CONSORTIUM FOR SMALL SCALE MODELING

COSMO

IMS

השירות המטאורולוגי

C2I status at IMS

GM 2021

IMS team

COSMO GM September 2021

C2I Migration

COSMO

ICON-LAM

COSMO-IL-IFS
Operational

COSMO-IL-EPS
Operational

ICON-IL-SEE-IFS
Operational
1

ICON-IL-IFS-EPS
In progress
2022
2

COSMO-IL-RUC
Operational
Aging HPC

~~ICON-IL-ICON~~
~~Test~~
~~Aging HPC~~

~~COSMO-IL-CAMS~~
~~Operational~~

~~COSMO-IL-1 km~~
~~Test cases~~

ICON-IL-CAMS
test
3

ICON-IL-1.25-0.6 km
Test case
4

Operational = daily runs exposed to the forecasters

ICON-IL-SEE-IFS

- **Platform**: Time Critical Suite on the ECMWF HPC
- **Model setup:** Domain: **4-45.5E/25.5-53N**

  Resolution: **~2.5km** horizontal, 65 levels vertical

  Range: **90h**

  IC/BC: **det. IFS**

  SBU/run: **~50K**

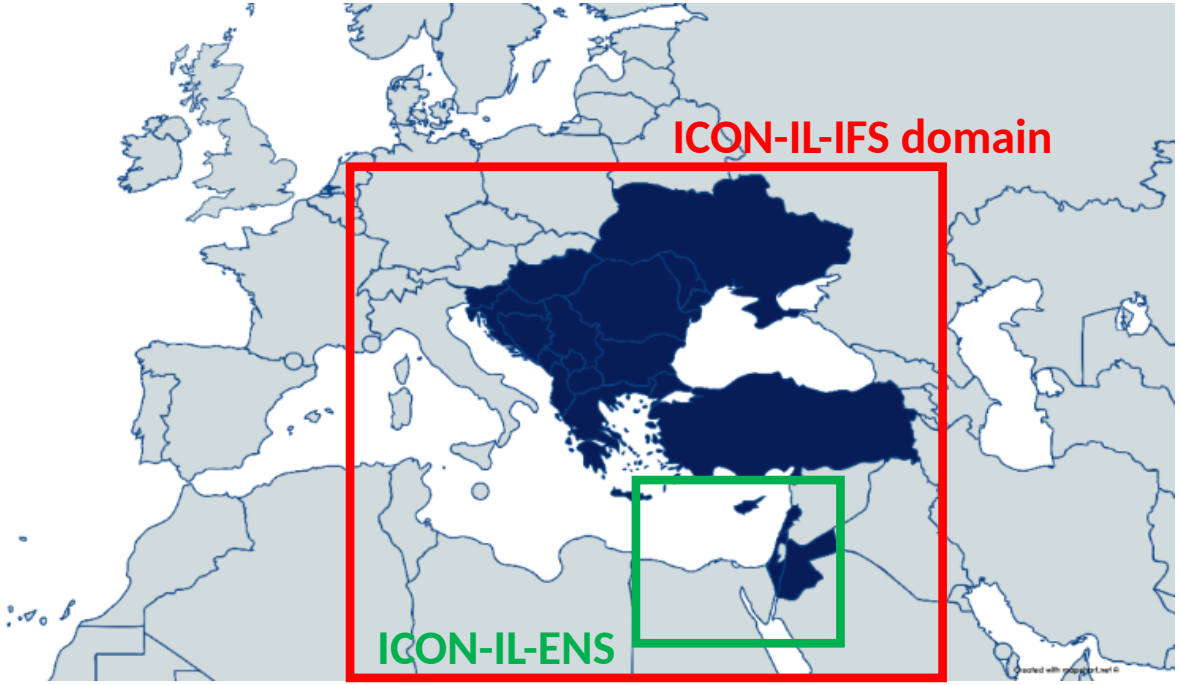
- **Oper. runs:** **2 runs/day** (00, 12 UTC)

  SBU/year: **36.5M**
  (not including runs for model tuning)

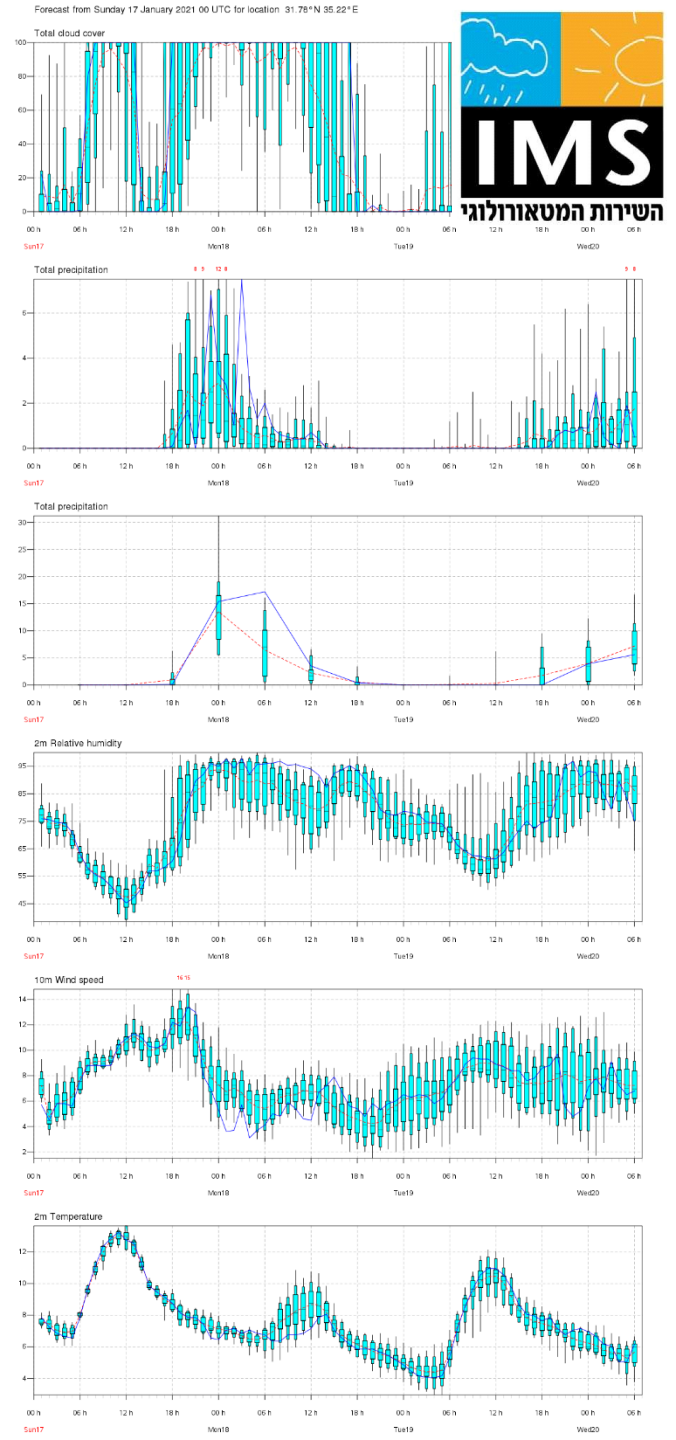
  Storage: **~150 T/year**

- **Data assimilation:** **LHN(IMS radar, Testing OPERA)**

WMO project SEE-MHEWS-A
Multi-Hazard Early Warning Advisory System for South-East Europe



Migrating COSMO-EPS to ICON-EPS

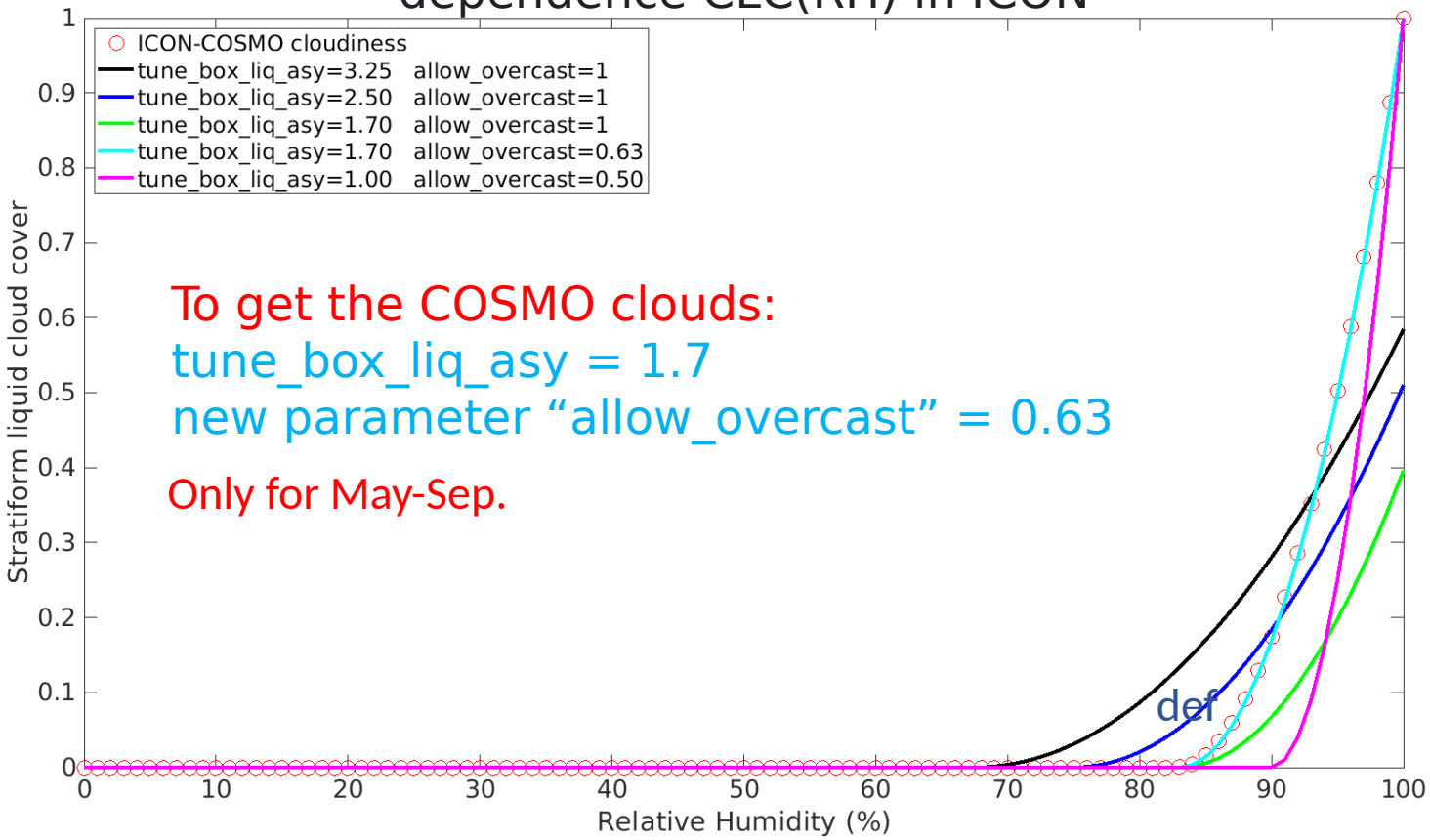


Hopefully will be ready in early 2022

- **Platform**: "Time Critical Suite" on the ECMWF HPC
- **Model setup:** Domain: **25-39E/26-36N**
- Resolution: **~2.5km** horizontal, 65 levels vertical
- Range: **90h**
- IC/BC: **20 ens. IFS + SPPT**
- SBU/run: **~100K**
- **Oper. runs:** **2 runs/day** (00, 12 UTC) in the summer to save SBUs only 00 UTC
- SBU/year: ~**65M**
- (not including runs for model tuning)
- Storage: **~250 T/year**
- **Data assimilation: LHN, (**in ICON LETKF will be tested)

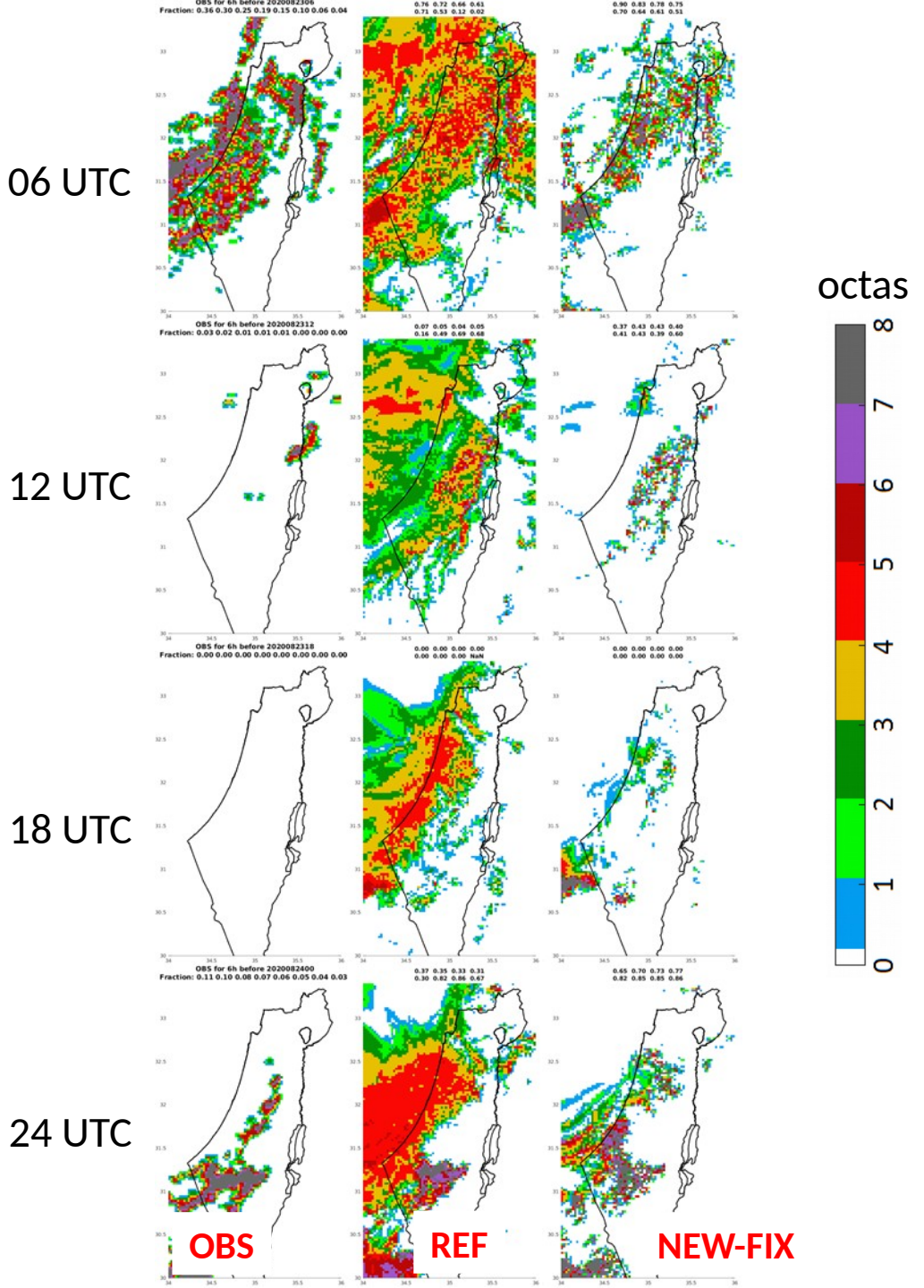
Cloud Cover verification versus Exam

20200821 + 2d



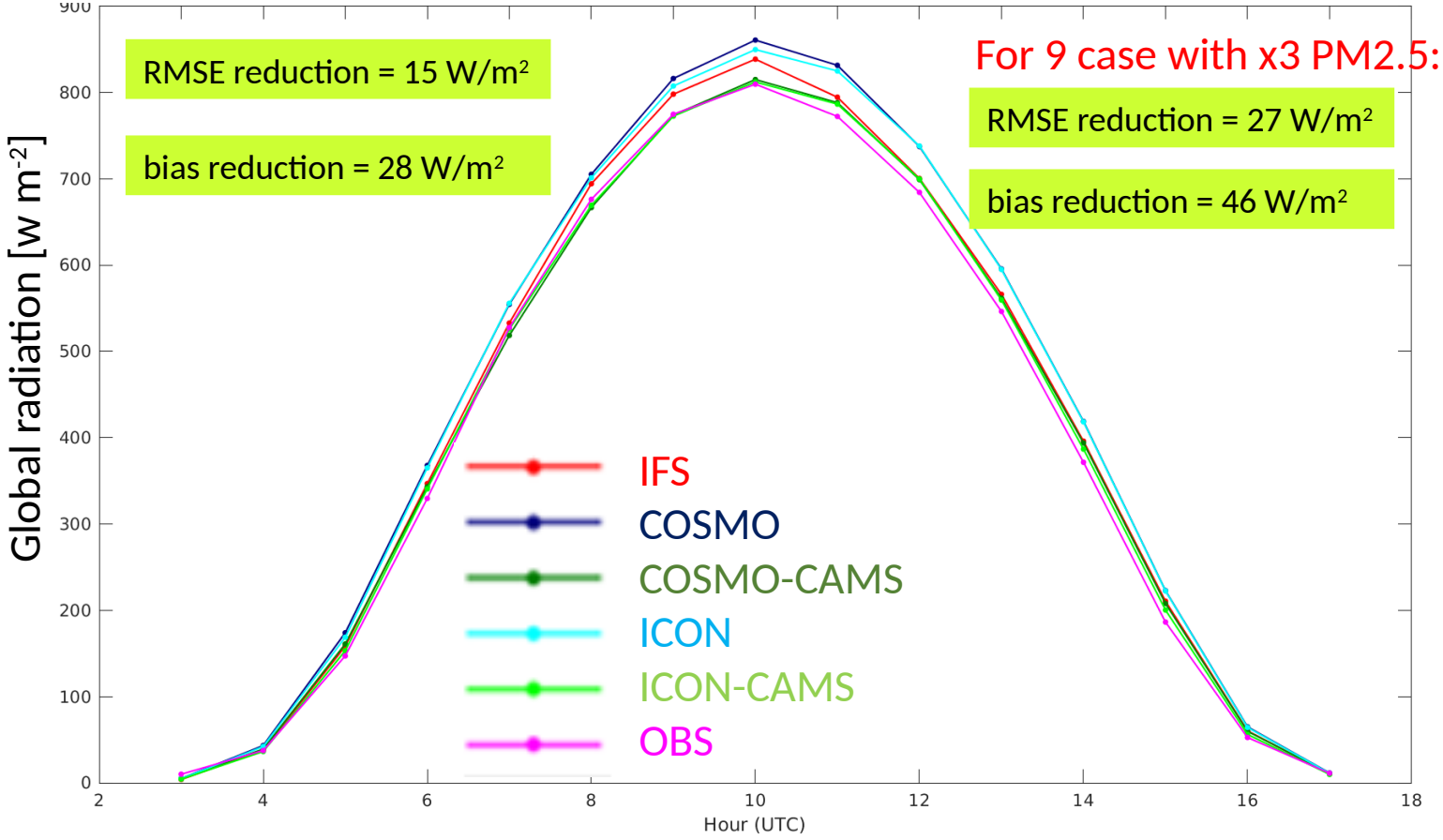
To get the COSMO clouds:
tune_box_liq_asy = 1.7
new parameter “allow_overcast” = 0.63

Only for May-Sep.

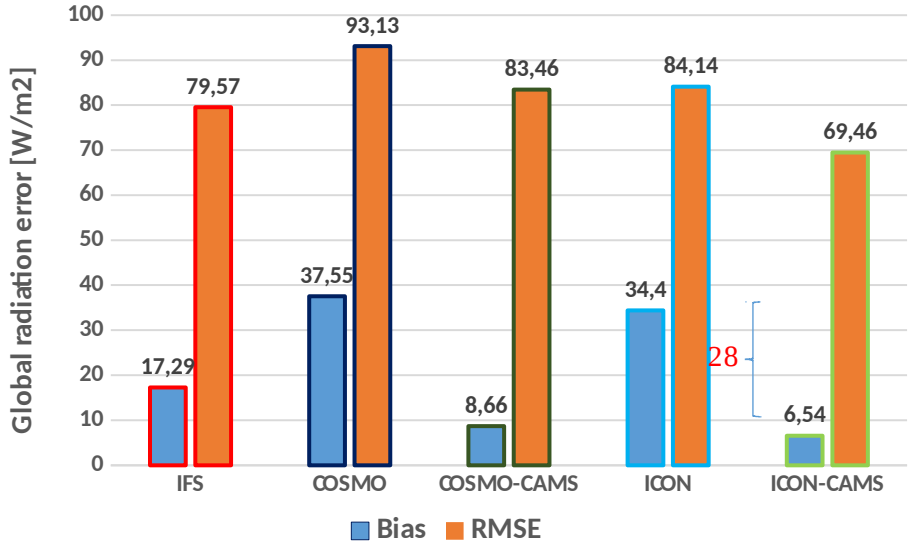


ICON-CAMS

- 28 test cases in 2020, 24 hours lead time
- When average measurements of PM2.5 all over Israel is more than x2 greater than annual average

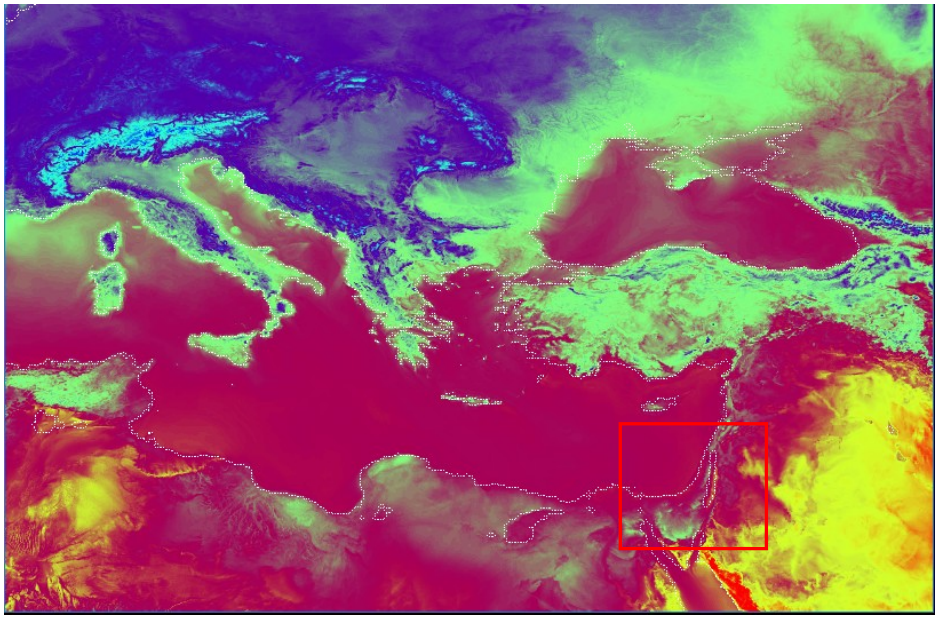


ICON is better than COSMO
ICON-CAMS is the best

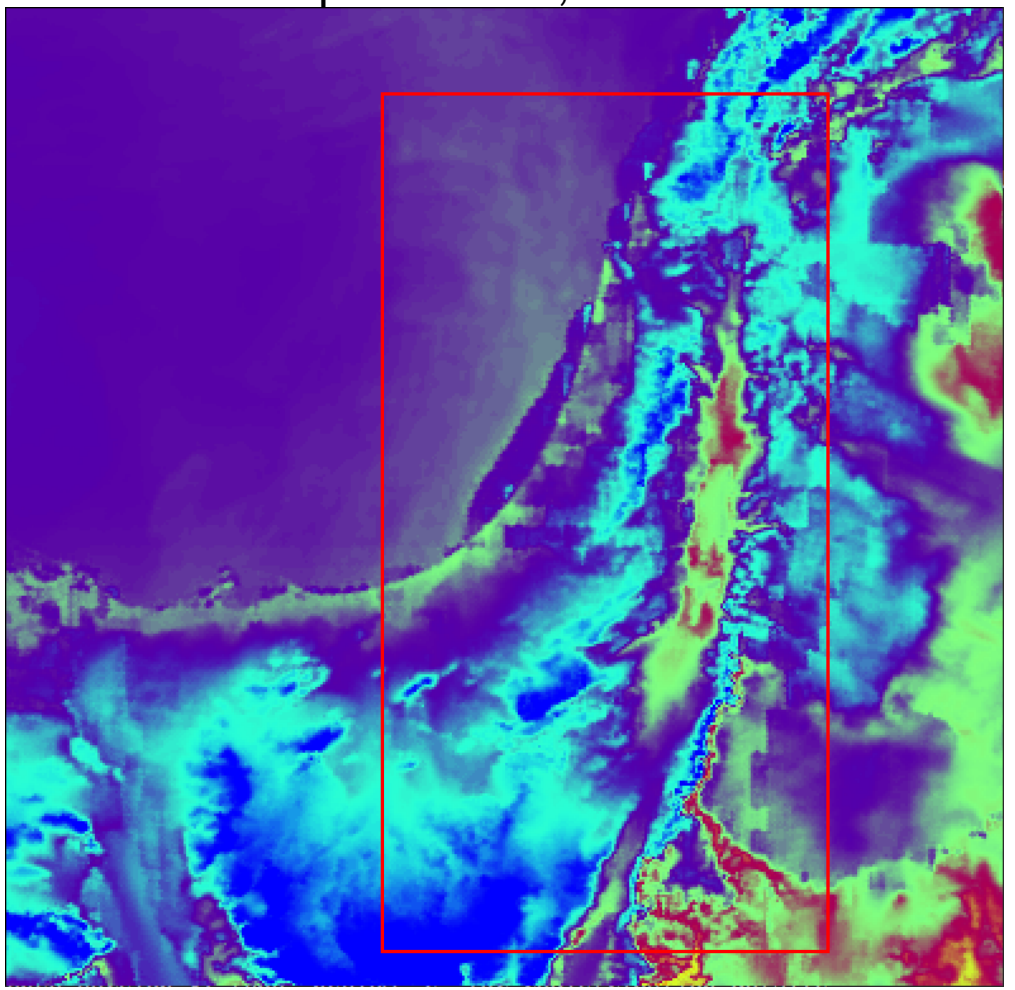


Testing ICON- 2 way Nesting

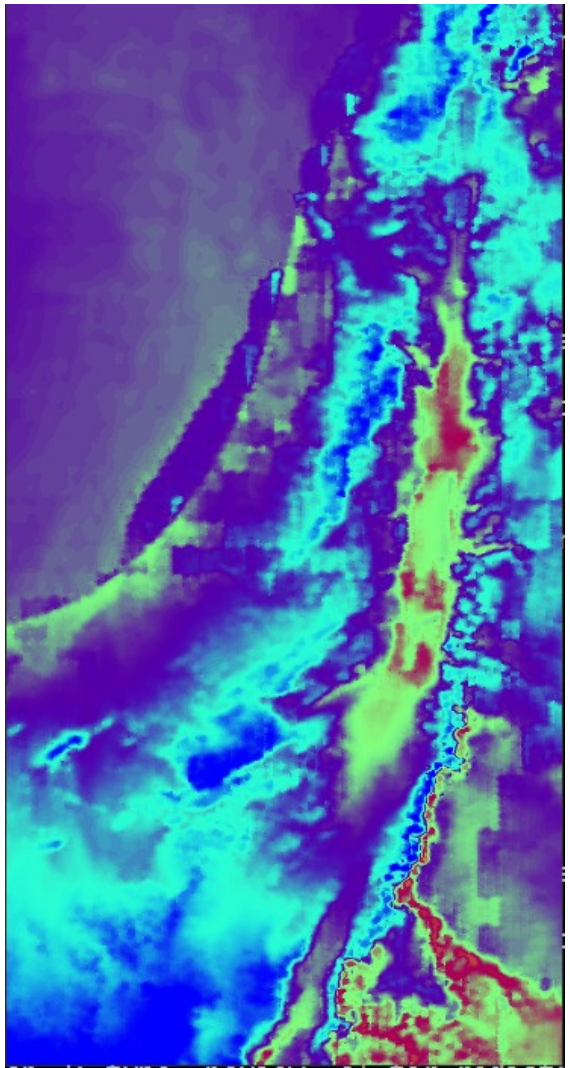
resolution = ~2.5 km
N points = 256,900



resolution = ~1.25 km
N points = 160,000



resolution = ~0.6 km
N points = 1,226,000



Shallow convection (SC) and grid scale precip.

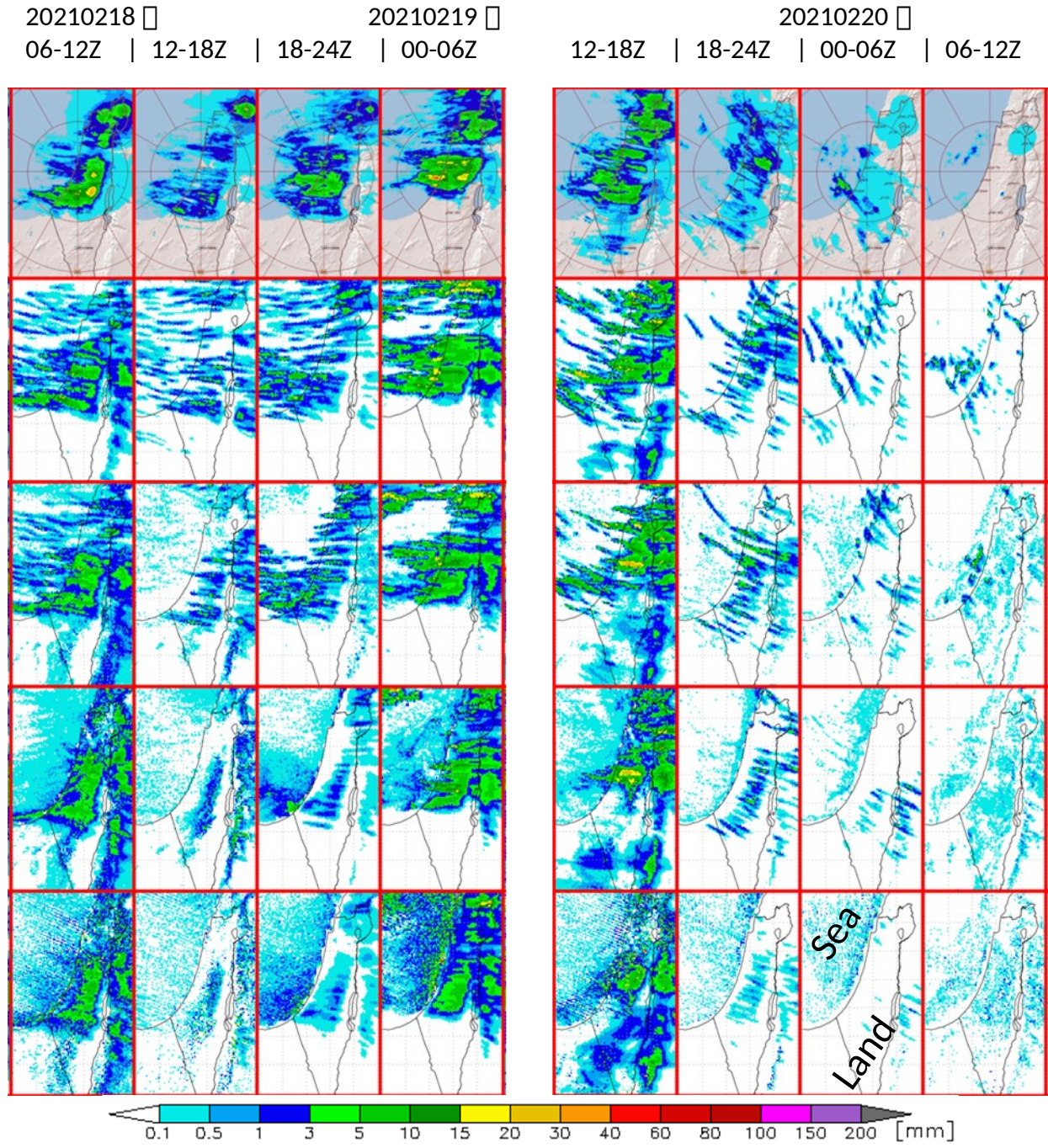
1. Reduction of maximum depth is a good solution for weak precipitation However, it “kills” SC which may have negative effect on other fields.

2. Increase of maximum depth increases SC precipitation but strongly decreases GS precipitation, leading to underestimation.

3. Stochastic SDE scheme improves the situation, still underestimating precipitation

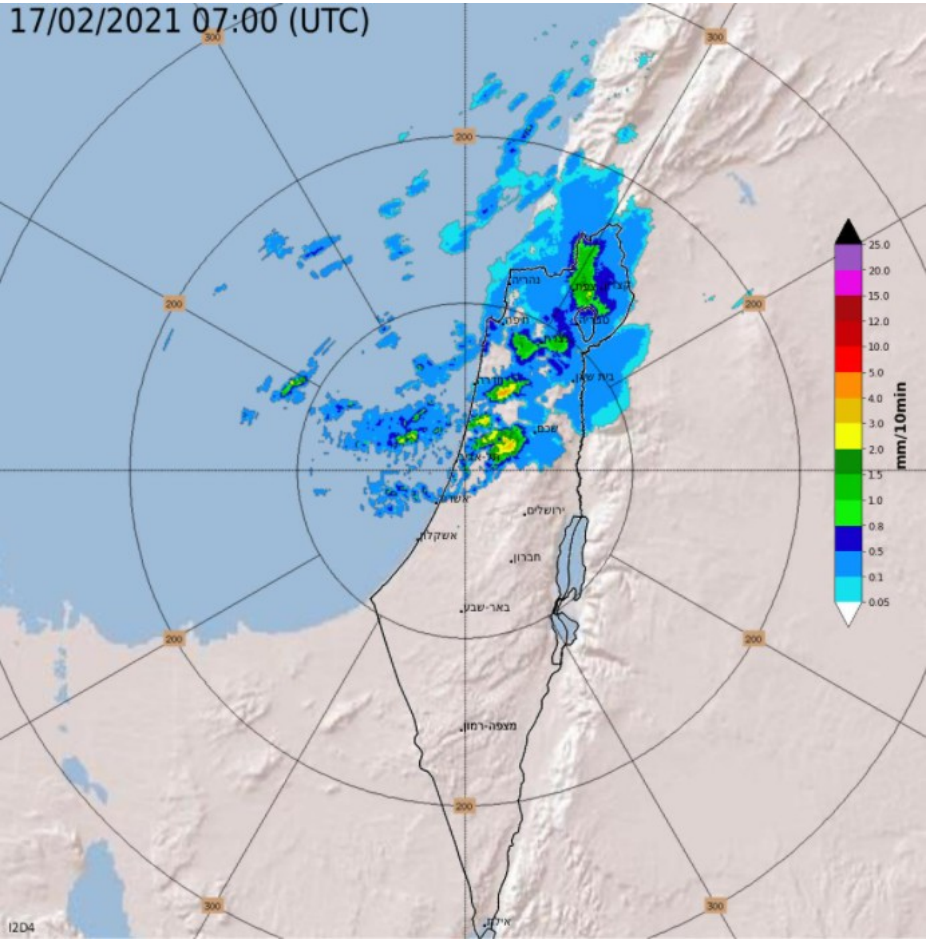
4. Strange land-sea contrast in SC precipitation

Example: 18-20/2/2021

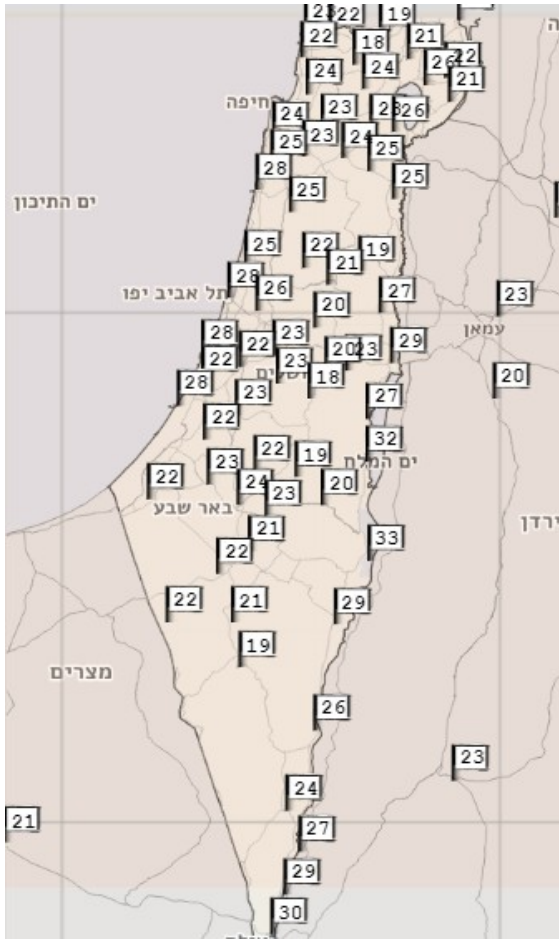


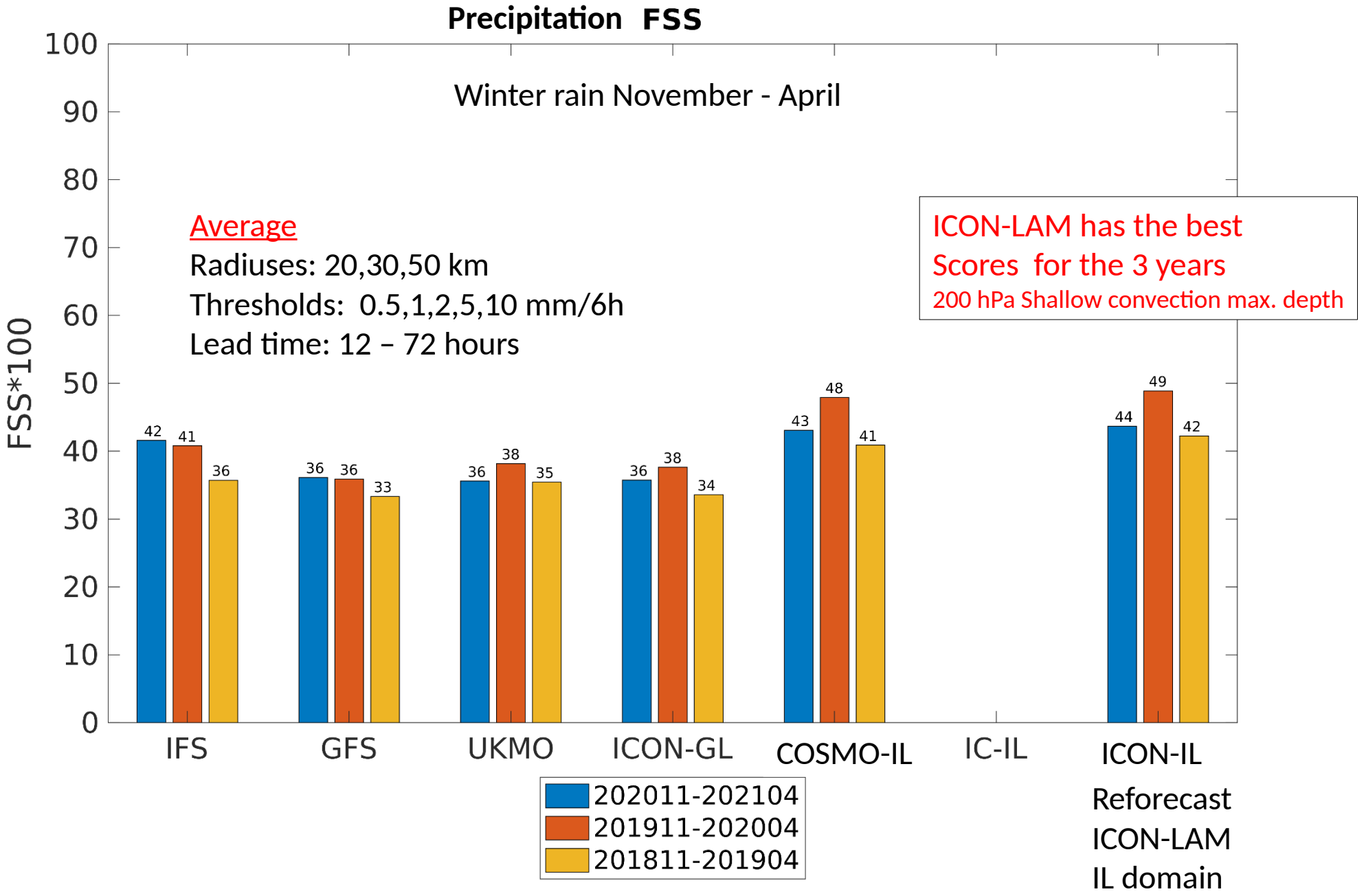
Verification over Israel

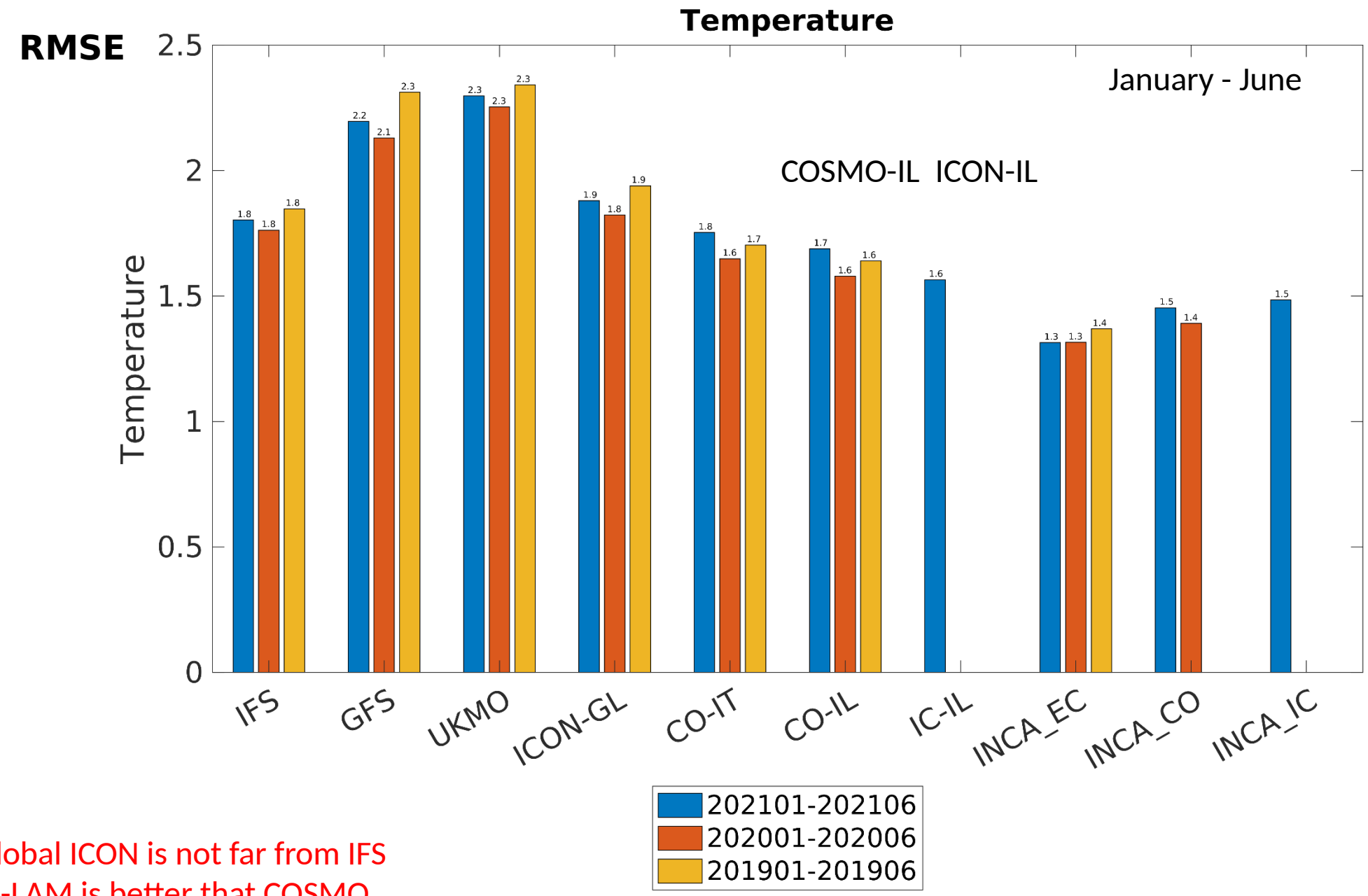
Radar composite



~ 80 meteorological stations




Precipitation FSS
Winter rain November - April
Average
Radiuses: 20,30,50 km
Thresholds: 0.5,1,2,5,10 mm/6h
Lead time: 12 – 72 hours
ICON-LAM has the best
Scores for the 3 years
200 hPa Shallow convection max. depth
FSS*100
100
90
80
70
60
50
40
30
20
10
0
42
41
36
36
36
33
36
38
35
36
38
34
43
48
41
44
49
42
IFS
GFS
UKMO
ICON-GL
COSMO-IL
IC-IL
ICON-IL
202011-202104
201911-202004
201811-201904
Reforecast
ICON-LAM
IL domain



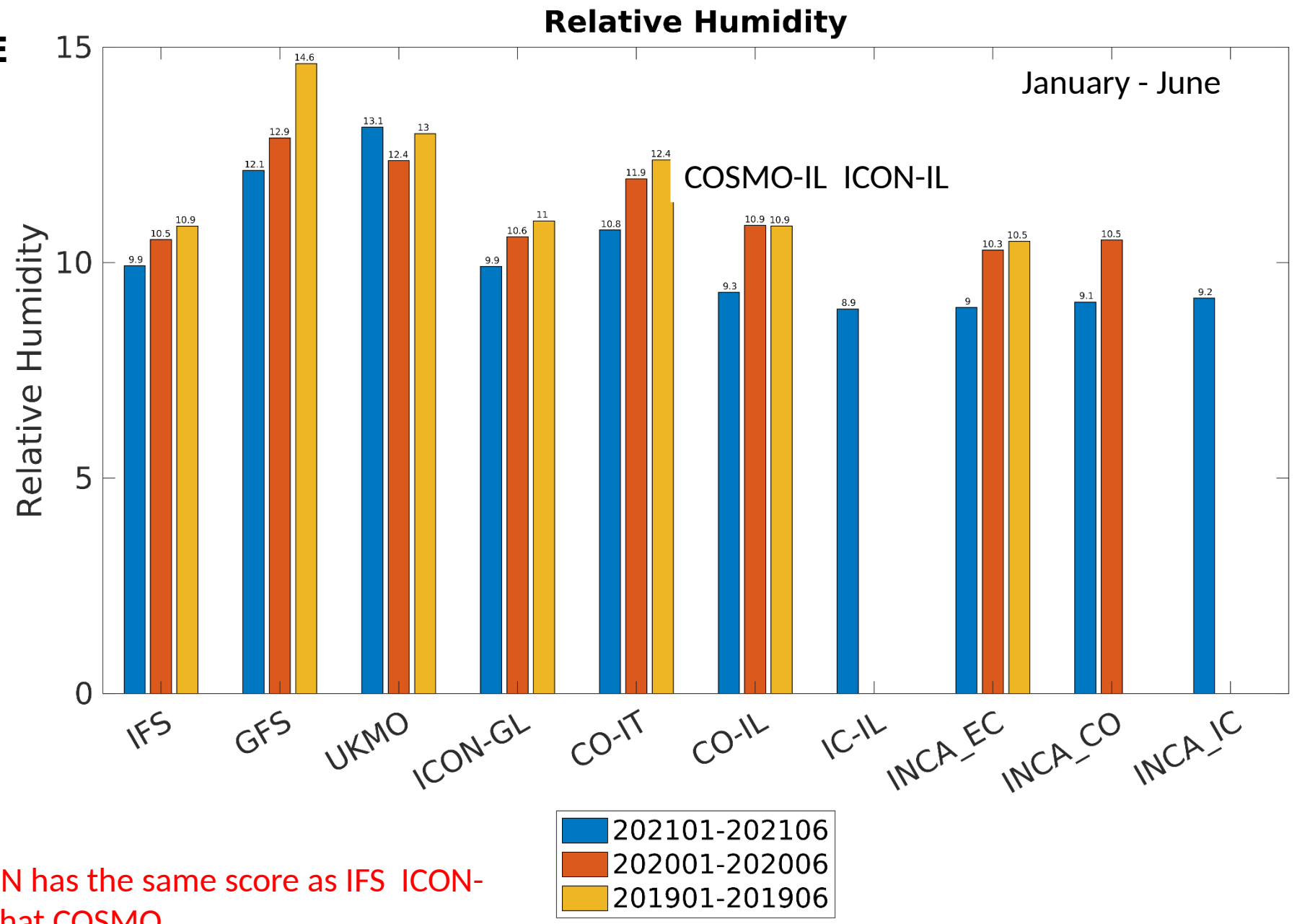
The Global ICON is not far from IFS

ICON-LAM is better that COSMO

INCA does not improve sig. the high resolution models

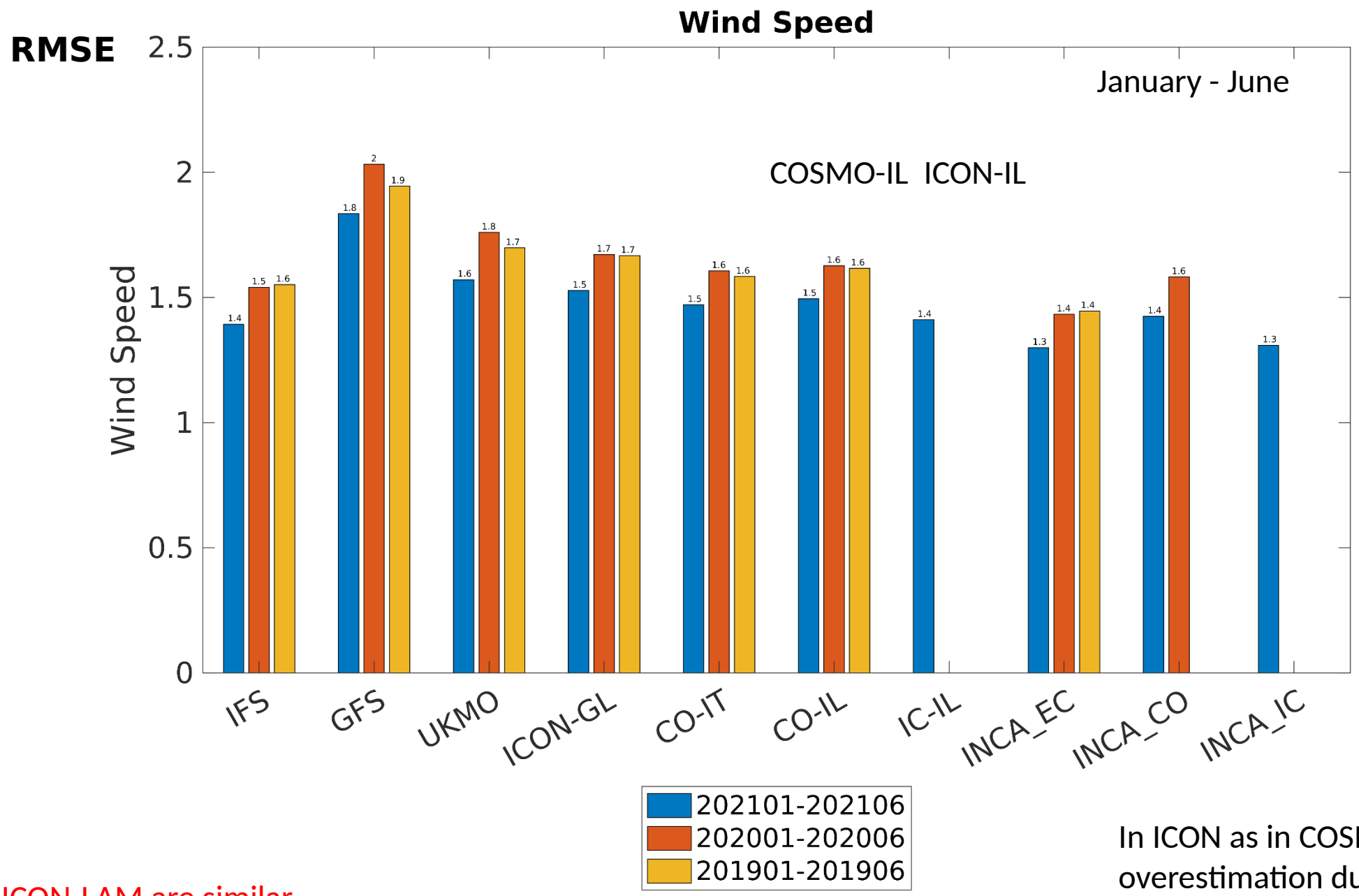
INCA- Integrated Nowcasting through Comprehensive Analysis

RMSE



The Global ICON has the same score as IFS ICON-LAM is better that COSMO

INCA does not improve the high resolution models

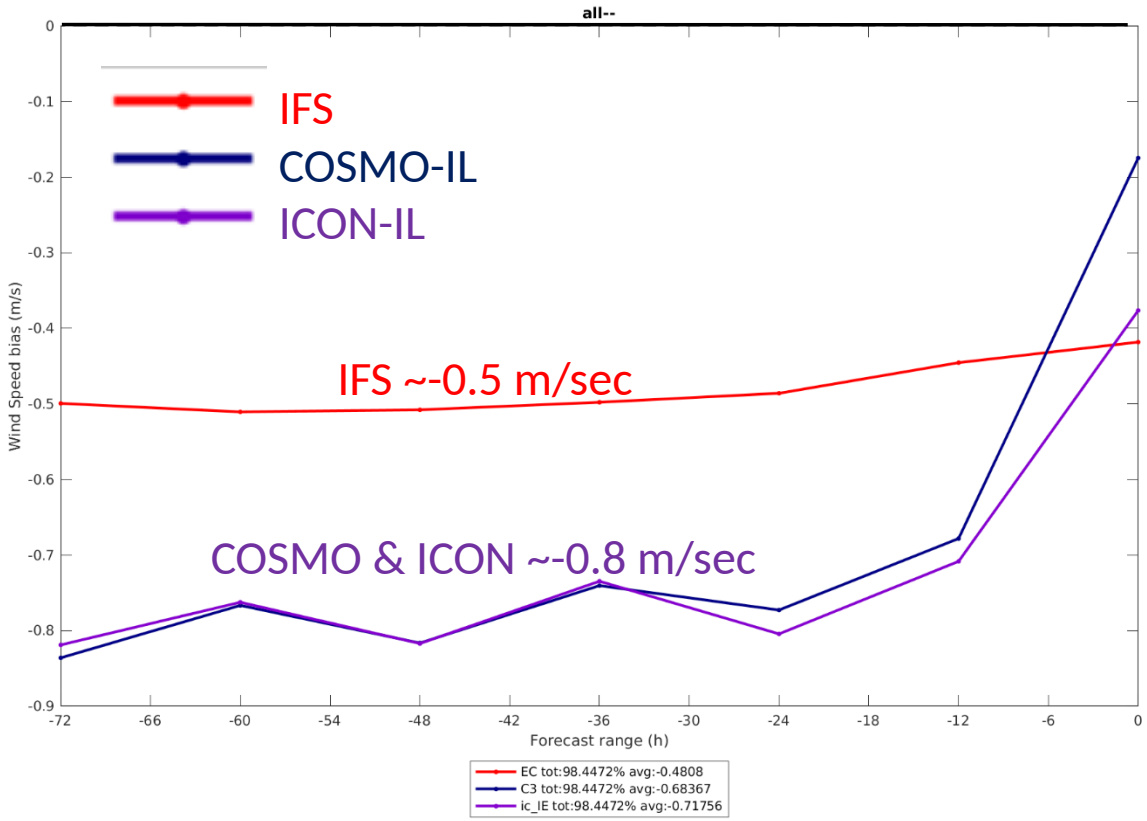


IFS and ICON-LAM are similar

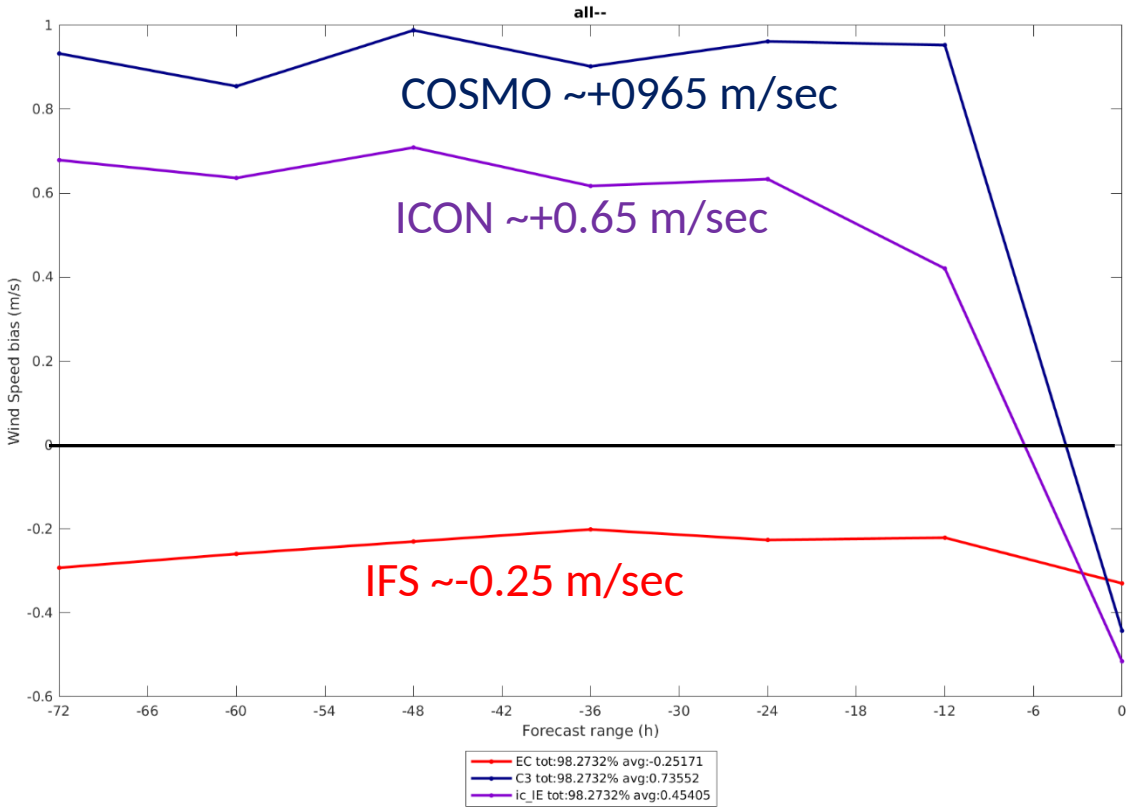
In ICON as in COSMO
overestimation during the day and
underestimation at night
SSO corrects the mean

Wind speed bias

night time (00Z) underestimation



day time (12Z) overestimation



ICON on ECMWF future Atos HPC

- Although the single Atos core is faster, the bottleneck is at core to RAM bandwidth (too many cores share the same memory access channel).
- A test that places an MPI task on every 8th core of each node and uses x8 nodes (=24) was 16% faster but costed ~8 times more.

platform	Nodes	tasks/node	threads	N tasks	time sec	SBU	Time TEMS/CCB	SBU TEMS/CCB	
CCB	10	36	2	360	370	597	1	1	reference
TEMS	3	128	2	384	424	866	1.22	1.45	with HyperThreading
TEMS	3	64	4	192	412	841	1.19	1.41	with HyperThreading
TEMS	3	64	4	192	410	837	1.18	1.40	with HyperThreading
TEMS	**3**	**32**	**8**	**96**	**396**	**809**	**1.14**	**1.35**	**with HyperThreading**
TEMS	3	16	16	48	454	927	1.31	1.55	with HyperThreading
TEMS	3	128	1	384	425	868	1.23	1.45	no HyperThreading
TEMS	3	64	2	192	874	1784	2.52	2.99	no HyperThreading
TEMS	3	32	4	96	801	1665	2.31	2.79	no HyperThreading
TEMS	3	16	8	48	793	1619	2.29	2.71	no HyperThreading
TEMS	12	32	4	384	315	2573	**0.91**	**4.31**	**Sparce runs**
TEMS	24	16	8	384	291	4753	**0.84**	**7.96**	**Sparce runs**

Best?

Still waiting for a solution - system (ECMWF, vendor) or software (ICON)

Conclusions

- ICON-LAM is proven to be better that COSMO
- Hopefully by early 2020 migrating COSMO-EPS to ICOS-EPS
- ICON-CAMS may be our next operational model.
- DA – LHN is operational, LETKF is the last goal.

- To be improved:
  - rain- define tune_rdepths to optimize shallow convection.
  - wind speed - overestimation during the day and underestimation at night
  - TEMS – find a solution for efficient ICON runs on the new Bologna computer

ims.gov.il/en/ModelMaps

Our new website

IFS - ECMWF | ICON - IL | COSMO - IL

Model Run Time:

03/09 12Z

Domain:

South East Europe

Category:

Surface

Map Type:

3 hr Precipitation

This maps shows in shades the accumulate precipitation amount (in millimeters) during the previous three hours.

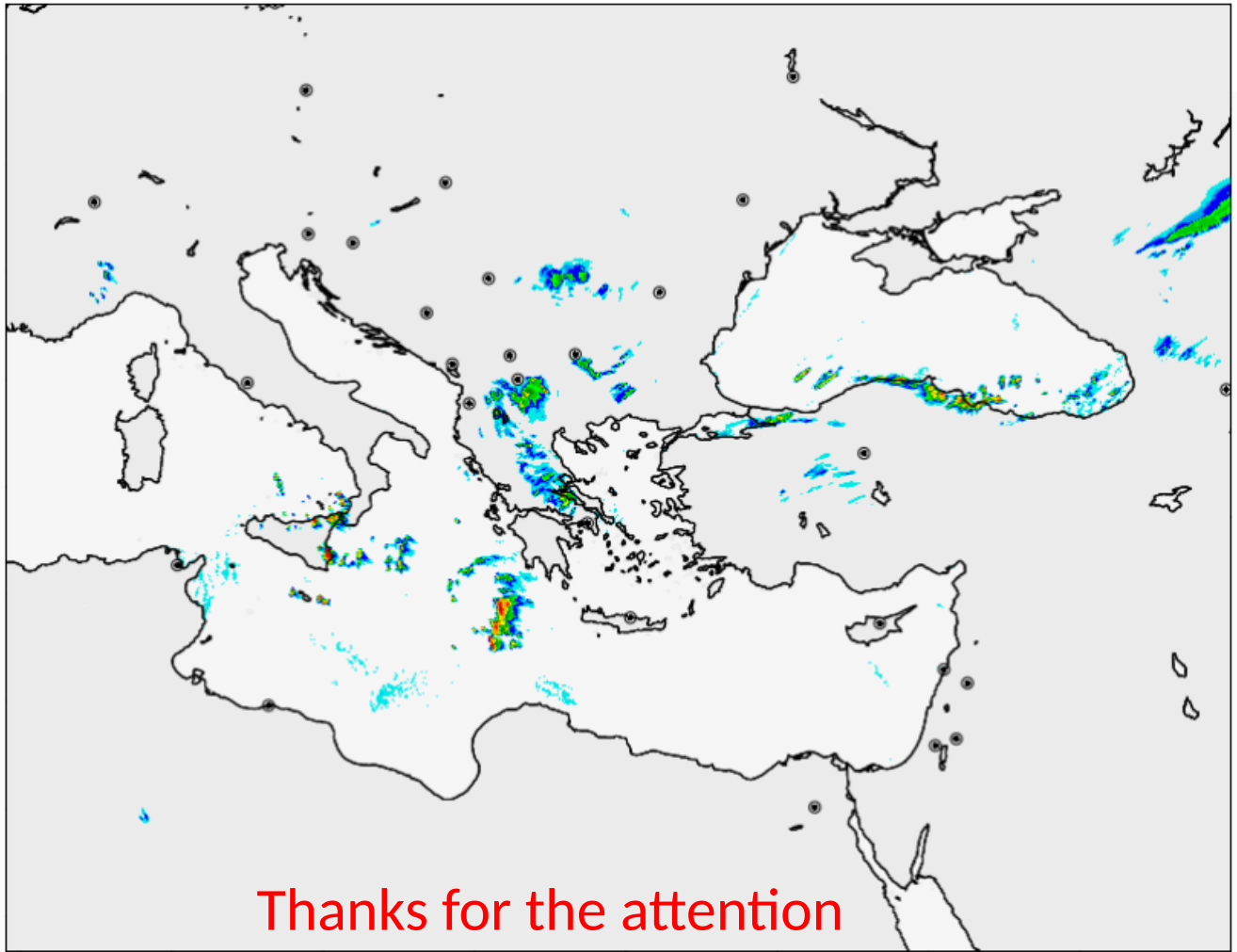
For further information on the presented models:

IFS - European Model

COSMO/IL - Regional Model

ICON/IL - Regional Model

06/09 06Z (+66h)



Precipitation (mm/3hr)

200
150
100
80
60
40
30
20
15
10
5
3
1
0.5
0.1
0