SPECIAL PROJECT PROGRESS REPORT

All the following mandatory information needs to be provided. The length should *reflect the complexity and duration* of the project.

Reporting year	2024
Project Title:	ICON NUMERICAL WEATHER PREDICTION METEOROLOGICAL TEST SUITE
Computer Project Account:	SPITRASP
Principal Investigator(s):	Rodica Dumitrache (NMA,Romania) [1] Enrico Minguzzi (Arpae-SIMC, Italy)[2]
Affiliation:	National Meteorological Administration (NMA) [1] Regional Agency for Prevention, Environment and Energy of Emilia-Romagna – Hydro-Meteo-Climate Service (Arpae-SIMC) [2]
Name of ECMWF scientist(s) collaborating to the project (if applicable)	Umberto Modigliani and his staff, Andrea Montani
Start date of the project:	2024
Expected end date:	2026

Computer resources allocated/used for the current year and the previous one

(if applicable)

Please answer for all project resources

		Previous year		Current year	
		Allocated	Used	Allocated	Used
High Performance Computing Facility	(units)	5 000 000	3 247 445 (~65%)	7 500 000	NMA – 373 490
Data storage capacity	(Gbytes)	6 000	27 000	6000	30 000

Summary of project objectives (10 lines max)

The ICON Numerical Weather Prediction Test Suite Special Project continues the activities started in the previous three special projects, therefore ensuring the usage of a homogeneous verification platform for both versions of ICON model. This is meant as a benchmark in order to evaluate new versions of the model against exiting operational ones, prior to their official release. The aim of using this type of controlled approach for standardized testing and verification is to ease the comparison of corresponding model versions (operational against new), in an effort to assess the impact of new features introduced in the code. The set-up and configuration of the model versions will focus on minimising initial and lateral boundary conditions effect, also eliminating the data assimilation system. Through this approach, performance of each new model version can be thoroughly tested, with an emphasis on newly introduced code developments.

Summary of problems encountered (10 lines max)

No problems encountered.

Summary of plans for the continuation of the project (10 lines max)

The detailed guidelines for the proper use and execution of each NWP test using the Atos platform prepared during previous special projects related to this activity will be revised considering the ICON model and corresponding model configurations. A detailed description of all steps will be included, from the compilation of a new ICON model test version to the final production of the graphics for the statistical scores extracted. Activities (including use of resources) consist in evaluating ICON versions v.265 and v.261, as well as maintenance of the Test Suite.

List of publications/reports from the project with complete references

I. Cerenzia, E. Minguzzi – *"NWP ICON Test Suite"*, WG6 – NWP Test Suite Meeting, videoconference, 20 January 2023

M. Milelli and colleagues - "*WG6 News about our activities*", The 24th COSMO General Meeting, Athens, Greece, 12 - 16 September 2022

F. Gofa - "*Overview of activities*", The 24th COSMO General Meeting, Athens, Greece, 12 - 16 September 2022

I. Cerenzia, E. Minguzzi – *"NWP ICON Test Suite"*, The 24th COSMO General Meeting, Athens, Greece, 12 - 16 September 2022

Summary of results

Project activities were concentrated on running and testing the ICON test suite running on the Atos HPC . These activities include:

- Running of the ICON Test Suite to the Atos system (model configuration and integration, processing of model output for production of feedback files)
- Running of the MEC system for production of feedback files
- Running of the FFV2 (previously Rfdbk) package dedicated to the calculation of statistical scores.

Phase I: Set-up of the ICON model

Configuration of the ICON-LAM test suite followed that employed in previous years for the COSMO Test Suite.
For every experiment (ie. for every Icon version), simulations were carried out for the same one-month periods, one in winter and one in summer. Starting from 2023, it was chosen to use July and December 2021 (July and December 2017 were used for previous experiments). The integration domain was slightly reduced at the south boundary
For each month, a continuous 31 days forecast was produced, forced with analysed boundary conditions ("hindcast mode"). For technical reasons, the forecasts were restarted every 5 days, but this has no effect of the continuity of the simulations.
This document describes the results of two experiments, that use Icon versions 2.6.1 and 2.6.5.1

Phase II: Configuration and Execution of ICON-LAM Runs

Icon-LAM configuration

The main simulation settings were the same for the two experiments:

- horizontal resolution: 2.5 km (R2B10; 1,997,000 cells). The integration domain is show in Figure 1
- vertical resolution: 65 levels
- Initial and lateral boundary conditions by ECMWF HRES analysis and forecast (at 03, 09, 15, 21UTC, with 3 hours forecast-range)
- time step 24"
- soil variables initialized from ICON-EU, then free soil
- SST and sea ice fields updated every 24 hours from the IFS analysis.

There were however significant differences in model setup between the two experiments: Icon version 2.6.1 required a specific configuration to compensate for a bug that was corrected in version 2.6.5, while in the latter experiment the optimal model configuration was restored.
The main differences in model configuration between the two experiments are summarised in table 1.

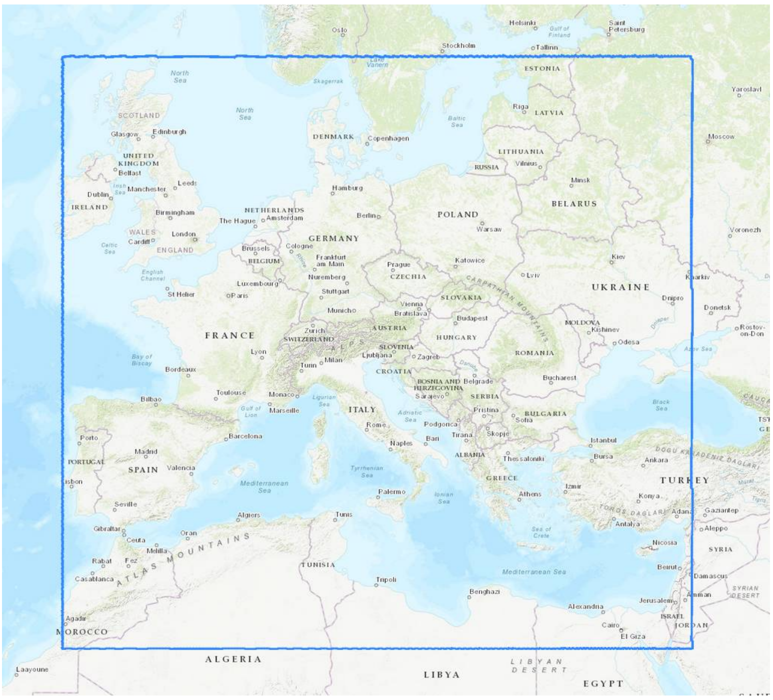


Fig. 1 Integration domain for the ICON-LAM model at 2.5km horizontal resolution.

Keyword	2.6.1 (old)	2.6.5 (new)
icpl_turb_clc	1	2
max_calibfac_clcl	-	2
itune_gust_diag	-	3
direct_albedo_water	4	3
albedo_whitecap	0	1
rat_sea	7	0.8
frcsmot	0.2	0
alpha1	0.75	0.125
rlam_heat	1	10

Keyword	2.6.1 (old)	2.6.5 (new)
itype_lwemiss	1	2
itype_vegetation_cycle	1	2
exner_expol	0.333	0.6
inwp_radiation	1	4
tune_zvz0i	1.25	0.85
tune_box_liq	0.05	0.04
tune_rhebc_land	0.75	0.825
tune_rcucov	0.05	0.075
tune_box_liq_asy	3.5	4

Table 1: Icon-LAM configuration differences between experiments 2.6.1 and 2.6.5.1

Model output in unstructured grib2 format is stored on the permanent storage of the ECMWF (ECFS). The model output (hindcast) includes the following variables:

Type of level	Number of fields	variables
Mean sea level	1	PMSL
Surface	38	……..
Soil	35	T_SO, SMI, W_SO, W_SO_ICE, RUNOFF_S, RUNOFF_G
Height above ground	8	T2M, TD_2M, RELHUM_2M, U_10M, V_10M. VMAX_10M, TMAX_2M, TMIN_2M
Top	2	ASOB_T, ATHB_T
IsobaricLayer	3	CLCL, CLCM, CLCH
Model layer	585 (9*65)	U,V,T,P,QV,QC,QI,QR,QS
Model level	132 (2*66)	W, TKE

Apart from this, a file containing information regarding constant model parameters is also produced. This file include the following parameters:

Type of level	Number of fields	variables
Surface	9	HSURF, lsm, DEPTH_LK, fldfrc, LAI, vegetation, ROOTDP, SOILTYP, sdsgso
GeneralVertical	66	HHL

For the ICON-LAM simulations on Atos, the following options for compiler and scheduler were employed:

Modules used to compile the model:

- prgenv/intel
- intel/2021.4.0
- hpcx-openmpi/2.9.0
- hdf5/1.10.6
- netcdf4/4.7.4
- ecmwf-toolbox/2021.12.0.0
- intel-mkl/19.0.5

Compiler flags:

- CC=mpiicc
- FC=mpif90
- CFLAGS='-gdwarf-4 -O3 -qno-opt-dynamic-align -ftz -march=native -fp-model=precise
- ICON_FCFLAGS='-O2 -assume realloc_lhs -ftz -fp-model=precise'
- BLAS_LAPACK_LDFLAGS='-lmkl_gf_lp64 -lmkl_sequential -lmkl_core'
- ICON_ECRAD_FCFLAGS="-D__ECRAD_LITTLE_ENDIAN"
- EXTRA_CONFIG='--disable-ocean --enable-grib2 --disable-coupling --enable-ecrad --enable-openmp --disable-jsbach --enable-mixed-precision'

Slurm options for Icon execution (flags for #SBATCH):

- --qos np
- --account=spitconv
- --ntasks=576
- --cpus-per-task=1

- --hint=nomultithread
- --mem-bind=local

The following experiments were either performed or are expected to be run on Atos :

ICON-LAM version	**Simulation period**	**Set-up on Atos**	**Status**
2.6.1	July 2017, December 2017	direct nesting in IFS (configuration R2B10)	finished
2.6.5.1	July 2017, December 2017	direct nesting in IFS (configuration R2B10)	finished
2.6.5.1	July 2021, December 2021	direct nesting in IFS (configuration R2B10); new simulation period; new topography (Merit); updated namelists (radiation scheme ECRAD); new soil initial conditions (ICON-EU); slightly smaller domain; revision of ecflow suite	finished
2.6.6	July 2021, December 2021	Same as previous.	expected

Phase III: Model Output Verification

The Model Equivalent Calculator (MEC) software for the production of Feedback Files, and verification scripts based on the R package FFV2 were implemented and available on the ATOS system. The production of feedback-files using MEC is performed on the **Atos HPC machine** (which is also used for the model runs) and employs part of the available billing units. The FFV2 package and model output verification procedures are performed on the **ECS** interface. The conversion of observations from bufr to netcdf format (using *bufr2netcdf*) can also be performed on the **ECS** interface. The current operational bufr2netcdf version used on the Atos machine is **2.13 (precompiled using gcc).**
The verification procedure includes the conversion of observations from bufr to netcdf format (using *bufr2netcdf*), pre-processing of model output in grib format for ingestion in MEC, processing model output and corresponding observations to obtain feedback files (MEC), execution of verification procedures (FFV2) and transfer and visualization of results on the COSMO shiny server.
The verification system is based on the use of Feedback files, that hold information on observations and their usage in the data assimilation system and are available for for several observation systems. They are produced by MEC and ingested in FFV2, that uses them to compute the verification scores. The production of Feedback files and verification procedures are based on observations datasets available from the MARS database and converted from bufr to NetCDF format locally.

MEC characteristics and requirements:

- <u>IO specifications</u>
- model in Grib2 format – COSMO or ICON-LAM
- parameters - PS, T, U, V, P, Q (mandatory, all model levels); T2M, TD2M, CLC, CLCT, CLCL, CLCM, CLCH, CLC, H_SNOW, TOT_PREC, VMAX_10, TMIN_2M, TMAX_2M
- observations (CDFIN: BUFR converted by bufrx2netcdf to NetCDF)
- output: feedback files, NetCDF feedback files including all forecasts valid at the time of observation.

- The current operational **MEC version** used on the Atos machine is V2_20, compiled using the hpcx-openmpi/2.9.0 environment module.In order to run the MEC processing chain, the following steps were implemented on the Atos machine:
- pre-processing of model output files stored on ECFS: model output files stored as grib2 files containing 24 time steps each are split into either hourly or three hourly files (depending on user needs); for each time step, two types of such files are produced:
  - files containing parameters on model layer, model level, isobaric level and parameters on fixed levels (height above ground), such as temperature, wind components, mean sea level pressure, cloud cover and so on.
  - files containing accumulated parameters: precipitation, 10 meter wind gust, maximum and minimum 2 meter temperature.
- preparation (creation and linking) of input files required by MEC: constant files produced by the model, model grid file description, forecast files, observations
- set -up of MEC namelist file and run scripts
- production of feedback-files using MEC
- The MEC tests were submitted/run using the following **resource configuration**:
- #SBATCH --qos=np
- #SBATCH --nodes=8
- #SBATCH --ntasks-per-node=64
- #SBATCH --cpus-per-task=4
- #SBATCH --threads-per-core=2
- #SBATCH --hint=multithread
- #SBATCH --contiguous
- #SBATCH --mem-bind=local
- #SBATCH –mem=16384

The costs for producing a month of feedback files for one model configuration (including pre-processing of model output files) is around 200 000BUs. The total resources for MEC and FFV2 used for this project is 373,490 SBU after running 2 months of 2 model configurations.

The objective verification using the FFV2 package is performed through grid-to-point comparisons that provide a correspondence between gridded surface and upper-air model data to point observations. Statistical scores will be computed for each period of interest, taking into account all observations available in the integration domain. However, results can be further on obtained for different station stratifications or subdomains, depending on developer and user requirements.

FFV2 characteristics and requirements:

- R interface for ICON feedback files
- main purpose of is to load feedback file content with R
- additional functionalities useful for verification implemented as well
- namelist based verification scripts using FFV2 do the verification

Installation

Sources: R language

Dependencies: NetCDF library and R with additional R packages: sp, rgeos, parallel, data.table, SpecsVerification, matrixStats, RNetCDF, stringr, survival, grid, verification, reshape2, pcaPP

- input - feedback files obtained previously with MEC - one file for each validity date and observation type

The selected NWP suite stations are situated in an area covering -25/24/65/65 (W/S/E/N) and are around 3200. Due to the specifications of the verification system for hindcast runs (single run), +24 hours lead time is shifted to 0. The verification modules for testing the two versions of the ICON model include *surface continuous parameters, precipitation verification (6h and 12h)* and *upper air verification (TEMP based)*, as follows:

- 2m temperature (T2M), 2m dew point (TD2m), 10 meter wind speed (FF), total cloud cover (N), surface pressure (PS): mean error (ME), root mean square error (RMSE), mean absolute error (MAE), standard deviation (SD), R^2, TCC (tendency correlation), LEN (number of observations used), OMEAN and FMEAN (observed and forecast mean), etc.;
- precipitation for selected thresholds (greater than 0.2, 0.4, 0.6, 0.8, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 16, 18, 20, 25, 30): probability of detection (POD), false alarm rate (FAR), equitable threat score (ETS), frequency bias (FBI), Performance diagrams, etc.
- upper air temperature (T), relative humidity (RH) and wind speed (FF) for selected pressure levels (250., 500., 700., 850., 925., 1000.): BIAS, MAE, RMSE, SD, etc.

The steps followed for the MEC/FFV2 verification procedure are listed below:

- conversion of observations from bufr to netcdf format (using *bufr2netcdf*) – previously performed by ARPAE colleagues
- pre-processing of model output in grib format for ingestion in MEC
- processing model output and corresponding observations to obtain feedback files (MEC)
- execution of verification procedures (FFV2)
- transfer and visualisation of results on the COSMO shiny server

The verification was performed with grid-to-point comparisons in order to compare gridded surface and upper-air model data to point observations, similar to the VERSUS verification procedures employed for previous model versions. The selected NWP suite stations are situated in an area covering **-25/24/65/65 (W/S/E/N)** and are around **3200** for this stratification (see figure 2). Suspect observation values had been previously created for each parameter (forecast-observation greater than a specific limit are excluded) and included in the verification test in order to eliminate errors that are connected with observations. Due to the requirements of MEC software, all observations are previously converted in netcdf format with the bufr2netcdf software.

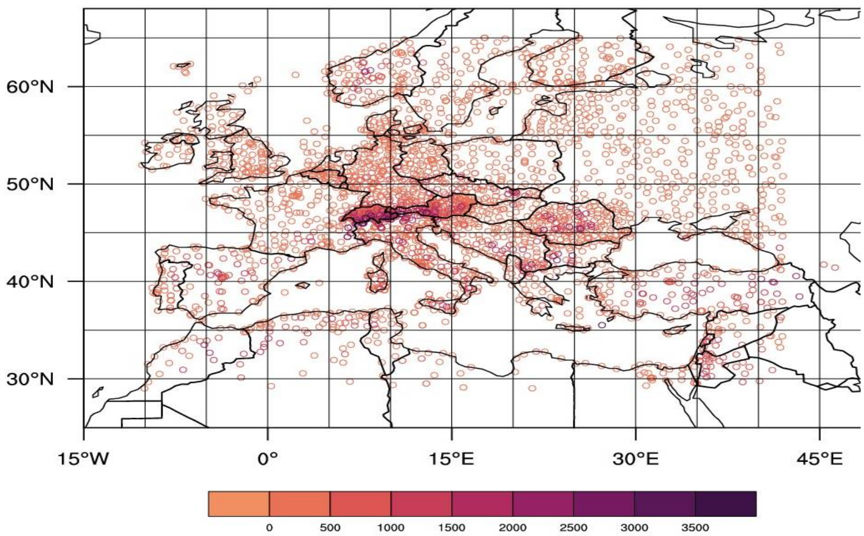


Fig. 2 Location of meteorological stations used for the verification.

The verification modules for testing ICON v2.6.1 and ICON v2.6.5 are the following:

- **surface continuous parameters:** 2m temperature (T2M), 2m dew point (TD2m), 10meter wind speed (FF), total cloud cover (N), surface pressure (PS): mean error (ME), root mean square error (RMSE), mean absolute error (MAE), standard deviation (SD), R^2, TCC (tendency correlation), LEN (number of observations used), OMEAN and FMEAN (observed and forecast mean);

- **precipitation verification** (6h, 12h) for selected thresholds (greater than 0.2, 0.4, 0.6, 0.8, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 16, 18, 20, 25, 30): probability of detection (POD), false alarm rate (FAR), equitable threat score (ETS), frequency bias (FBI), Performance diagrams, etc.
- **upper air verification (TEMP based):** temperature (T), relative humidity (RH) and wind speed (FF) for selected pressure levels (250., 500., 700., 850., 925., 1000.): BIAS, MAE, RMSE, SD, etc.

VERIFICATION RESULTS

The verification results presented in the following section (figures 3-20) are a sample of the derived statistics, with a complete overview of all the statistical analysis (graphs and numbers) available at: http://www.cosmo-model.org/shiny/users/fdbk/ (user fdbk).
Note: *Verification was performed taking into account all configurations of the analysed models. This allowed for a full comparison between all configurations, thus additional comparisons to the ones presented below are also available.*

The verification results were performed for the months of July and December 2021. The statistical results are presented in Annex I for surface parameters, Annex II for precipitation and Annex III for upper air parameters.

Note: *Due to the specifications of the verification system for hindcast runs (single run), +24 hours lead time is shifted to 0.*

3.1 Continuous Surface Parameters

2m Temperature (Fig.3): The differences are small with respect to RSME and ME for this parameter. Specifically, the ME exhibits an improvement with ICON 2.6.5 mainly in the winter warm hours and in the summer afternoon hours. The ME tendency of both model versions to overpredict temperature during the morning and midday hours of the day and underestimate during the afternoon period is reduced for both seasons with the newer version, more obviously in the summer season. No clear diurnal cycle of error is present as it was the case with COSMO model.

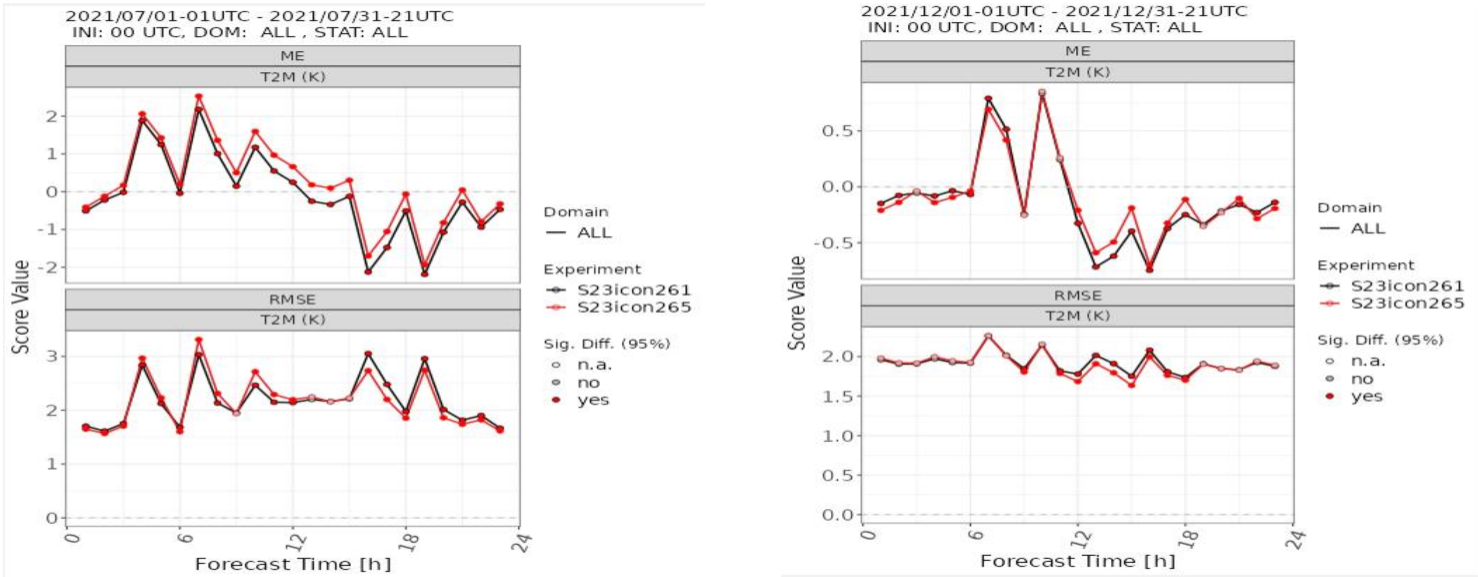


Fig. 3 2-meter temperature verification results - July 2021 (left), Dec 2021 (right), for: ICON v.2.6.1 -2p8/65levels (black), ICON v.2.6.5 -2p8/65levels (red). ME (top) and RMSE (bottom). Red/gray filled dots indicate a significant/insignificant (95% level) difference of scores between the model versions.

2m Dew Point Temperature (Fig.4): Similarly with 2mT, RMSE values are slightly altered with newer ICON model version. Small change is exhibited during winter warm hours of the day that error is reduced and reaches values smaller than 2 deg. Analysis of ME however, shows that the underestimation of both model versions that is especially large in the summer is further increased. This behaviour is even more striking in the winter period as the underestimation with the new version of ICON model is much increased compared to the older version.

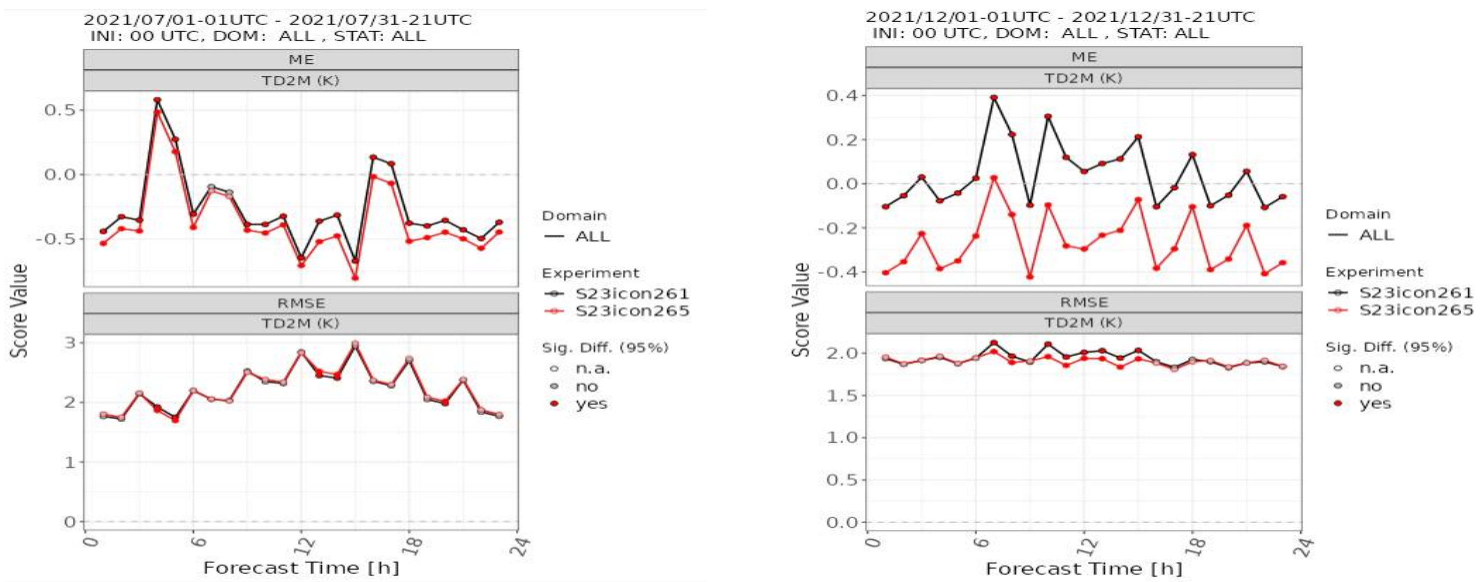


Fig. 4 2-meter dew point temperature verification results - July 2021 (left), Dec 2021 (right), for: ICON v.2.6.1 -2p8/65levels (black), ICON v.2.6.5 -2p8/65levels (red). ME (top) and RMSE (bottom). Red/gray filled dots indicate a significant/insignificant (95% level) difference of scores between the model versions.

10m Wind Speed (Fig.5): NWP test statistical results exhibit almost identical values for both seasons for both model versions. The trend has also not changed with smaller errors during the summer period and a larger underprediction of wind values in the winter month. Focusing on the winter ME, it is shown that with ICON v.2.6.5, the underestimation seems to be slightly higher for all hours of the day.

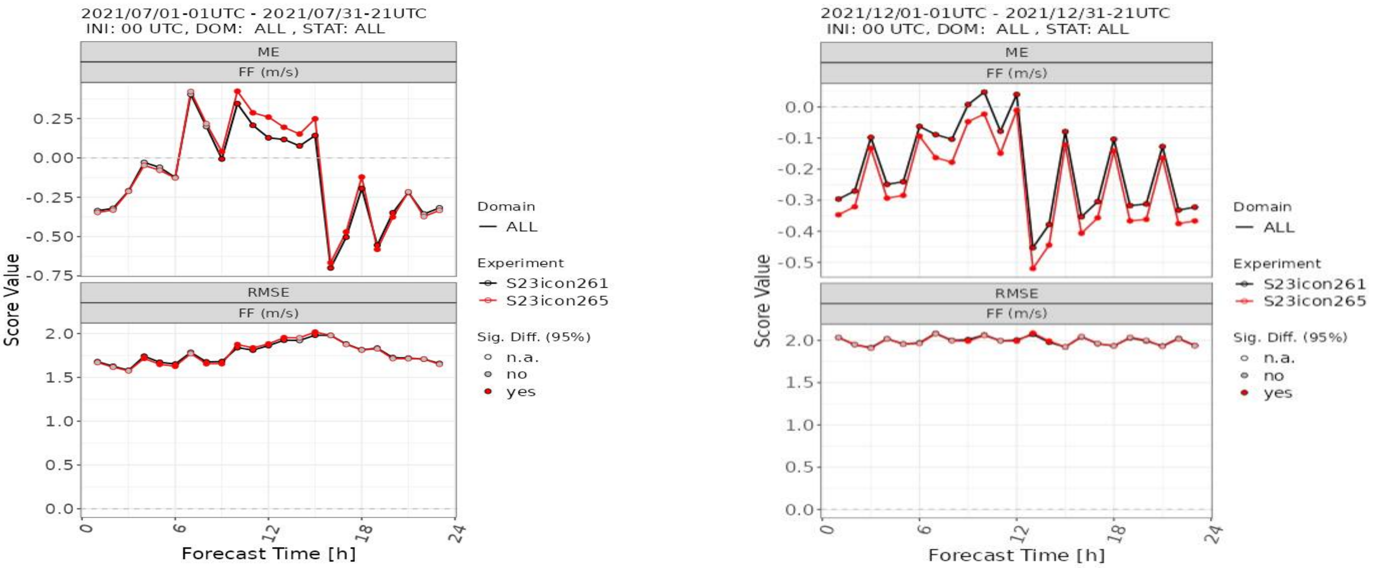


Fig. 5 10-meter wind speed verification results - July 2021 (left), Dec 2021 (right), for: ICON v.2.6.1 - 2p8/65levels (black), ICON v.2.6.5 -2p8/65levels (red). ME (top) and RMSE (bottom). Red/gray filled dots indicate a significant/insignificant (95% level) difference of scores between the model versions.

Total Could Cover (Fig.6): TCC is a parameter that exhibits also minimum change in the verif results between the 2.6.1 and 2.6.5 model versions with respect to RMSE. Small worsening of the performance is shown during warm hours of the day. ME error however exhibits some interesting differences among the two versions. While during the summer there is a strong overestimation of cloudiness, with newer version it is significantly reduced for most hours of the day. In the winter period, the overestimation of 2.6.1 is reduced and during the warmer hours an underestimation is exhibited in the warm hours of the day.

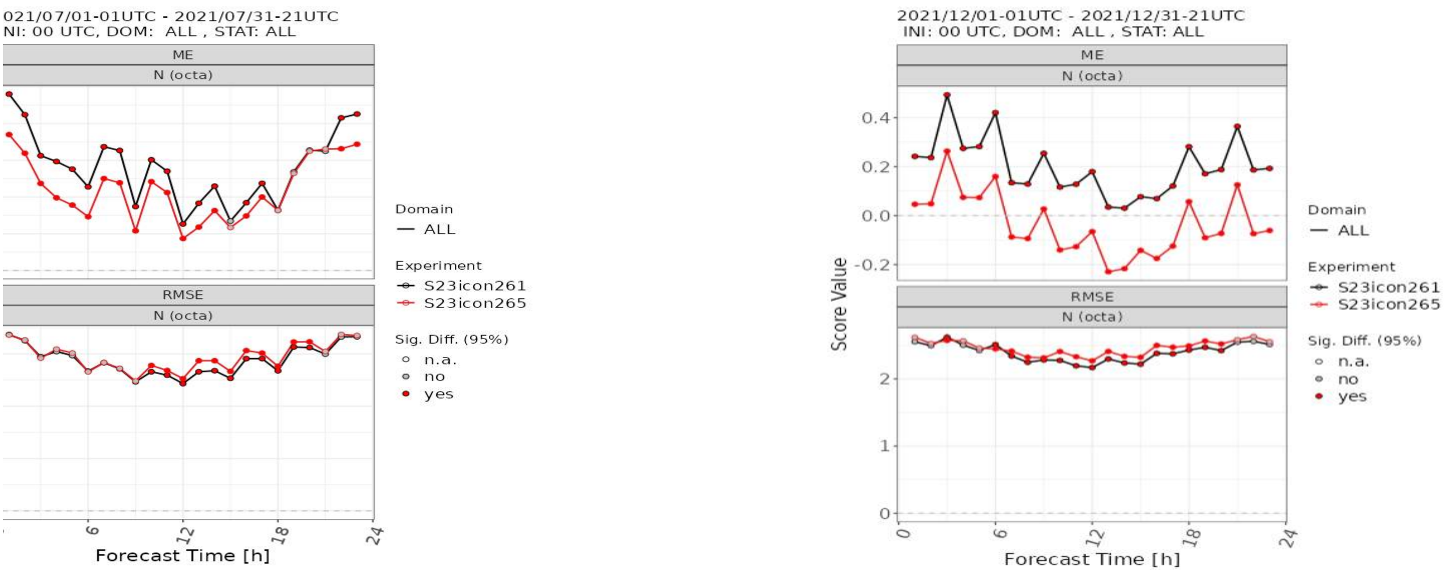


Fig. 6 Total cloud cover verification results - July 2021 (left), Dec 2021 (right), for: ICON v.2.6.1 -2p8/65levels (black), ICON v.2.6.5 -2p8/65levels (red). ME (top) and RMSE (bottom). Red/gray filled dots indicate a significant/insignificant (95% level) difference of scores between the model versions.

Surface Pressure (Fig.7): Surface pressure statistical indices exhibit an underestimation of observed values for both seasons and both model versions. With the use of newer ICON version in the summer however the underestimation is increased and becomes as significant as in the winter period. This behaviour is linked also with increased error with ICON v.2.6.5 version during the summer that is slightly increased also with forecast time. Identical errors are exhibited during winter period.

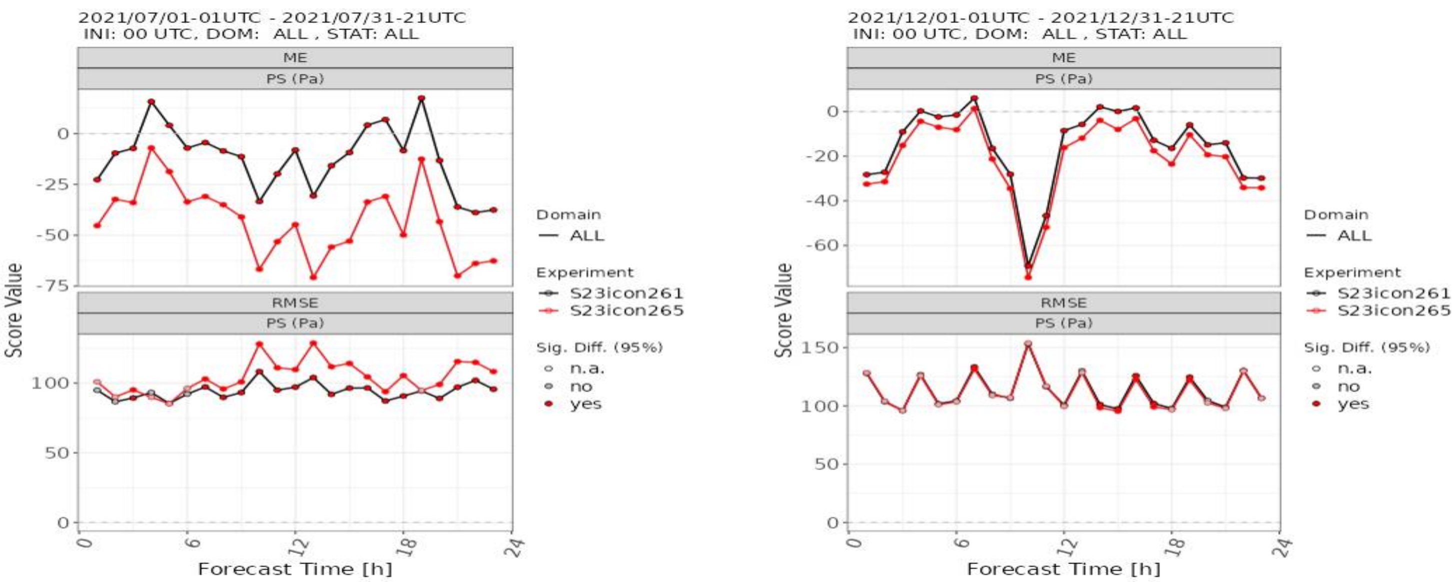
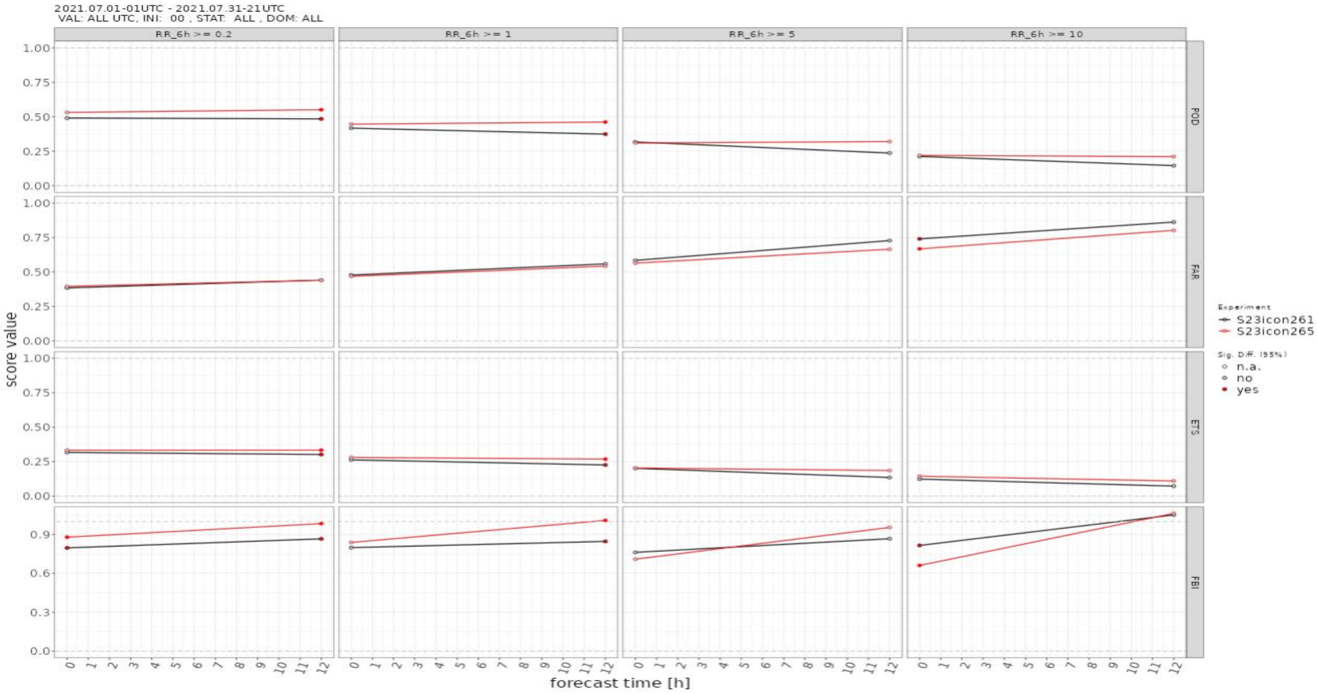


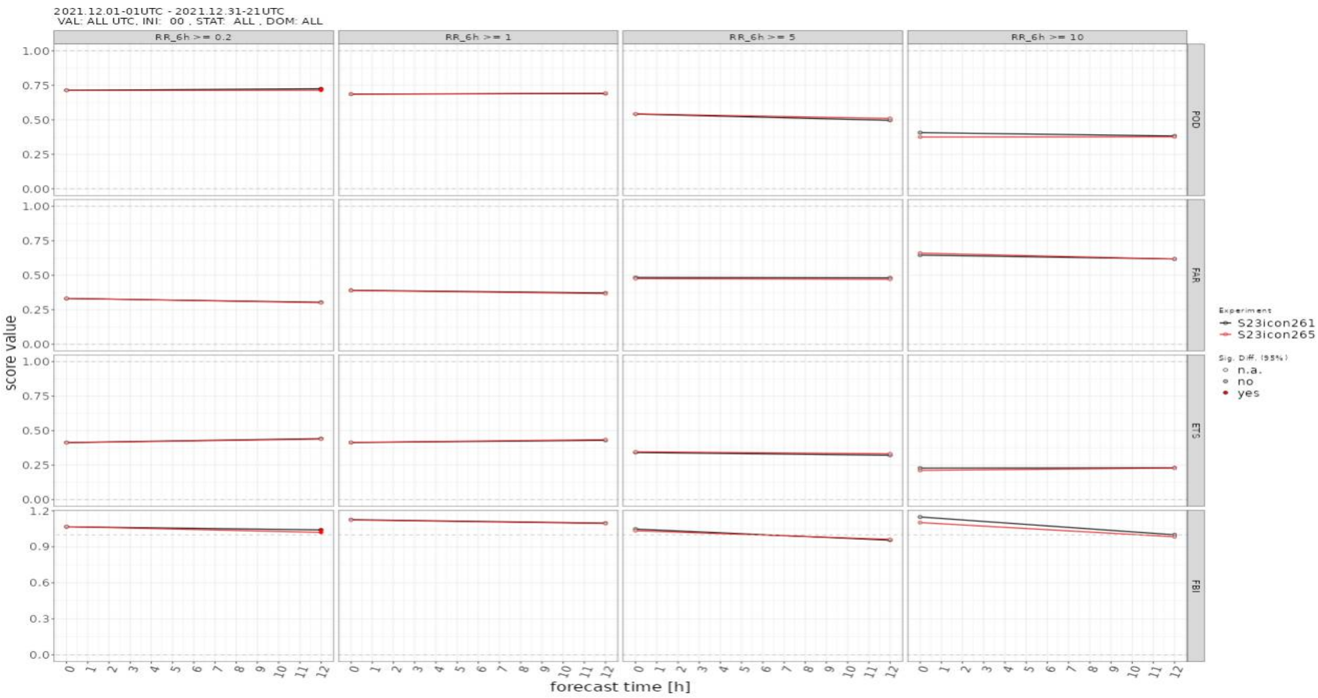
Fig. 7 Surface pressure verification results - July 2021 (left), Dec 2021 (right), for: ICON v.2.6.1 -2p8/65levels (black), ICON v.2.6.5 -2p8/65levels (red). ME (top) and RMSE (bottom). Red/gray filled dots indicate a significant/insignificant (95% level) difference of scores between the model versions.

Dichotomic Surface Parameters: All Models

6h Precipitation (Fig.8): Regarding the forecast of 6h precipitation, the statistics for the two versions of the model are almost identical for the winter month with very small improved statistical indices for the higher thresholds. For the summer month however, all scores for all thresholds seem improved with version ICON v.2.6.5. Specifically, POD is increased mainly in small thresholds, FAR is decreased mainly in larger thresholds, ETS exhibits a slight improvement in all cases and FBI reveals an almost perfect or reduced underprediction in smaller thresholds while for larger precipitation amounts the underprediction is further increased.



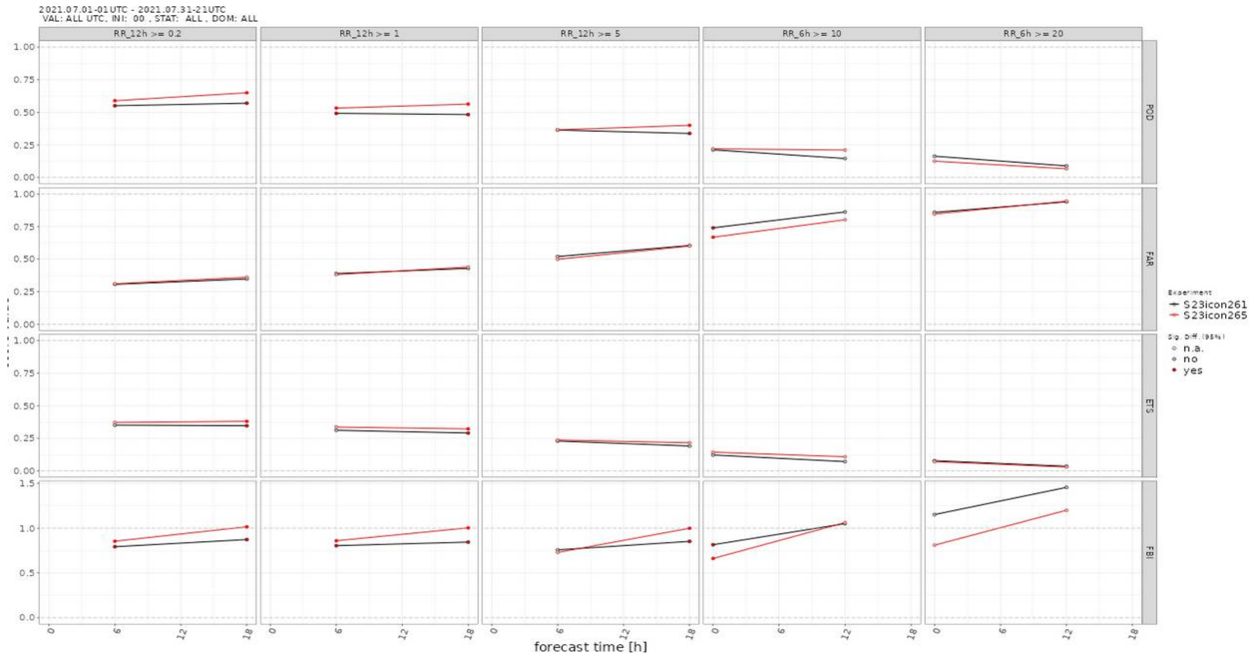
(a)



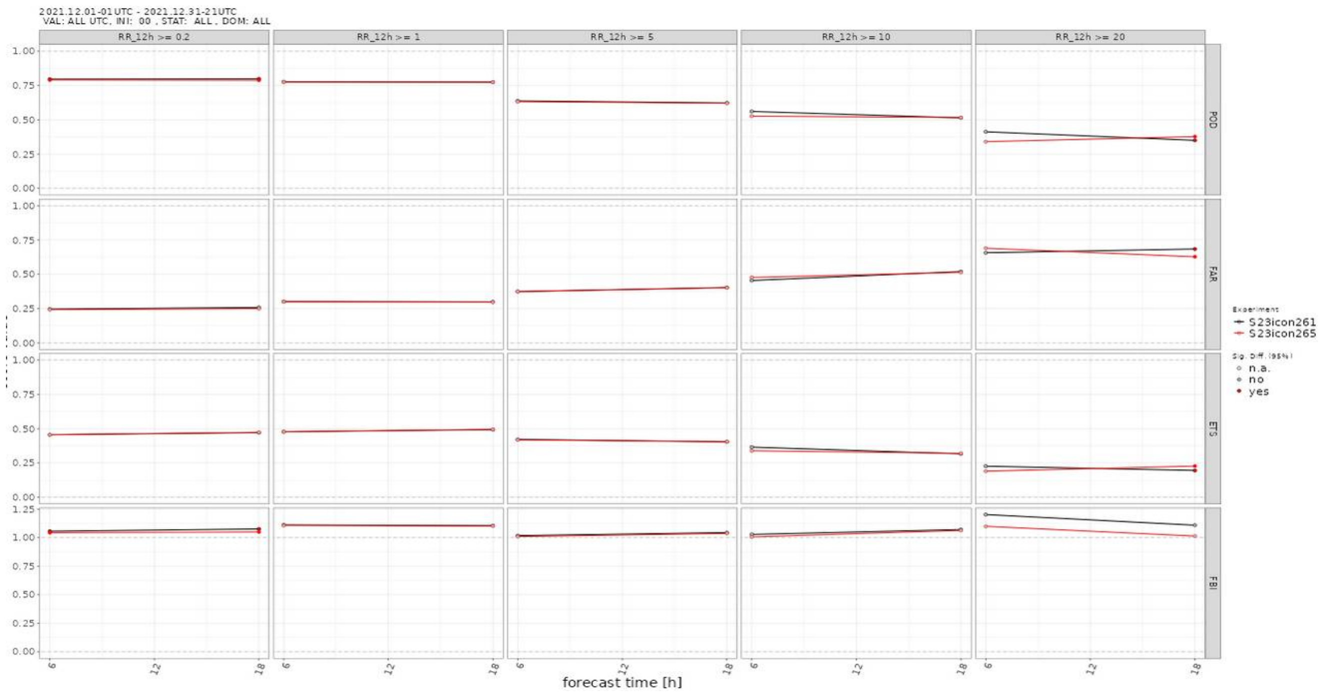
(b)

Fig. 8 RR_6h verification results - July 2021 (left), Dec 2021 (right), for: ICON v.2.6.1 -2p8/65levels (black), ICON v.2.6.5 -2p8/65levels (red). POD, FAR, ETS and FBI (top to bottom). Thresholds 0.1, 1, 5, 10, 20mm/6h (left to right).

12h Precipitation (Fig.9): As with the 6h precipitation, performance of 12h accumulated amounts reveal similar behaviour. While there are small differences in more indices, with the newer version in the summer period there is a distinct improvement in POD mainly for minimum thresholds (yes/no preci), very small reduction of FAR for higher preci amounts, a marginal improvement in ETS for all cases and a reduction of underprediction in small precipitation amounts and reduction of over prediction in large amounts.



(a)



(b)

Fig. 9 RR_12h verification results - July 2021 (left), Dec 2021 (right), for: ICON v.2.6.1 -2p8/65levels (black), ICON v.2.6.5 -2p8/65levels (red). POD, FAR, ETS and FBI (top to bottom). Thresholds 0.1, 1, 5, 10, 20mm/6h (left to right).

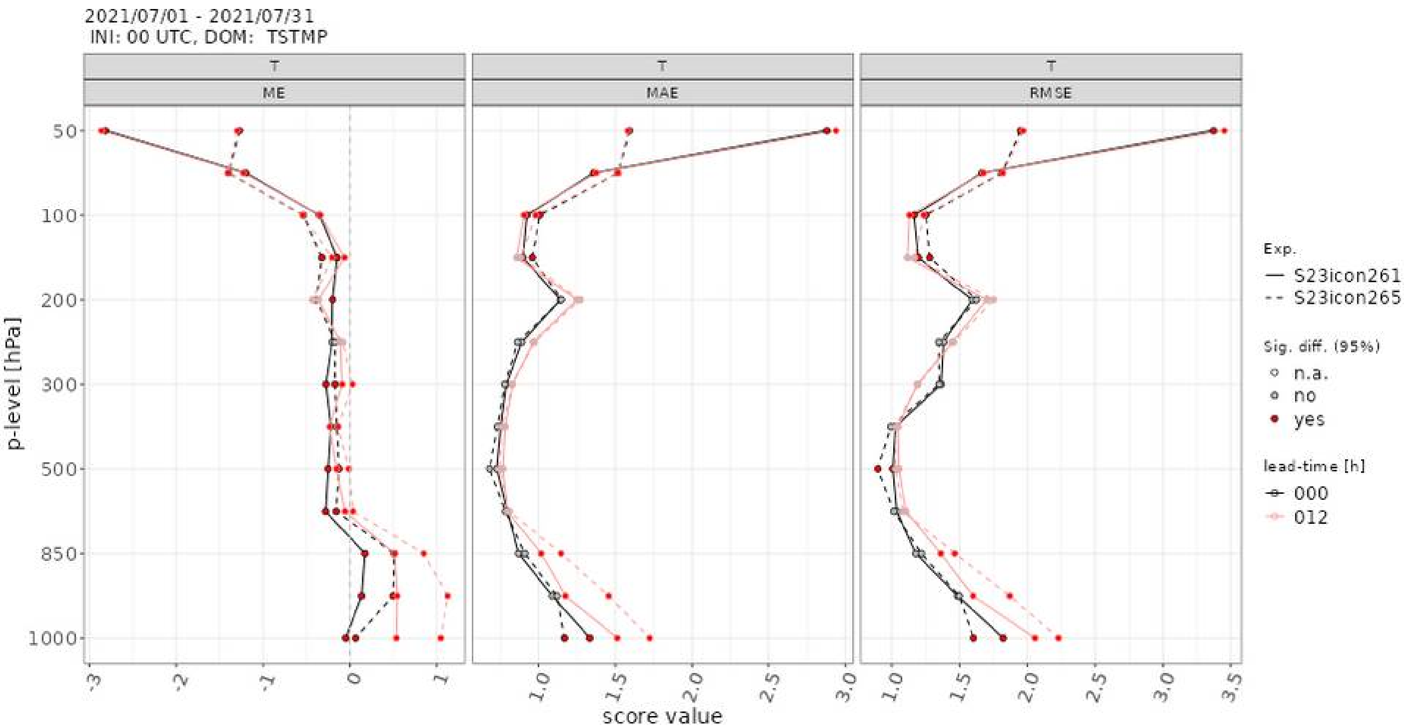
Upper Air Parameters: All Models (Fig. 10-12)

The scores for upper air parameters (relative humidity, temperature, and wind speed) among ICON 2.6.1 and 2.6.5 versions are presented below.

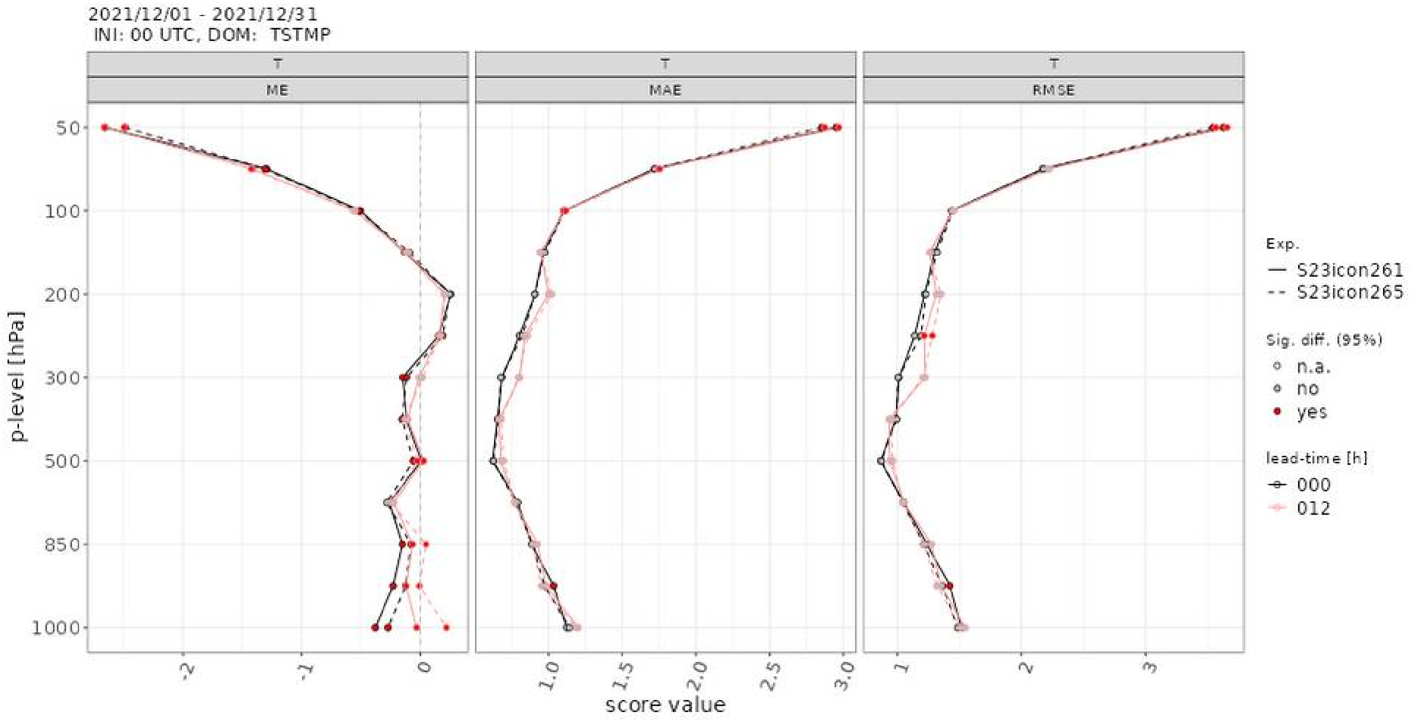
Relative Humidity forecasts performance for ICON-LAMs suggest no change in performance with respect to RMSE in all levels but in the upper atmosphere, where a reduction of the error is exhibited in both seasons. The ME and for atmospheric levels below 500mb reveal an underestimation for both forecast hours and seasons but more for the summer month which with the newer model version is reduced. For levels between than 500-150mb the behaviour is reversed with a tendency to overestimate RH values mainly with the new model version.

Temperature ICON-LAM statistical values are identical for the winter with very small changes in the summer only in levels below 850mb. During summer, the low-level overestimation of both models mainly in the 12UTC results is greater with newer model which leads to increased RMSE values. For winter, ME reveals a reduction in underprediction for both 00 and 12 UTC with newer model version.

Wind Speed, for this parameter not significant changes are shown among the two model versions. During both months all statistical indices indicate almost identical performance for 00UTC while for 12UTC there are differences in upper atmosphere not in RMSE error but with the amplitude of the tendency to underestimate which is exhibited from all models and both forecast hours.

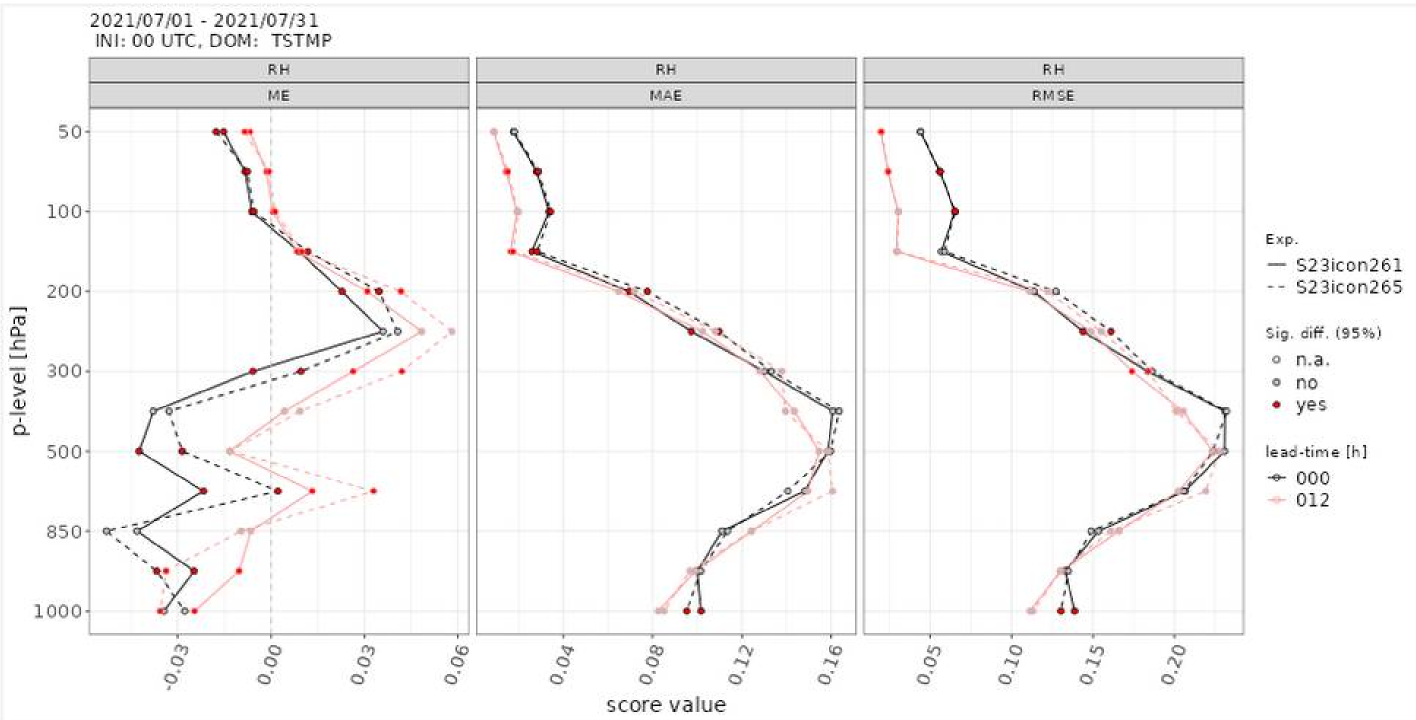


(a)



(b)

Fig. 10 Upper Air Temperature verification results - July 2021 (a), Dec 2021 (b), +00/24 hours (black) and +12 hours (pink) for: for: ICON v.2.6.1 -2p8/65levels (solid), ICON v.2.6.5 -2p8/65levels (dashed). ME, MAE and RMSE (left to right).



(a)

(b)

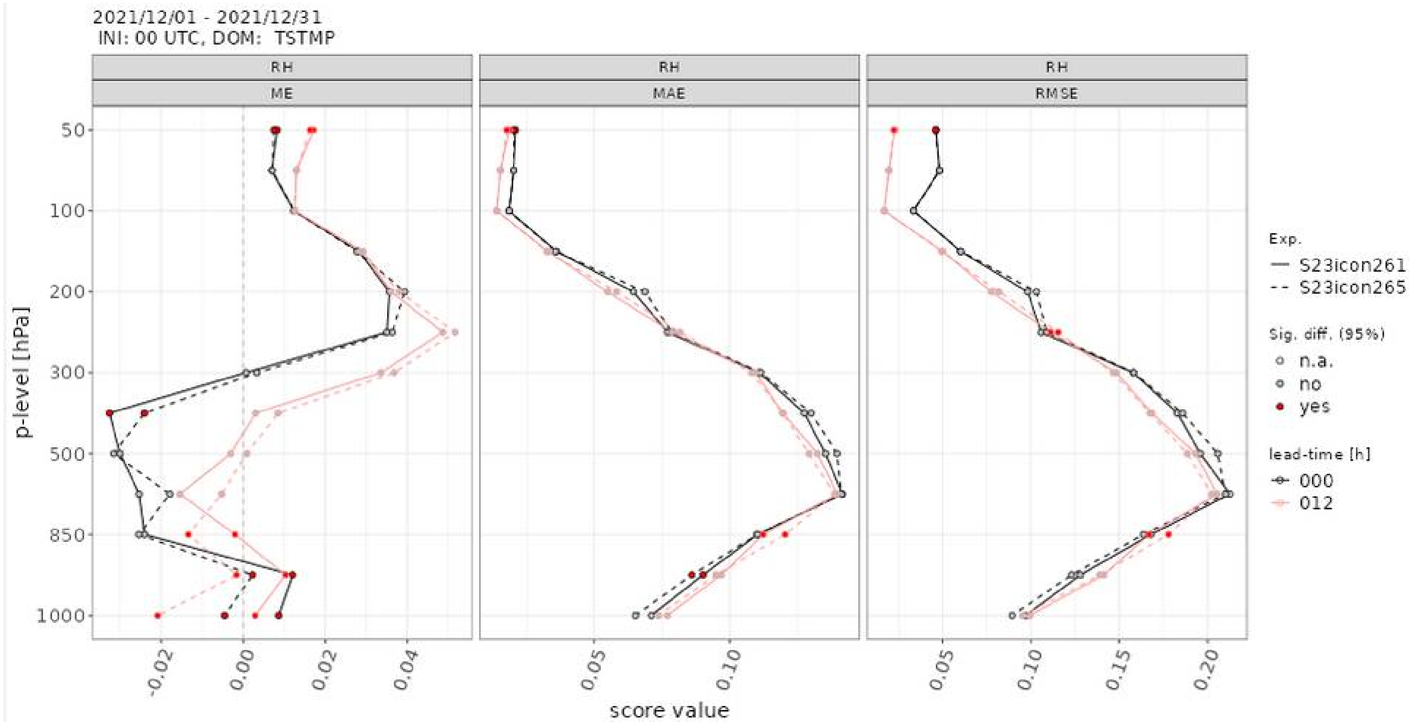
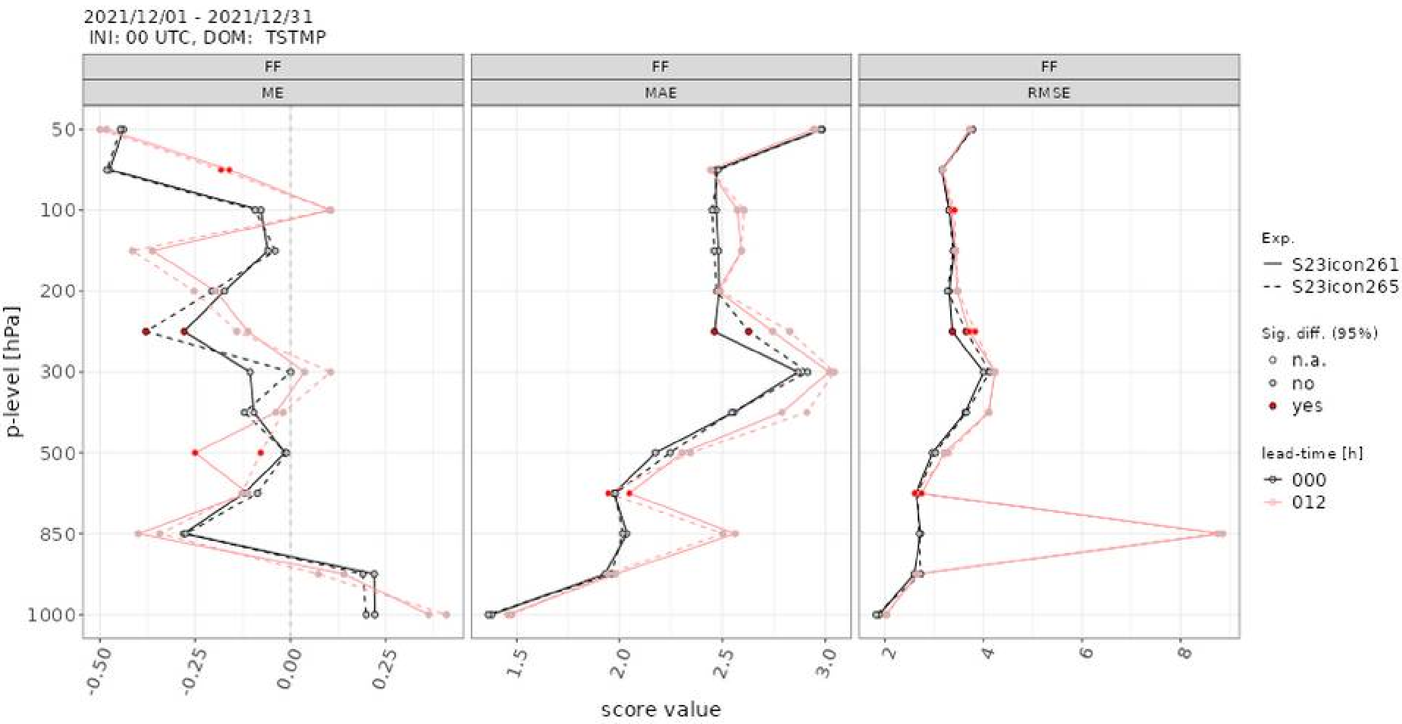


Fig. 11 Upper Air Relative Humidity verification results - July 2021 (a), Dec 2021 (b), +00/24 hours (black) and +12 hours (pink) for: for: ICON v.2.6.1 -2p8/65levels (solid), ICON v.2.6.5 -2p8/65levels (dashed). ME, MAE and RMSE (left to right).



(a)

(b)

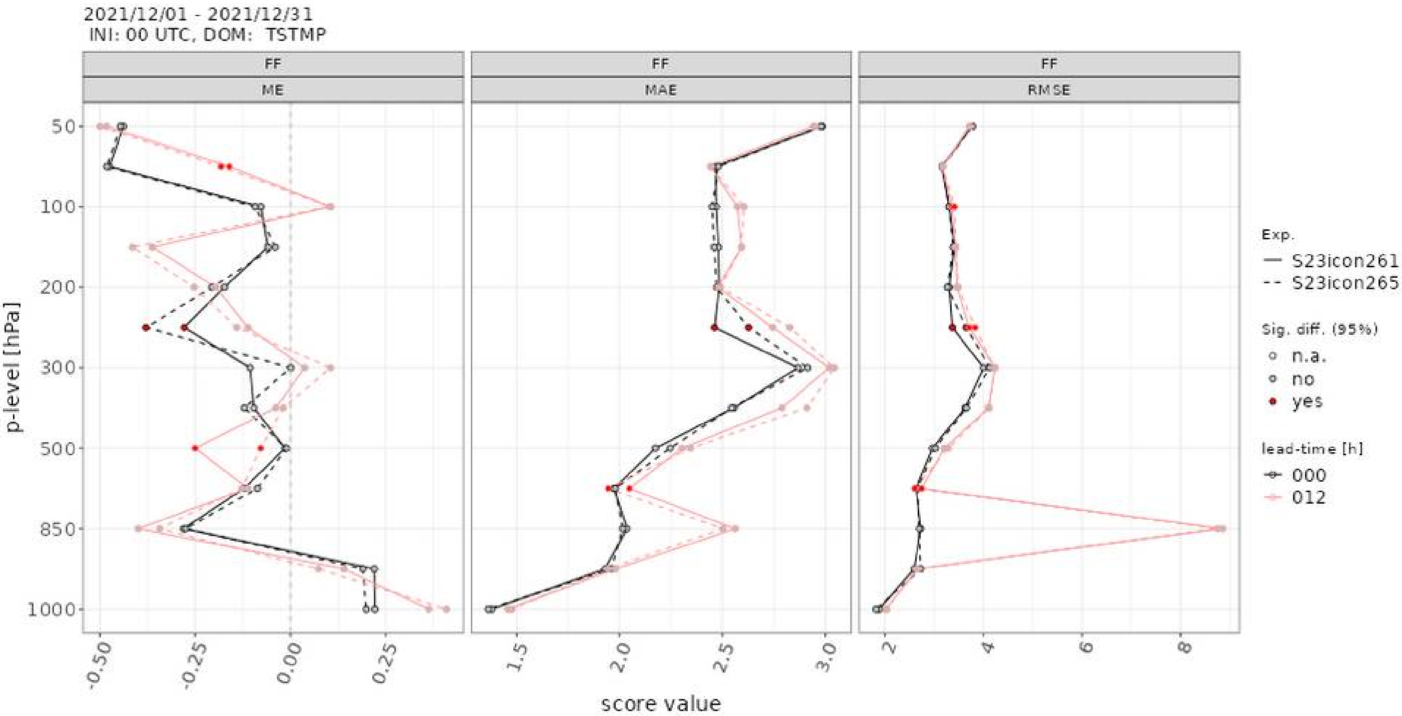


Fig. 12 Upper Air Wind Speed verification results - July 2021 (a), Dec 2021 (b), +00/24 hours (black) and +12 hours (pink) for: for: ICON v.2.6.1 -2p8/65levels (solid), ICON v.2.6.5 -2p8/65levels (dashed). ME, MAE and RMSE (left to right).

Phase IV: Additional steps

Activities (including use of resources) to test a new official open source version of the ICON-LAM model prior to its release which is anticipated in the second part of the year.

The verification system MEC/FFV2 newest version functionalities will be tested in the next model validation procedures.

Maintenance of the Test Suite.

Revision of the detailed guidelines for the proper use and execution of each NWP test using this platform prepared during previous special projects related to this activity according to present results from the testing of the new ICON-LAM configurations, taking into account the activities described above.

Detailed descriptions of all steps will be included in Technical Reports, from the compilation of a new model test version to the final production of the graphics for the statistical scores extracted, including detailed guidelines for the proper use and execution of NWP tests using ICON-LAM, before the official release of new model versions.