Verification of COSMO/ICON-LAM over Italian domain

(June 2022 – November 2023)

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CNMCA, National Center for Aerospace Meteorology and Climatology

COSMO WG5 meet, 24 January 2024

Operational ICON-IT @ CNMCA - Italy

Operational SETUP:

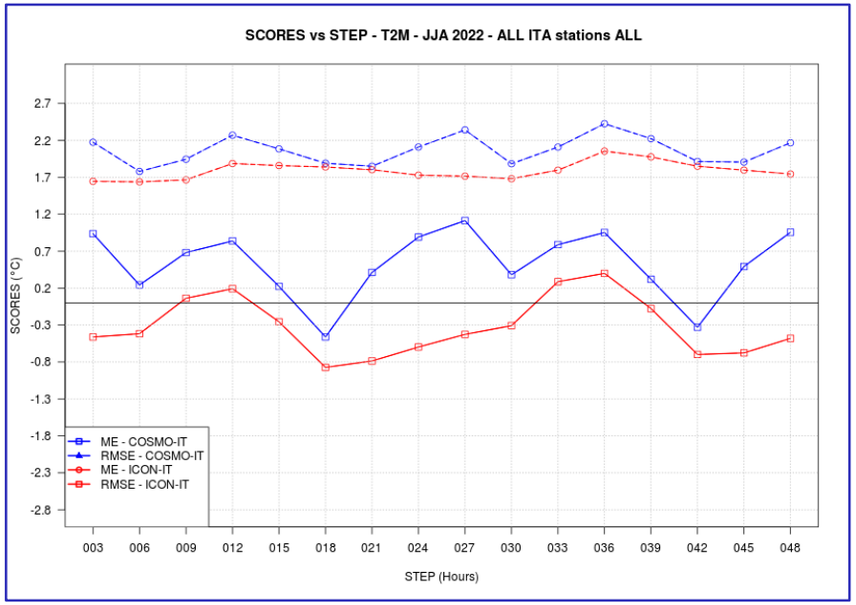
Grid: R19B7 (2.1 km) /65vl - same domain as COSMO-IT
IFS LBC and ICON-KENDA - 1h DA cycle, init_mode=5 (Incremental Analisys Update)
lshallowconv_only = .false.
lgrayzone_deepconv = .true.
tune_box_liq =0.08
tune_box_liq_asy = 2

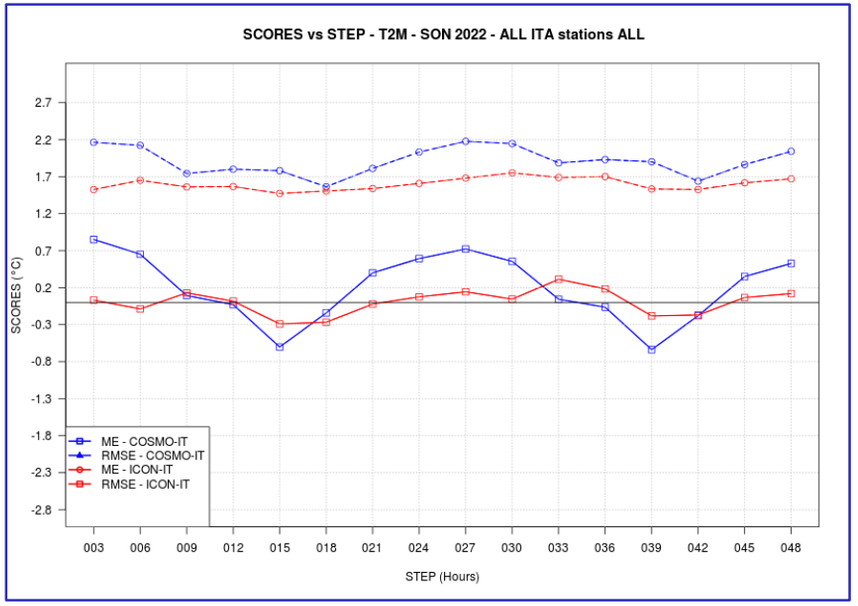
- Operational on ECMWF-Cray HPC since july 2020, ready to run on local hpc (Intel 2022.0.2 + Intel MPI 2021.5.1)
- model version: development version from January 2021 (not updated up to now because unresolved communication problems under cray environment at ECMWF)
- Surface + upper air verification with MEC-RFDBK software

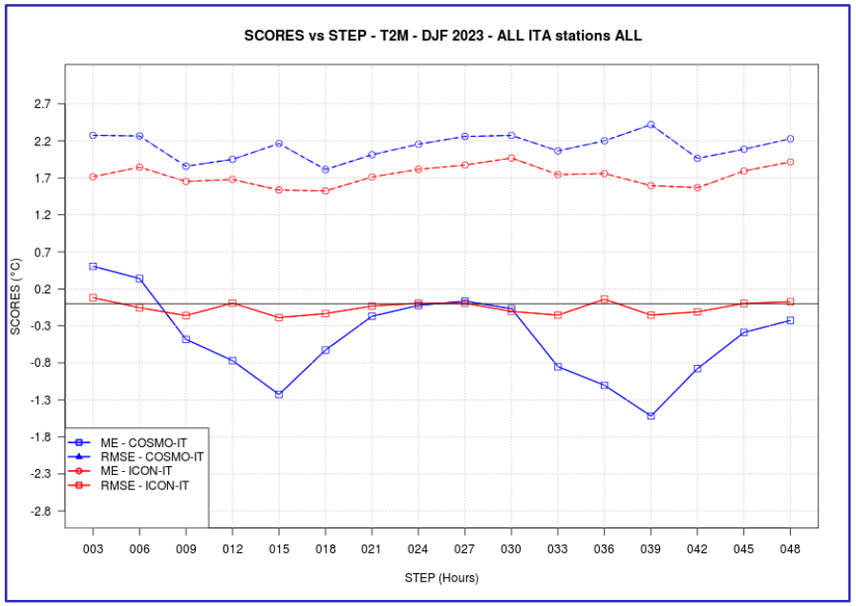
COSMO-IT vs ICON-IT (00UTC run)

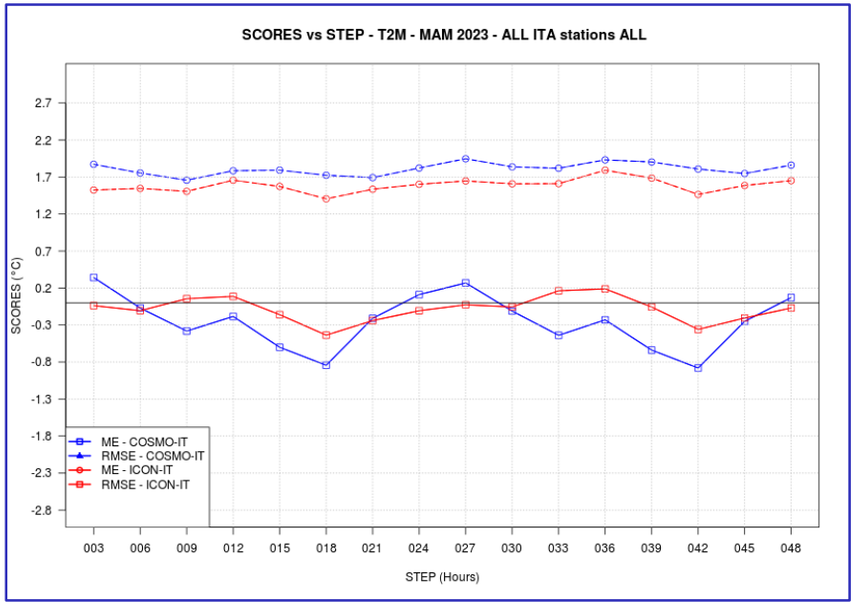
2m-Temperature

Forecast verifications against SYNOP





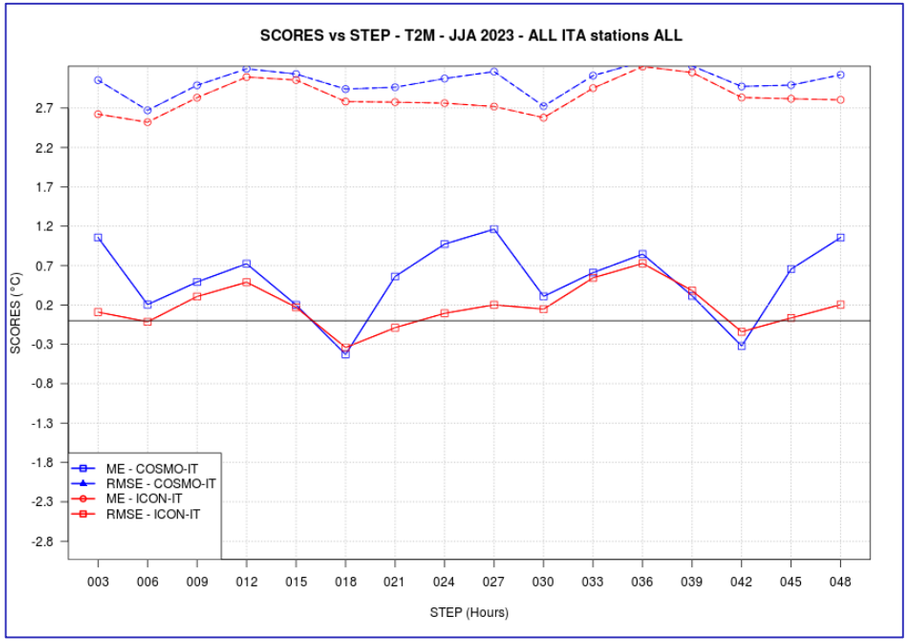


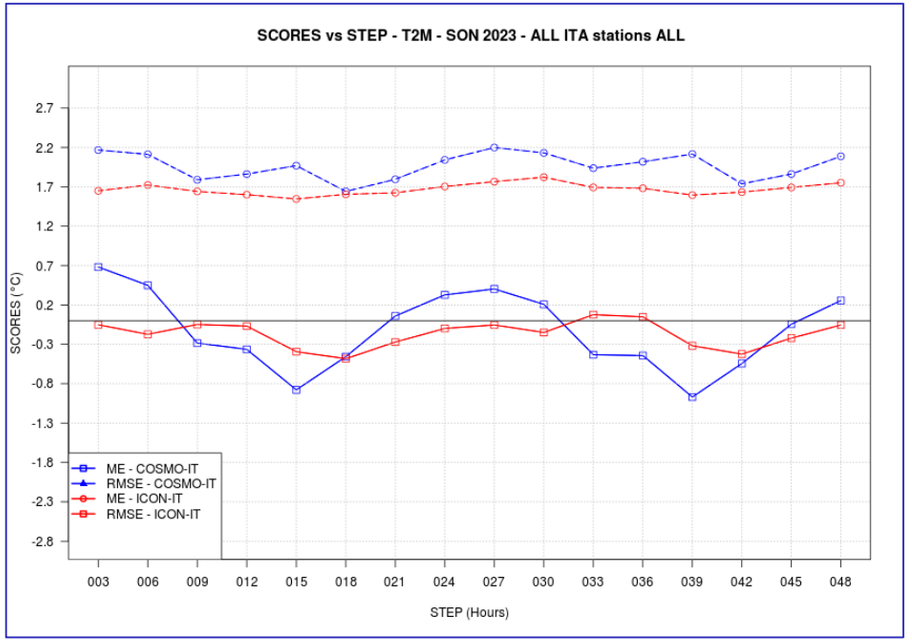


COSMO-IT vs ICON-IT (00UTC run)

2m-Temperature

Forecast verifications against SYNOP

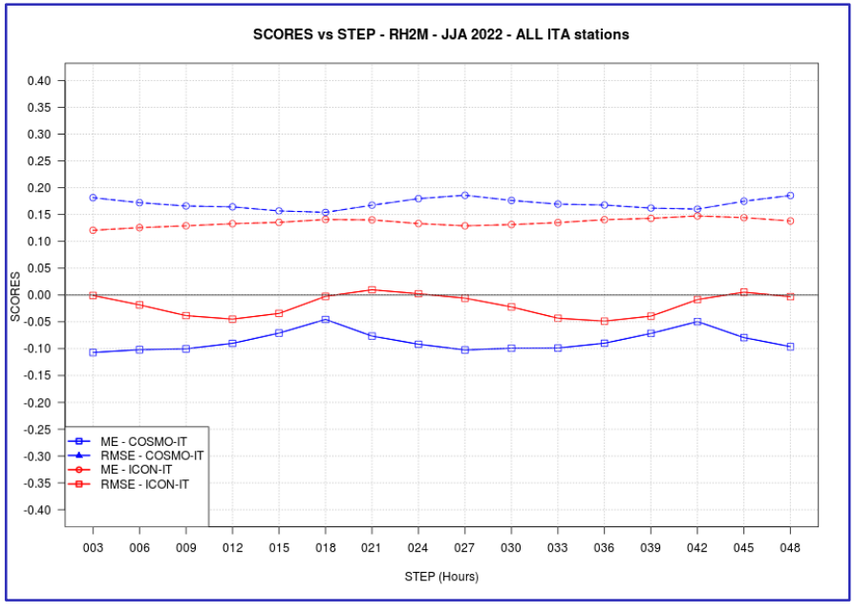


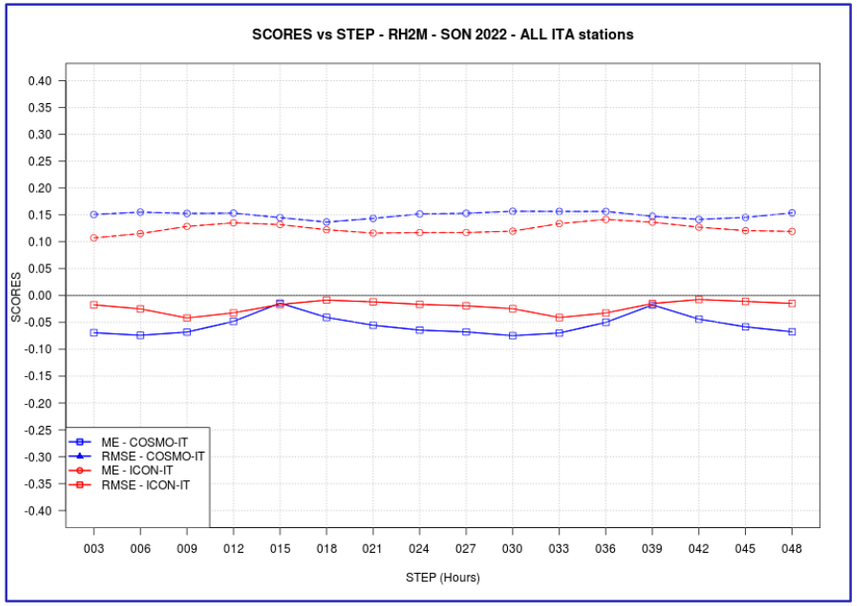


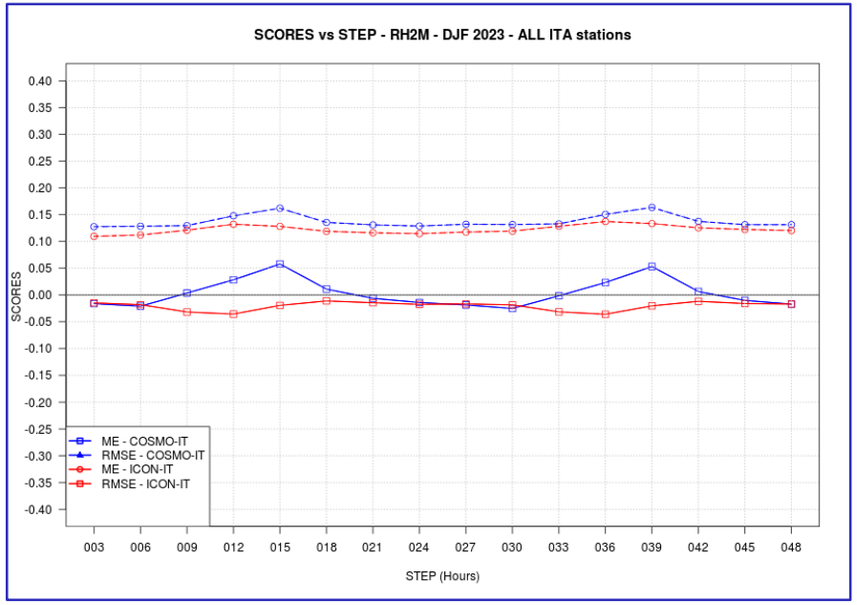
COSMO-IT vs ICON-IT (00UTC run)

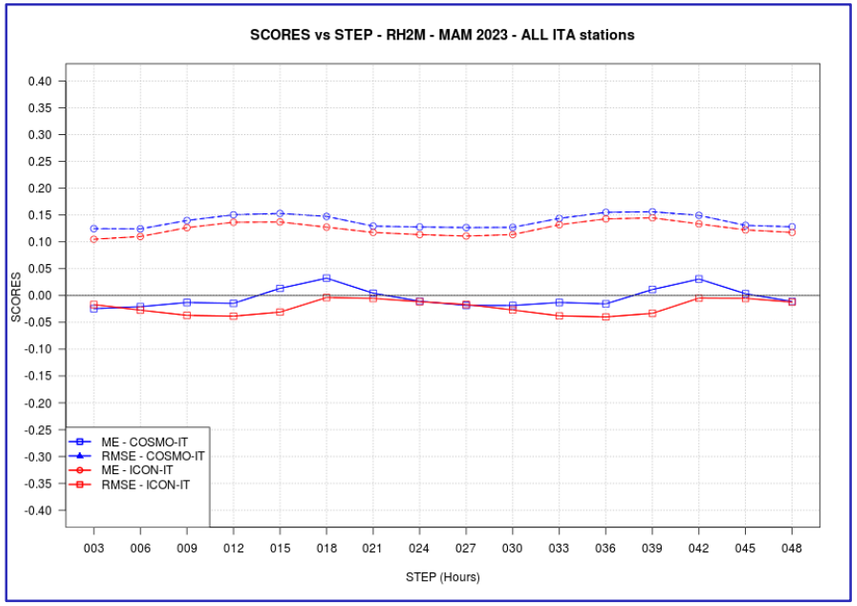
2m-Relative Humidity

Forecast verifications against SYNOP









COSMO-IT vs ICON-IT (00UTC run)

2m-Relative Humidity

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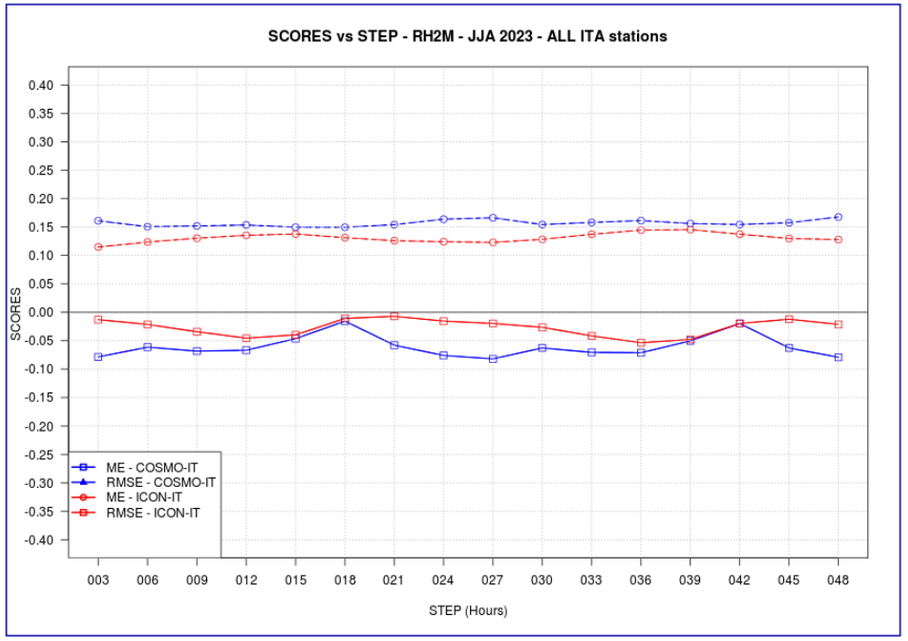
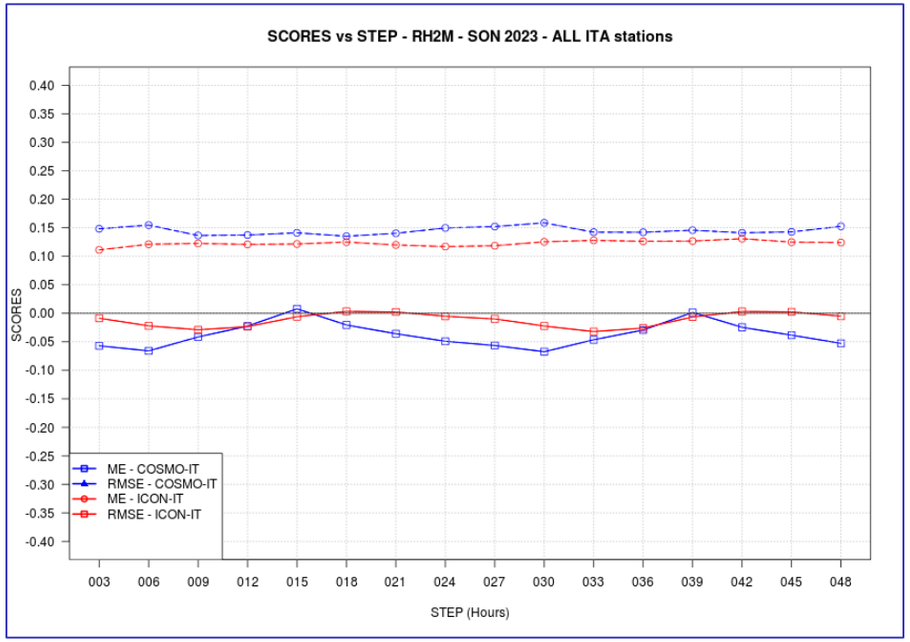
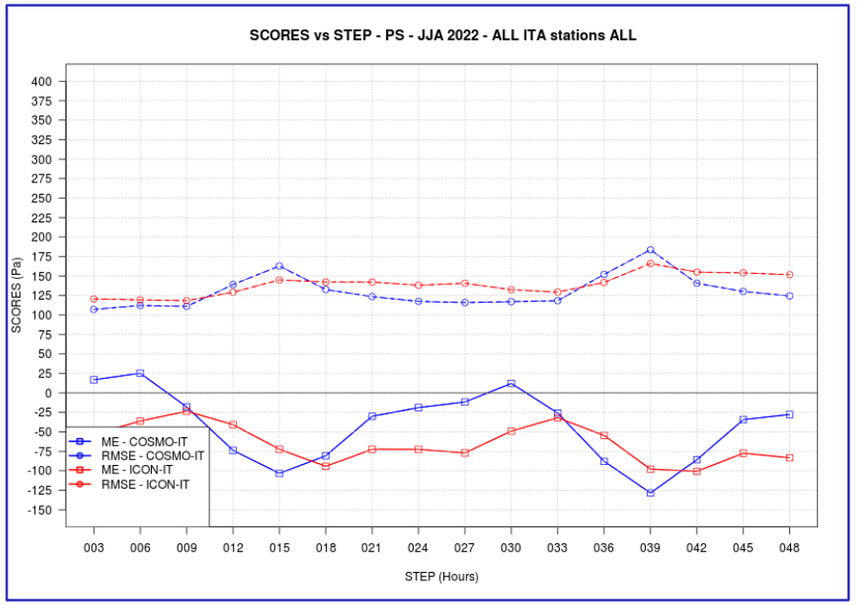


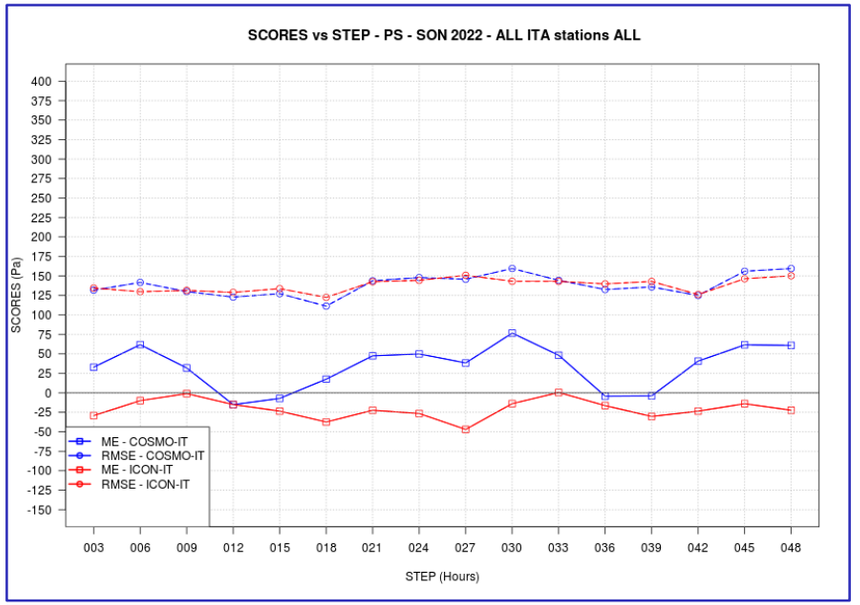


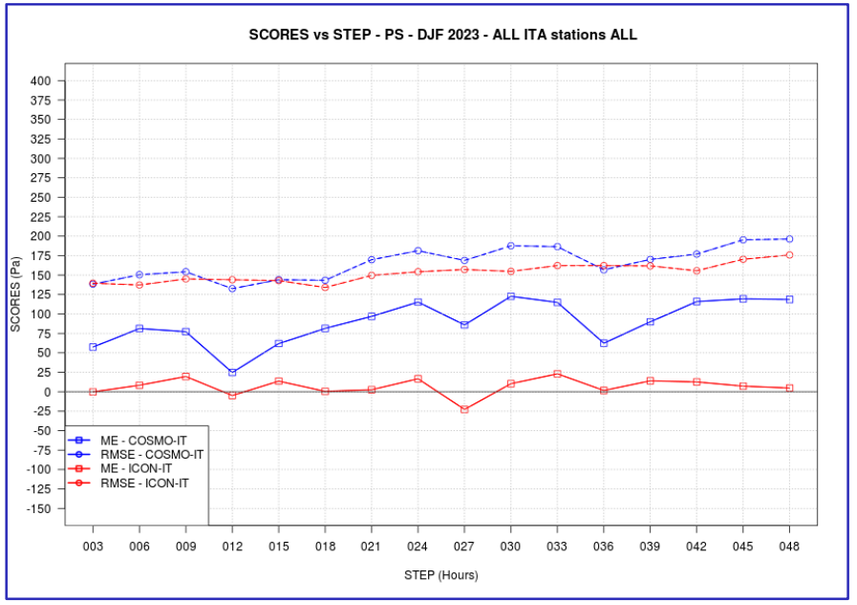
COSMO-IT vs ICON-IT (00UTC run)

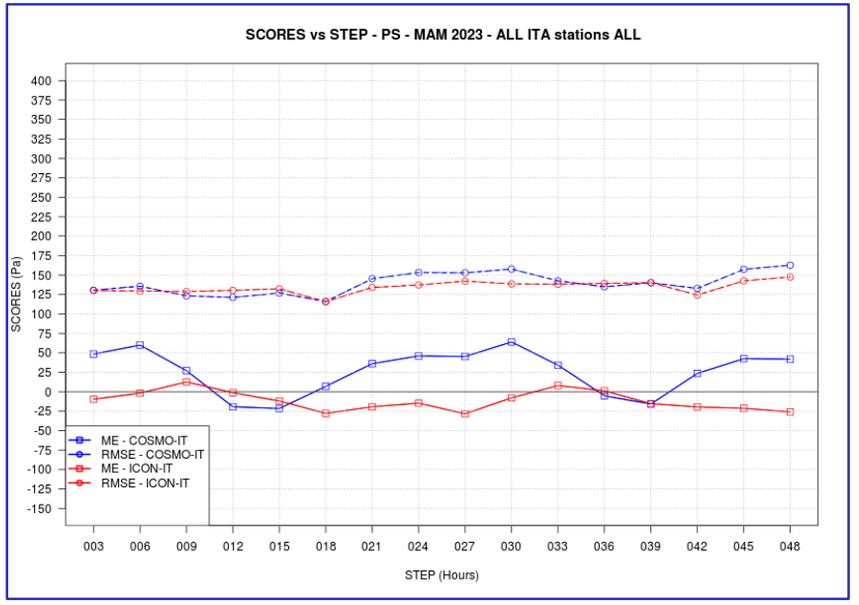
Surface Pressure

Forecast verifications against SYNOP





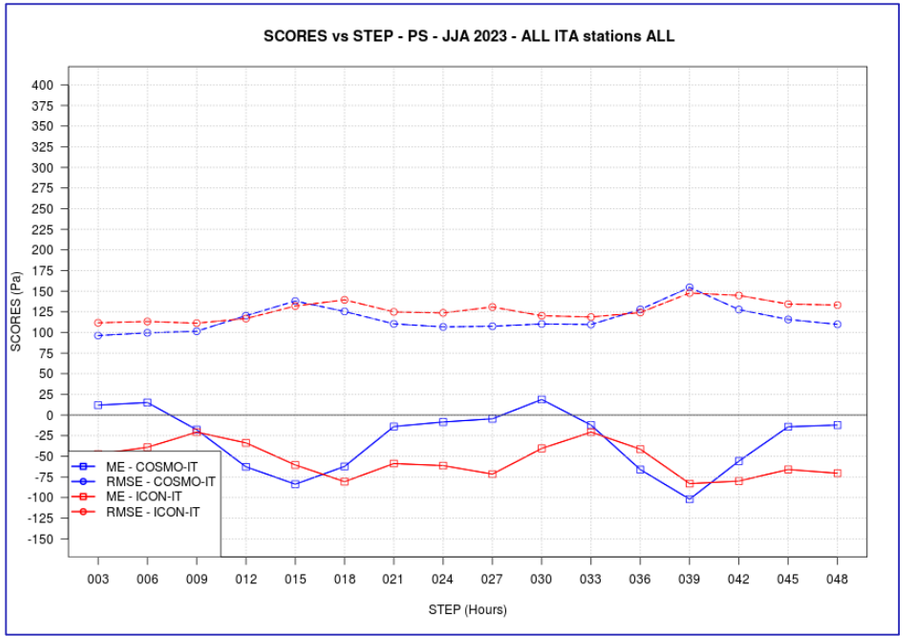


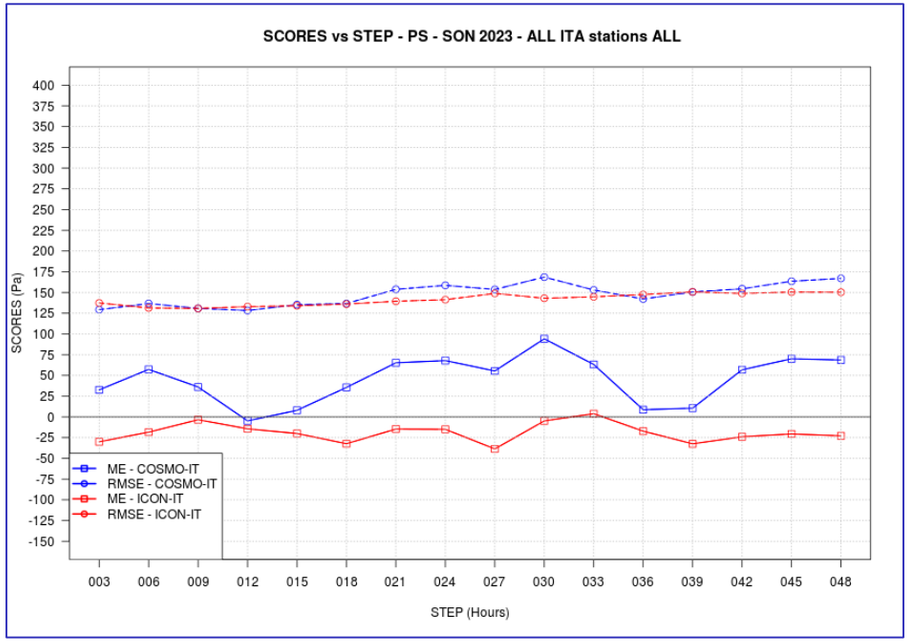


COSMO-IT vs ICON-IT (00UTC run)

Surface Pressure

Forecast verifications against SYNOP

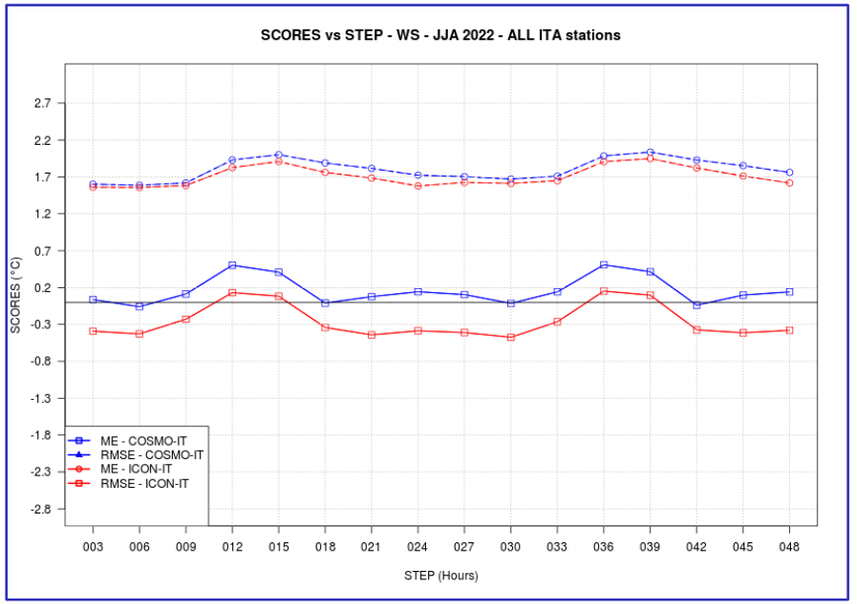


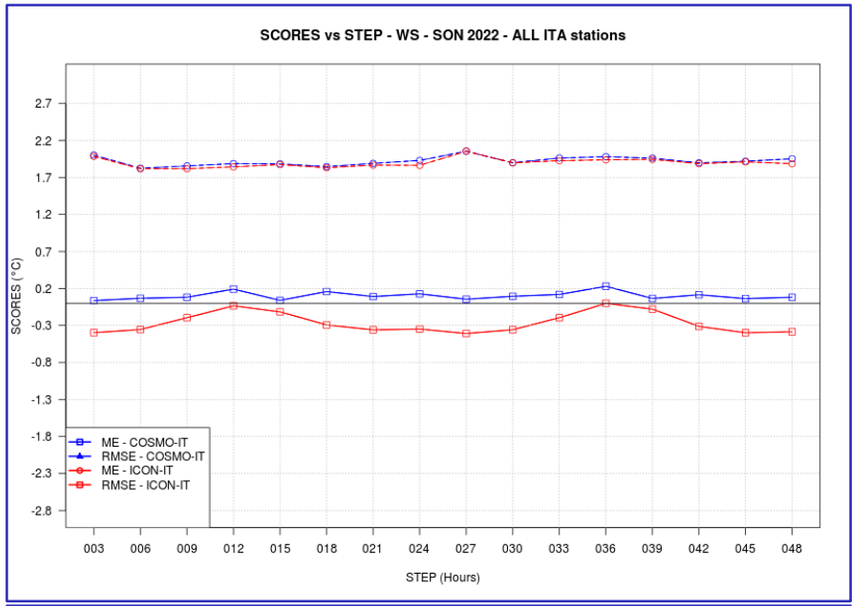


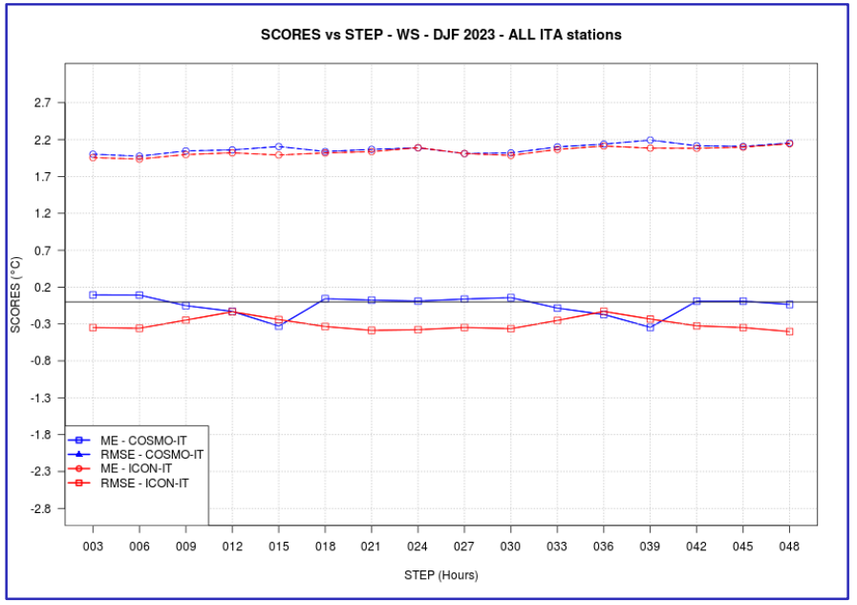
COSMO-IT vs ICON-IT (00UTC run)

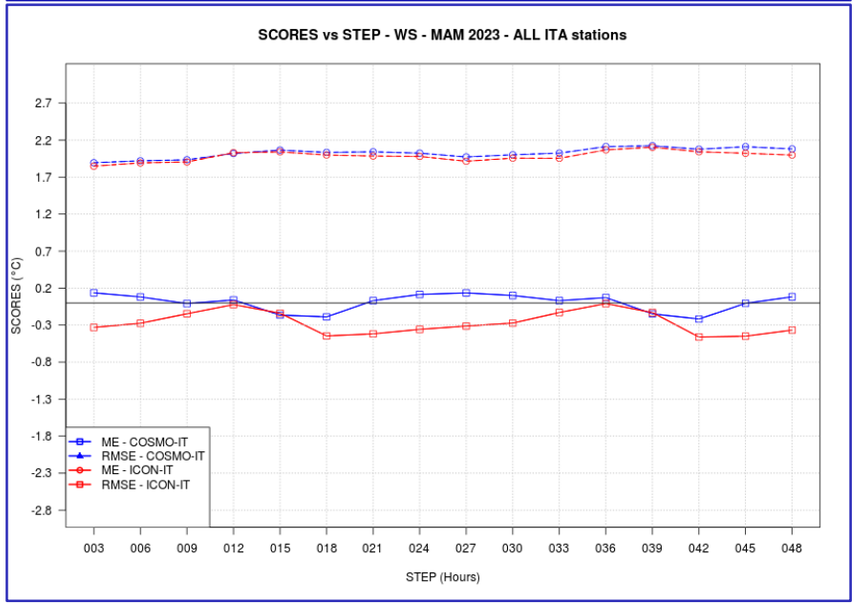
Wind Speed

Forecast verifications against SYNOP





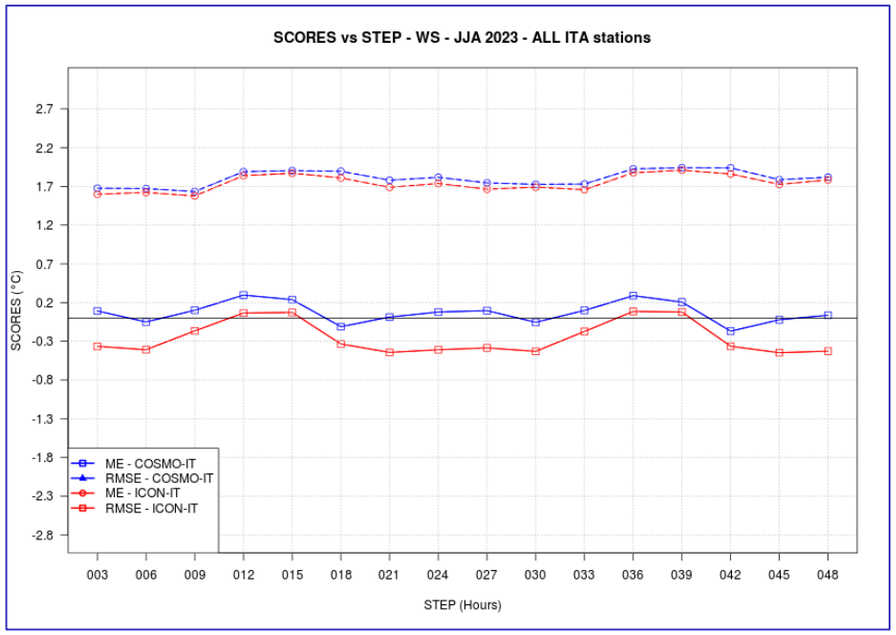


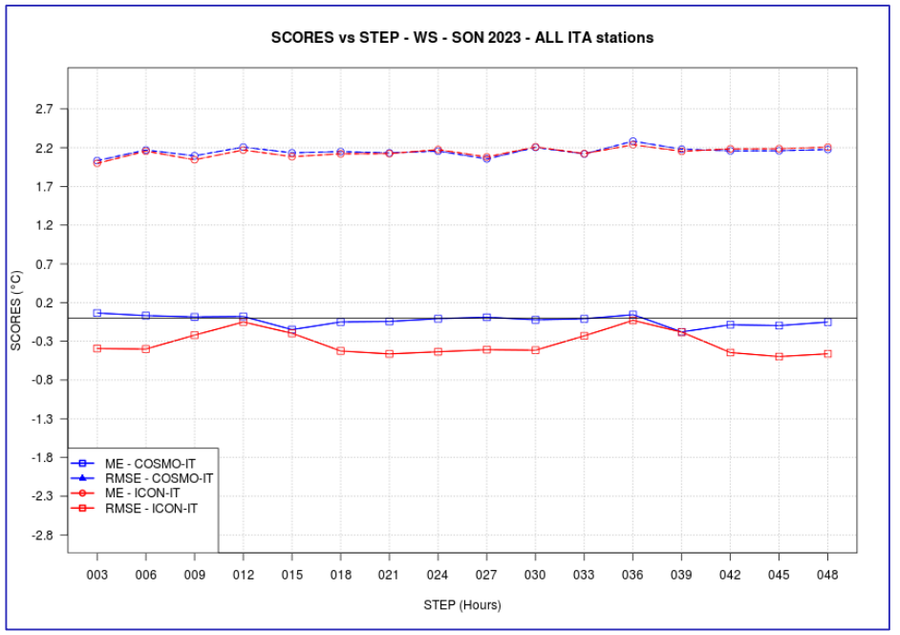


COSMO-IT vs ICON-IT (00UTC run)

Wind Speed

Forecast verifications against SYNOP

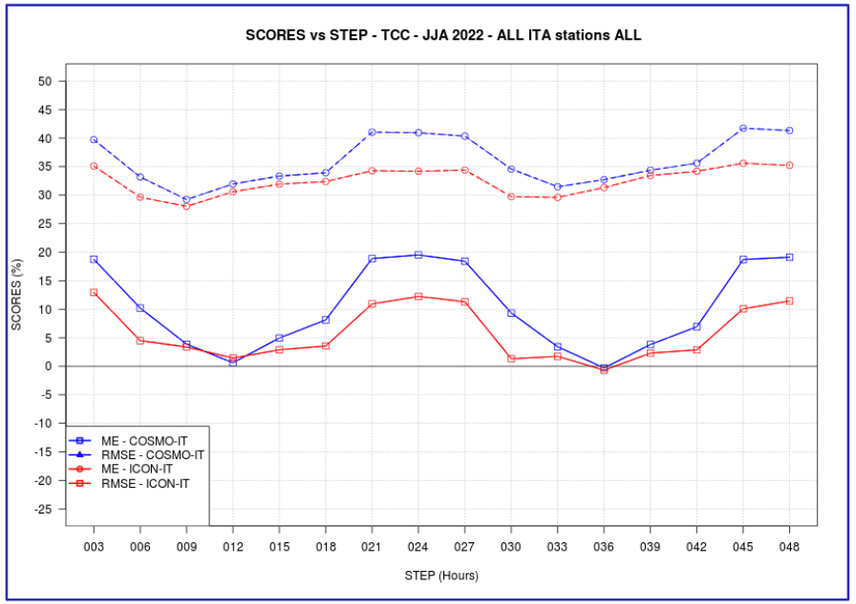


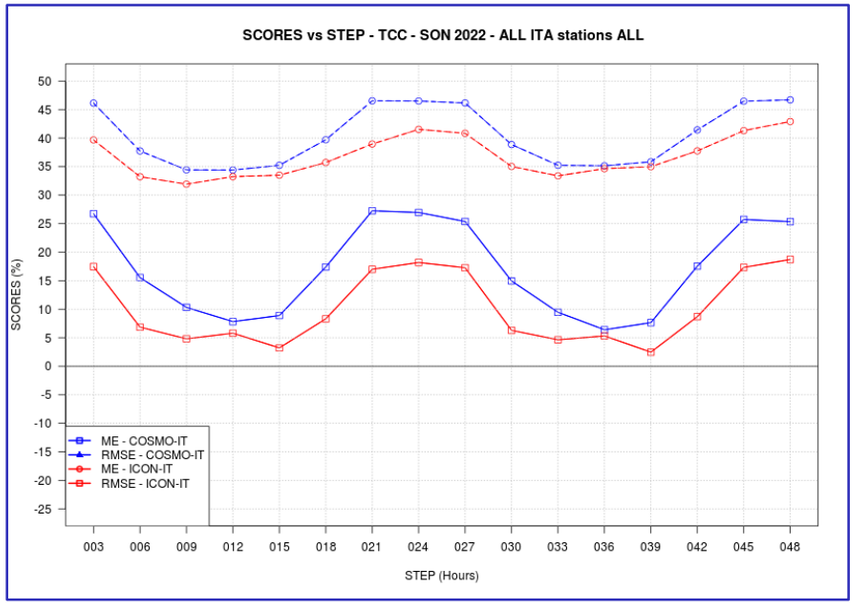


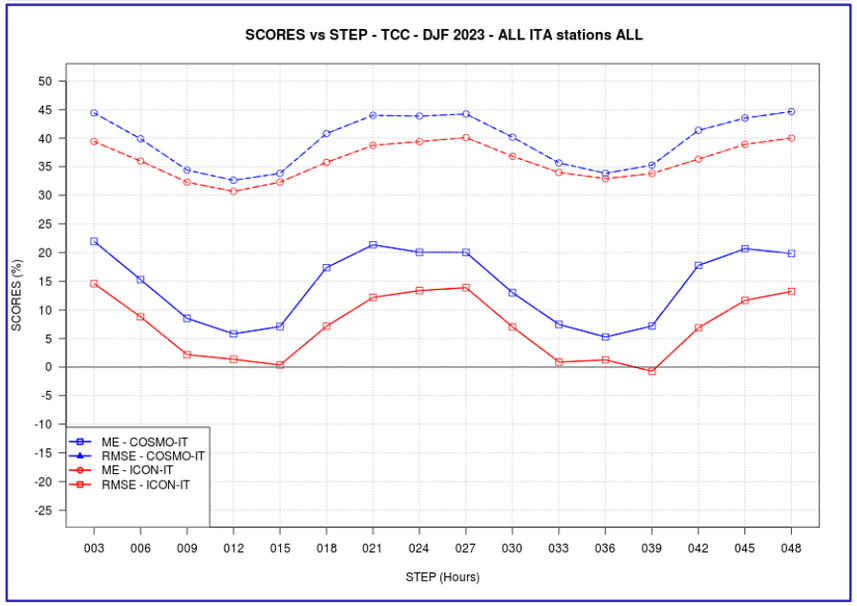
COSMO-IT vs ICON-IT (00UTC run)

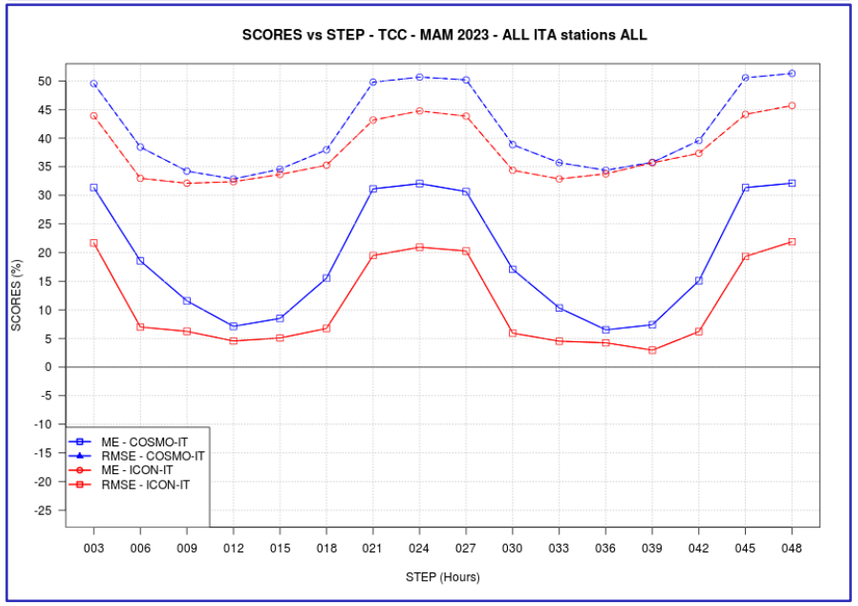
Total Cloud Cover

Forecast verifications against SYNOP









COSMO-IT vs ICON-IT (00UTC run)

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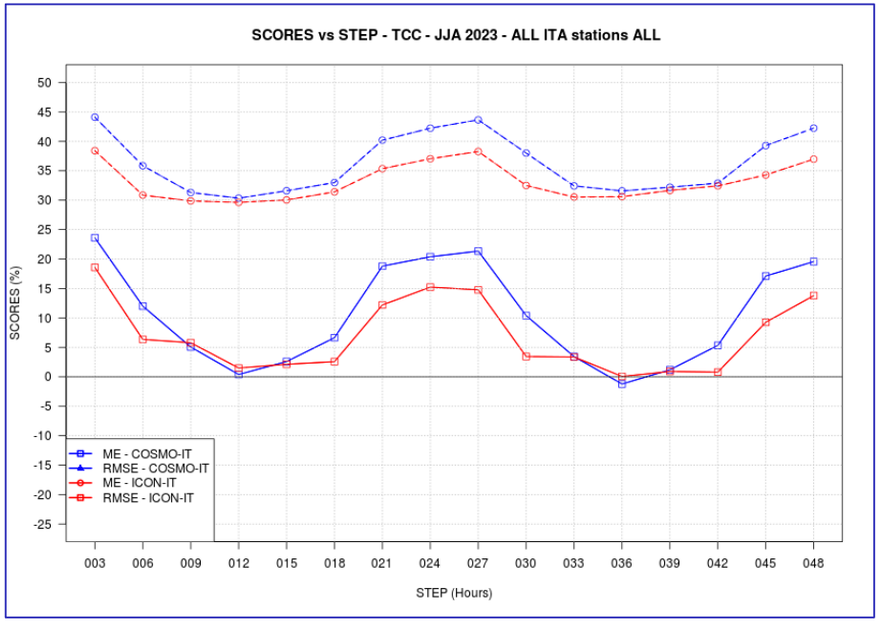
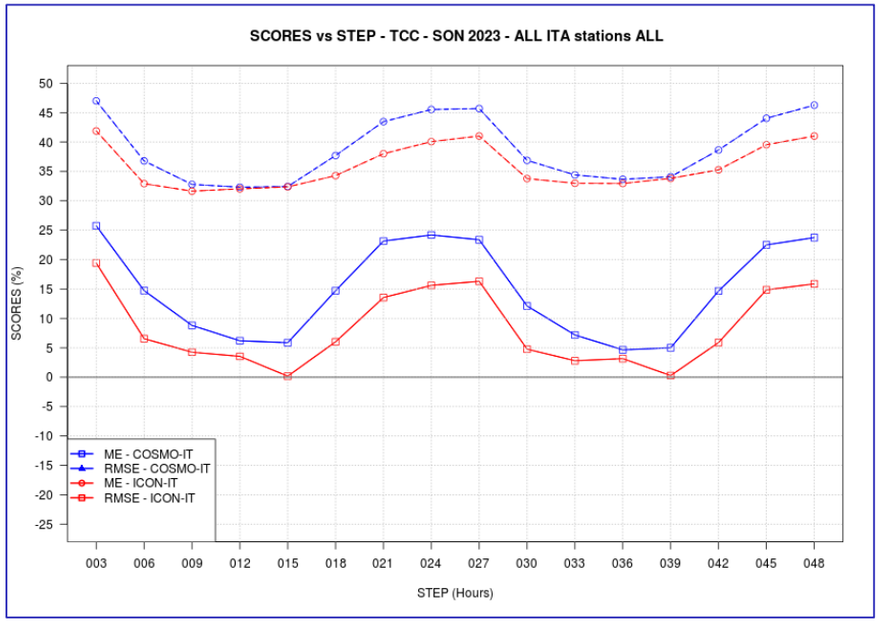
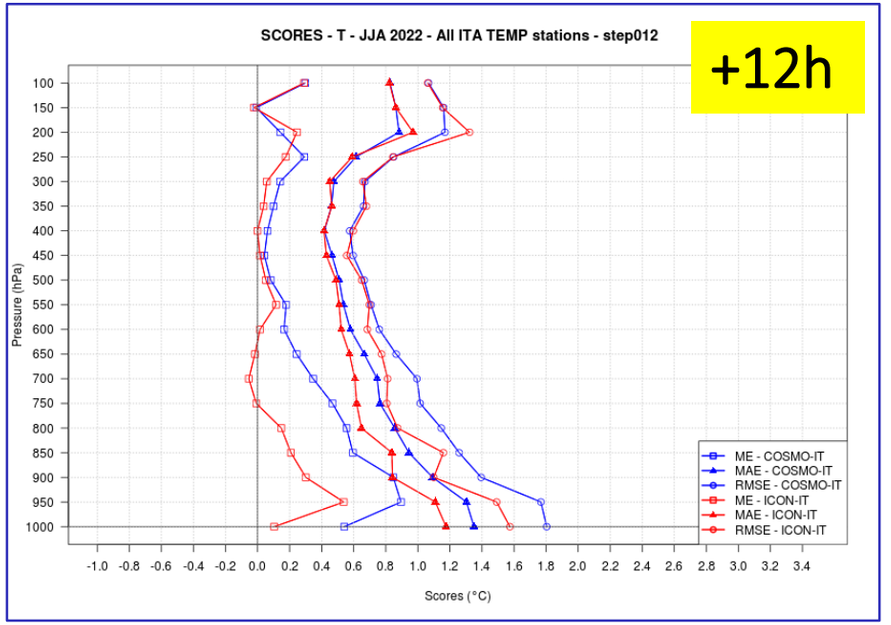


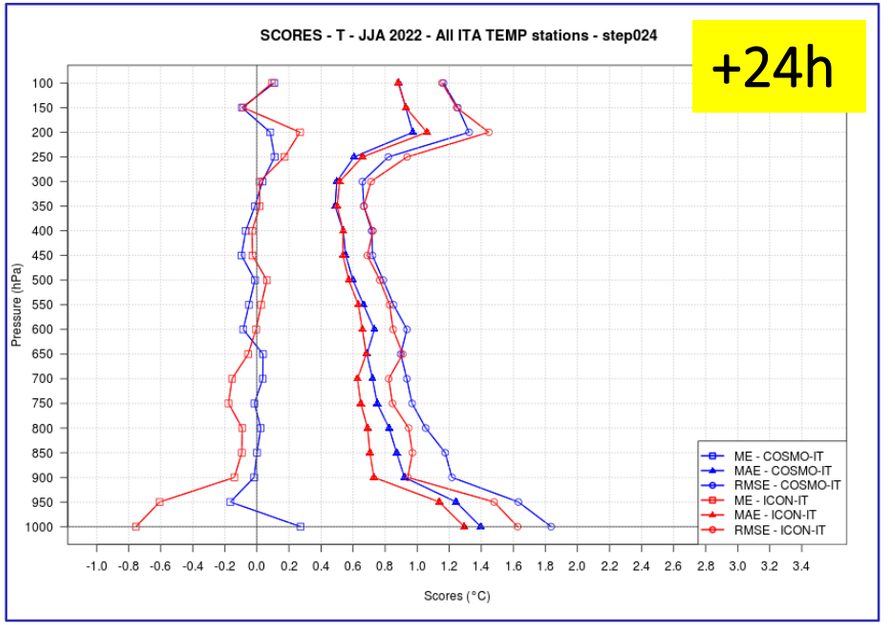


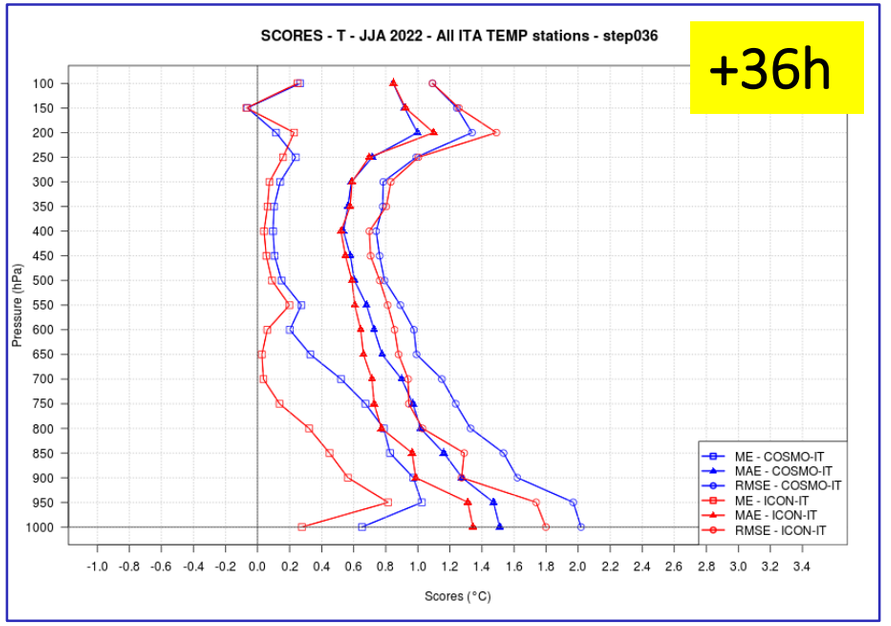
COSMO-IT vs ICON-IT (00UTC run)

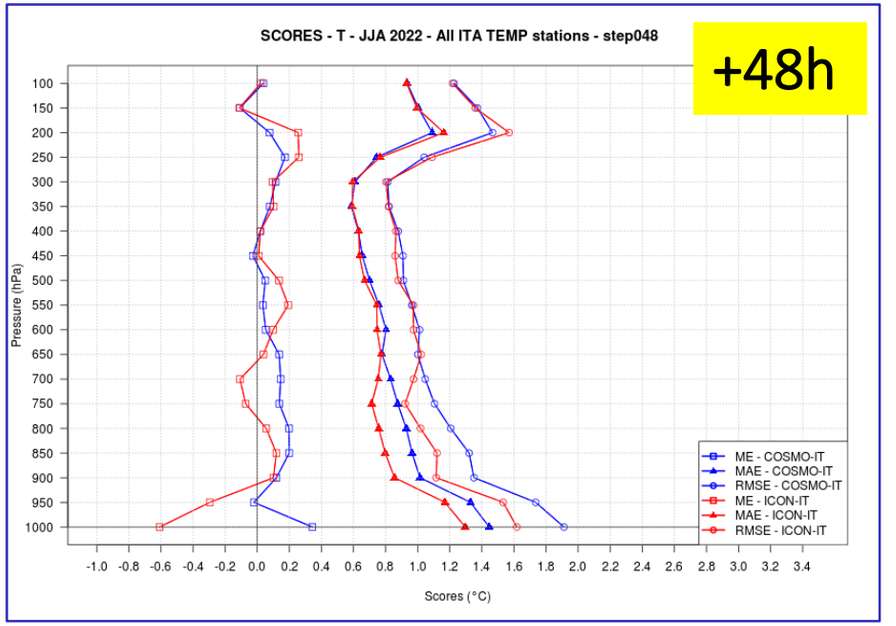
Upper Air Temperature

Forecast verifications against SOUNDINGS





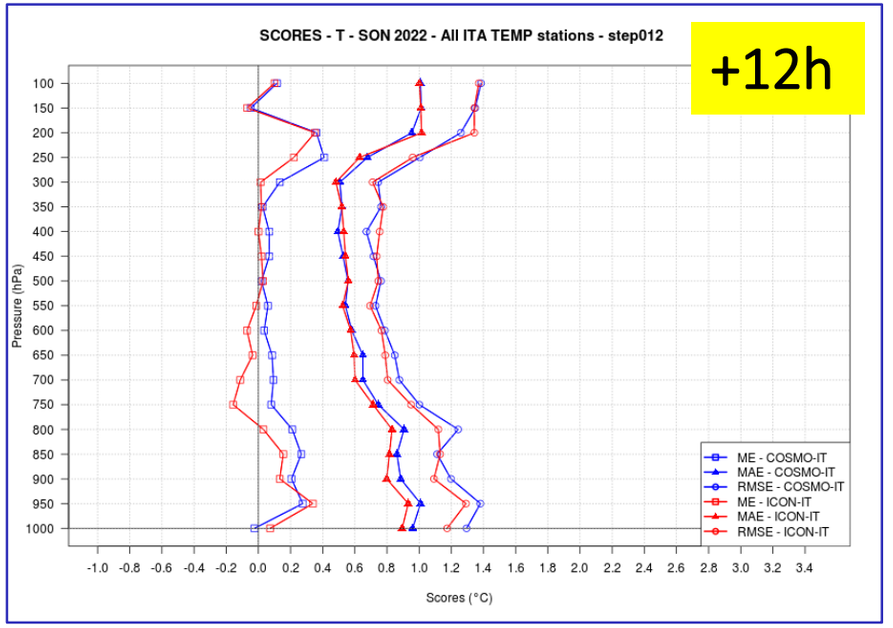


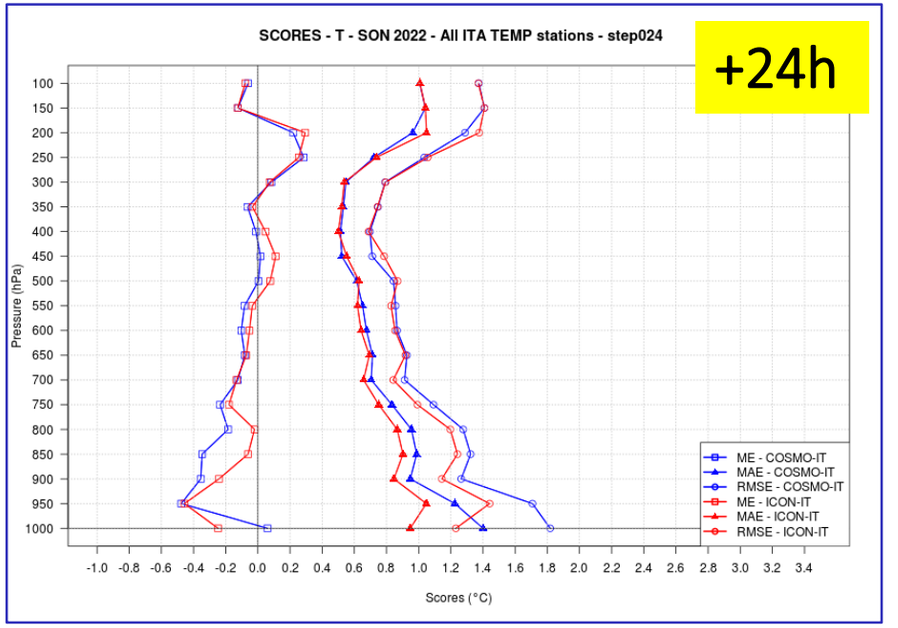


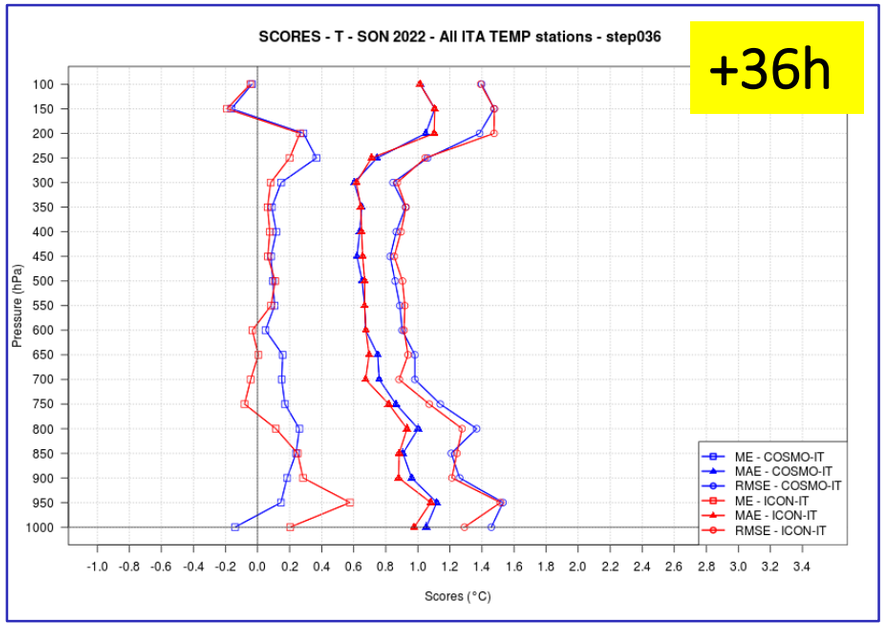
COSMO-IT vs ICON-IT (00UTC run)

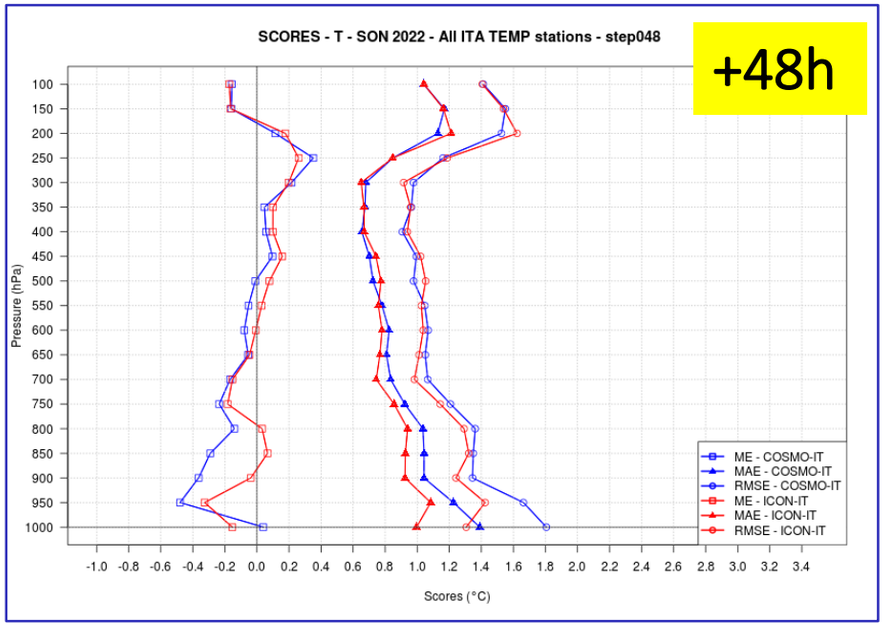
Upper Air Temperature

Forecast verifications against SOUNDINGS









COSMO-IT vs ICON-IT (00UTC run)

Upper Air Temperature

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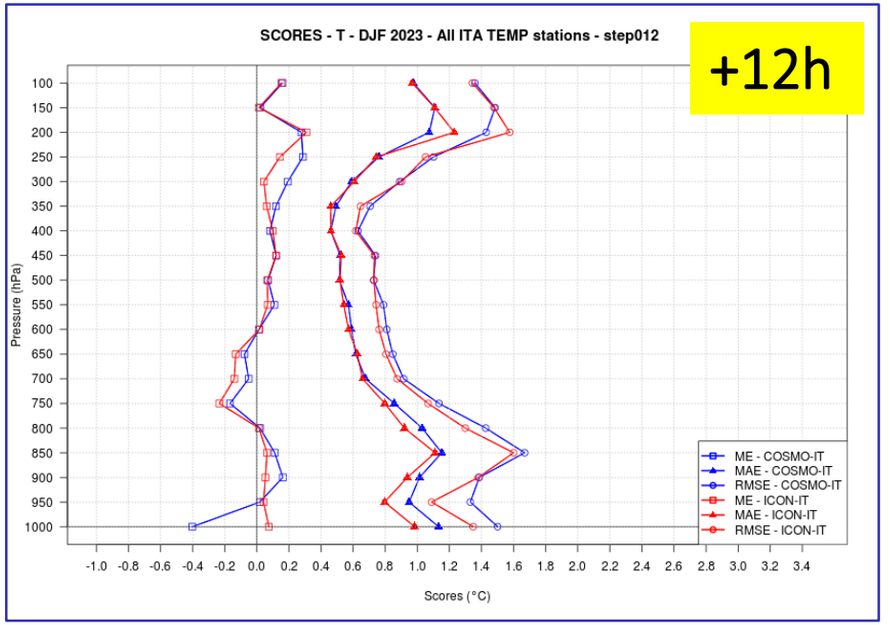
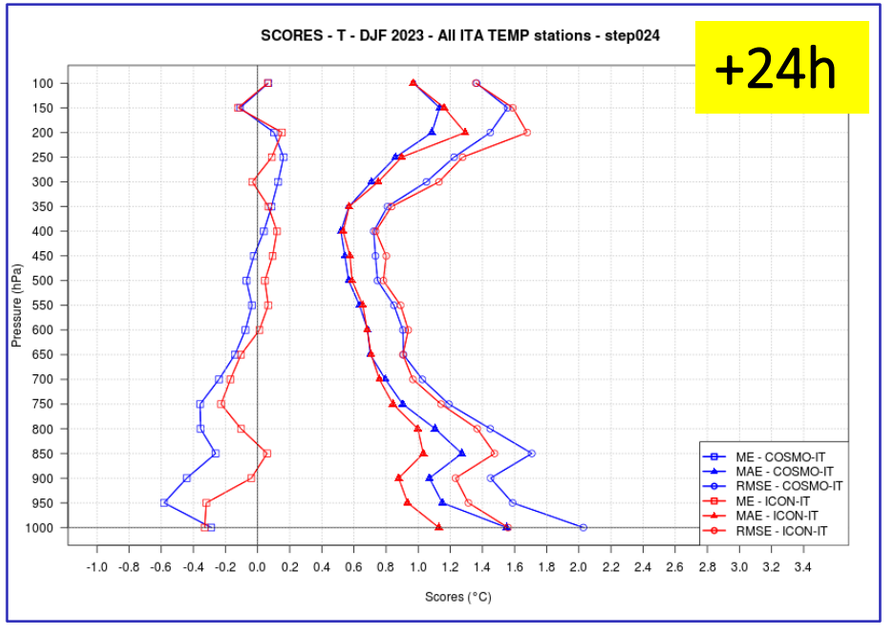
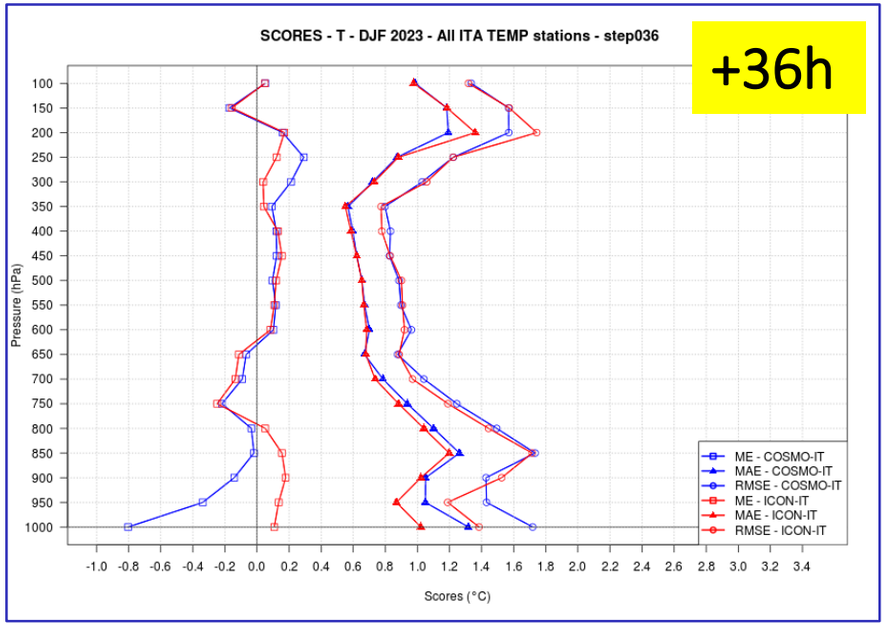
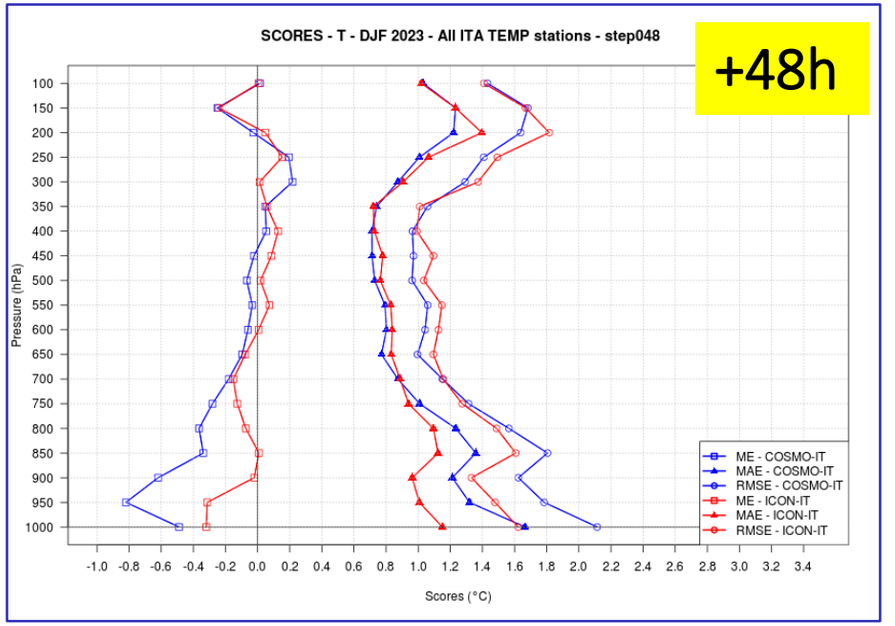




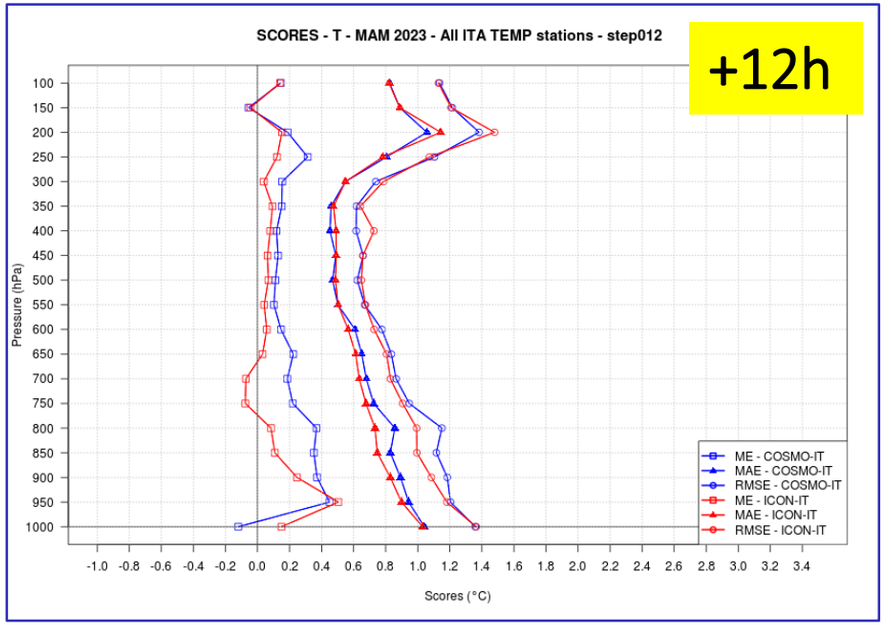


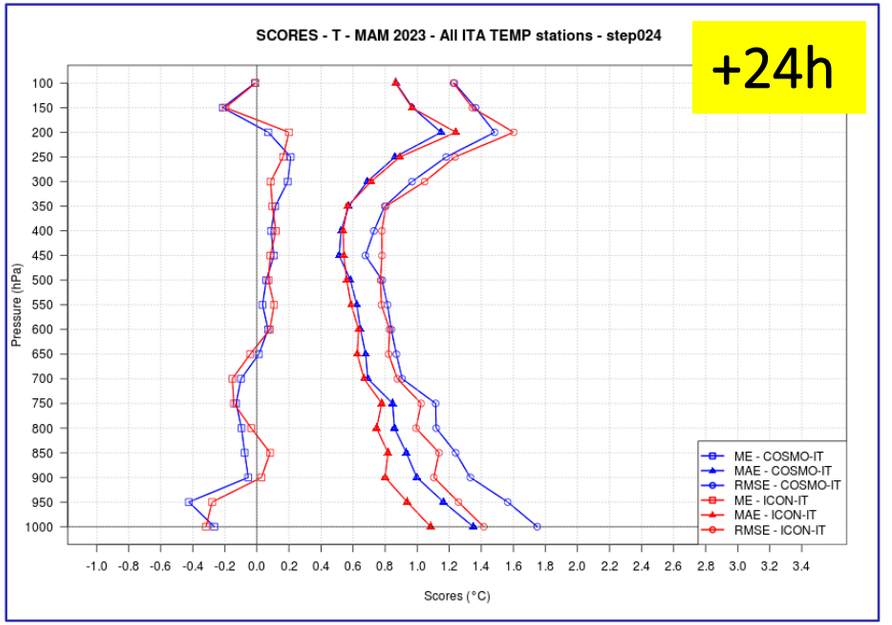


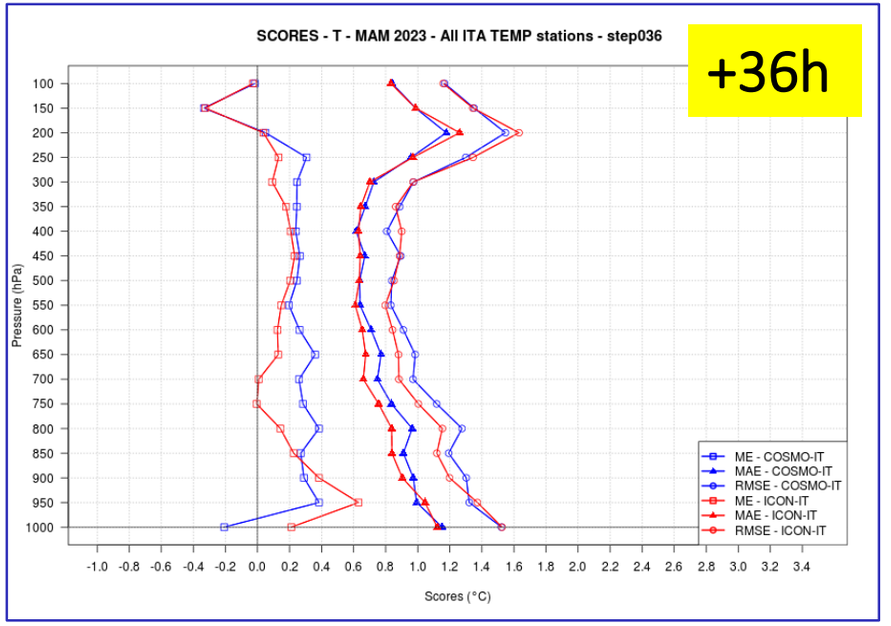
COSMO-IT vs ICON-IT (00UTC run)

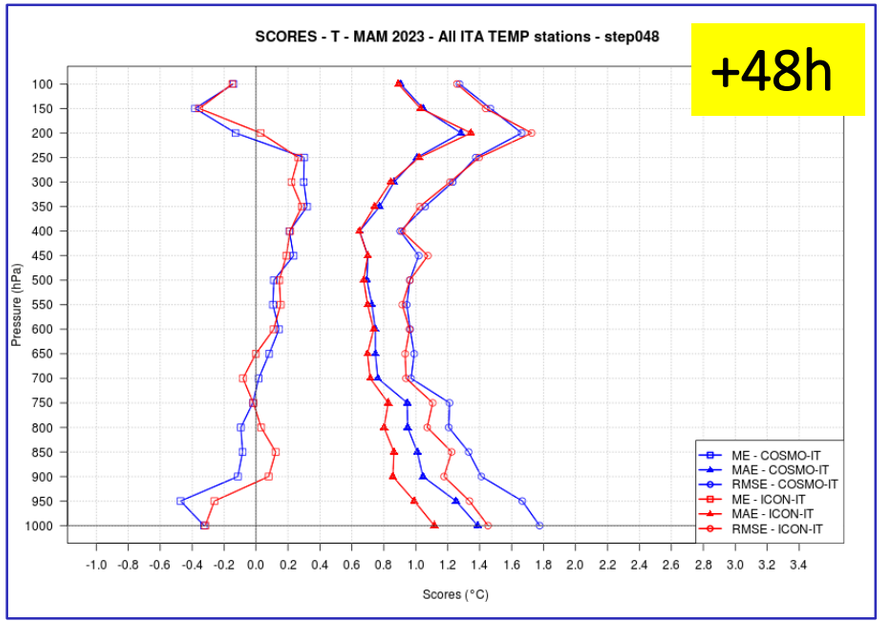
Upper Air Temperature

Forecast verifications against SOUNDINGS









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Upper Air Temperature

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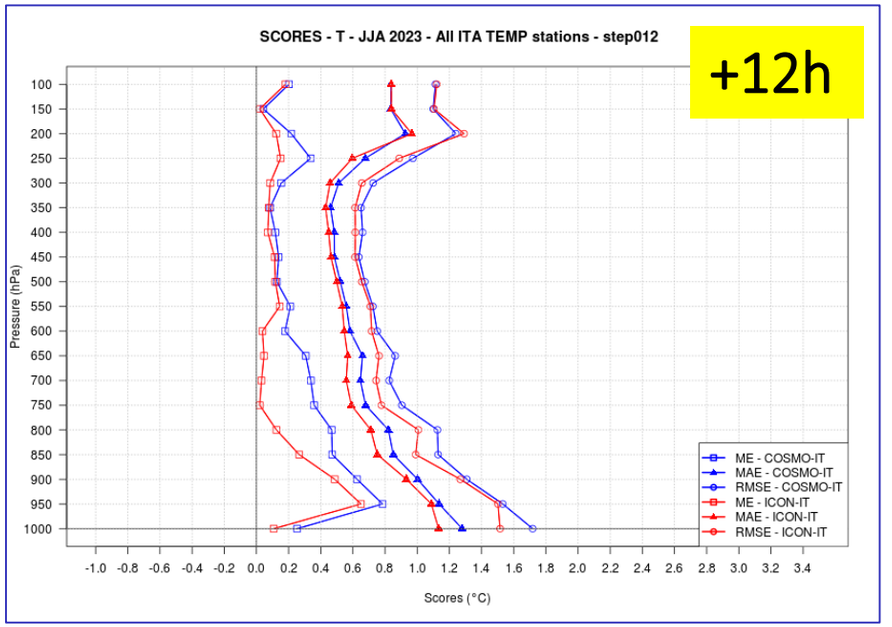

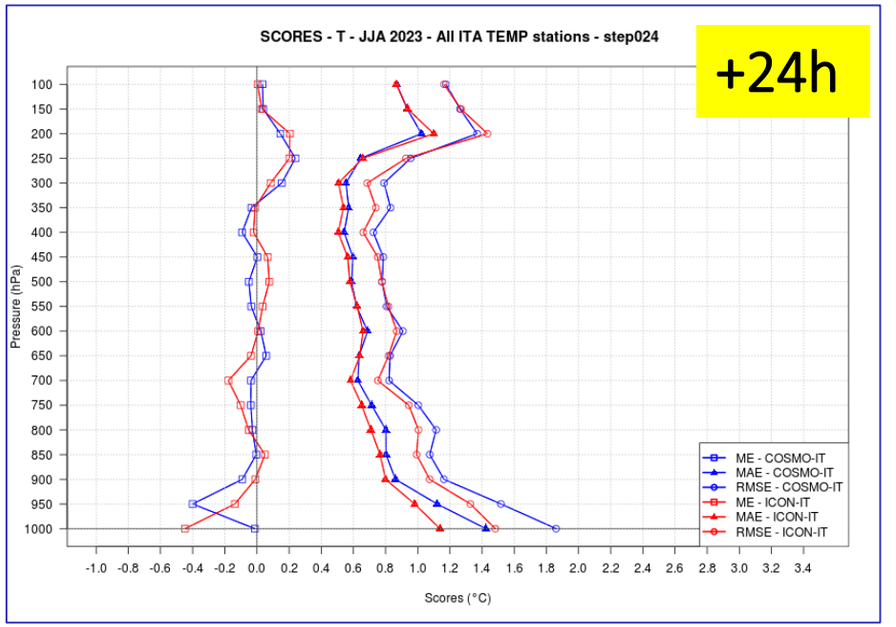

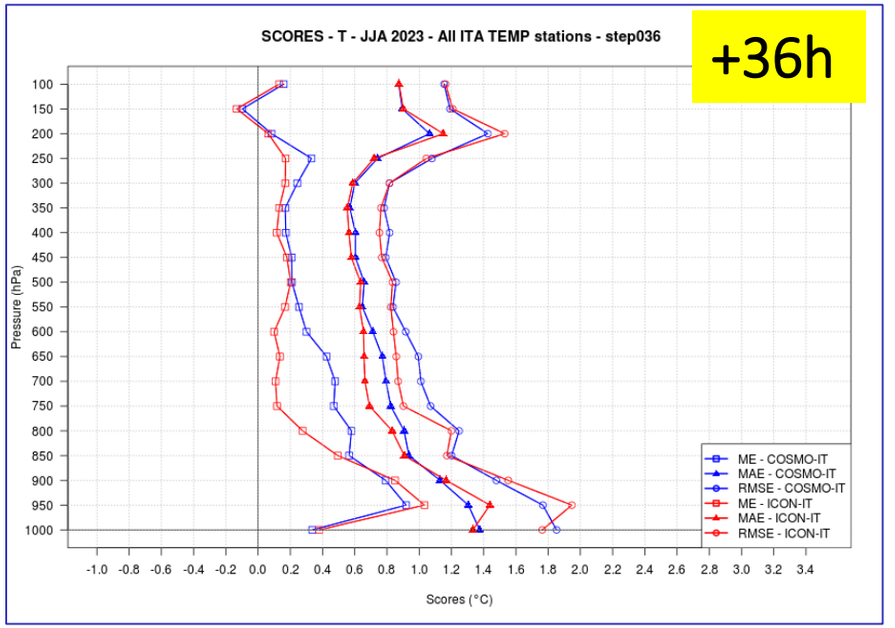

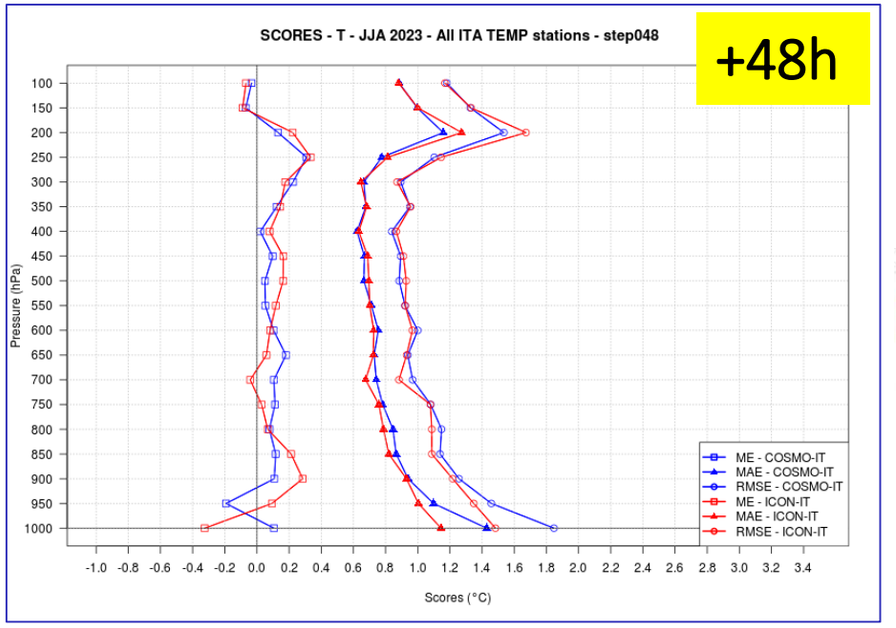

COSMO-IT vs ICON-IT (00UTC run)

Upper Air Temperature

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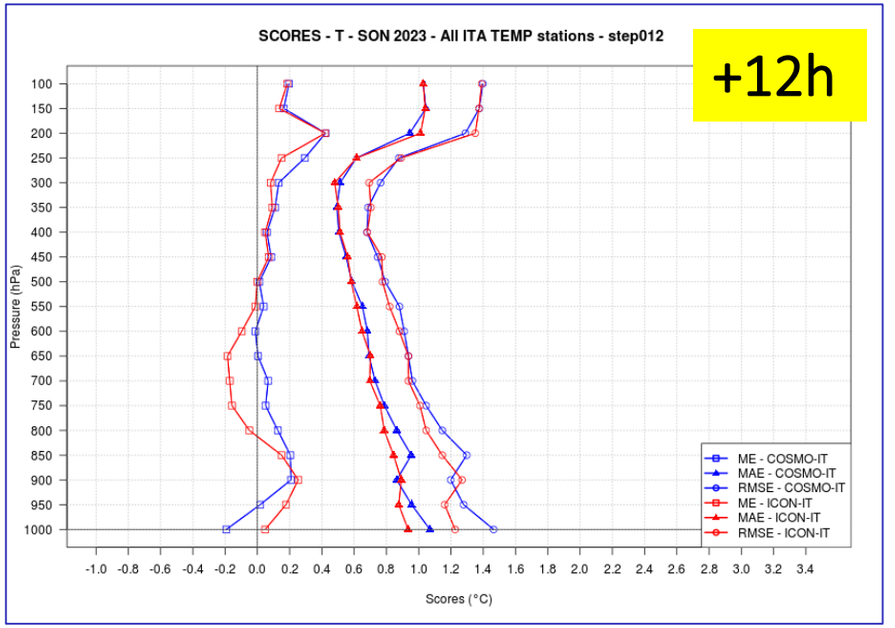
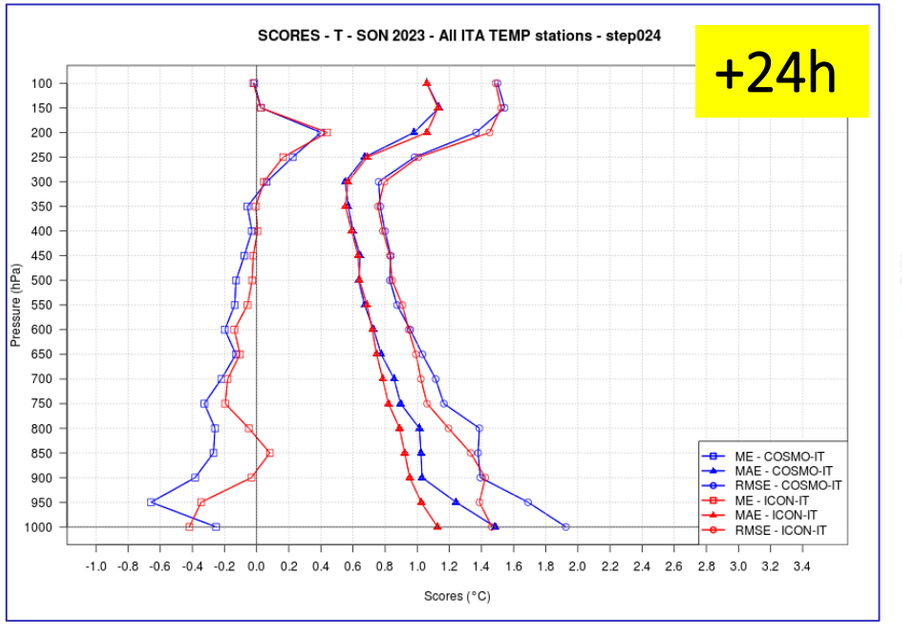
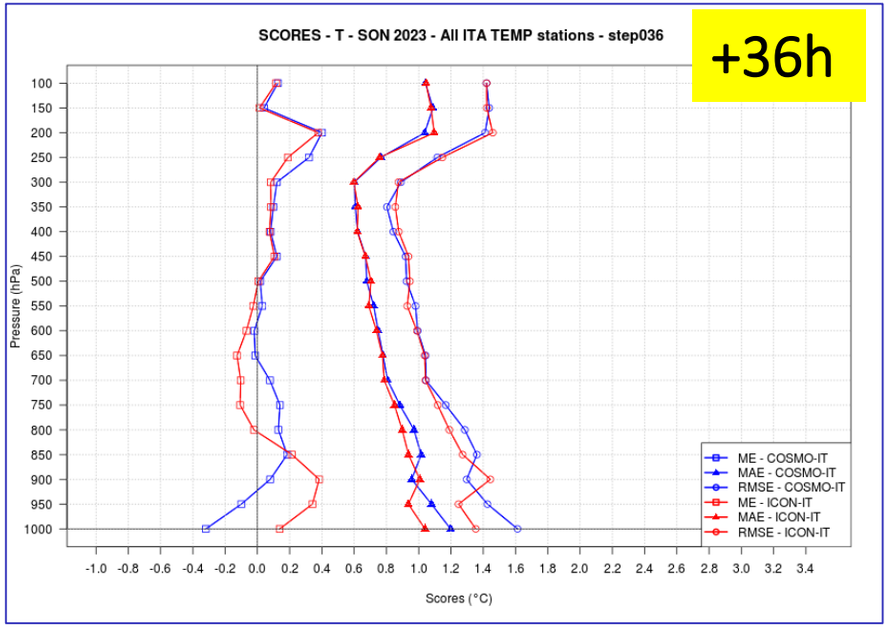
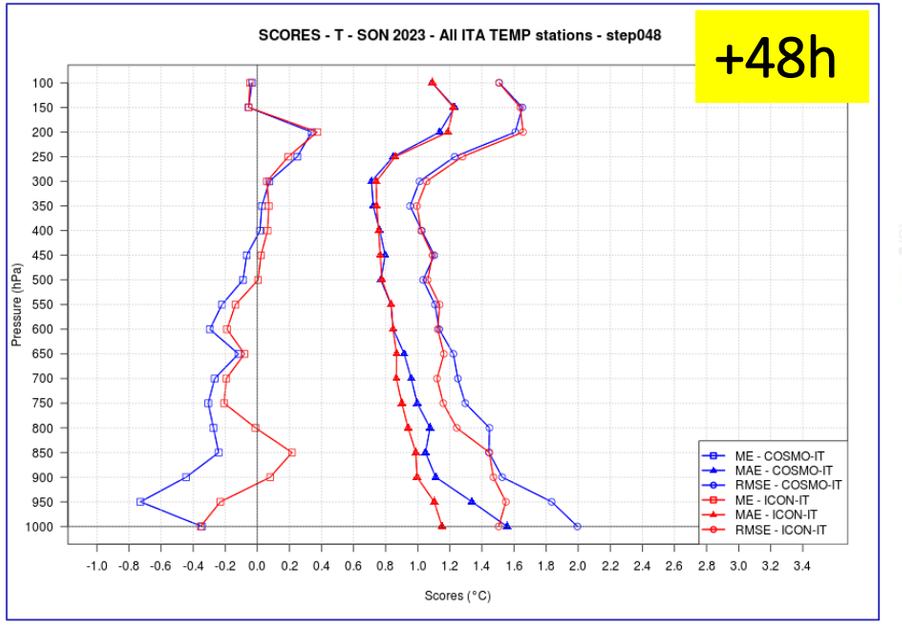




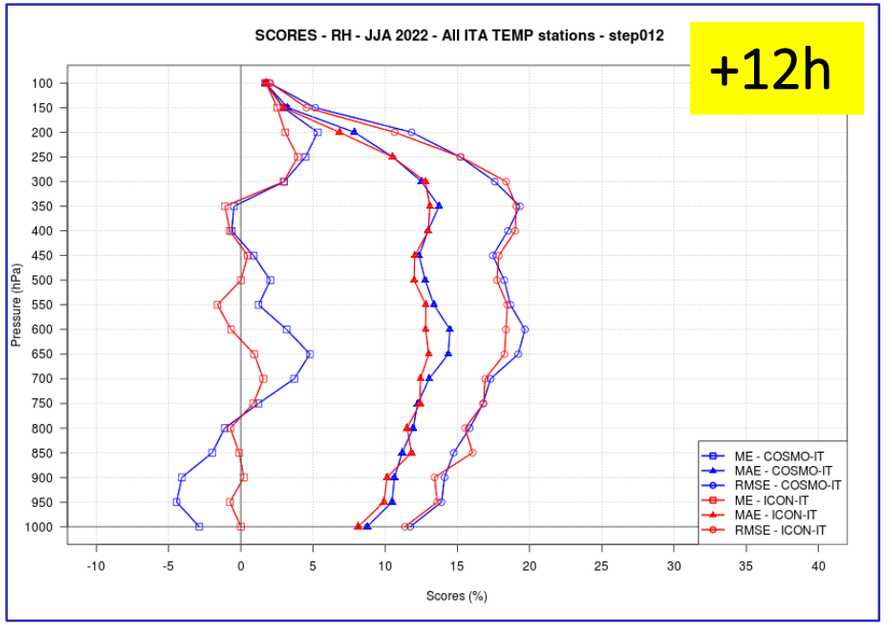


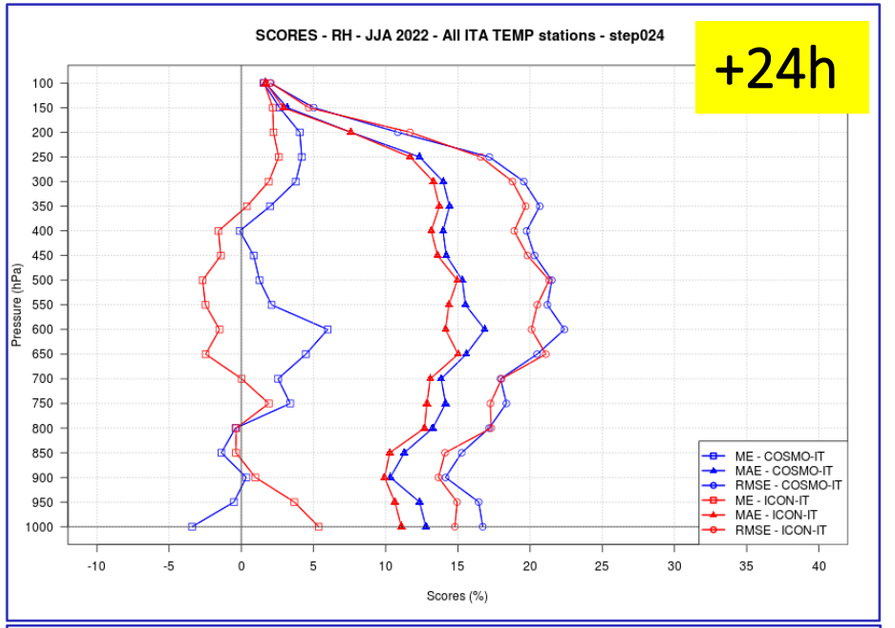


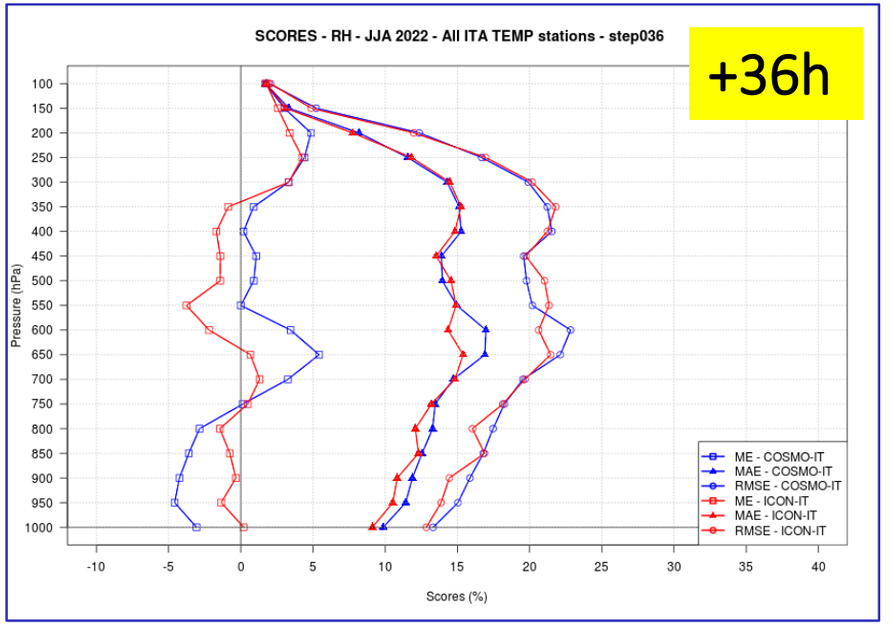
COSMO-IT vs ICON-IT (00UTC run)

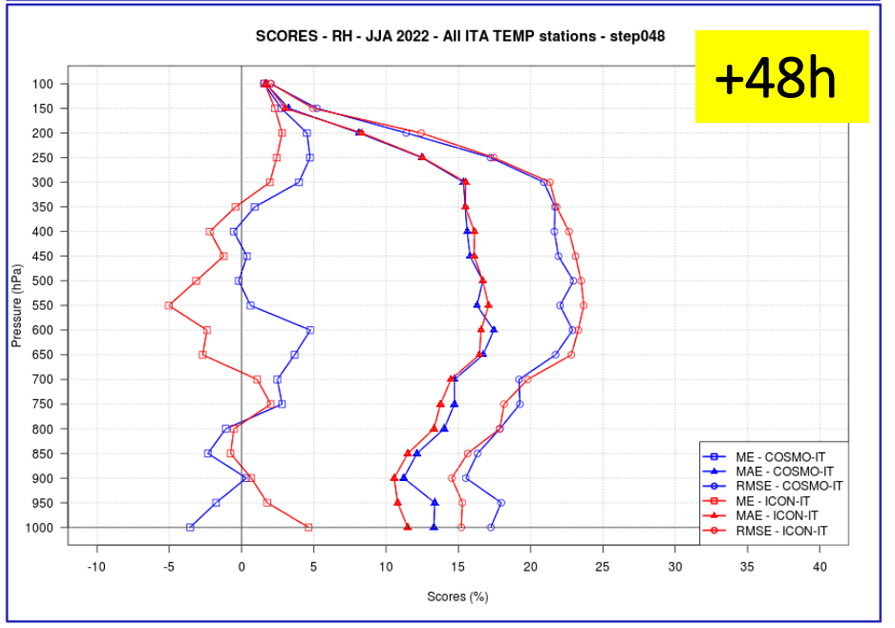
Upper Rel Humidity

Forecast verifications against SOUNDINGS





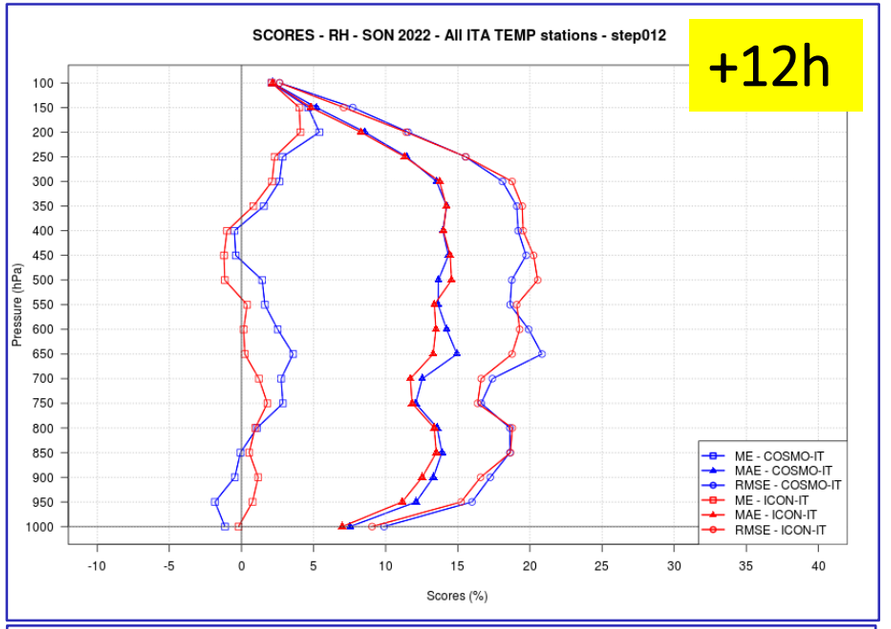


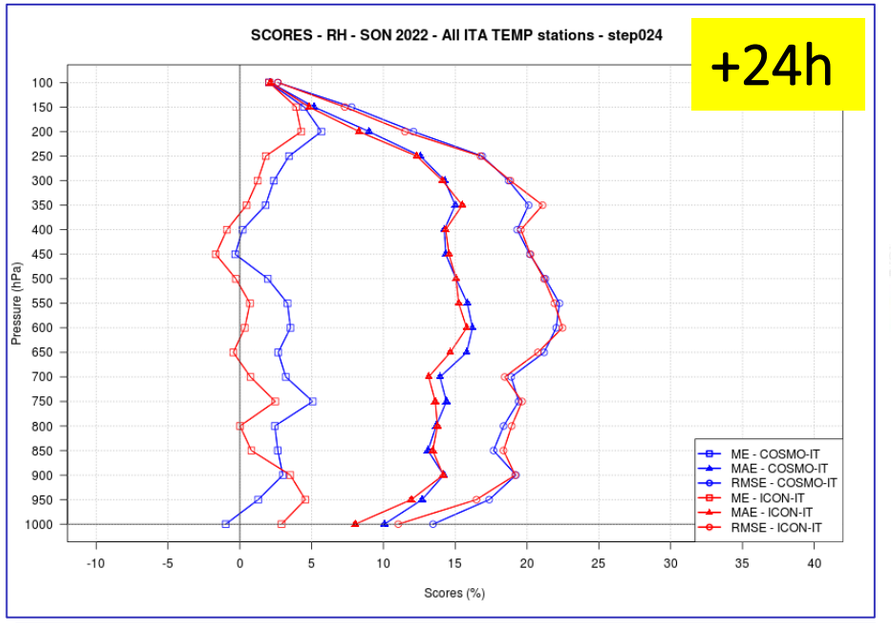


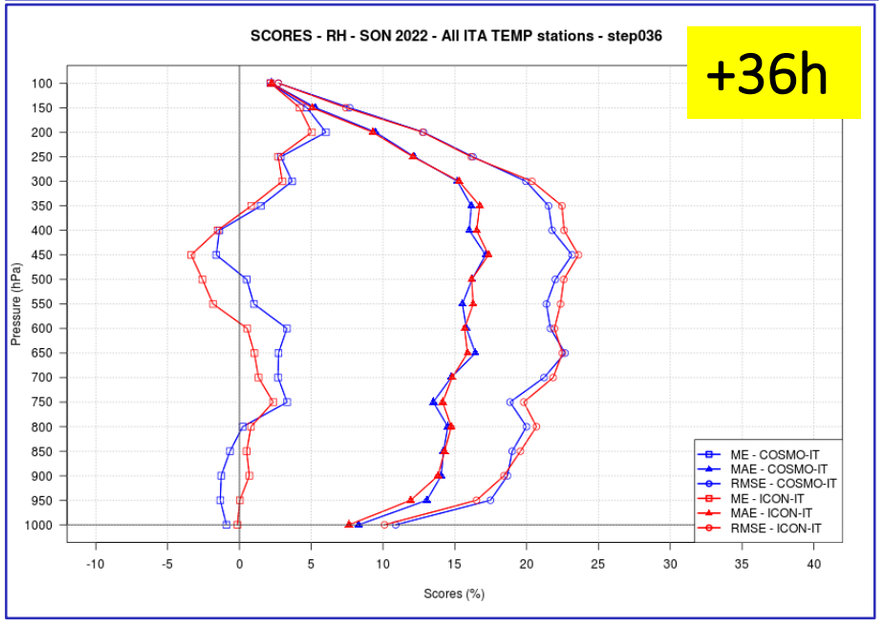
COSMO-IT vs ICON-IT (00UTC run)

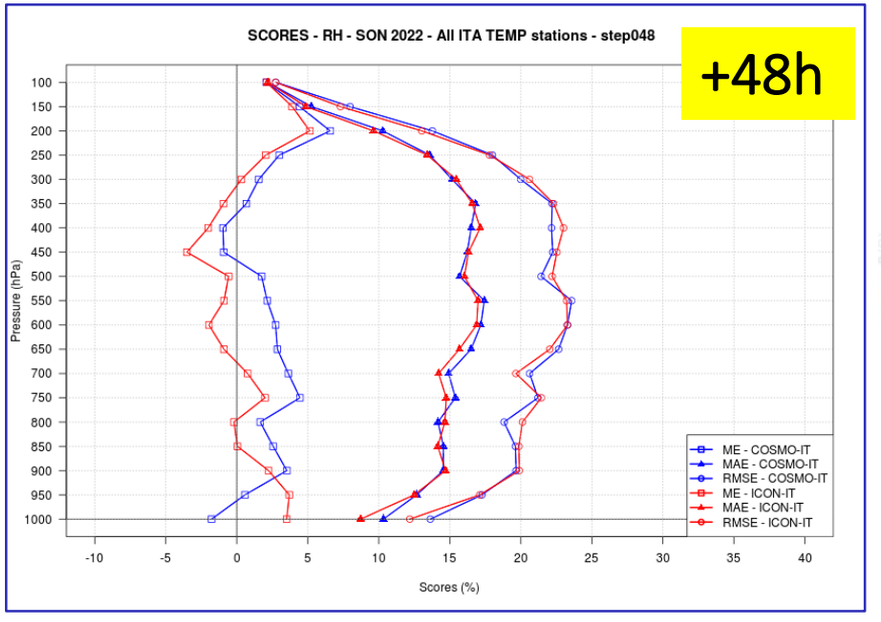
Upper Rel Humidity

Forecast verifications against SOUNDINGS





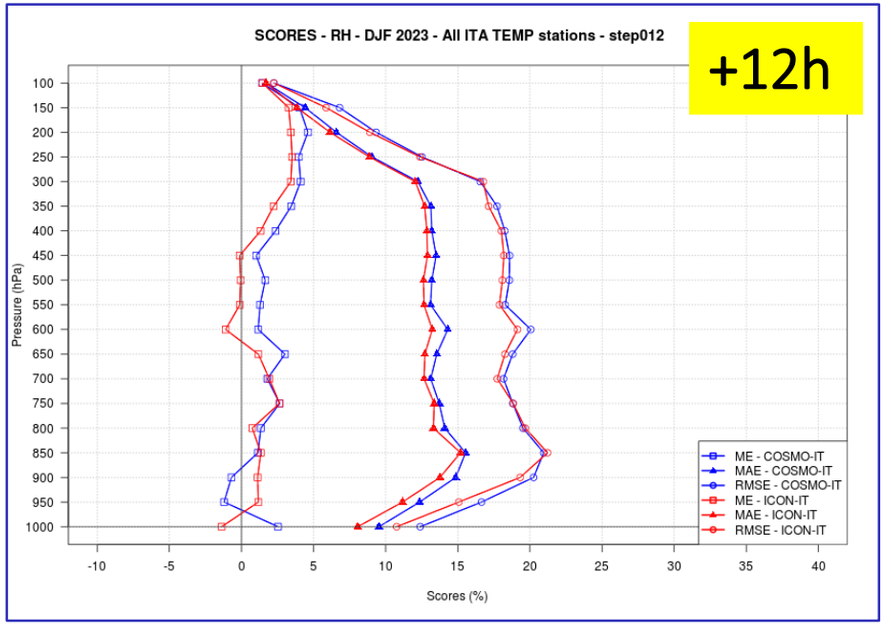


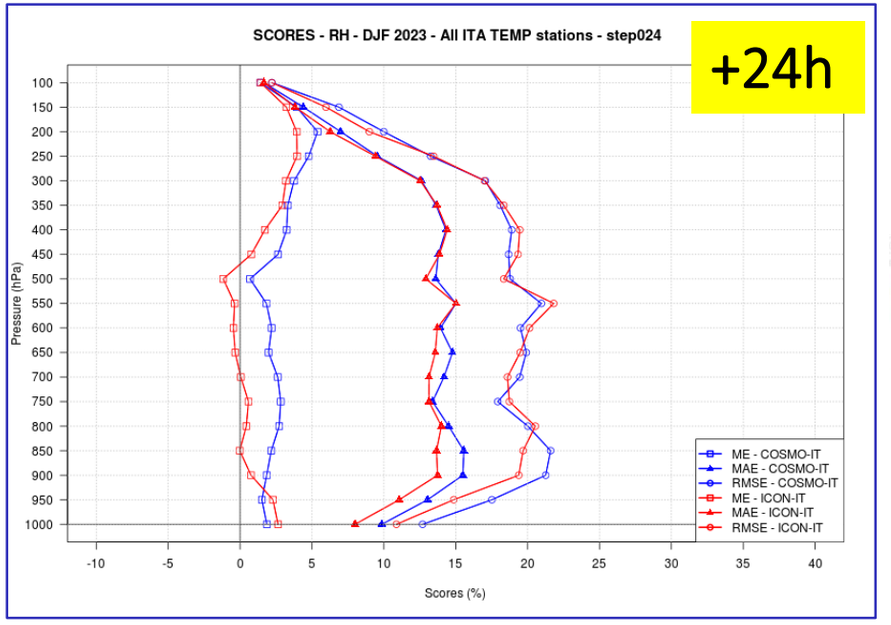


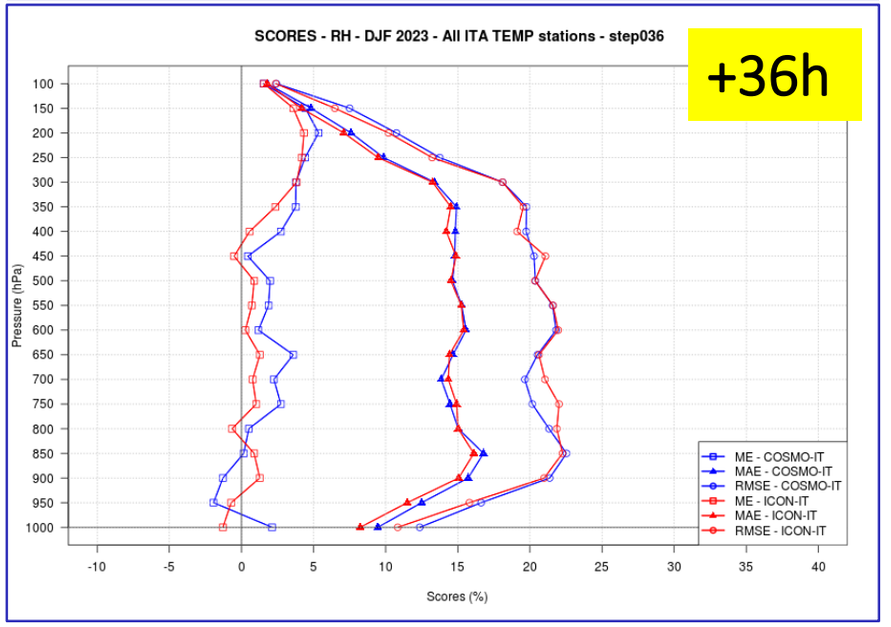
COSMO-IT vs ICON-IT (00UTC run)

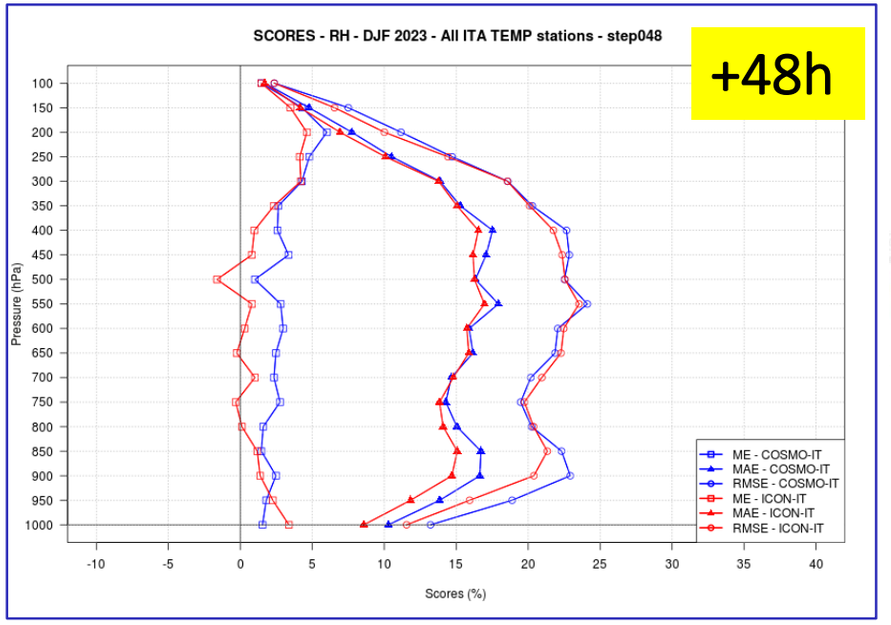
Upper Rel Humidity

Forecast verifications against SOUNDINGS





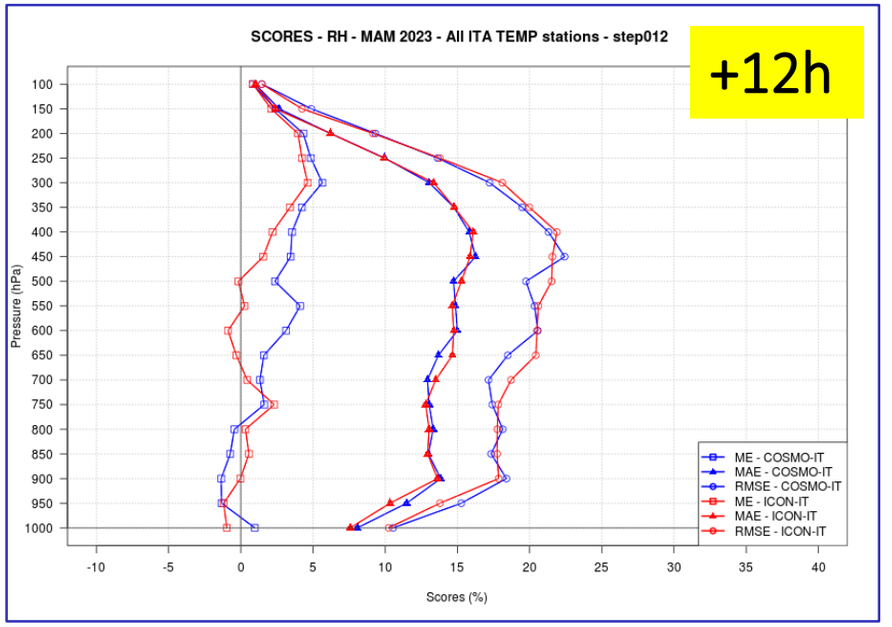


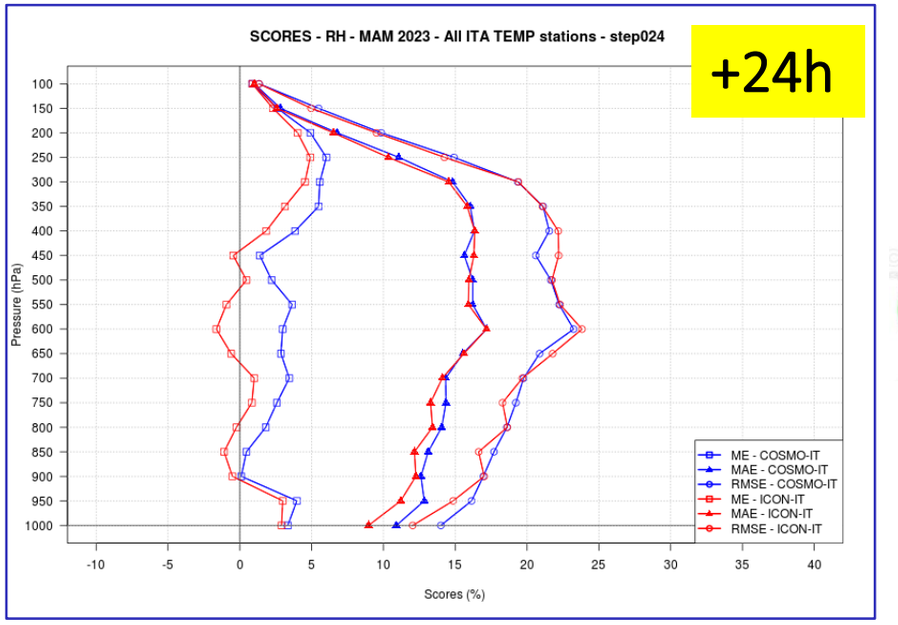


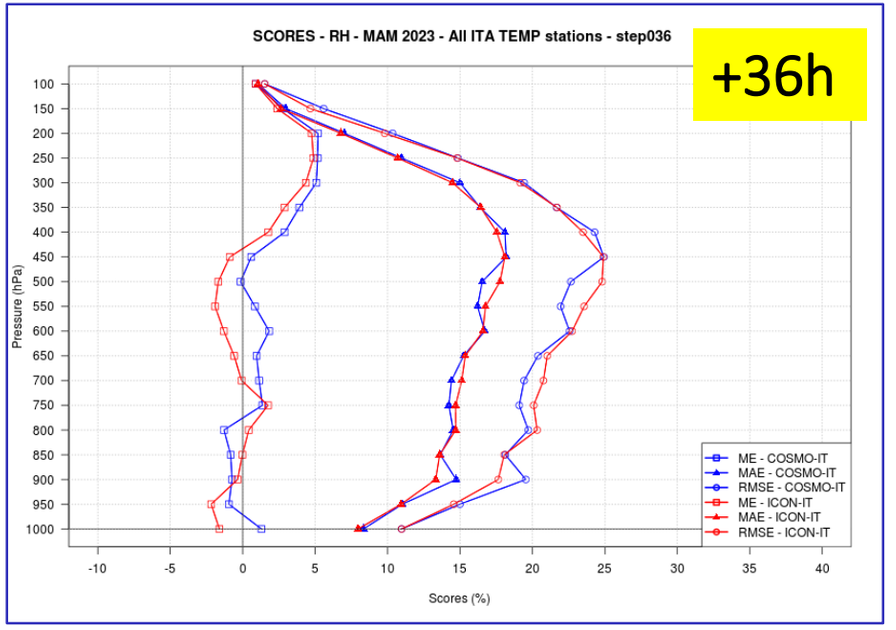
COSMO-IT vs ICON-IT (00UTC run)

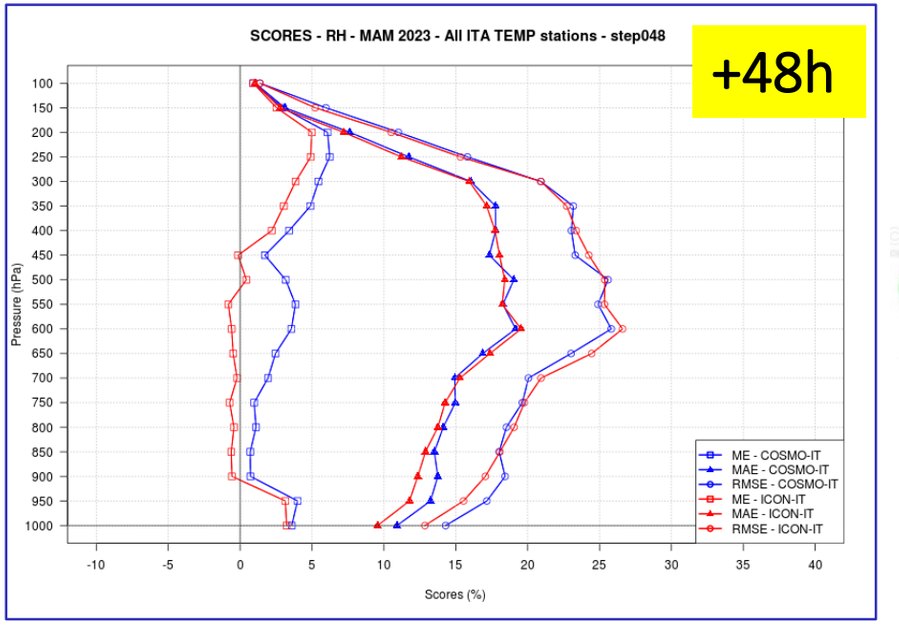
Upper Rel Humidity

Forecast verifications against SOUNDINGS





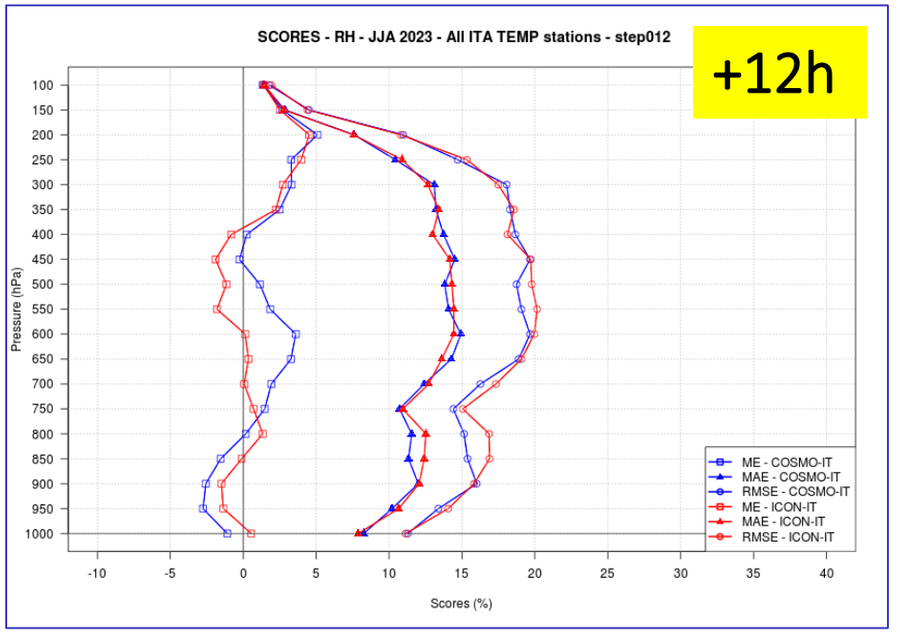


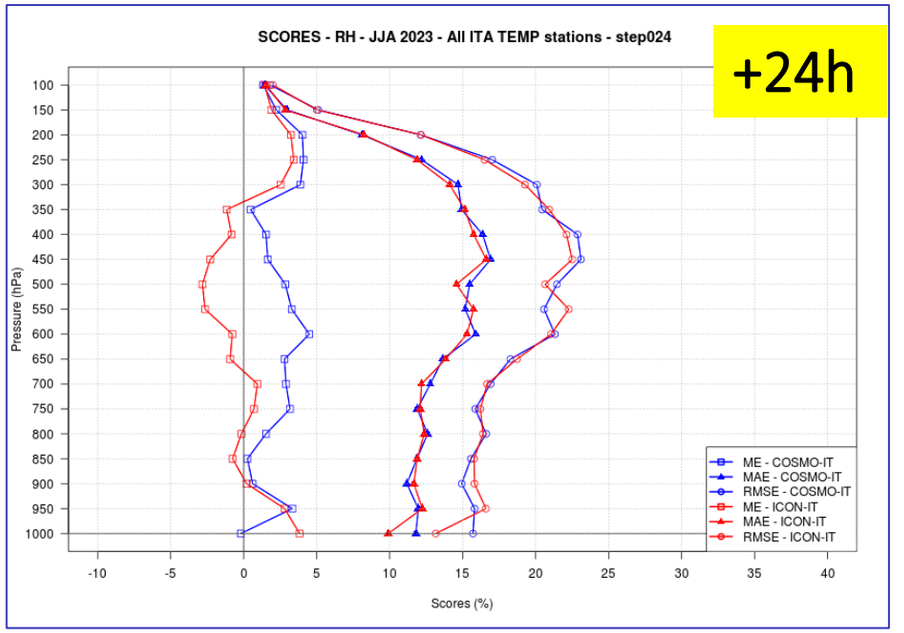


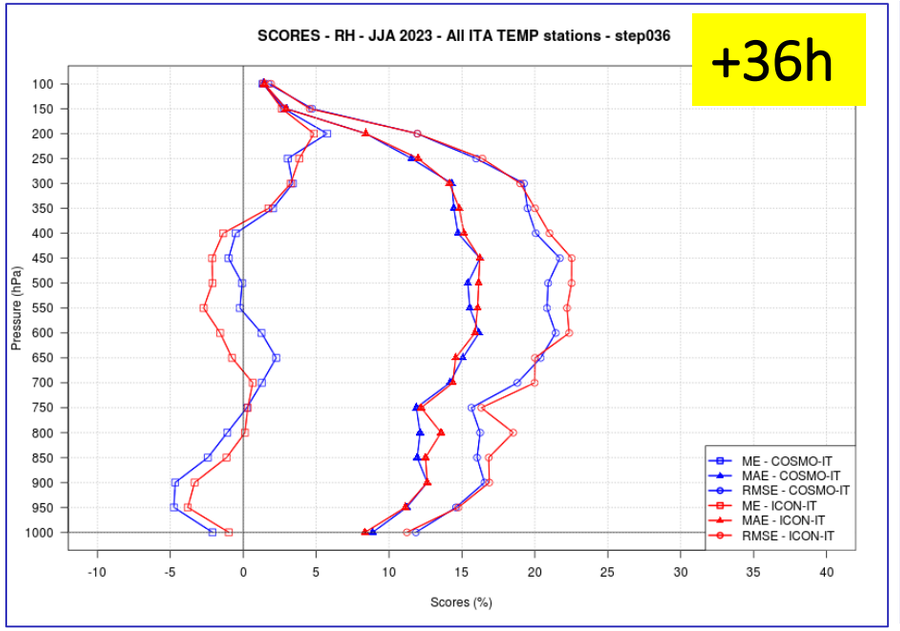
COSMO-IT vs ICON-IT (00UTC run)

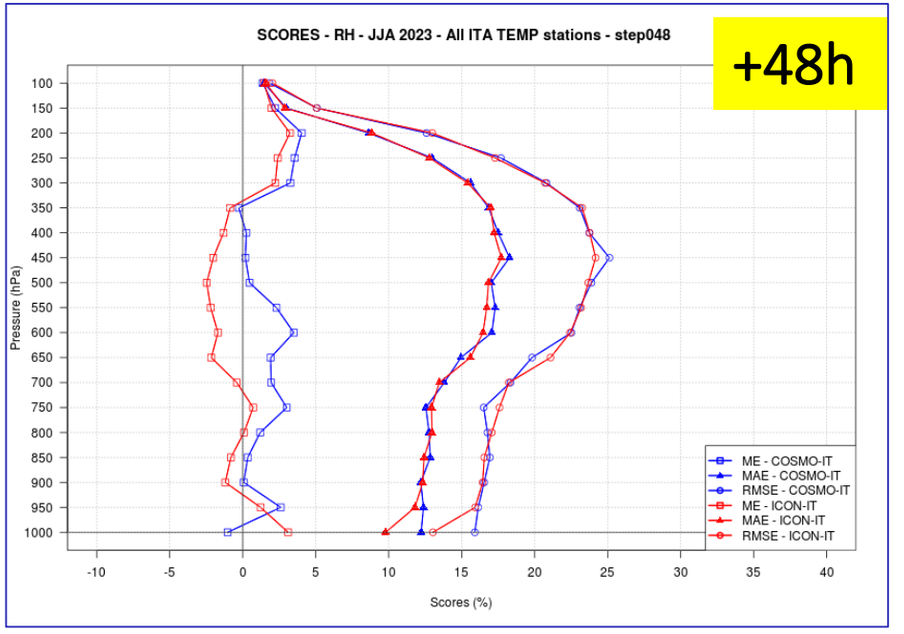
Upper Rel Humidity

Forecast verifications against SOUNDINGS





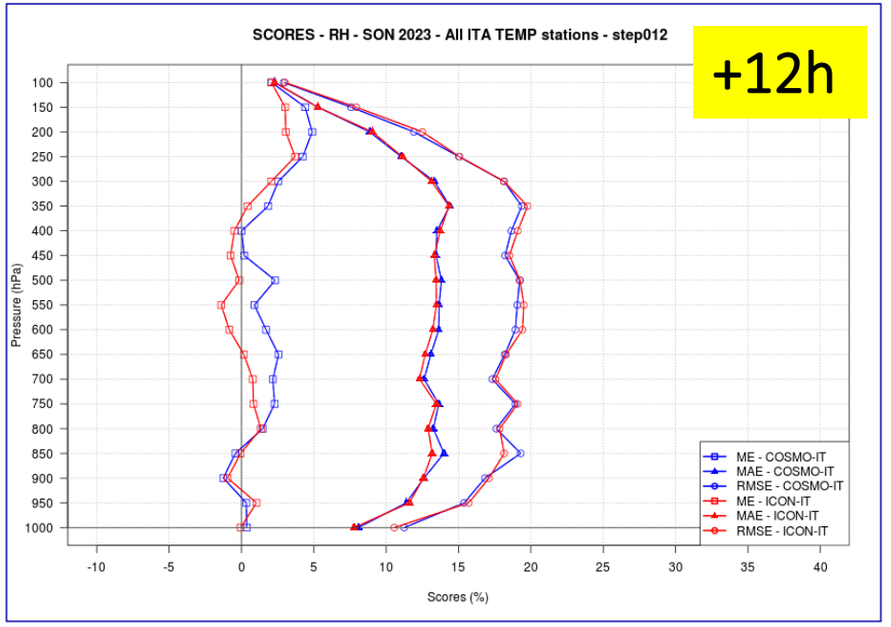


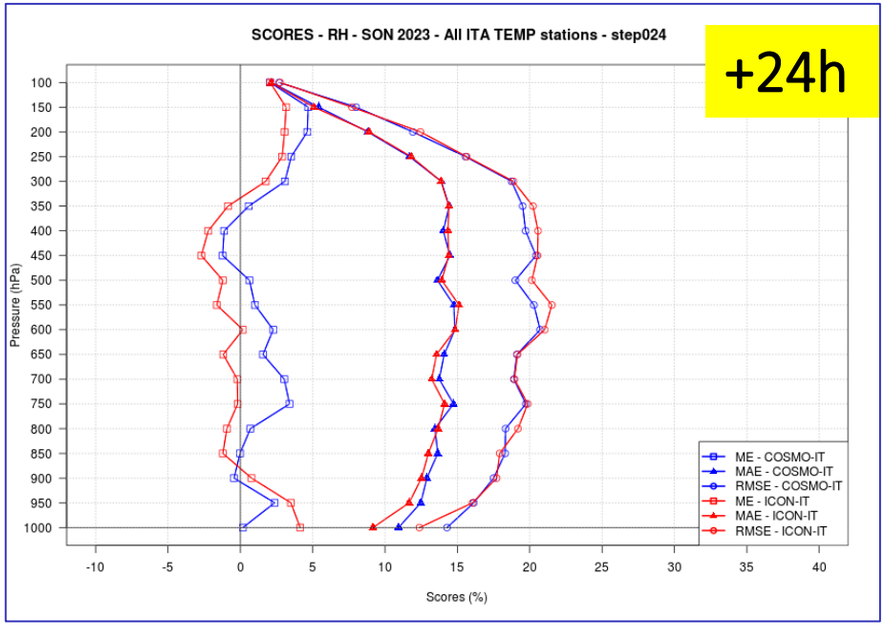


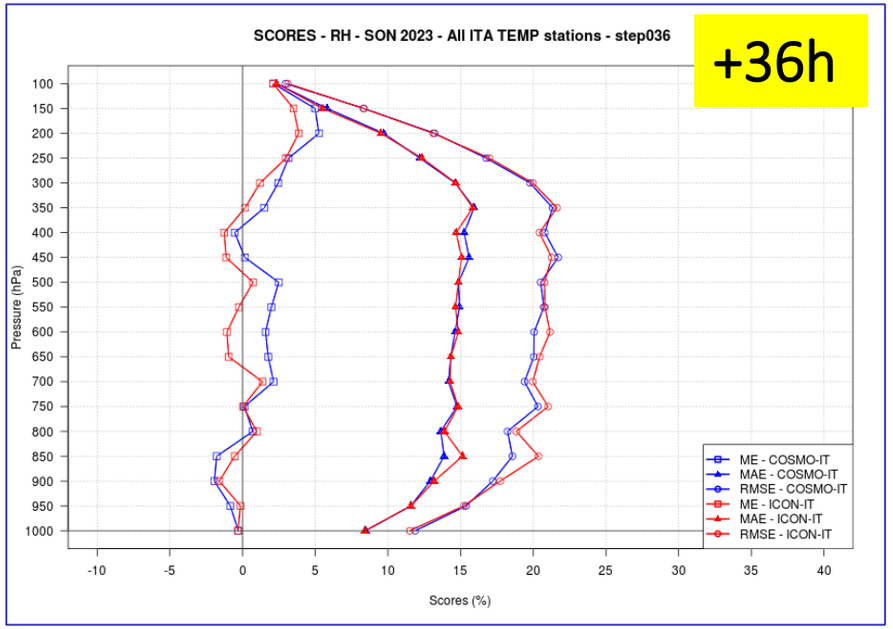
COSMO-IT vs ICON-IT (00UTC run)

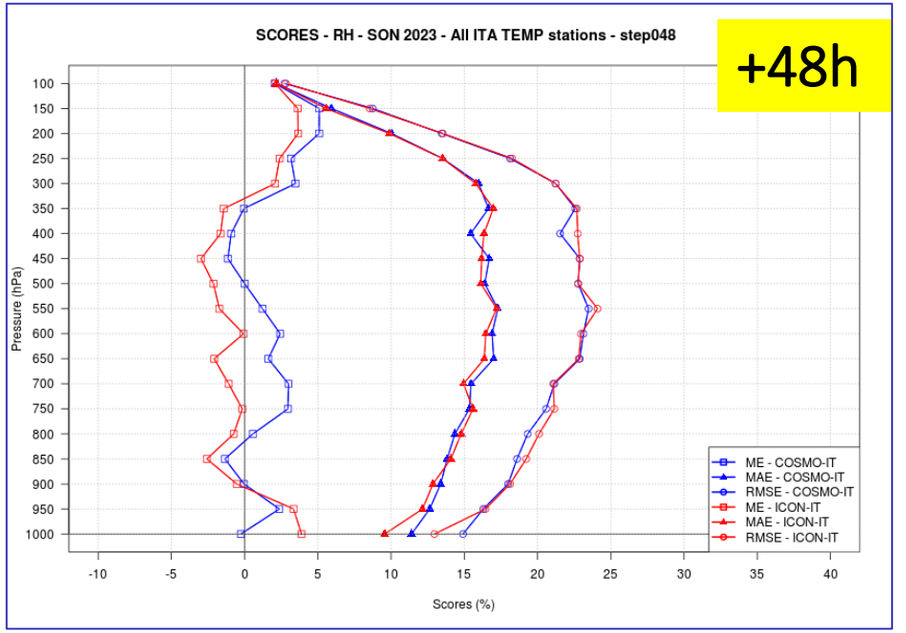
Upper Rel Humidity

Forecast verifications against SOUNDINGS





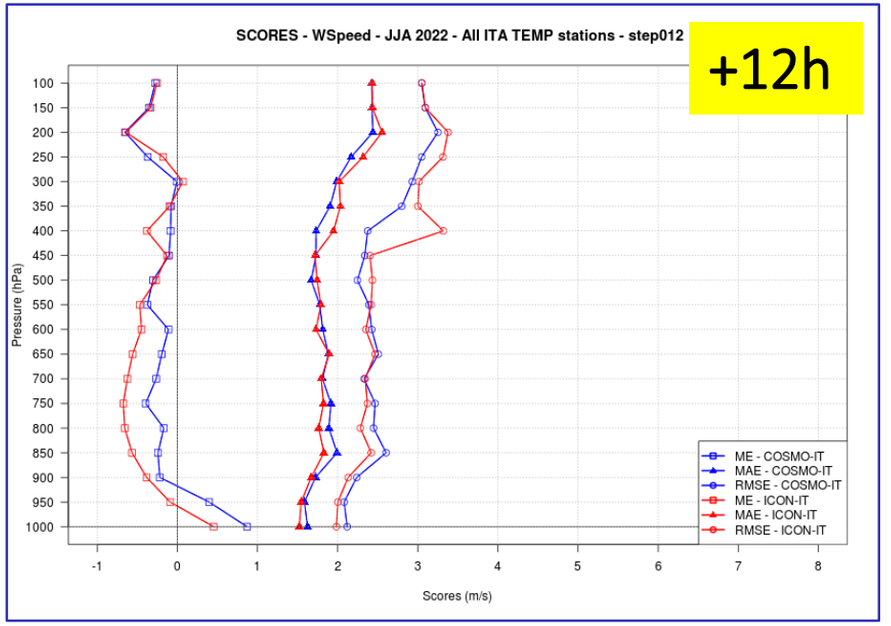


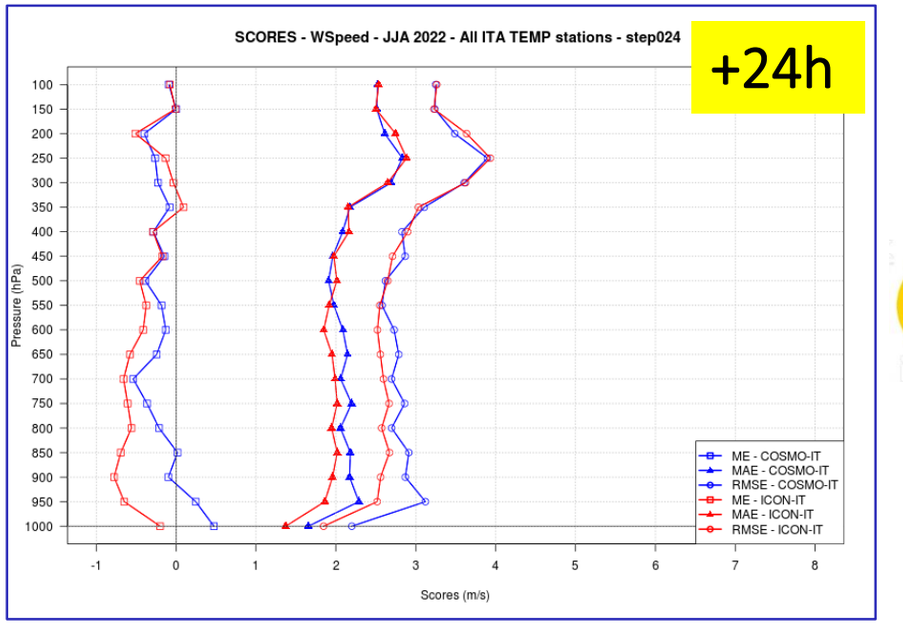


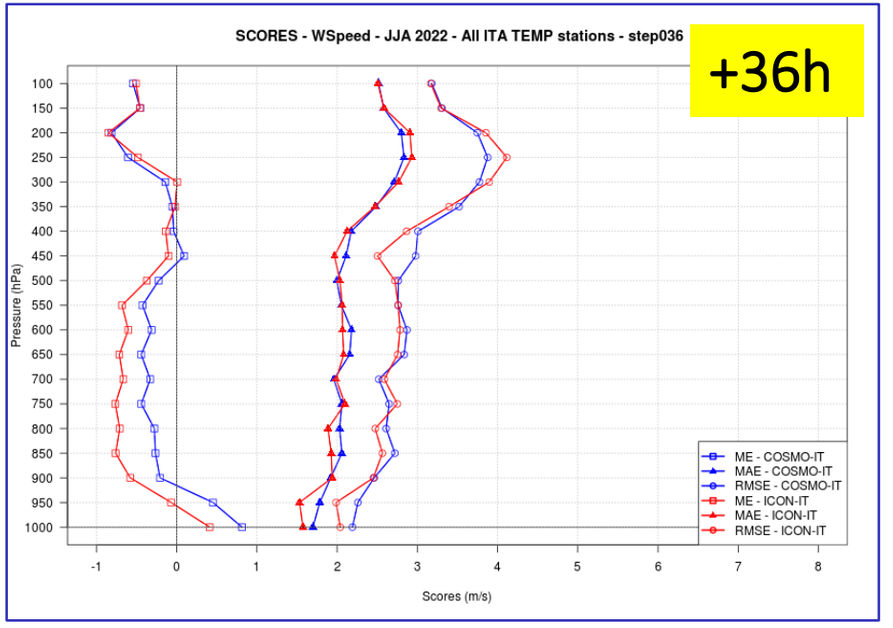
COSMO-IT vs ICON-IT (00UTC run)

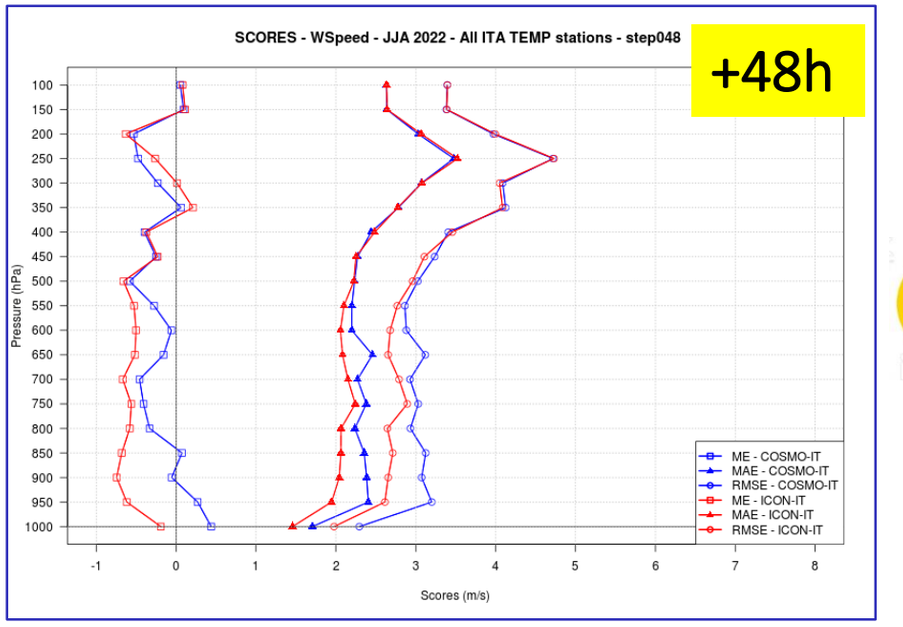
Upper Wind Speed

Forecast verifications against SOUNDINGS





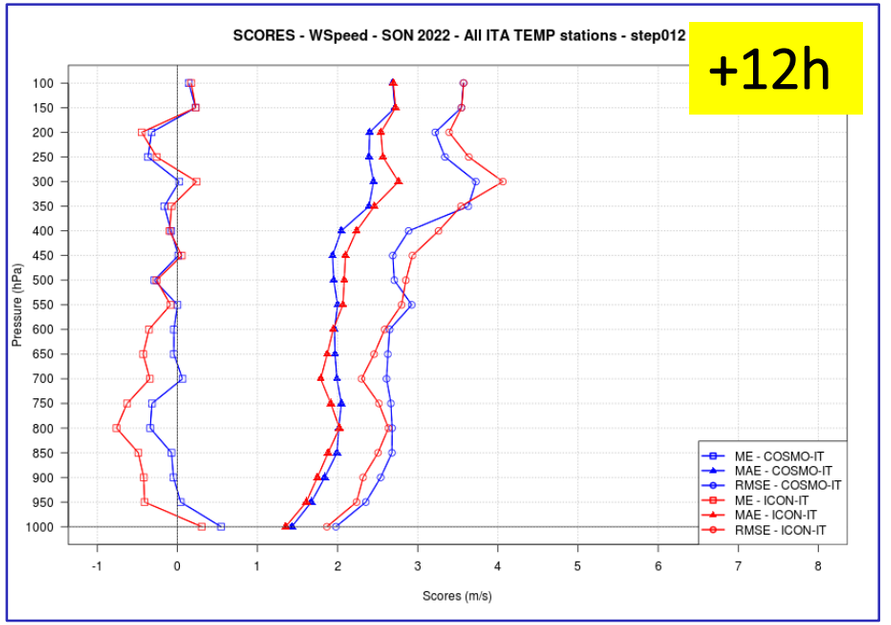


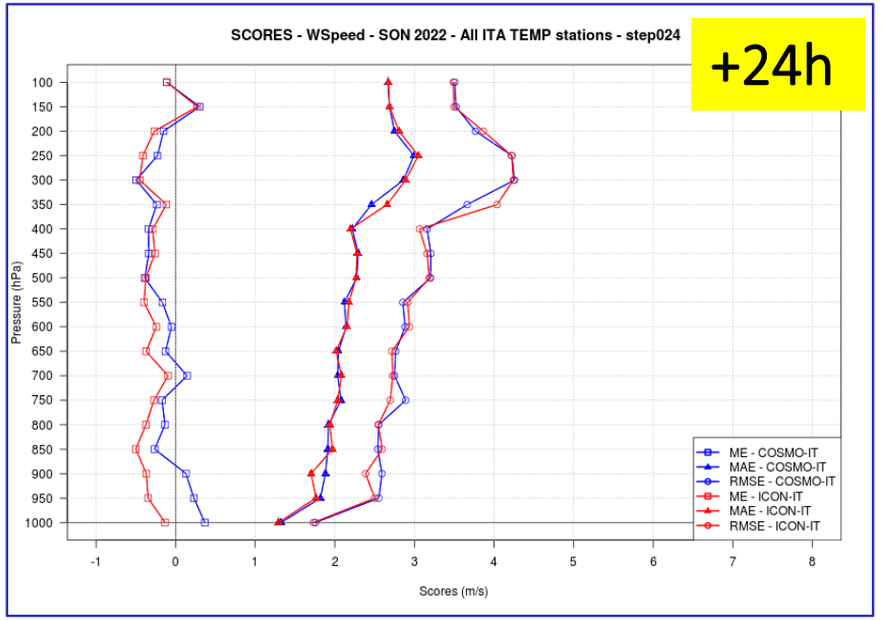


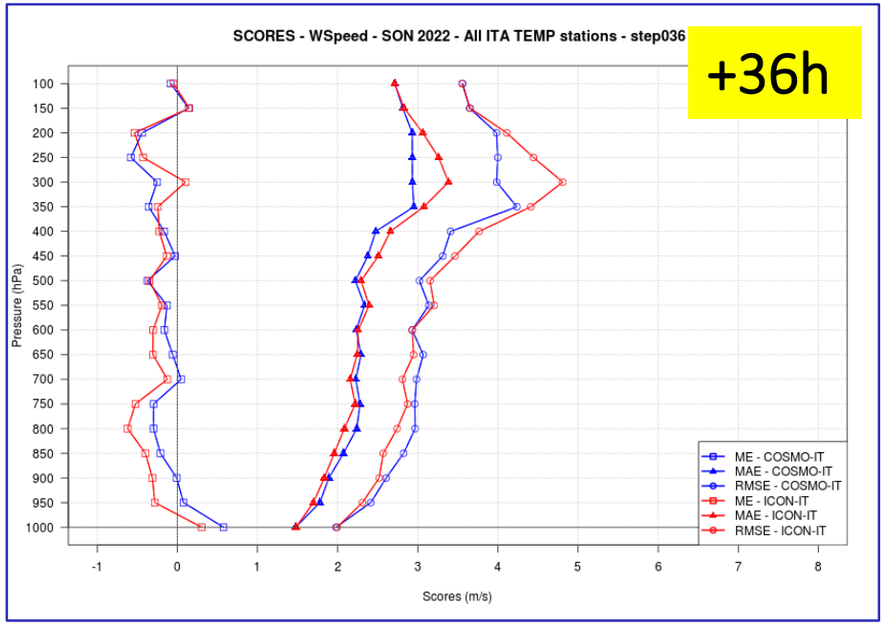
COSMO-IT vs ICON-IT (00UTC run)

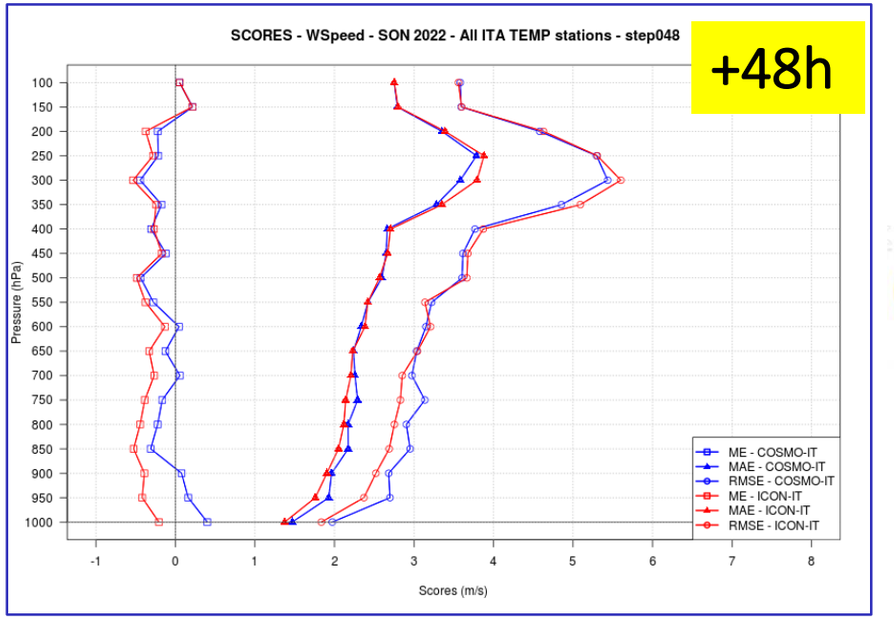
Upper Wind Speed

Forecast verifications against SOUNDINGS





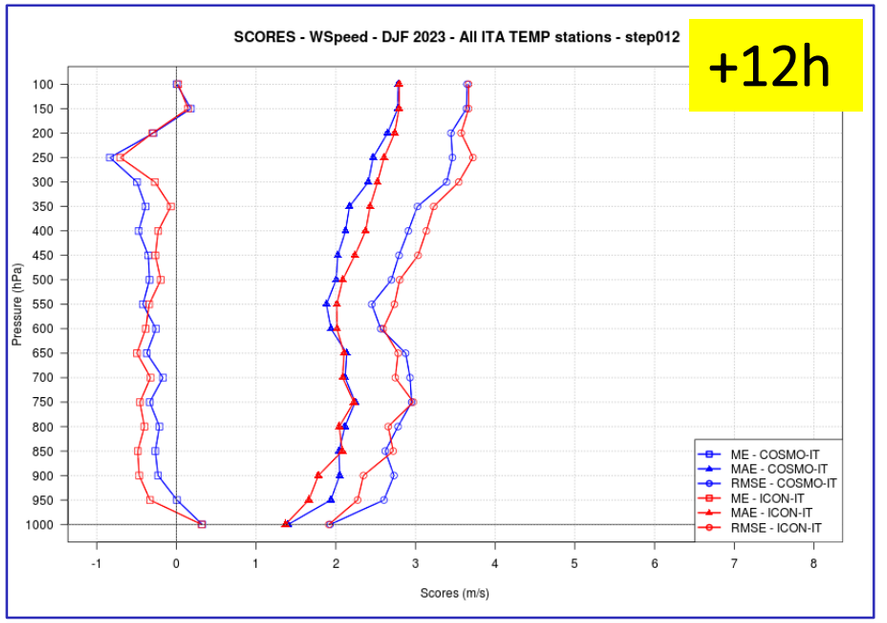


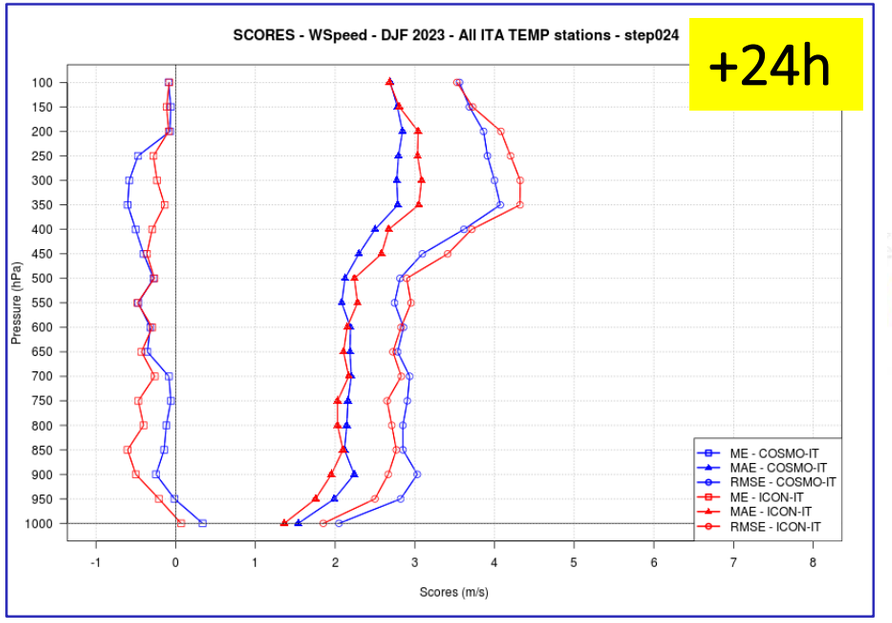


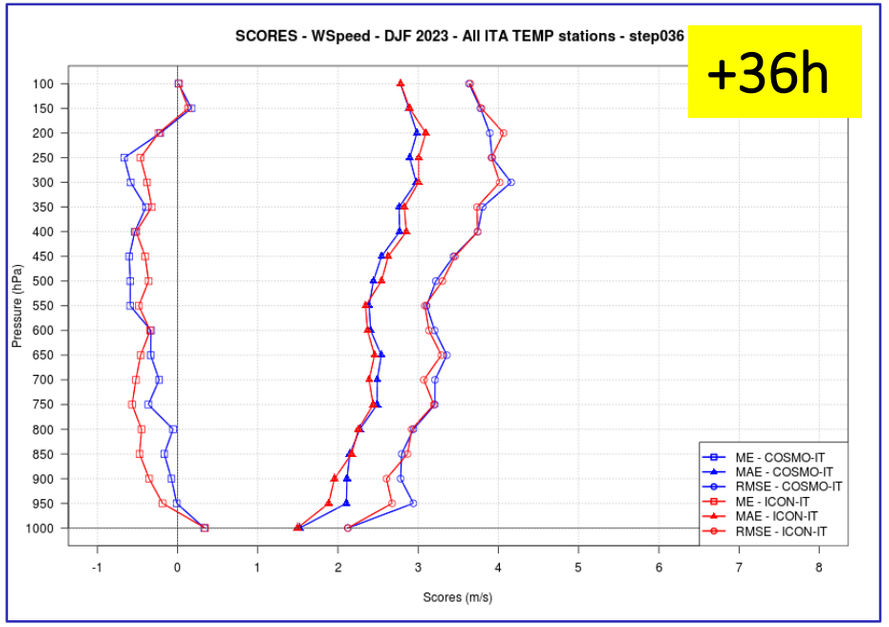
COSMO-IT vs ICON-IT (00UTC run)

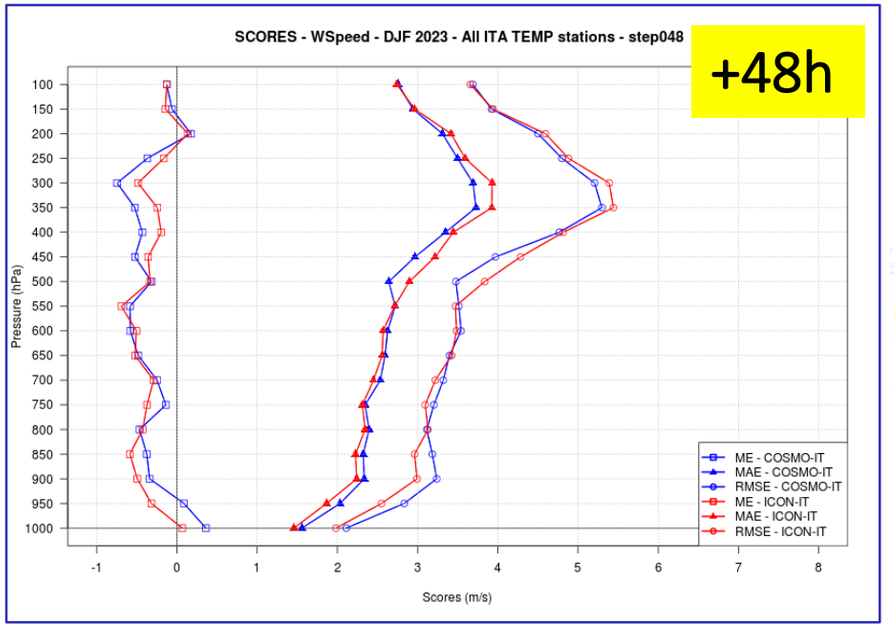
Upper Wind Speed

Forecast verifications against SOUNDINGS





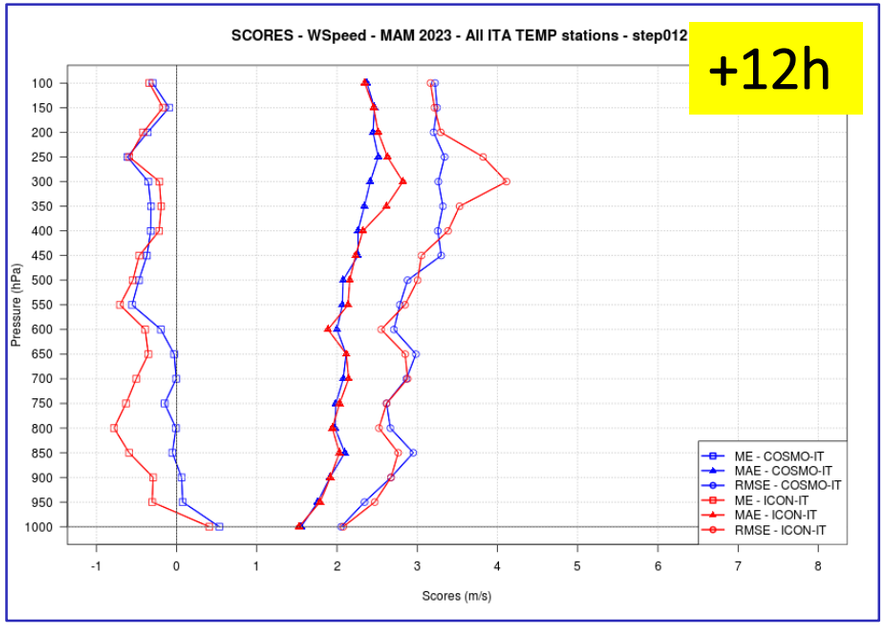


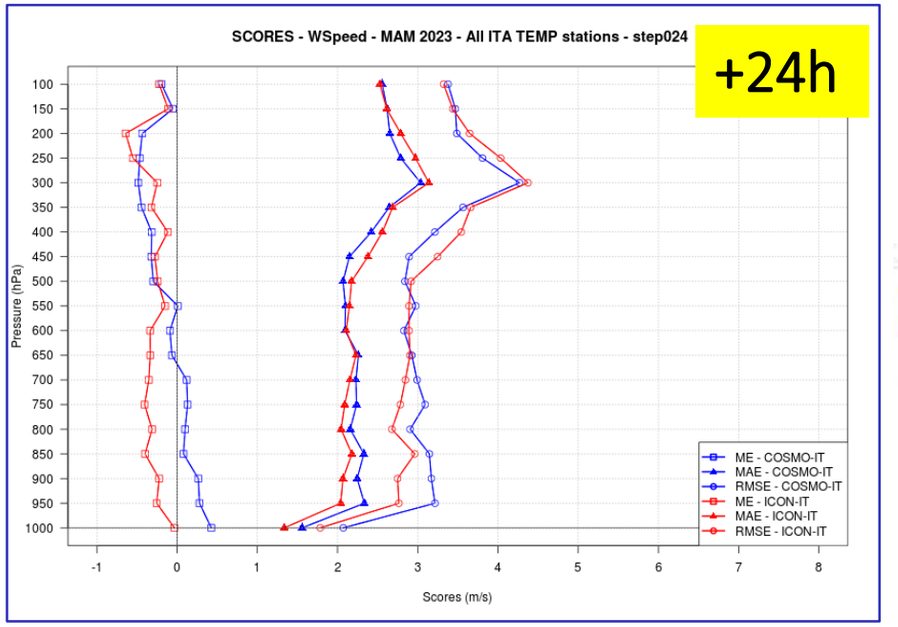


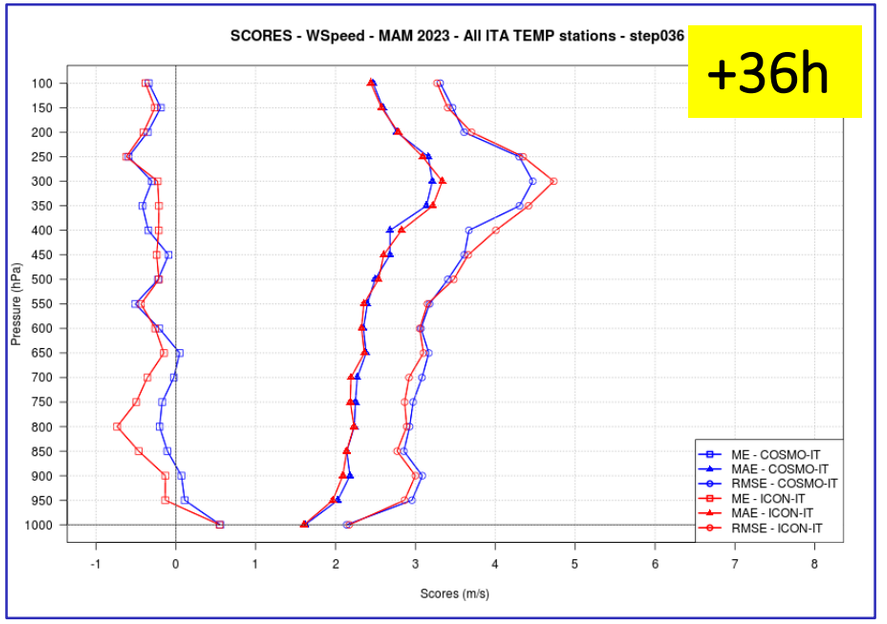
COSMO-IT vs ICON-IT (00UTC run)

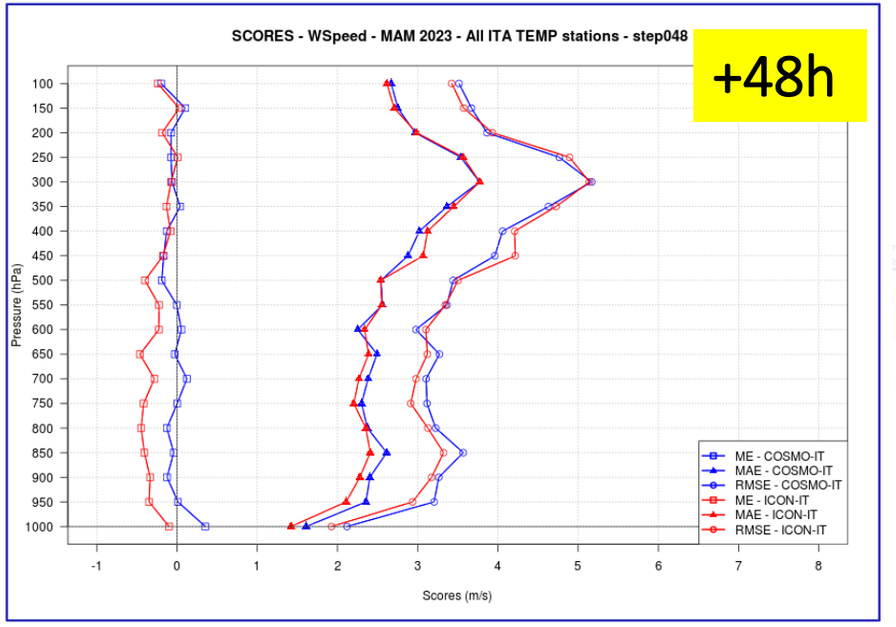
Upper Wind Speed

Forecast verifications against SOUNDINGS





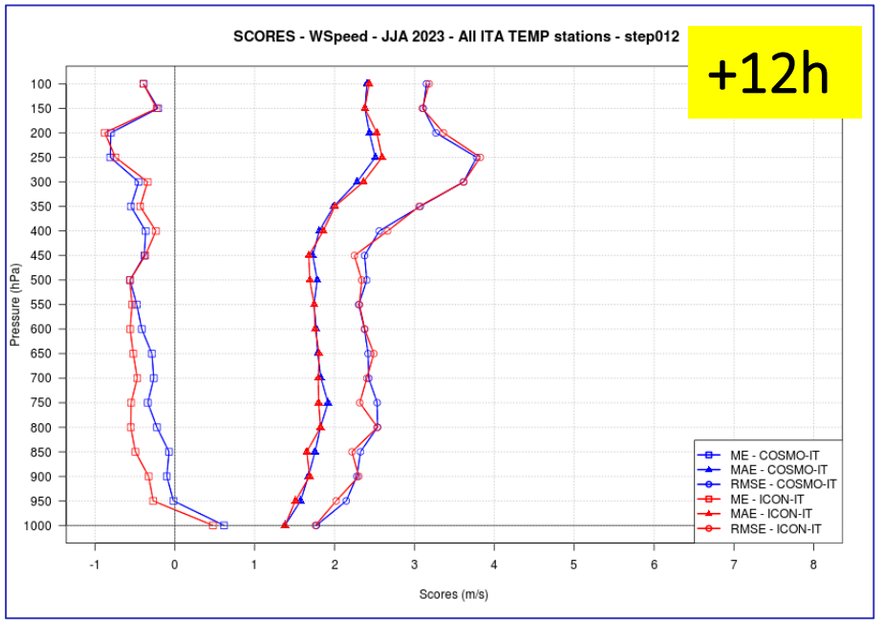


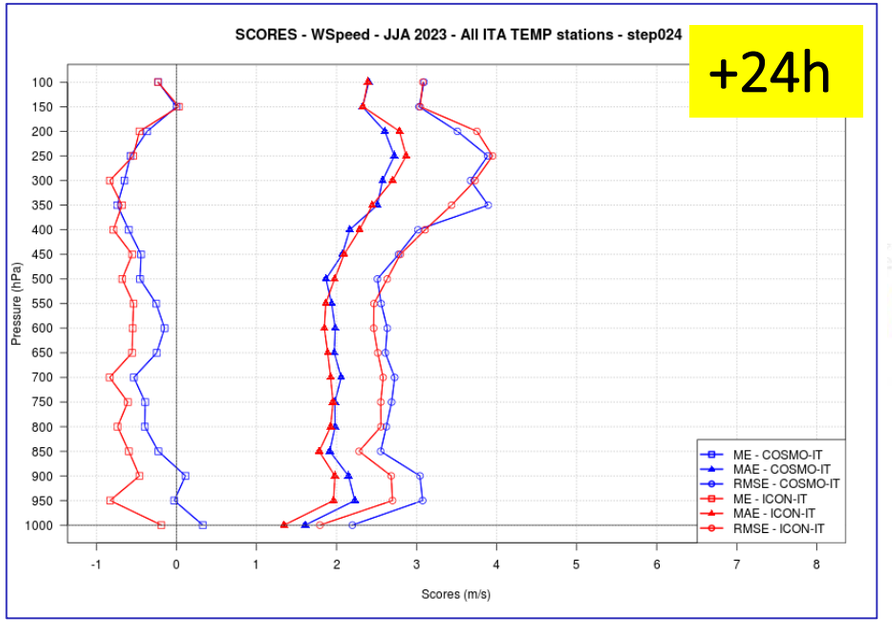


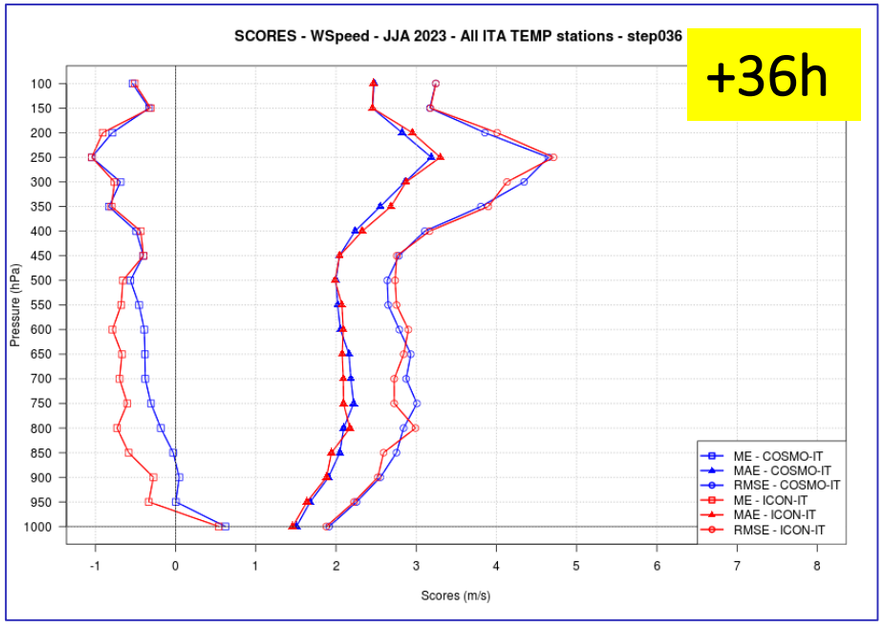
COSMO-IT vs ICON-IT (00UTC run)

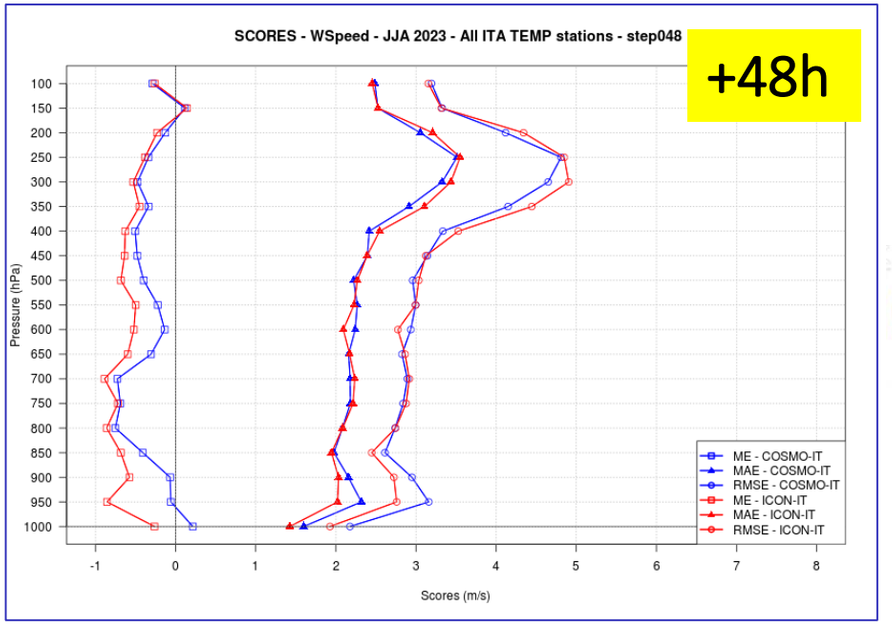
Upper Wind Speed

Forecast verifications against SOUNDINGS





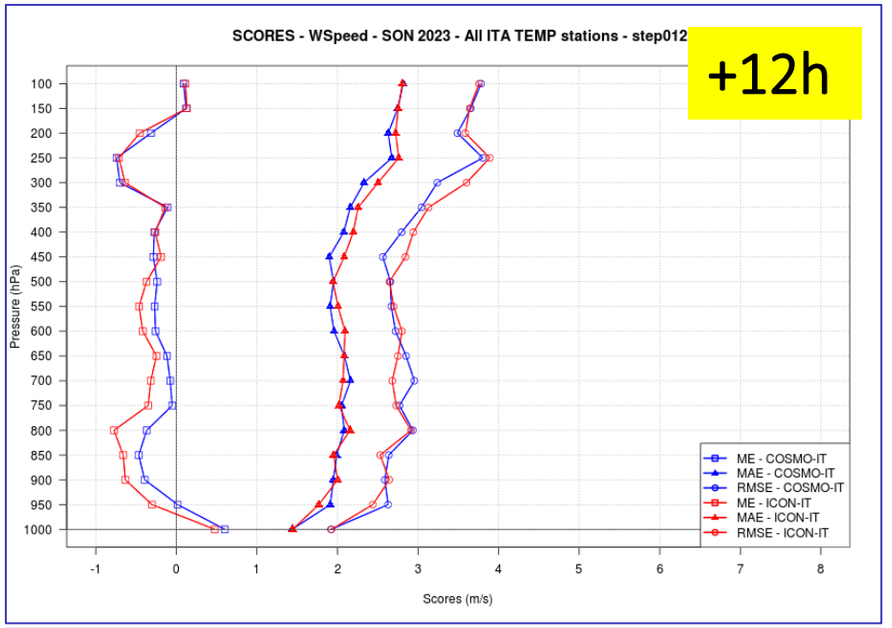


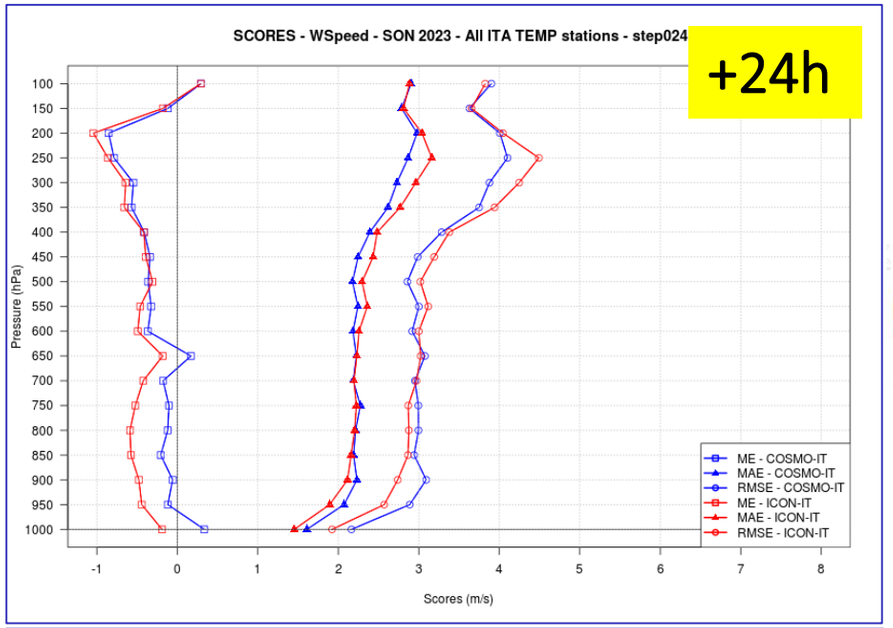


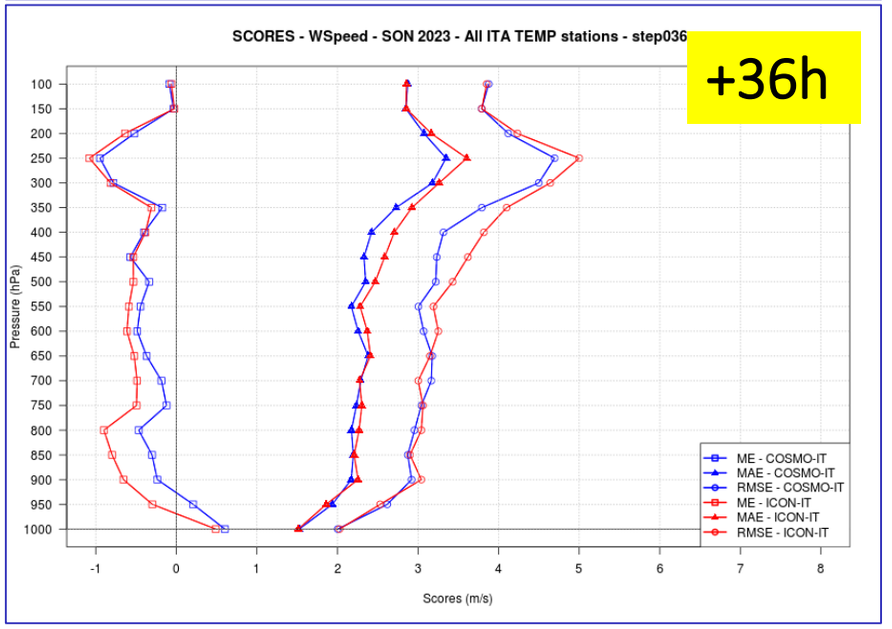
COSMO-IT vs ICON-IT (00UTC run)

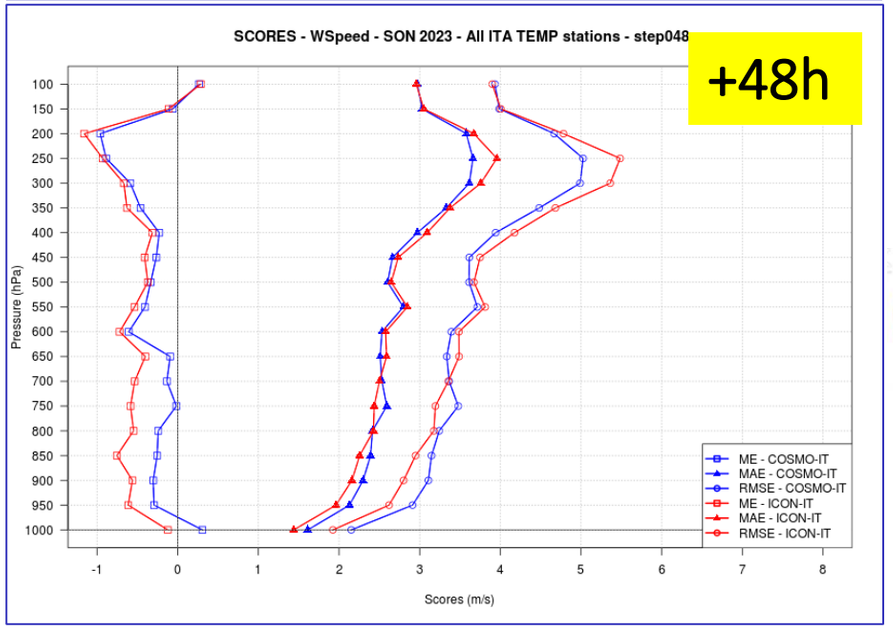
Upper Wind Speed

Forecast verifications against SOUNDINGS









Conclusions

- ✓ Results are **encouraging** as generally ICON-IT outperforms COSMO-IT for surface parameters and profiles of temperature and humidity, but wind parameter are little bit worse than COSMO-IT.

- ✓ The ICON model is fully operational at the Italian Met Service, together with COSMO-IT. The **full switch** to ICON is conditioned to the availability of the GPU version of the model, precondition for the implementation of the ICON-IT EPS. Therefore ICON will hopefully become the "reference" model by Q2 2024.

- ✓ ICON model will also be advantageous from a **computational** point of view. Taking into account that the cosmo-it and icon-it have the same setups (in terms of horizontal and vertical resolution and domain extent), on the basis of daily resource consumption (SBU) on the ECMWF cray-hpc, it can be estimated that the use of ICON model saves around 40% of computational resources.