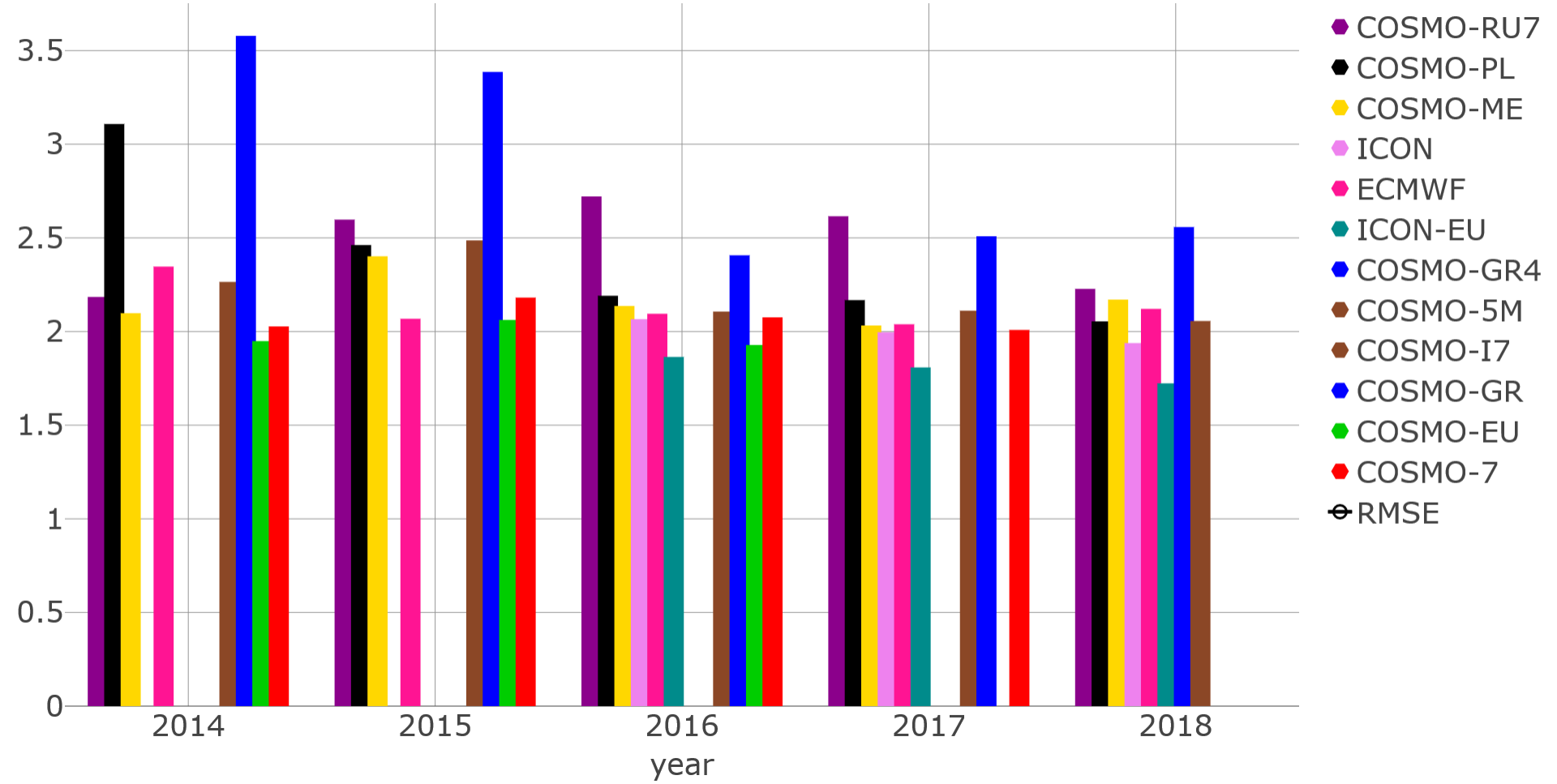
Temperature at 2 m scores
Common Area 1, ICON-EU RMSE



Summer
daytime RMSE
maximum

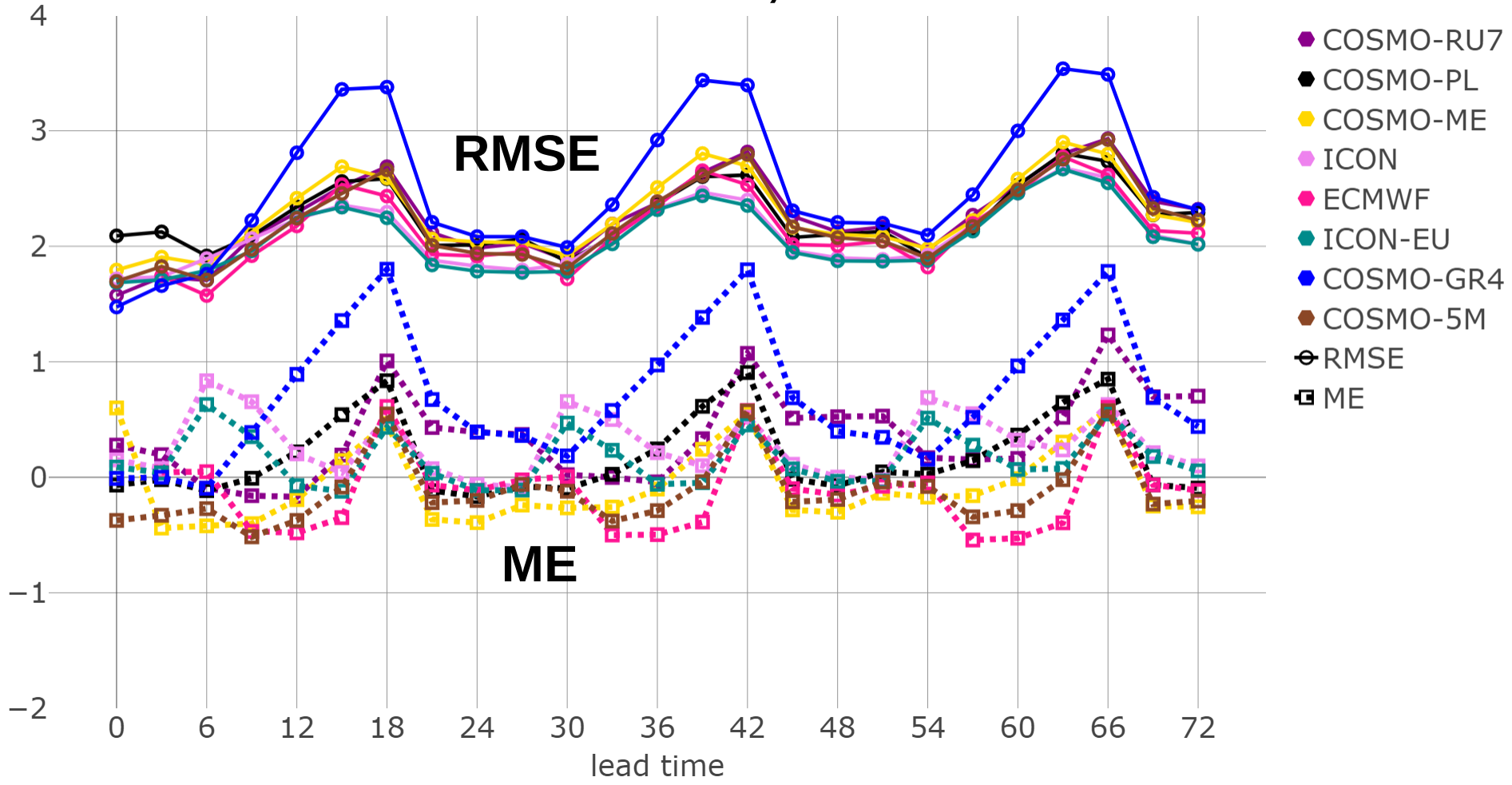
Winter
nighttime RMSE
maximum

Temperature at 2 m RMSE
Common Area 1, 12 hour lead time, Autumn



RMSE generally decreased slightly compared to the previous year, except for winter.

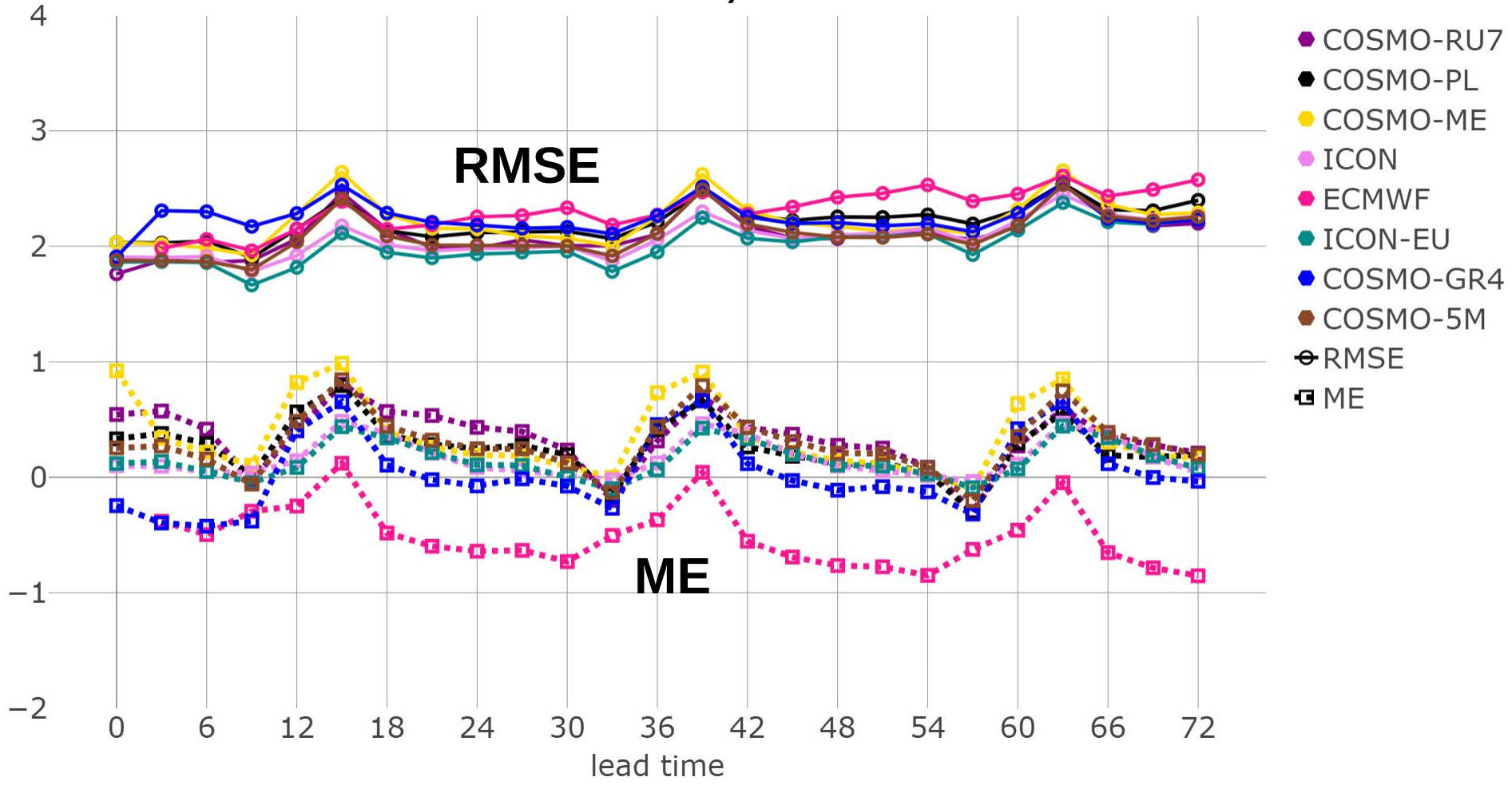
Dew point Temperature at 2 m scores
Common Area 1, Summer 2018



ME and RMSE maximum during late afternoon

ICON overestimates

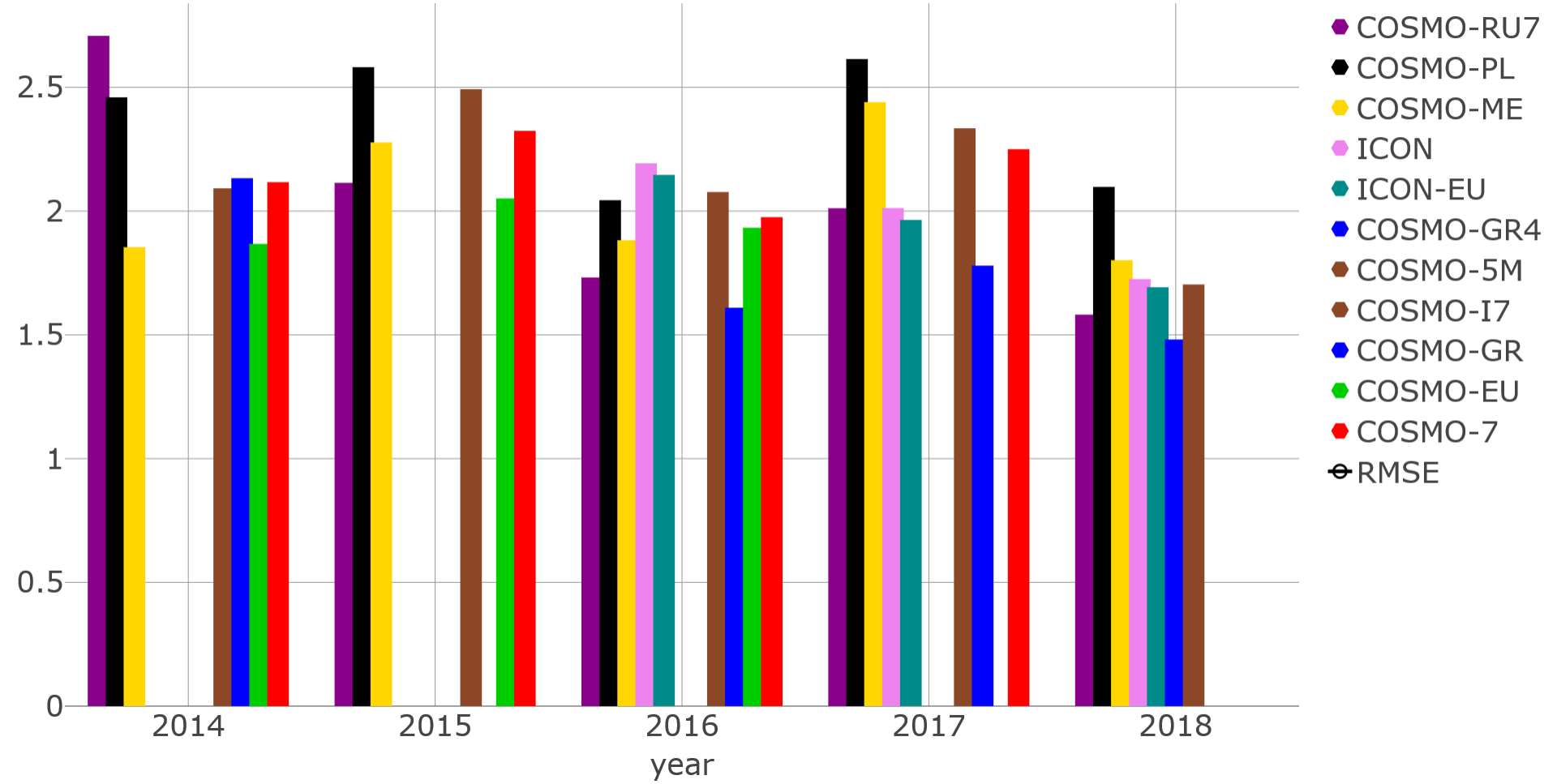
Dew point Temperature at 2 m scores
Common Area 1, Winter 2018-2019



ME and RMSE maximum during late afternoon

ICON overestimates

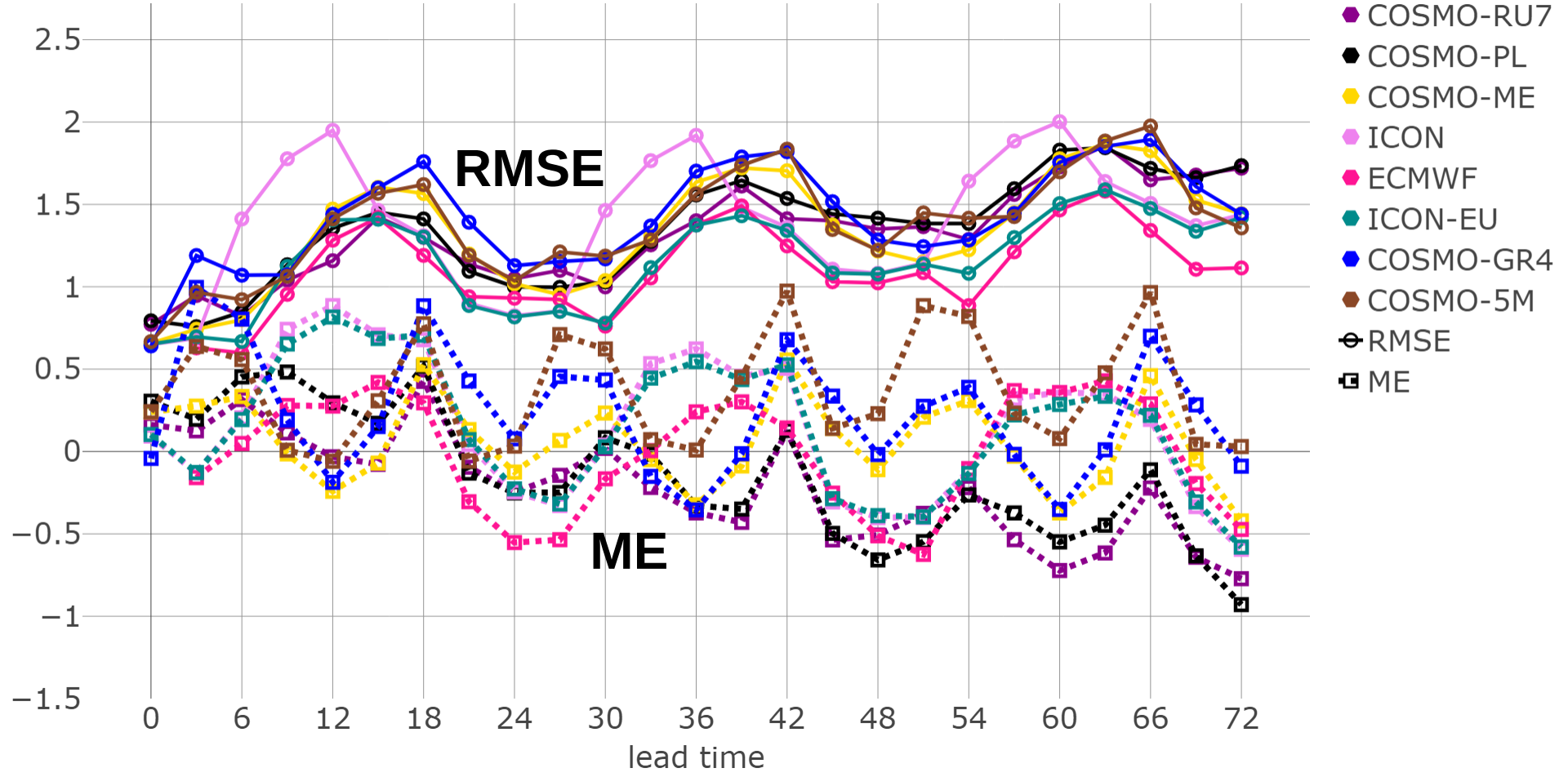
Dew point Temperature at 2 m RMSE
Common Area 1, 00 hour lead time, Summer



summer RMSE decreased, winter RMSE slight increase

ICON ME has decreased especially compared to 2016

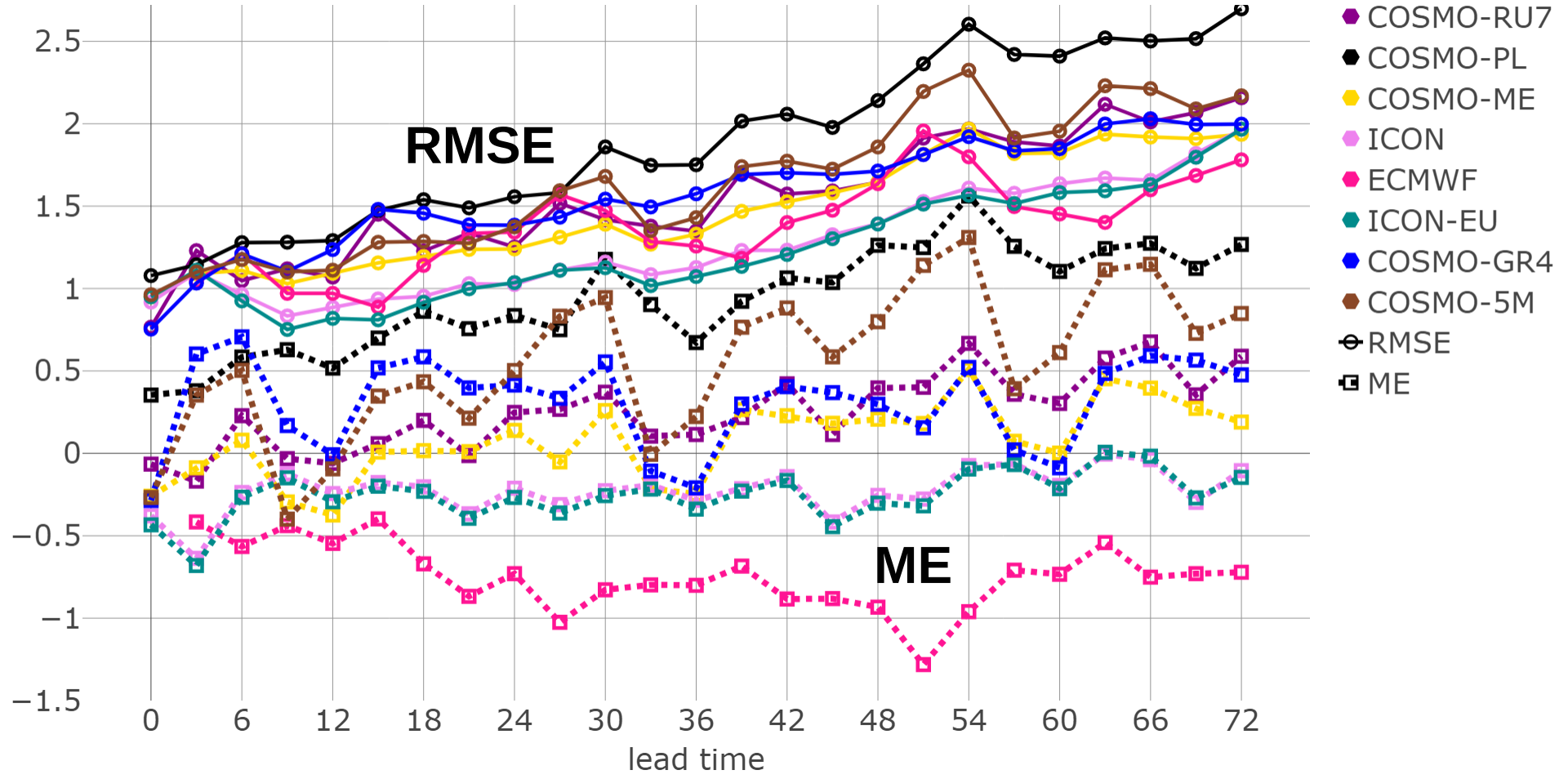
Pressure reduced to Mean Sea Level scores
Common Area 1, Summer 2018



RMSE
maximum during
afternoon

ICON and IFS have
better RMSE
than **COSMO**

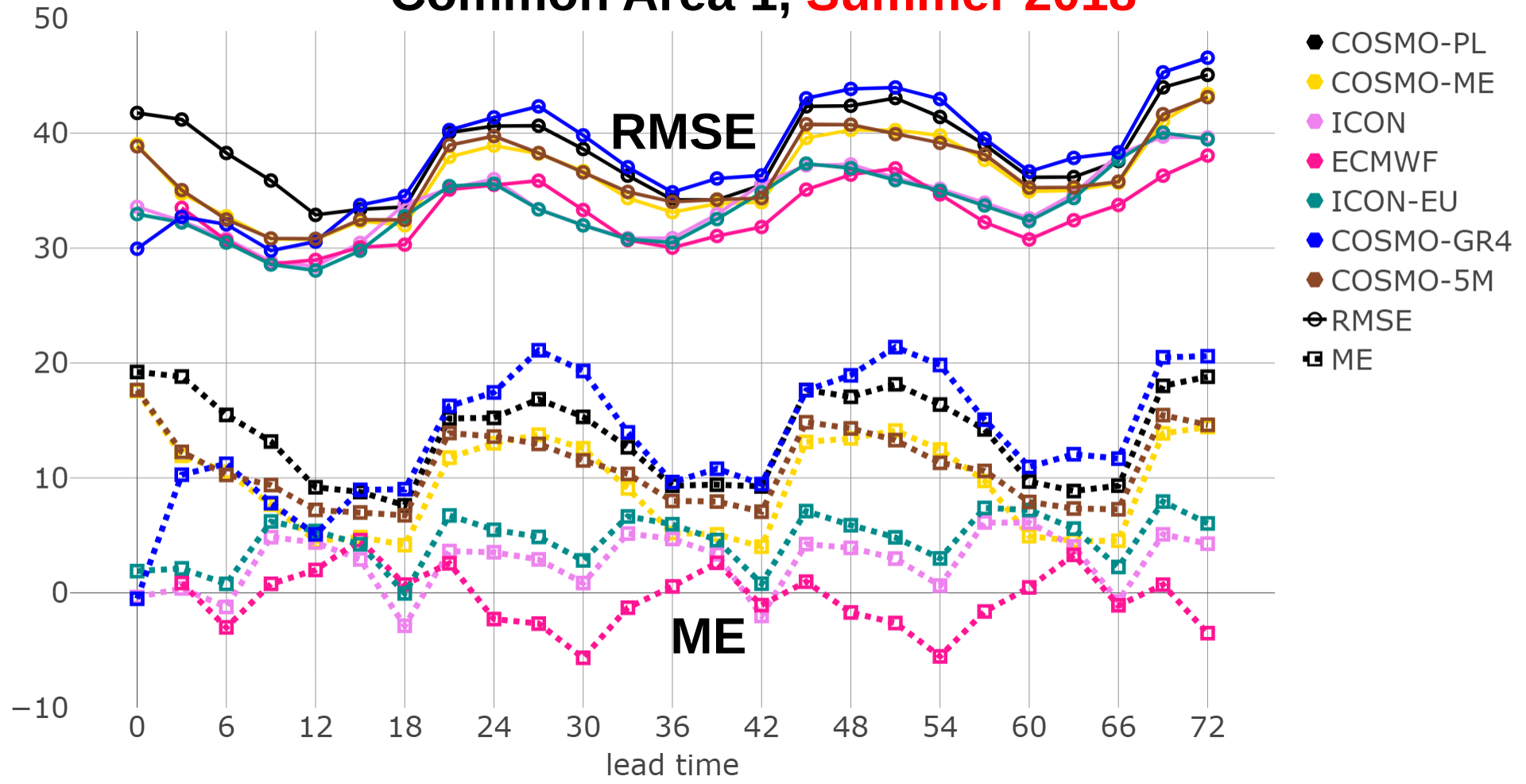
Pressure reduced to Mean Sea Level scores
Common Area 1, Winter 2018-2019



NO RMSE maximum during afternoon

ICON and IFS have better RMSE than **COSMO**

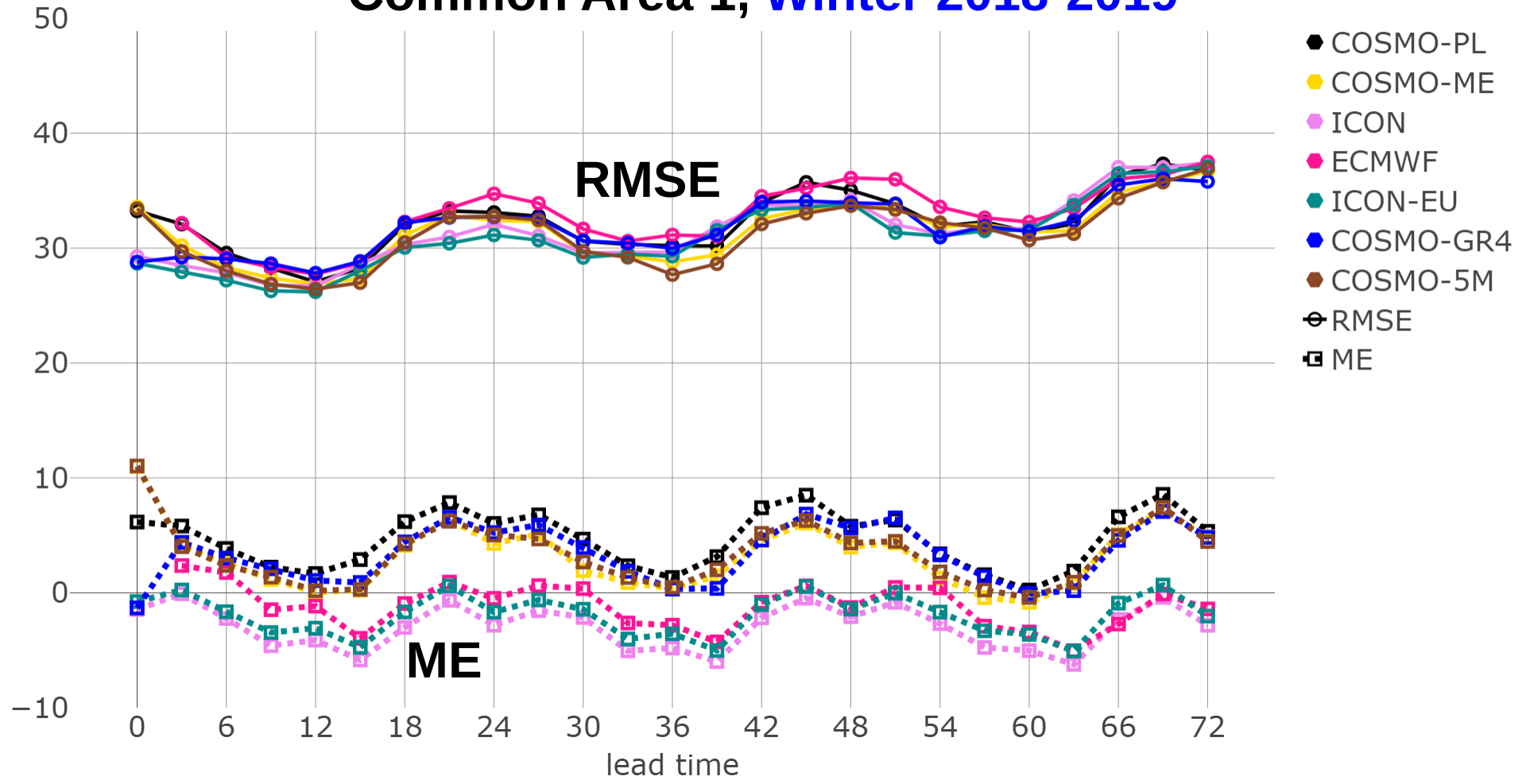
Total cloud cover scores
Common Area 1, Summer 2018



RMSE
maximum during
nighttime

better
ICON and IFS
RMSE

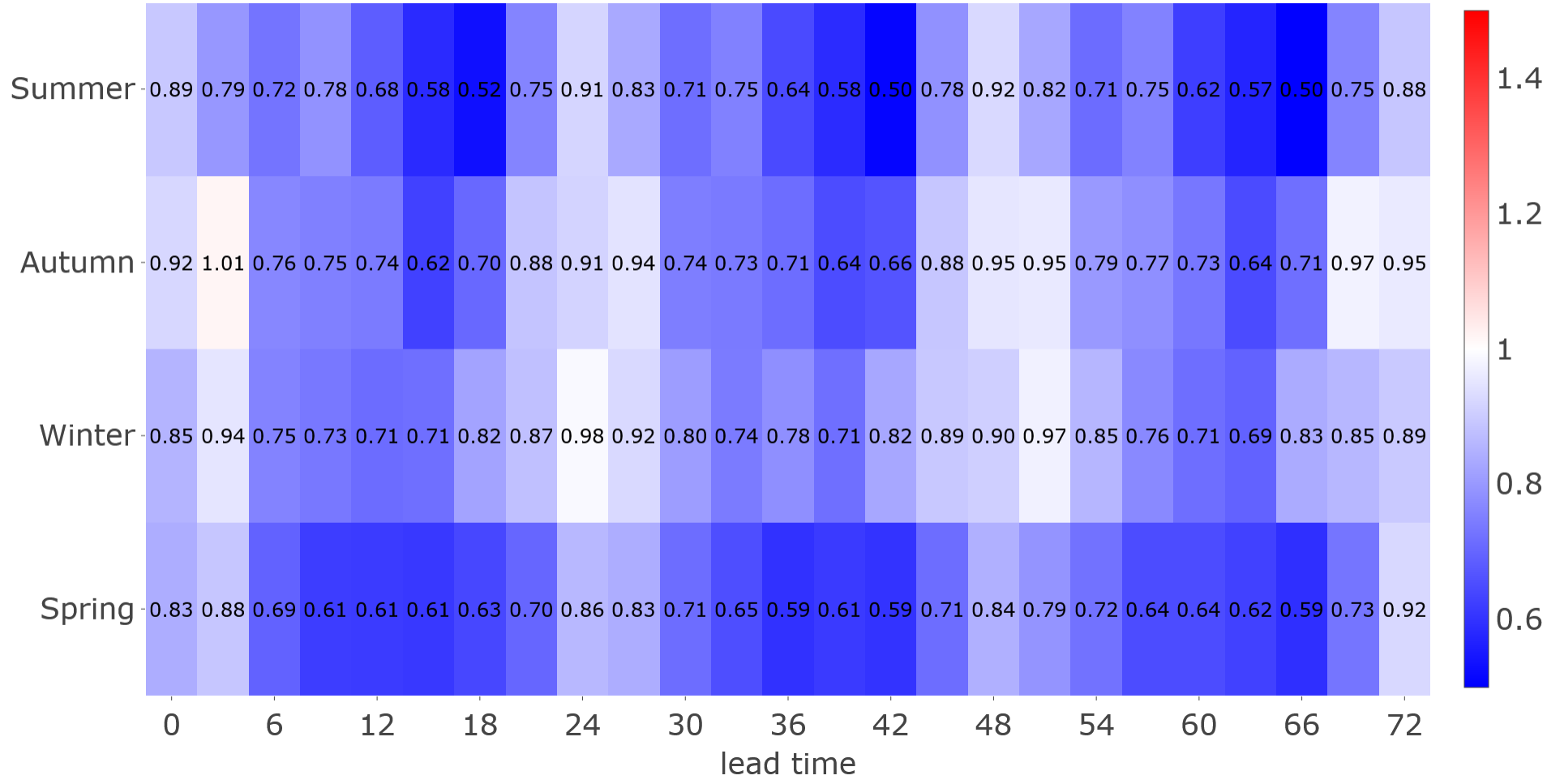
Total cloud cover scores
Common Area 1, Winter 2018-2019



RMSE
maximum during
nighttime

slightly better
ICON and **COSMO**
RMSE

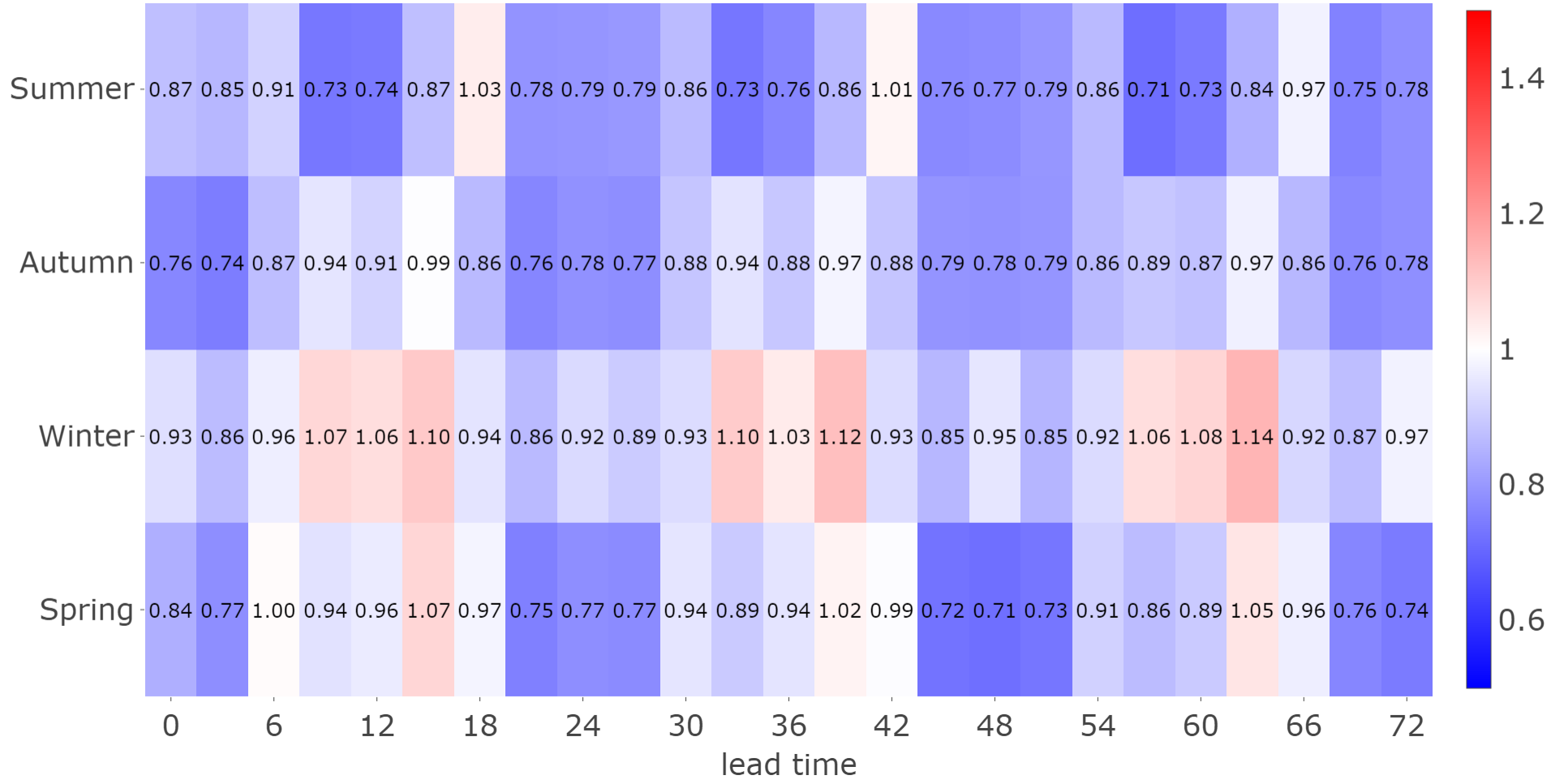
25-75% Total cloud cover FBI
Common Area 1, ICON-EU



The lowest TS
for 25-75%
Total cloud cover

25-75%
Total cloud cover
underestimated

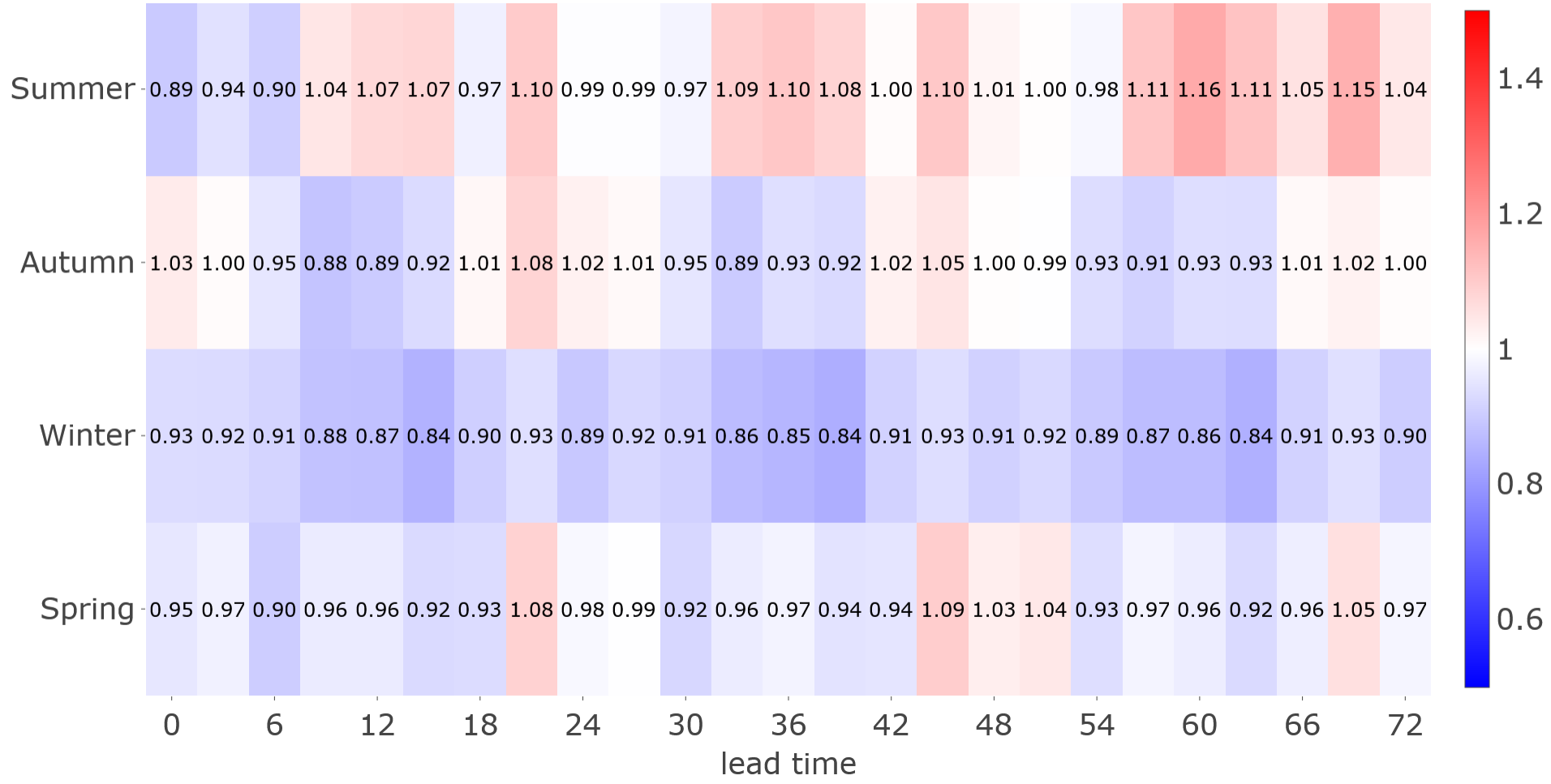
0-25% Total cloud cover FBI
Common Area 1, ICON-EU



<25% and >75%
TS higher
during summer

25-75%
Total cloud cover
underestimated

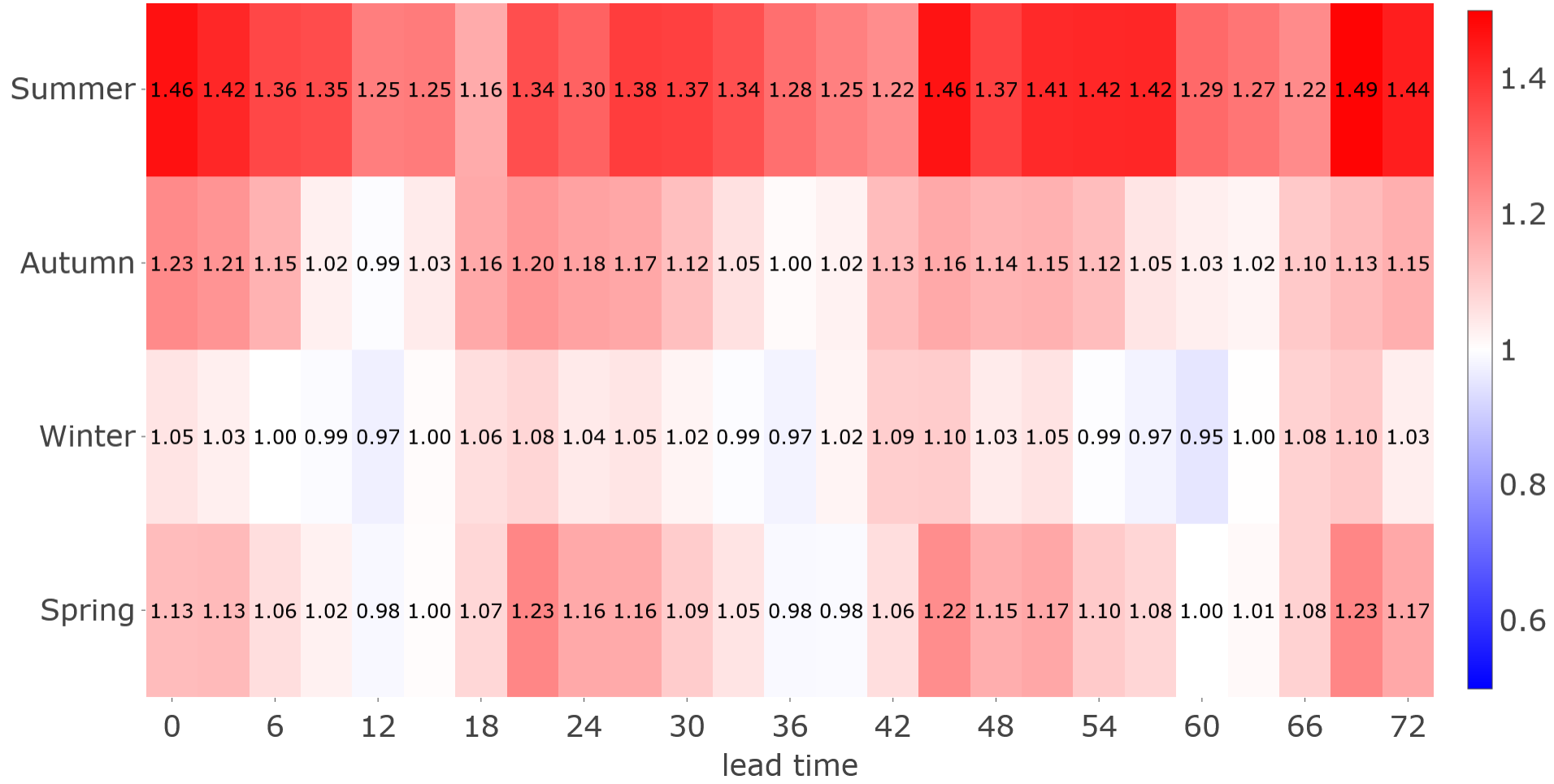
75-100% Total cloud cover FBI
Common Area 1, ICON-EU



<u><25% and >75%</u>
TS higher
during summer

COSMO
overestimate
<u>>75% TCC</u>

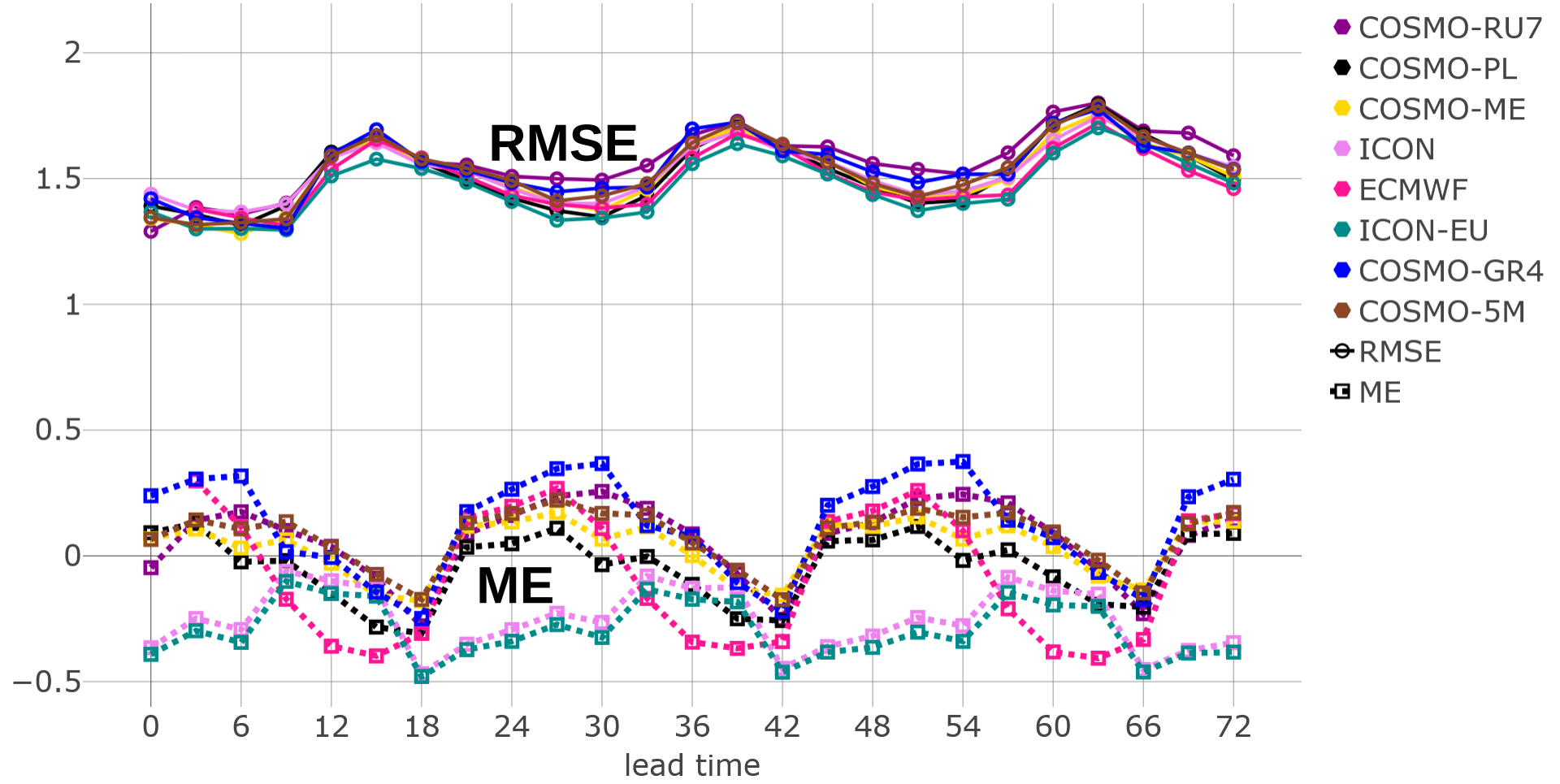
75-100% Total cloud cover FBI
Common Area 1, COSMO-PL



<25% and >75%
TS higher
during summer

COSMO
overestimate
>75% TCC

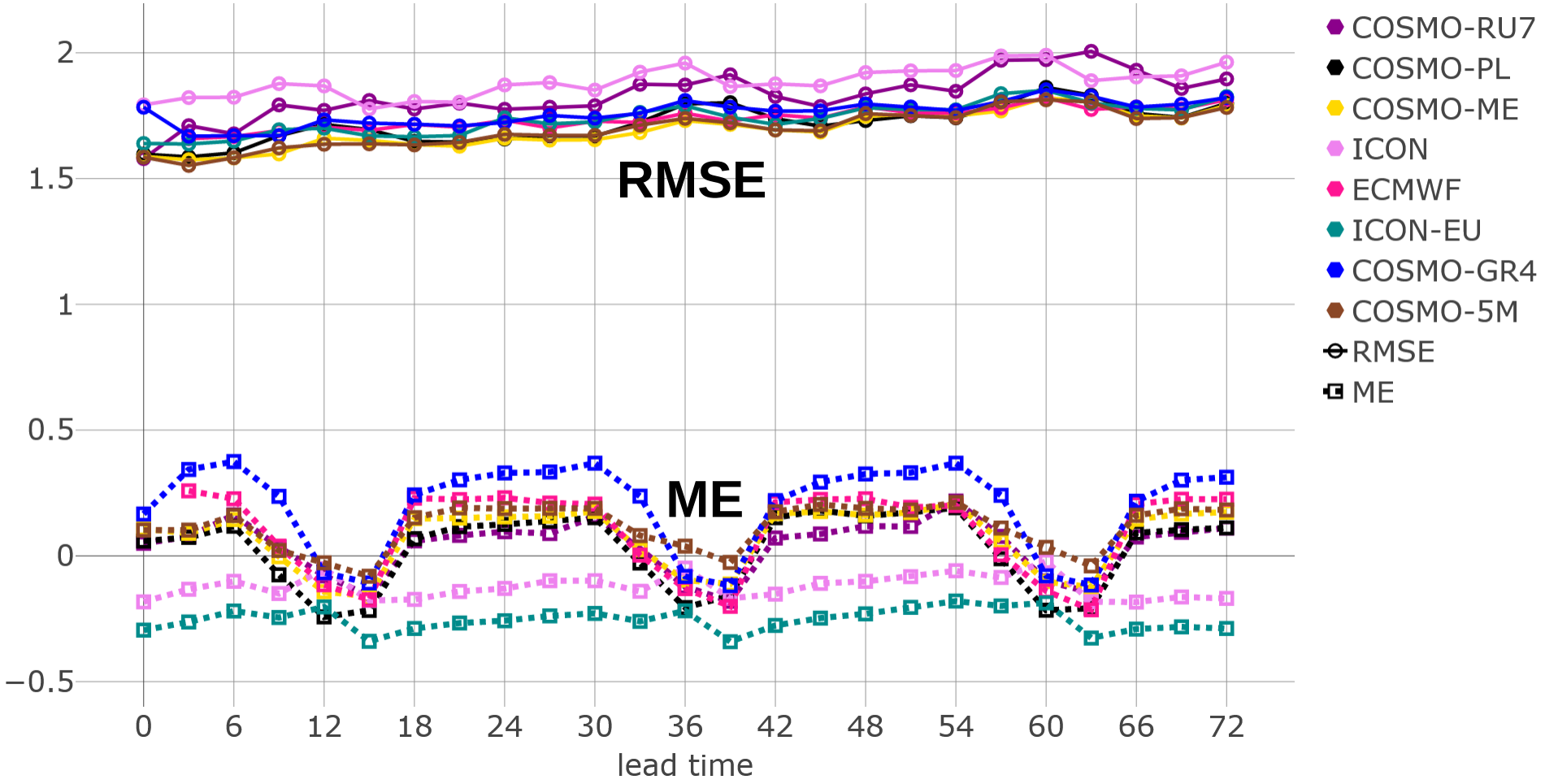
Wind speed at 10 m scores
Common Area 1, Summer 2018



Wind gust at 10 m
underestimated
by all models

ICON and ICON-EU
underestimate
Wind speed at 10 m

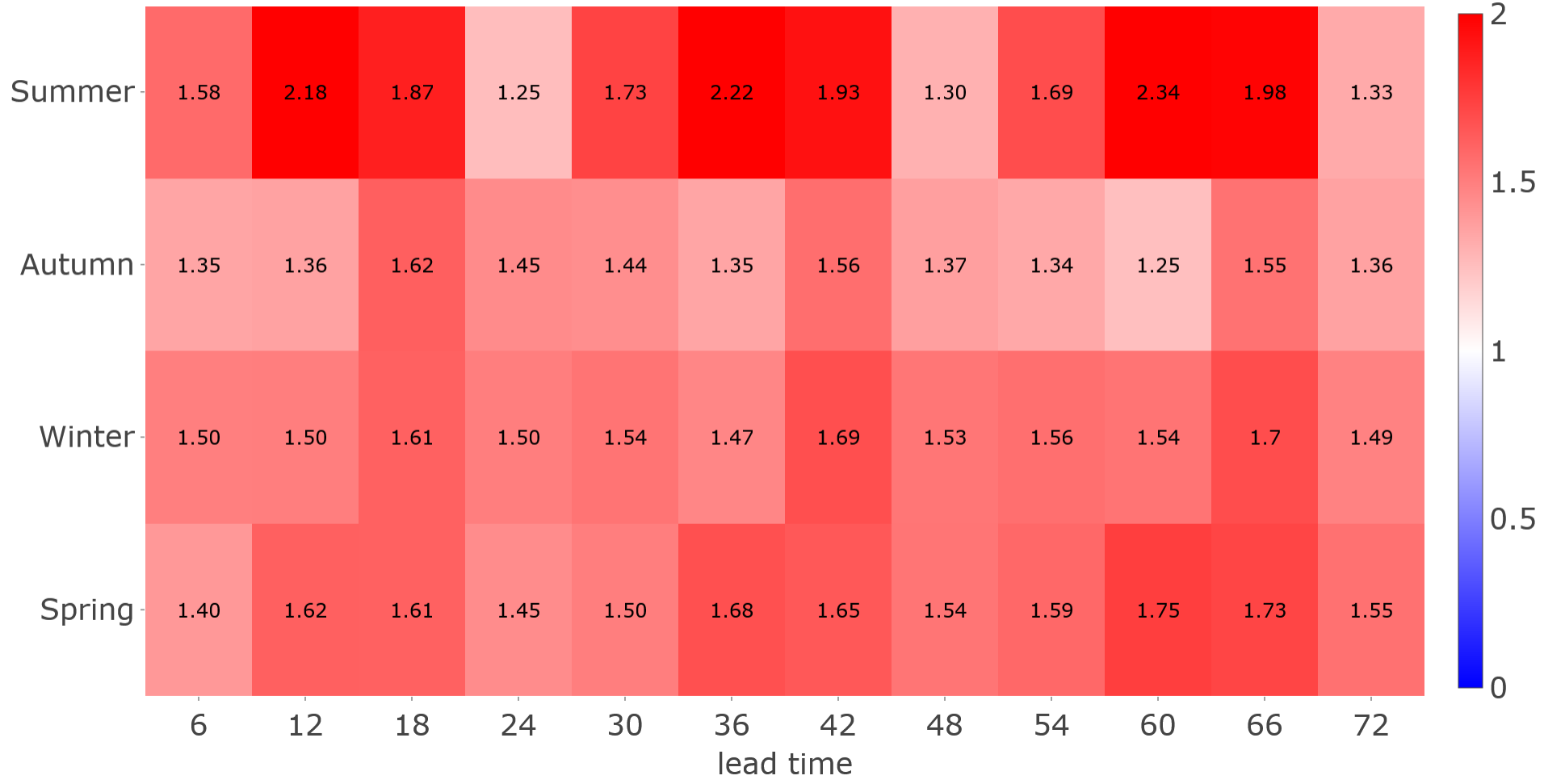
Wind speed at 10 m scores
Common Area 1, Winter 2018-2019



Wind gust at 10 m
underestimated
by all models

ICON and ICON-EU
underestimate
Wind speed at 10 m

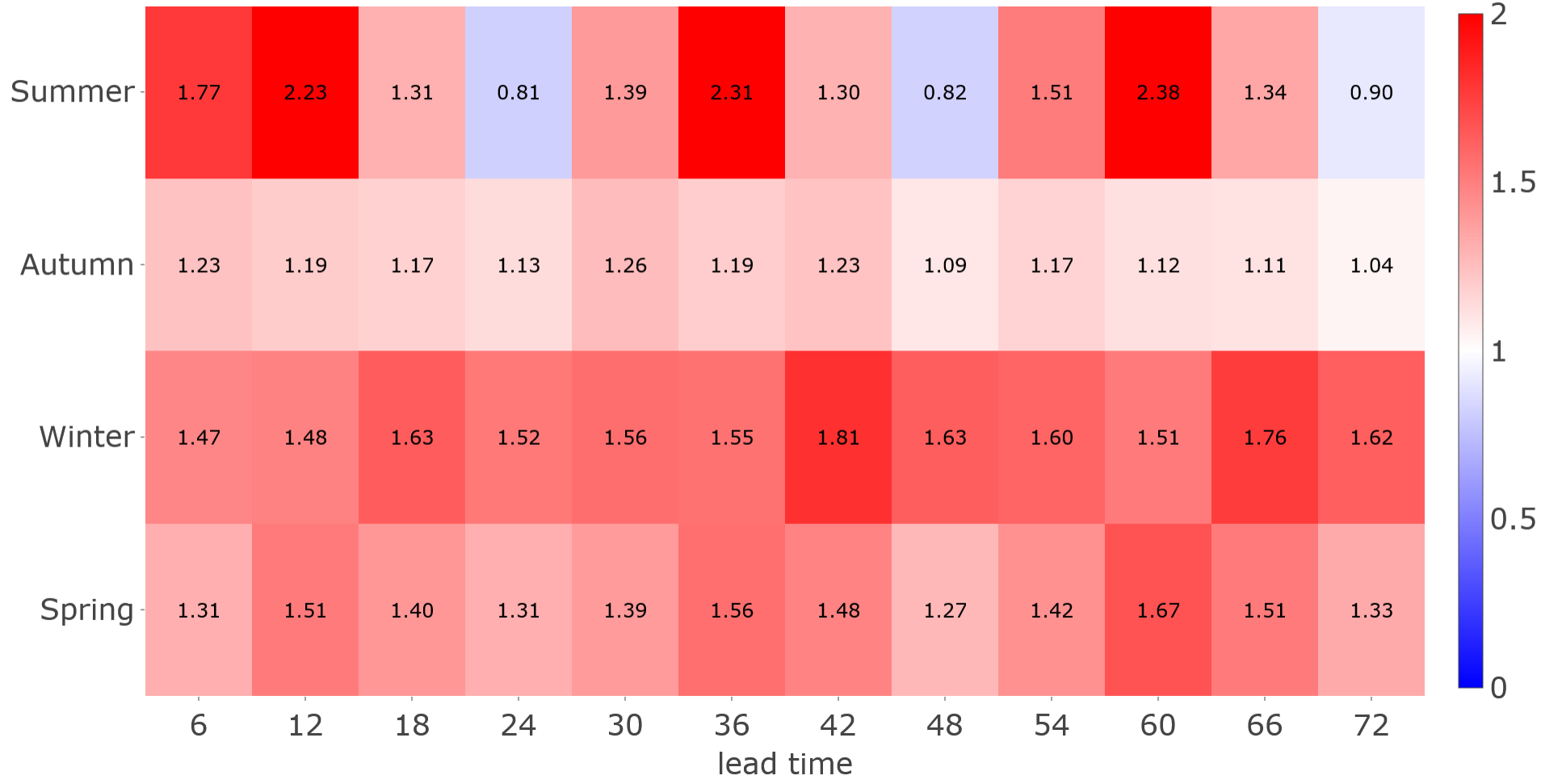
>0.2 mm Total precipitation in 6 hours FBI Common Area 1, ICON-EU



>0.2 mm Tot.prec. overestimated
"drizzle" persists

ICON overestimates >0.2 mm Tot.prec. more than **COSMO**

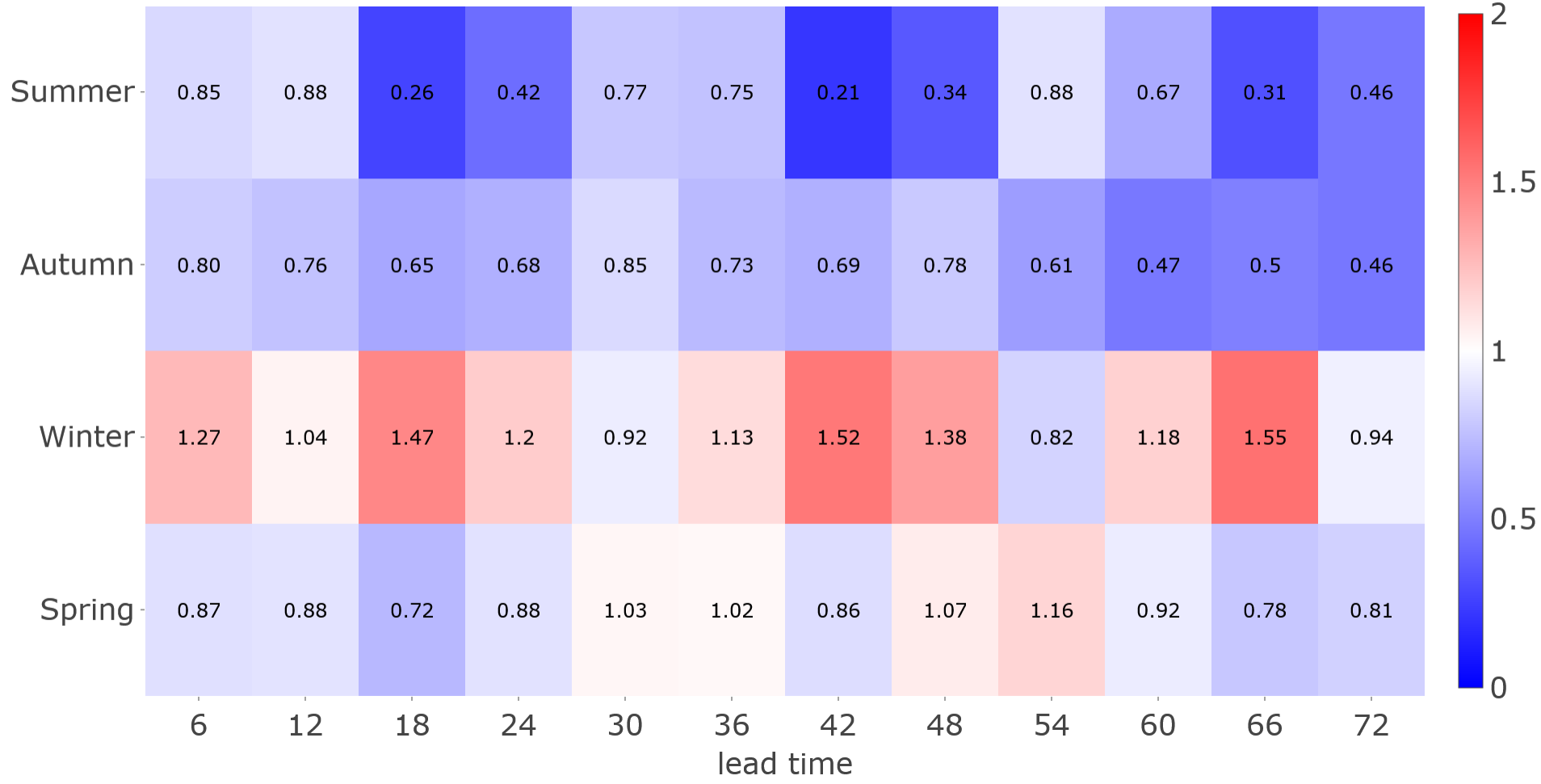
>0.2 mm Total precipitation in 6 hours FBI Common Area 1, COSMO-PL



>0.2 mm Tot.prec.
overestimated
"drizzle" persists

ICON overestimates
>0.2 mm Tot.prec.
more than **COSMO**

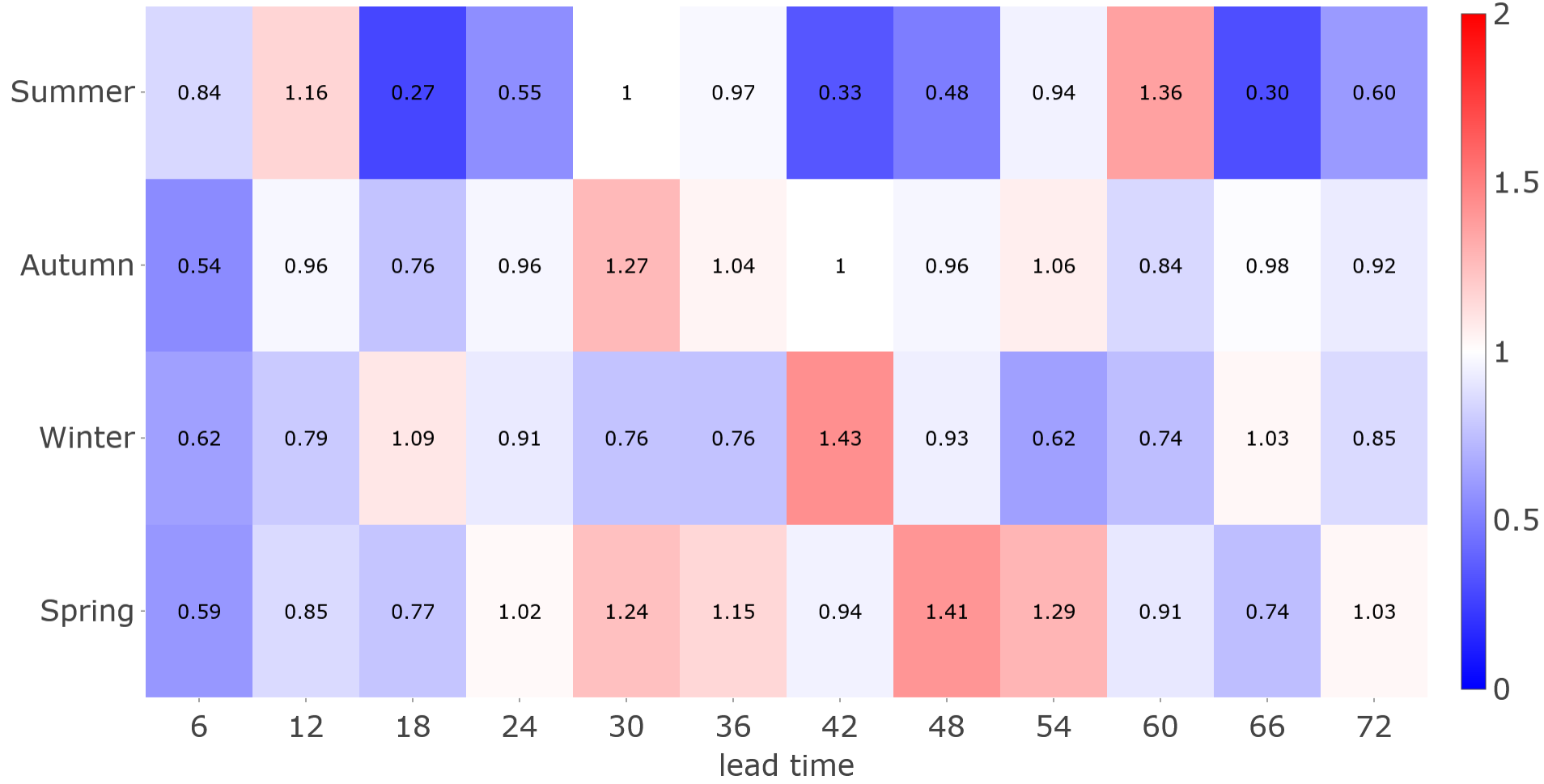
>10 mm Total precipitation in 6 hours FBI
Common Area 1, ICON-EU



COSMO underestimate
<u>>10 mm</u> Tot.prec
less during <u>JJA, SON</u>

COSMO has
lower FBI than **ICON**
during <u>winter</u>

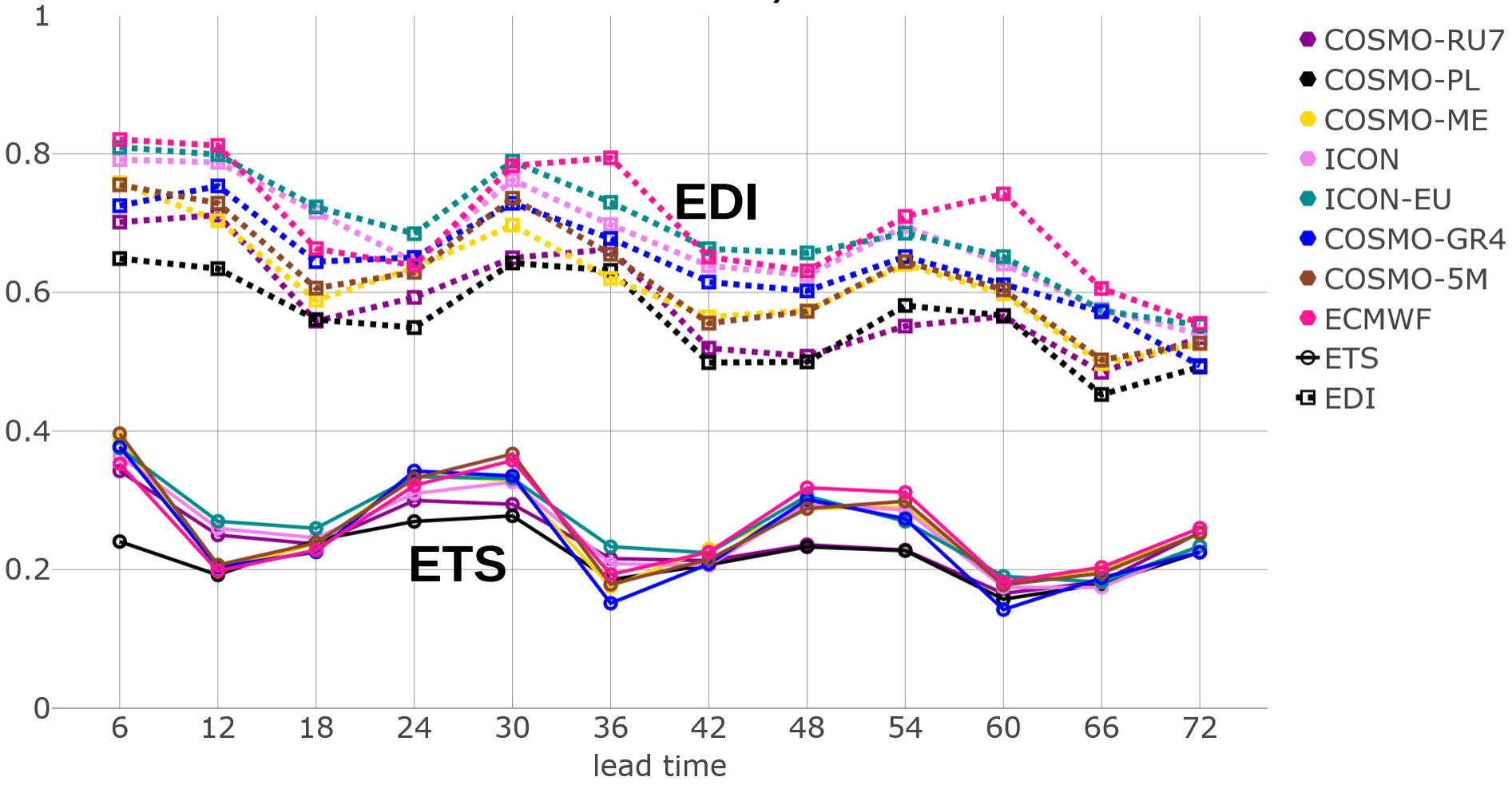
>10 mm Total precipitation in 6 hours FBI
Common Area 1, COSMO-5M



COSMO underestimate
<u>>10 mm</u> Tot.prec
less during <u>JJA, SON</u>

COSMO has
lower FBI than **ICON**
during <u>winter</u>

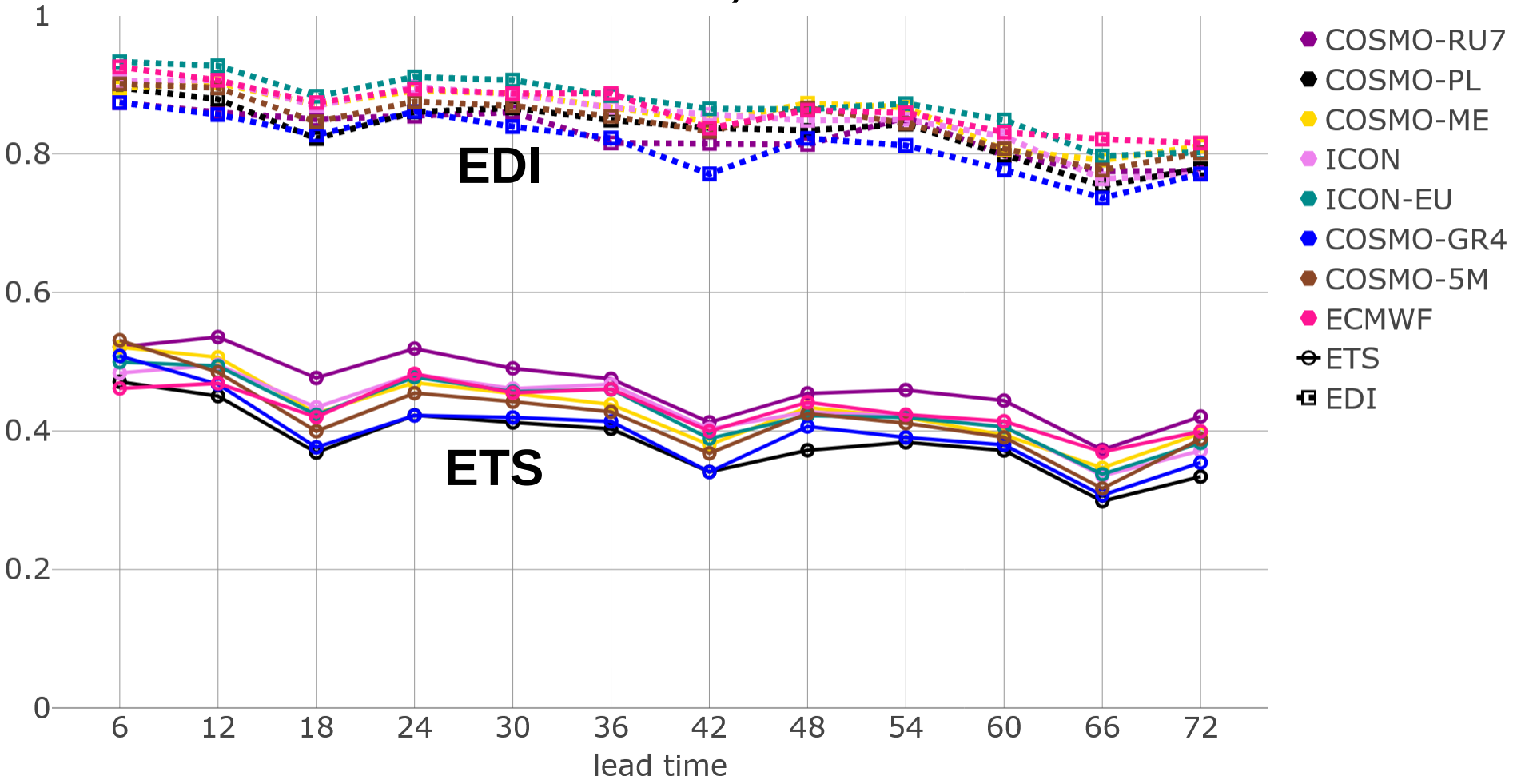
>0.2 mm Total precipitation in 6 hours scores
Common Area 1, Summer 2018



While having better FBI **COSMO** does not have better ETS than ICON

ETS higher at winter
worst 12-18 UTC
best 0-6 UTC

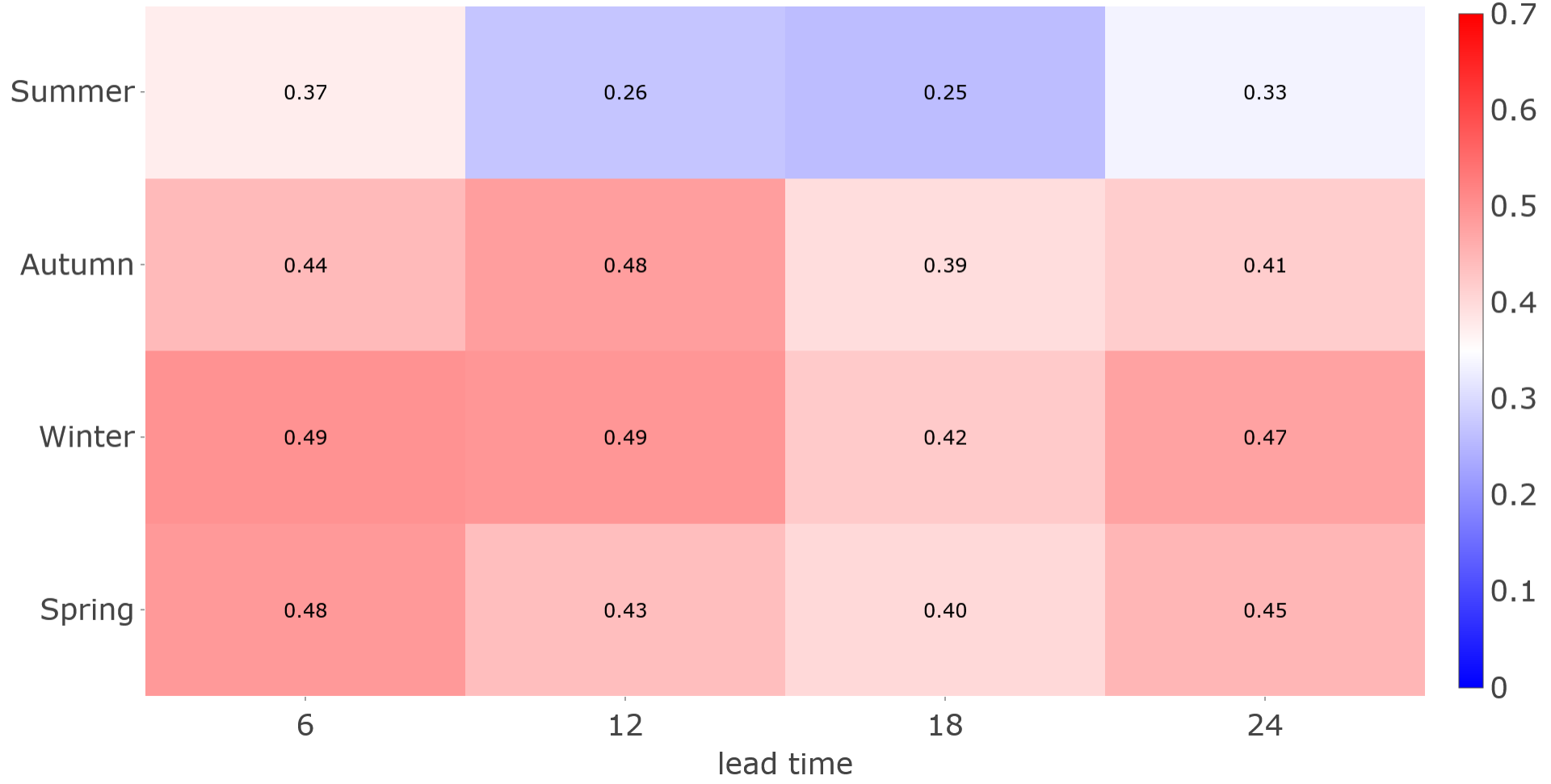
>0.2 mm Total precipitation in 6 hours scores
Common Area 1, Winter 2018-2019



While having better FBI **COSMO** does not have better ETS than ICON

ETS higher at winter
worst 12-18 UTC
best 0-6 UTC

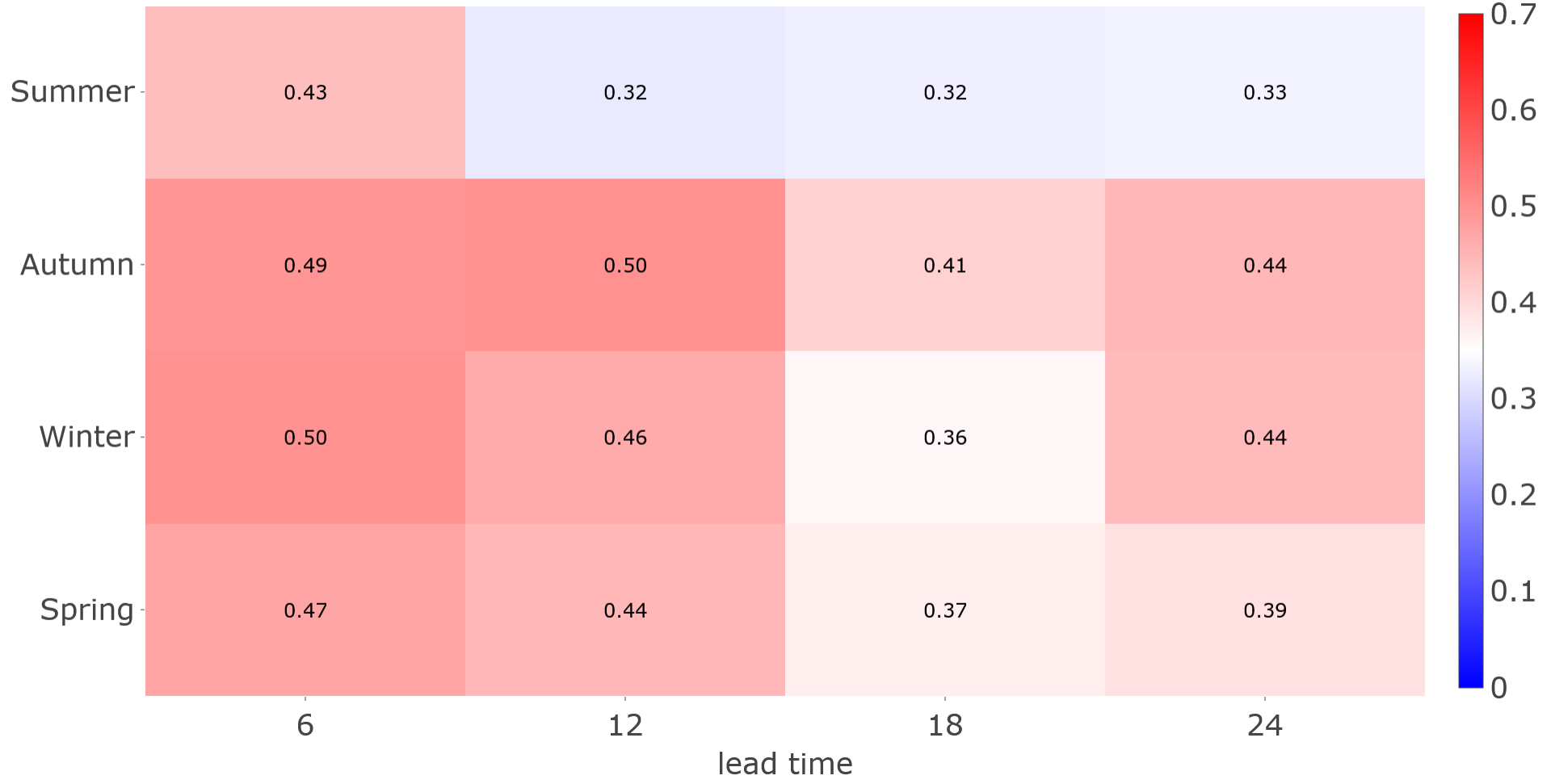
>0.2 mm Total precipitation in 6 hours ETS
Common Area 1, ICON-EU



COSMO-D2 has better ETS during summer

COSMO-D2 has better >10 mm ETS during autumn

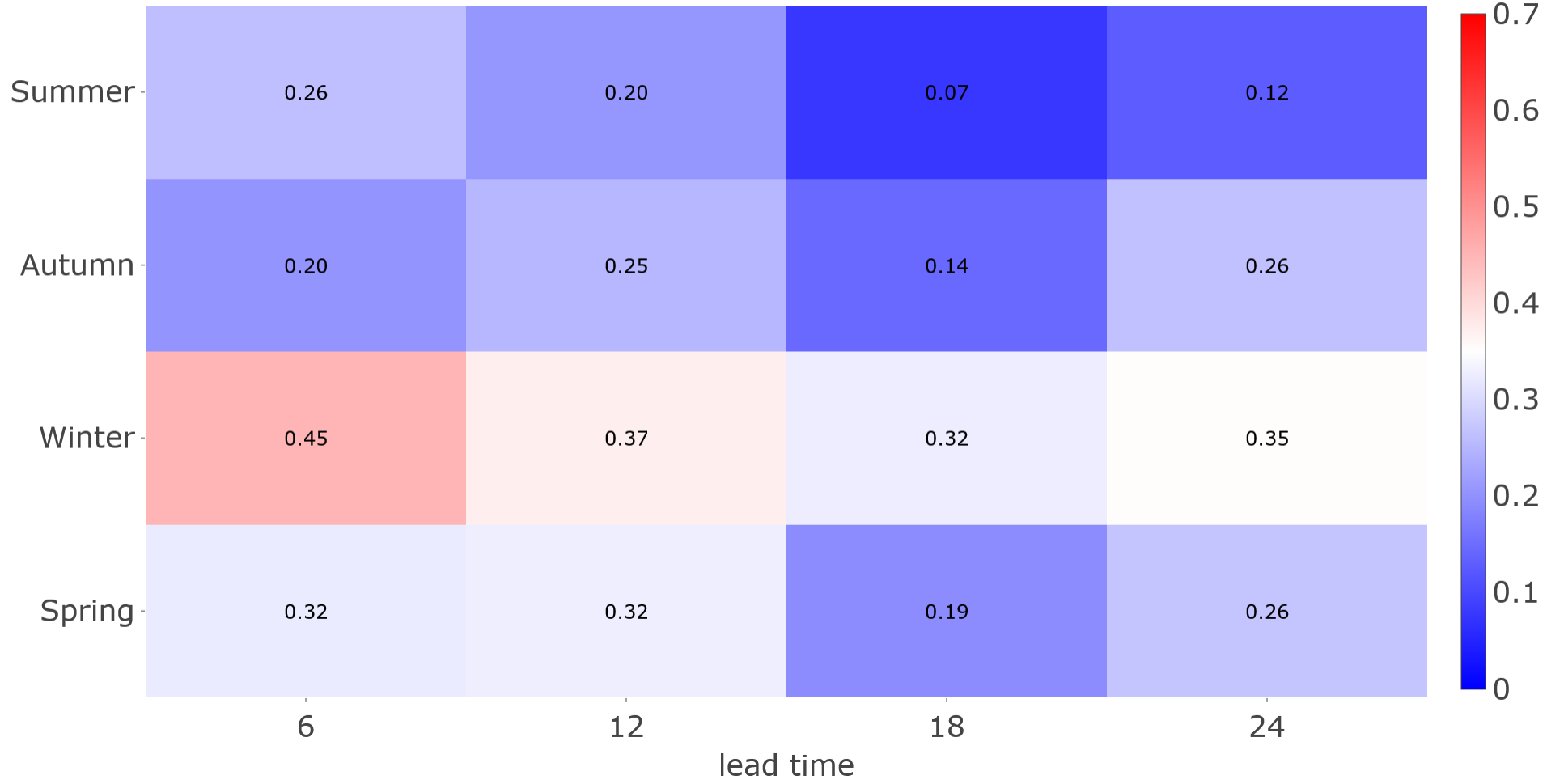
>0.2 mm Total precipitation in 6 hours ETS
Common Area 2, COSMO-D2



COSMO-D2 has better ETS during summer

COSMO-D2 has better >10 mm ETS during autumn

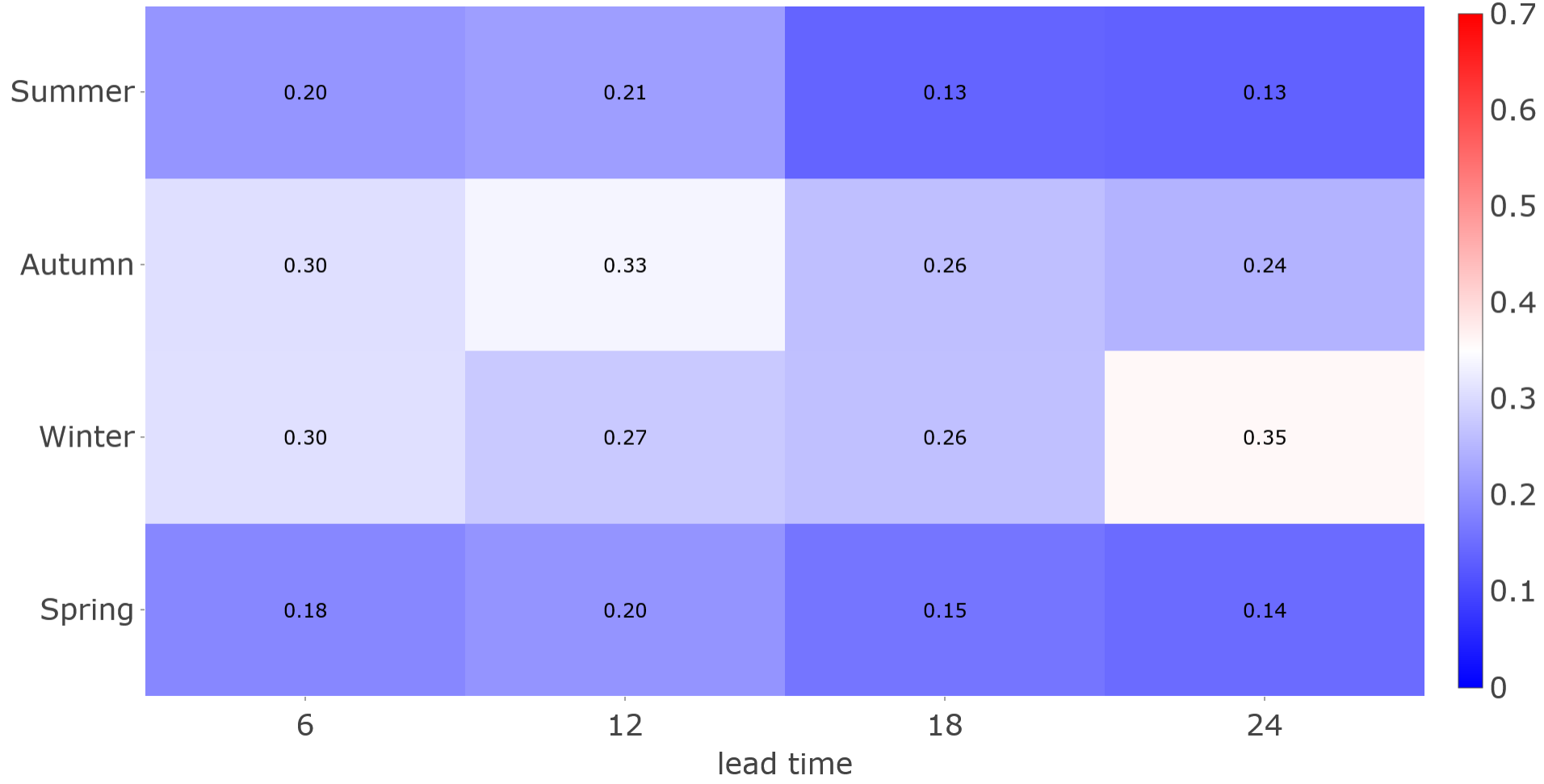
>10 mm Total precipitation in 6 hours ETS
Common Area 1, ICON-EU



ICON has
better <u>≥10 mm</u> ETS
during DJF and MAM

COSMO-D2 has
better <u>≥10 mm</u> ETS
during autumn

>10 mm Total precipitation in 6 hours ETS
Common Area 2, COSMO-D2



ICON has
better <u>>10 mm</u> ETS
during DJF and MAM

COSMO-D2 has
better <u>>10 mm</u> ETS
during autumn

CONCLUSIONS

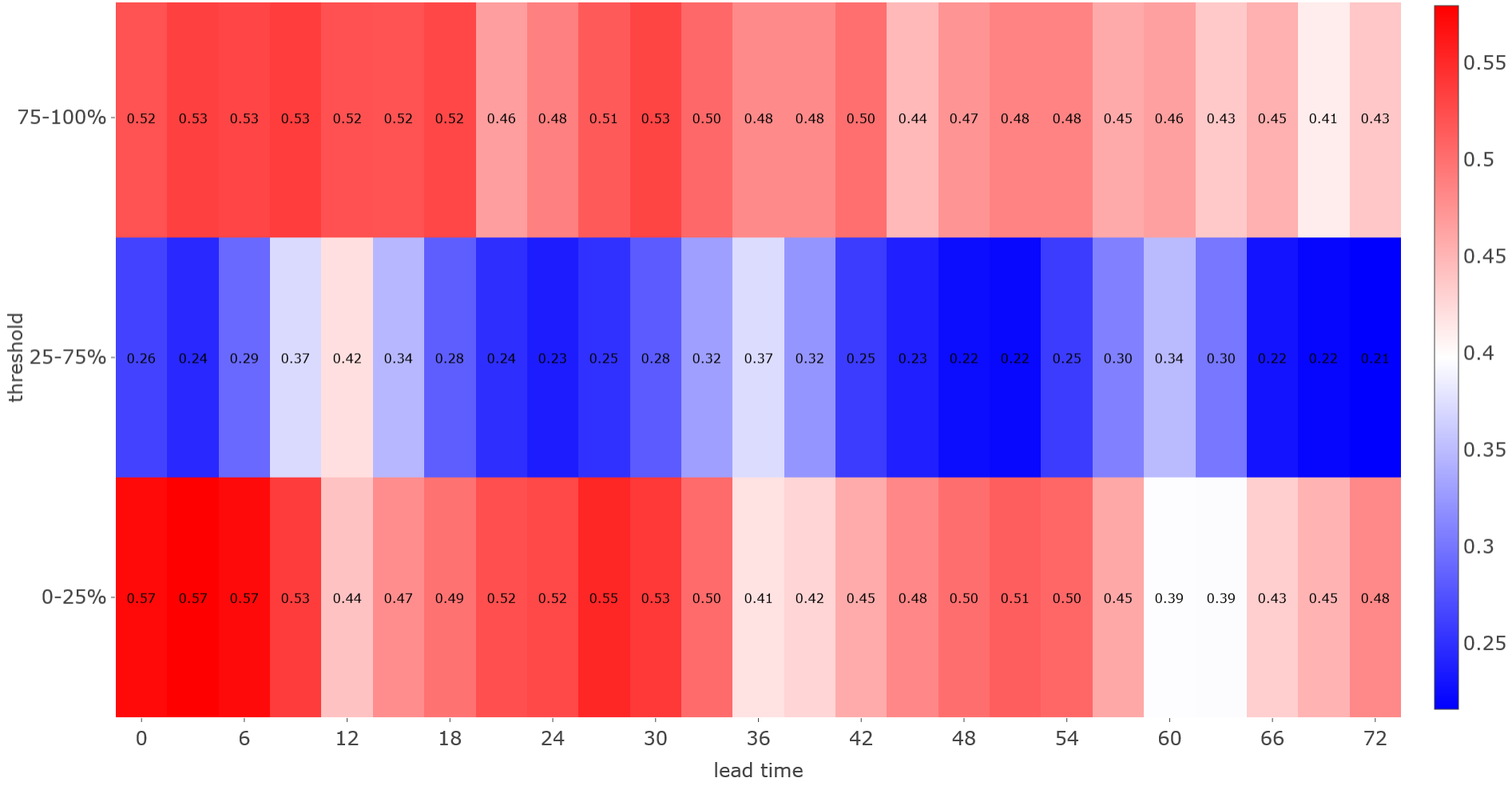
- ICON performs well. It has lower RMSE, especially after 9 hour lead time, compared to COSMO and IFS.
- Summer daytime and winter nighttime T2M RMSE is the highest for ICON. Diurnal variation underestimated.
- ICON tend to overestimate TD2M. ME and RMSE reaches maximum diurnal values during the late afternoon.
- TCC ME>0 at night (observation specifics?).
- 25-75% TCC events have lower TS. <25% and >75% TCC events are forecasted less successfully during summer, 25-75% TCC events more successfully.
- COSMO overestimates the frequency of >75% TCC (including overcast) conditions much more than ICON.
- ICON generally underestimate wind speed. All models tend to underestimate >15 m/s wind gust frequency.

CONCLUSIONS

- The common feature of overestimating low threshold precipitation frequency and underestimating high threshold precipitation frequency persists.
- Both ETS and FBI decrease for higher precipitation thresholds.
- ICON has generally higher FBI for low threshold precipitation events than COSMO: “drizzle” problem persists.
- While having better FBI, COSMO does not have better ETS than ICON: ICON has generally slightly better ETS than COSMO with similar diurnal and seasonal variation.
- ETS of precipitation events is the best during winter, the lowest score values – during summer. The worst ETS values generally occurring at 12-18 UTC, the best – at 0-6 UTC.
- COSMO-D2 has better ETS during summer than ICON and during autumn for high threshold precipitation events. ICON is still better for high precipitation events during winter and spring.

Thank you for your attention

Total cloud cover TS, Summer 2018
Common Area 1, ICON-EU



The lowest TS
for 25-75%
Total cloud cover

25-75%
Total cloud cover
underestimated