Regional Cooperation for
Limited Area Modeling in Central Europe

LACE
nwp central europe

LACE verification activities

Authors: Doina-Simona Tașcu with contributions of LACE partners

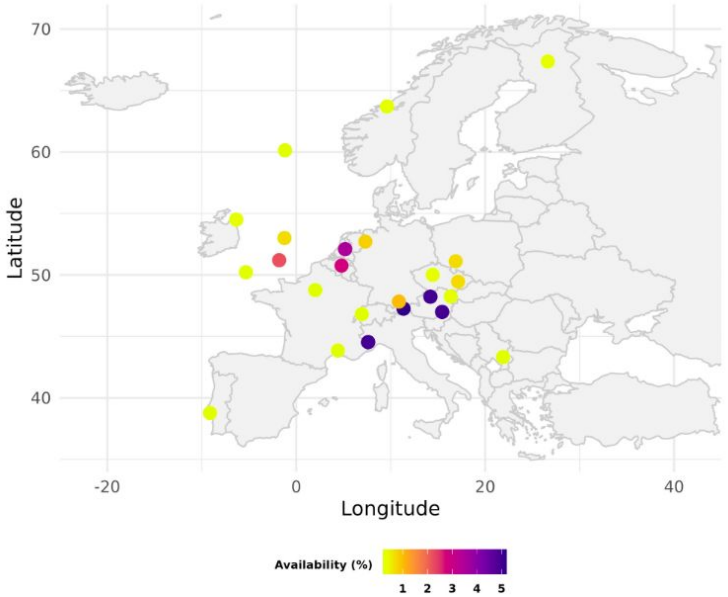
GeoSphere Austria · DHMZ · Czech Hydrometeorological Institute · HungaroMet Hungarian Meteorological Service · IMGW · METEO ROMANIA · SHMU · ARSO METEO Slovenia

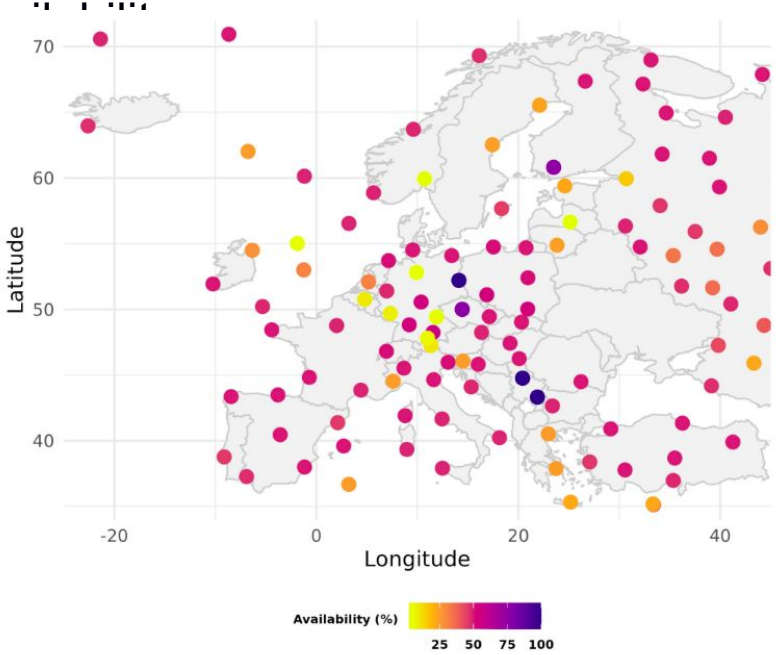
Martin Petráš's stay in Prague, 2025, with Alena Trojáková helping

Comparing TEMP in two available formats: OBSOUL <–> VOBS

- by identification of geographic and temporal gaps in the datasets
- characterize patterns of data sparsity
- verify that the updated code functions
- June 2025

- small number of stations -> more than **75%** data av

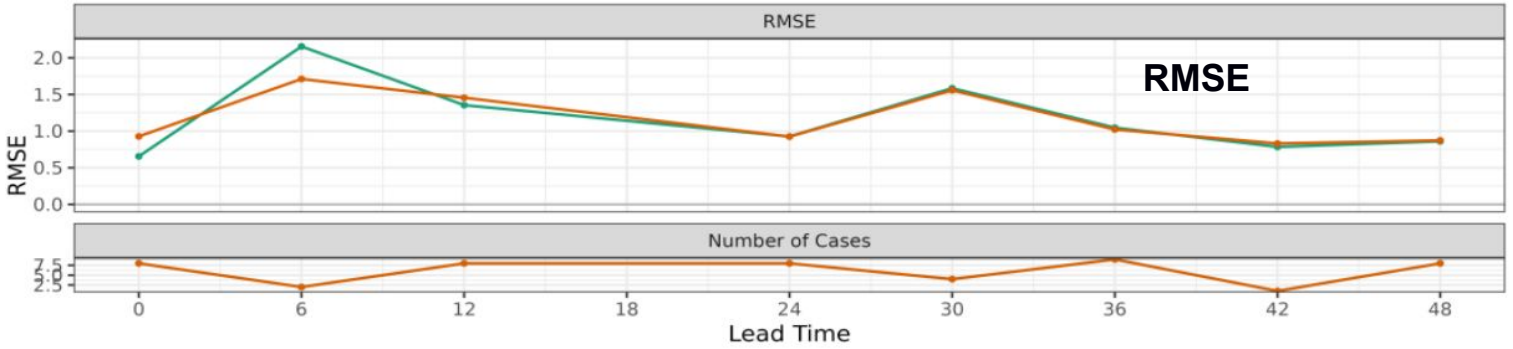




- the maximum data availability at non-synoptic does not exceed 5%

- **deode_clim**:
  - cy48t3_ALARO_CRO_500m
  - IC: global Digital Twin
- **deode_clim_init**:
  - cy48t3_ALARO_CRO_500m
  - IC: operational ALARO+ISBA model
  - 2.3 km, from CHMI
- 500 m horizontal resolution

Development of HARP Extending harpIO to enhance its functionality for upper air verification within the OBSOUL framework

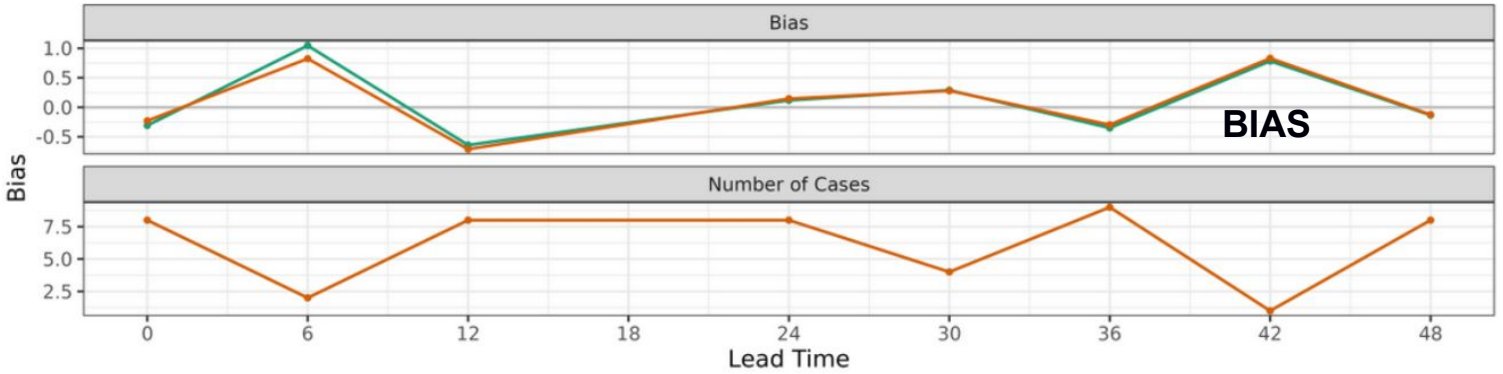


T850hPa

02.11 - 03.11.2024

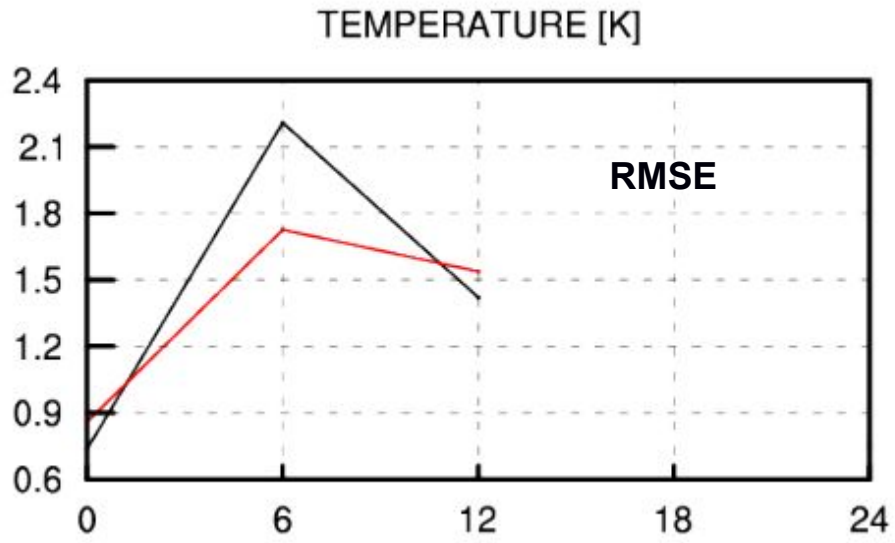
deode_clim

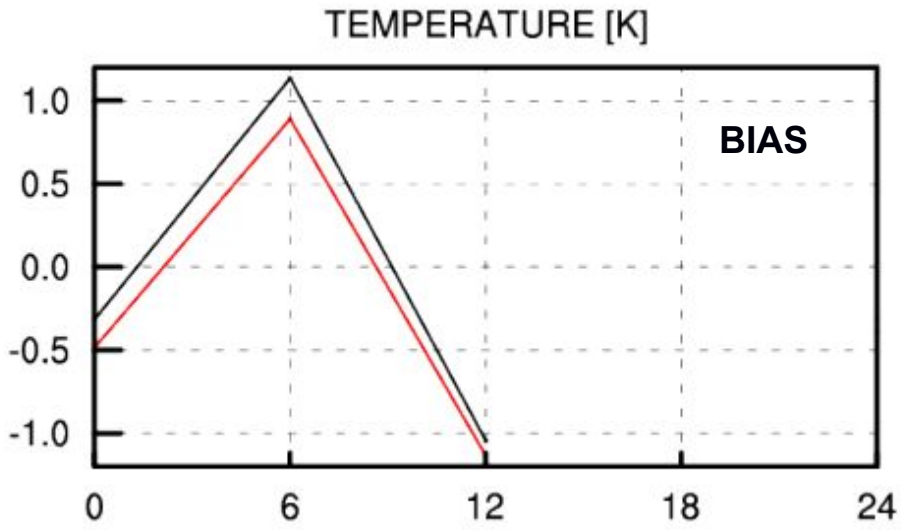
deode_clim_init



by using HARP

Development of HARP Extending harpIO to enhance its functionality for upper air verification within the OBSOUL framework





deode_clim

deode_clim_init

T850hPa

02.11 - 03.11.2024

- by CHMI VERAL package -

Many thanks to Martin Petráš for his invaluable contribution over the years!

- They reviewed the recommendations of research groups of ACCORD and NCAR <–> covering approaches of object-, neighbourhood-, and distance-based measurements, spatial alignment and field deformation

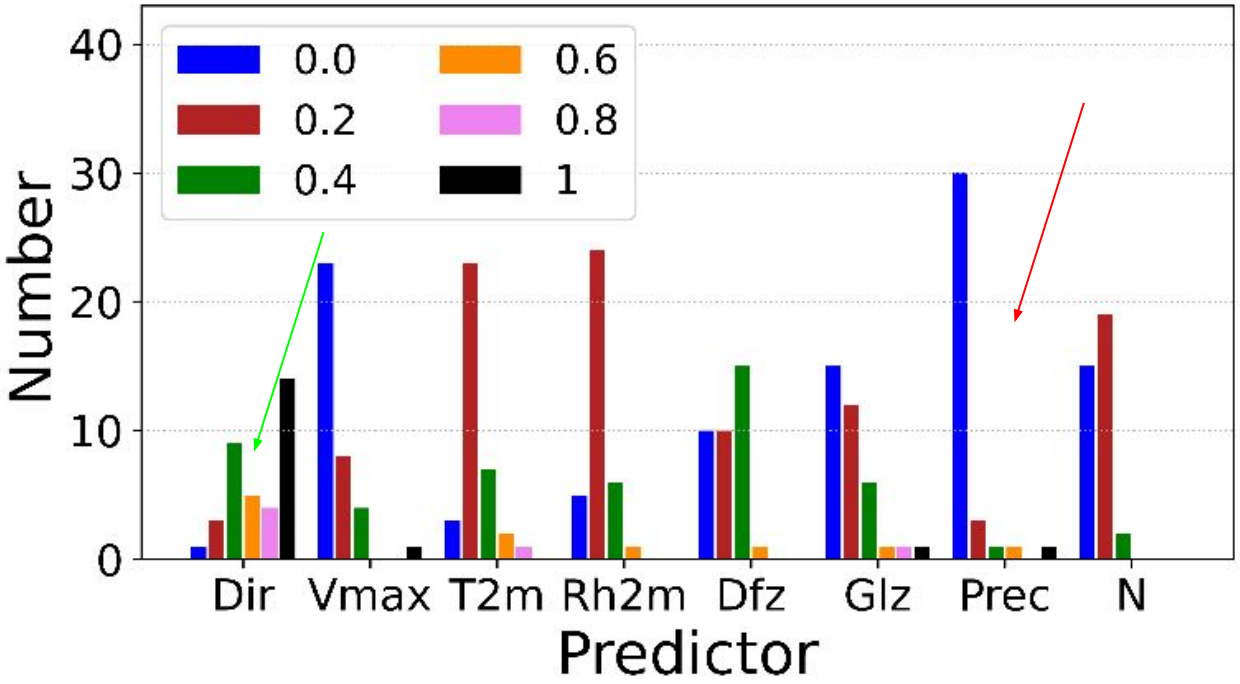
  - **MODE** <–> Method for Object-based Diagnostic Evaluation <–> from NCAR
  - **SAL** <–> Structure-Amplitude-Location
  - **Hausdorff-distance and Baddeley's delta metric**
  - **Measures of G and G_β**
  - **Image Warping**
  - **FSS** <–> Fractions Skill Score tests the ability to hit fractions correctly within a specified size of spatial window frame
  - **Panelification** <–> development of GeoSphere Austria

Verification of 10-m wind speed for HR20 and HRAN systems (Croatia)

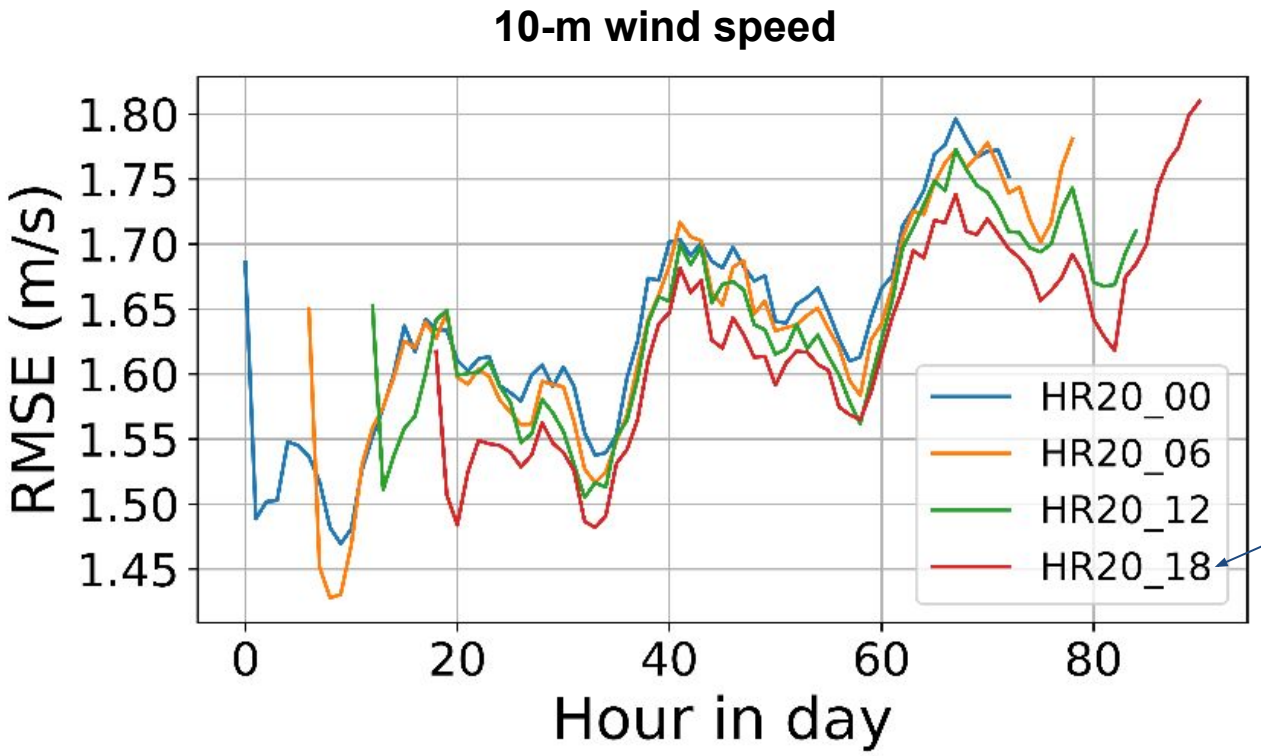
- HR20 at 2 km < – > the analogue method HRAN
- 10-minute averaged 10-meter wind speed forecasts
- 2024
- IC and LBC <–> from HR40 which in turn is using IFS-ECMWF as input in a lagged model
- the usage of the weighted combination of selected meteorological parameters
- stations having more than 10% data missing or those which were invalid data were excluding
- for the optimization of the predictor weighting < – > **8 parameters**
- training dataset – > based only on **00 UTC**
  - one-year training dataset
  - one from a separate eight-month

Verification of 10-m wind speed for HR20 and HRAN systems

- the most important benefit of predictors → by the wind direction
- the smallest impact → by the precipitation field



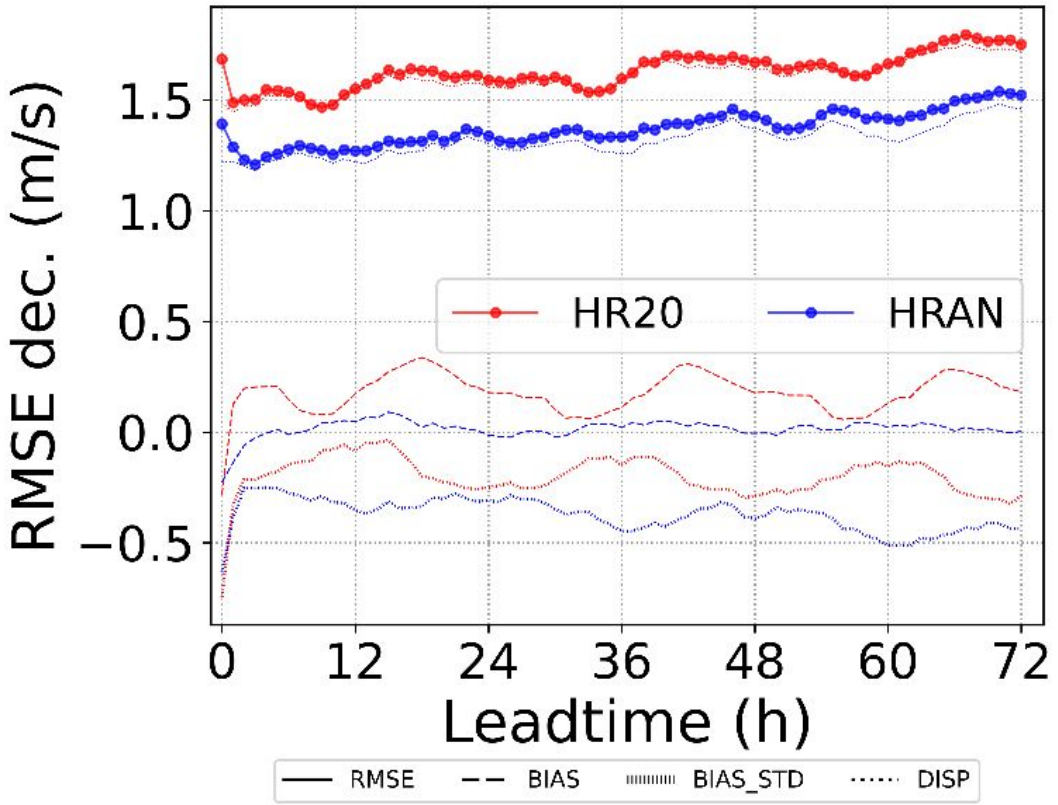
Verification of 10-m wind speed for HR20 and HRAN systems



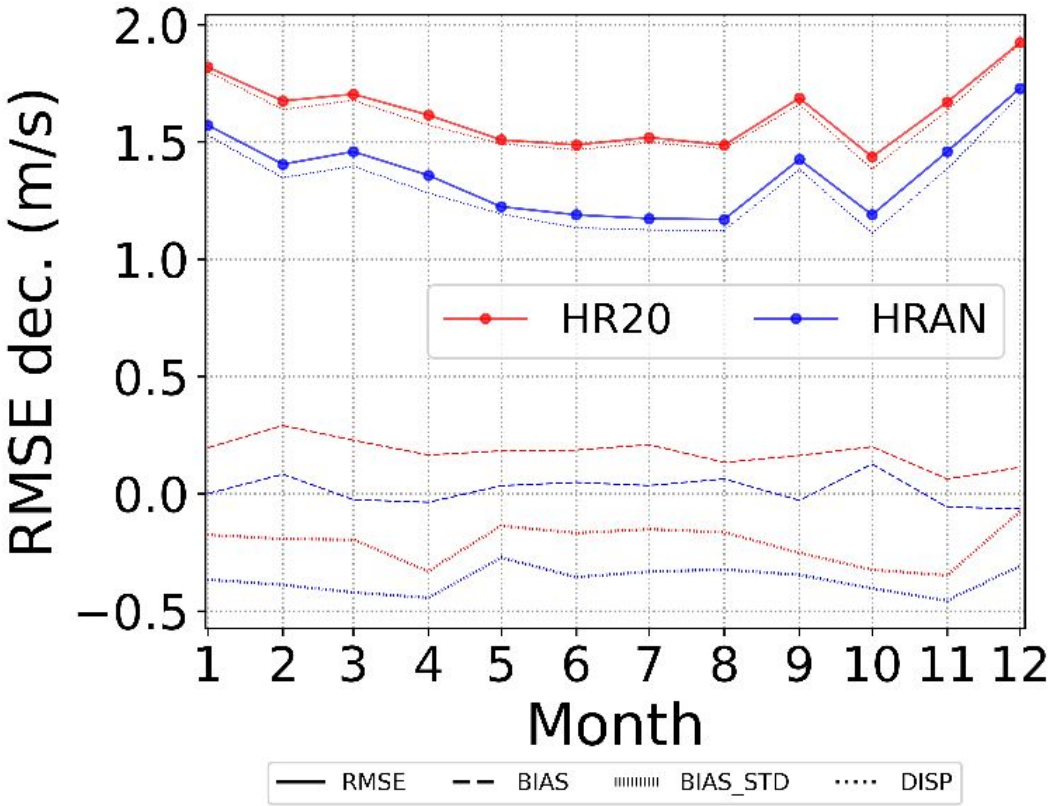
- different initialization times
- 36 locations

❖ lowest value

Verification of 10-m wind speed for HR20 and HRAN systems

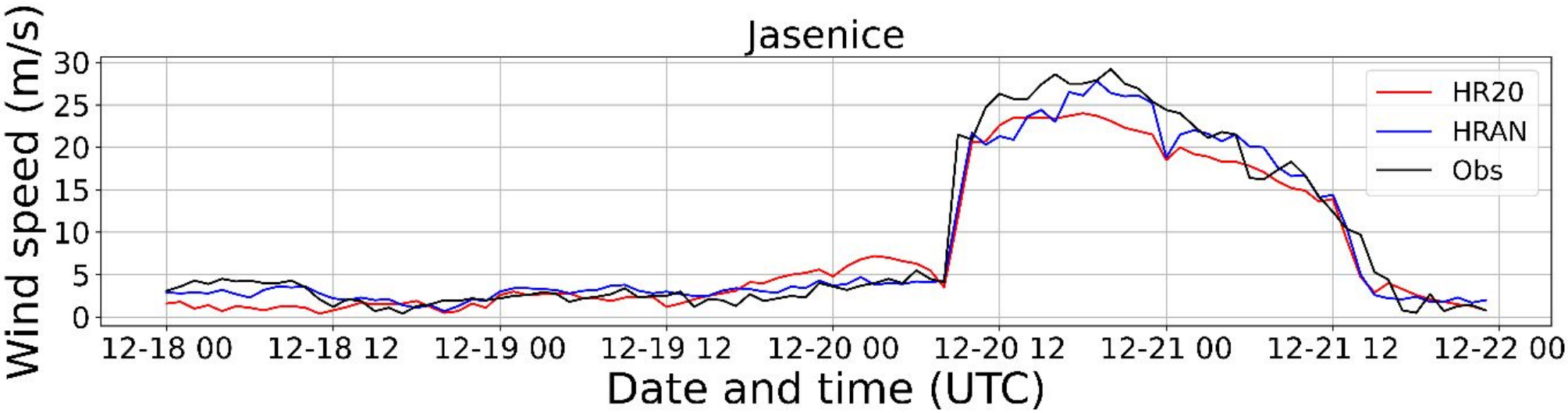


Verification of 10-m wind speed for HR20 and HRAN systems



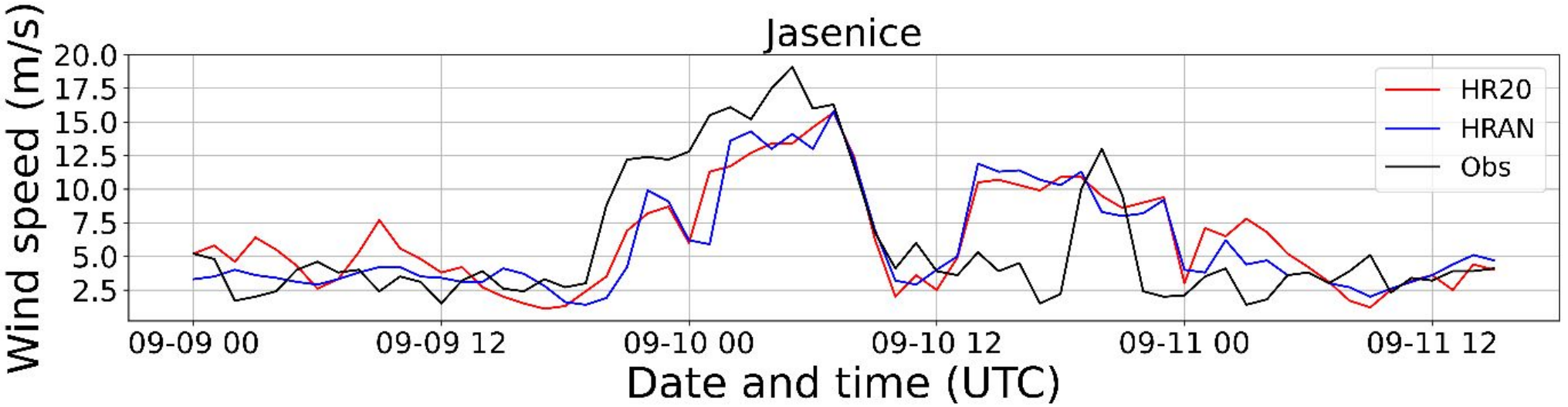
Verification of 10-m wind speed for HR20 and HRAN systems

- Case study: 18 to 22 December 2024



Verification of 10-m wind speed for HR20 and HRAN systems

- Case study: 9 to 11 September 2024



- Submitted article "*Verification of 10-m wind speed ALADIN-HR forecasts HR20 and HRAN*", authors: Iris Odak, Ivan Vujec, Mario Hrastinski

Verification of 2 m temperature for HR40 and HRAN systems (Croatia)

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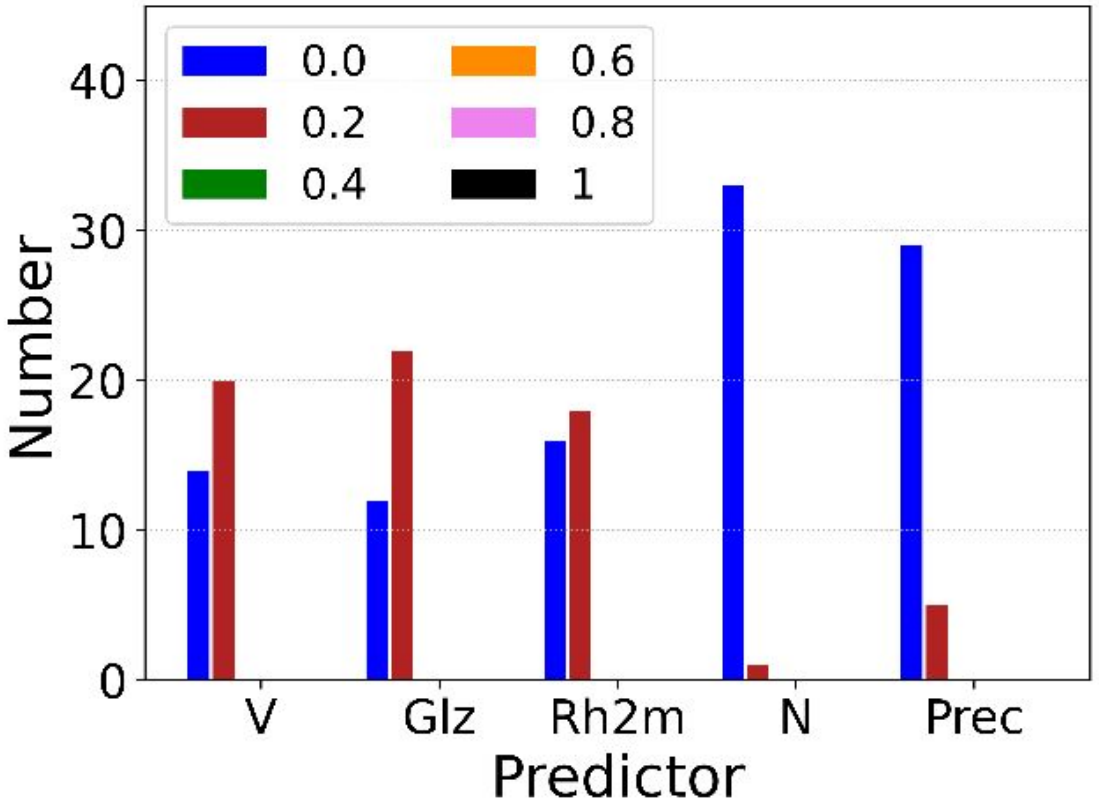
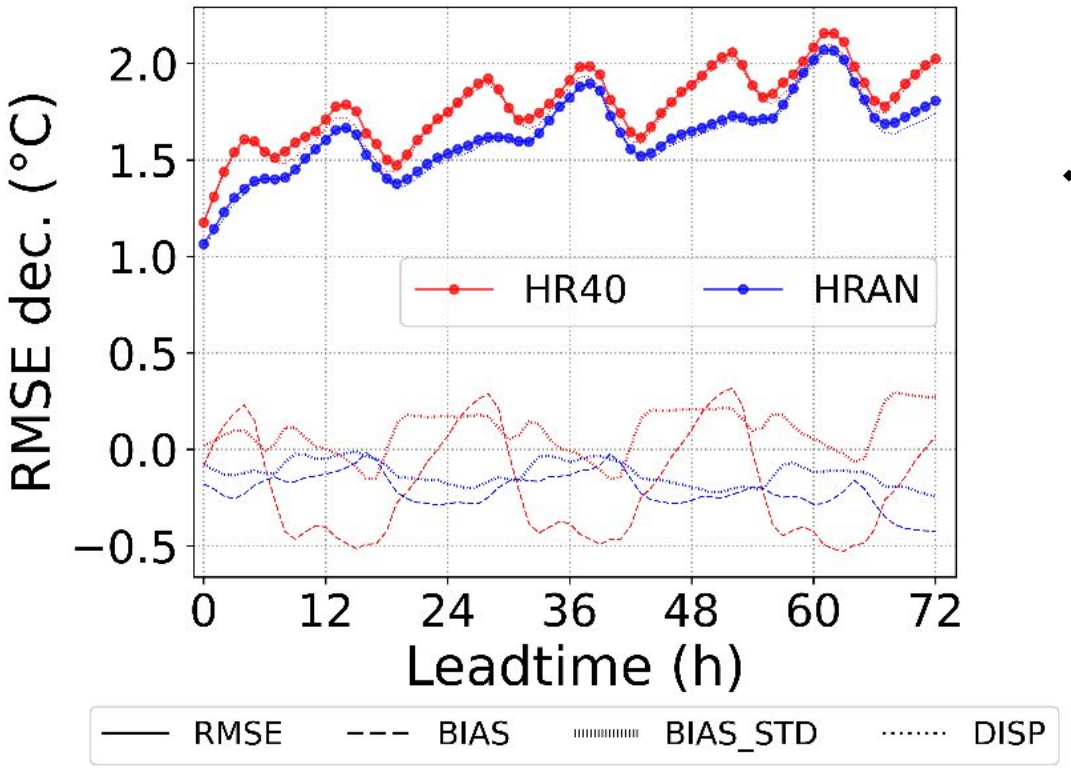
- HR40 at 4 km (ALARO-1 at 4 km) < – > the analogue method HRAN
- 2-m temperature forecasts
- 2024
- 34 stations
- the usage of the weighted combination of selected meteorological parameters
- stations having more than 10% data missing or those which were invalid data were excluding
- for the optimization of the predictor weighting < – > **6 parameters**
- training dataset – > based only on **00 UTC**

  - one-year training dataset

Verification of 2 m temperature for HR40 and HRAN systems



Verification of 2 m temperature for HR40 and HRAN systems



- Submitted article: "*Evaluation of 2-Meter Temperature ALADIN-HR Forecasts from HR40 Model Configuration and HRAN Post-Processing*", authors: Ivan Vujec, Iris Odak, Endi Keresturi

Validation of ALARO-EPS at 700 m by using HARP (Romania)

- Taking into account the work of Martin Bellus based on
  - ALARO-EPS
  - 750 m
  - 87 vertical levels
  - validation <–> 13th September 2024

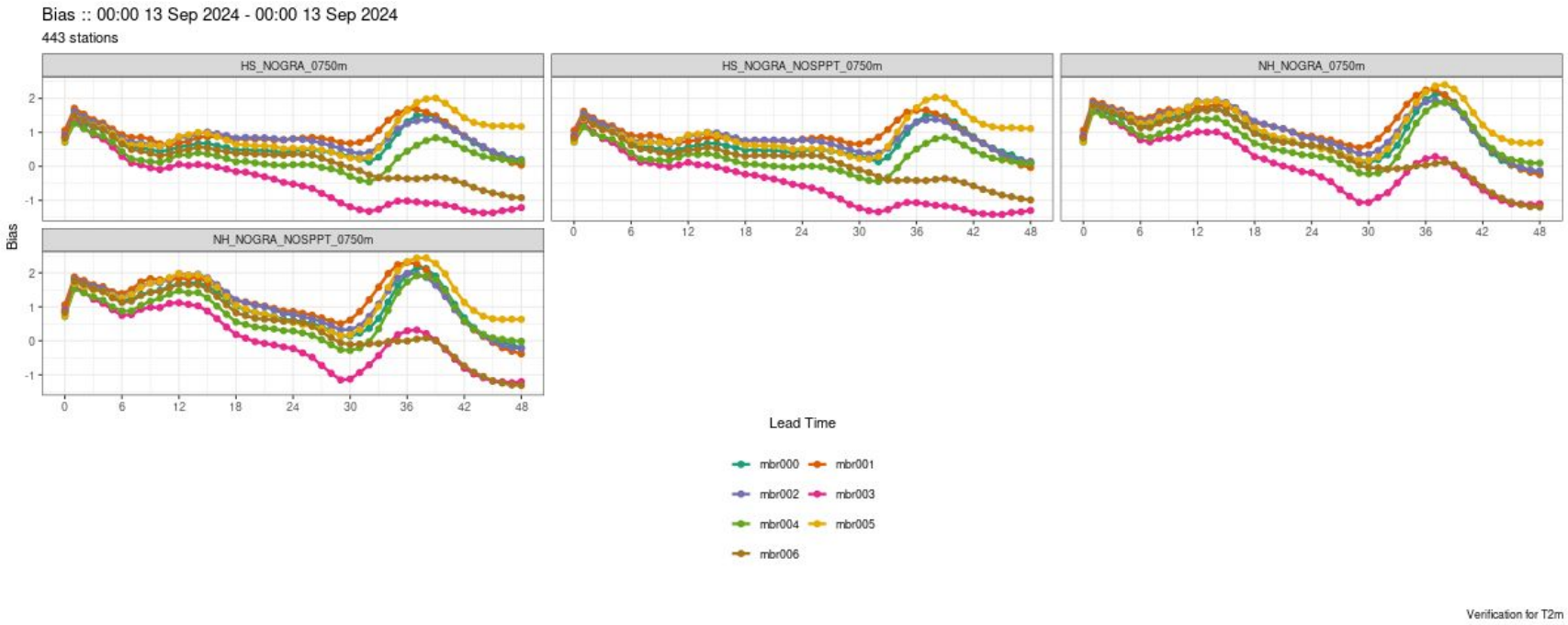
Many thanks to Martin Belluš for the fruitful and special collaboration over the years!

Validation of ALARO-EPS at 700 m by using HARP

- EPS: 6 members + 1 control
- 4 versions of ALARO setup:
  - hydrostatic (HS)
  - non-hydrostatic (NH)
  - no prognostic groupels (NOGRA)
  - no stochastic physics (NOSPPT - i.e. only multiphysics)

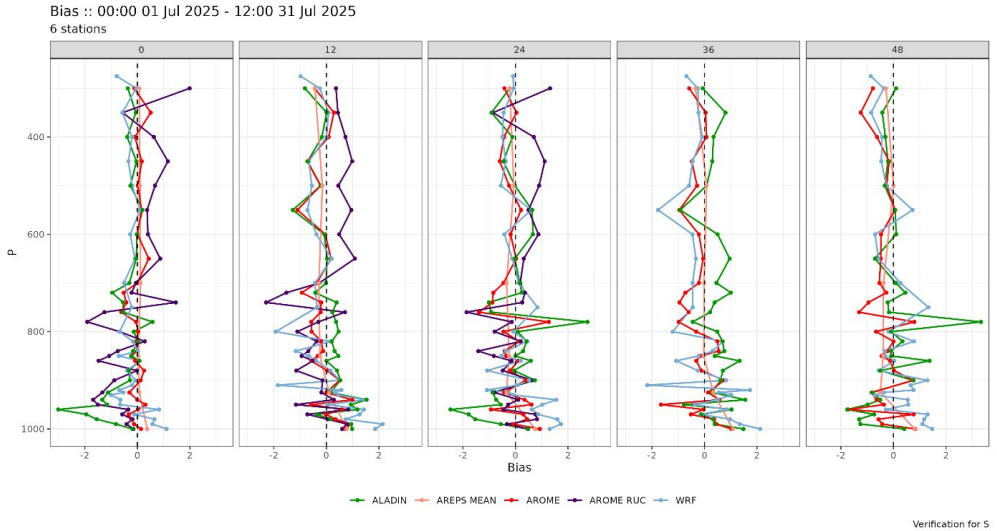
- the calculation of the verification scores
  - point-to-point verification by using the HARP system
  - 443 synop stations from the OPLACE database
  - for several meteorological parameters: T2m, RH2m, MSLP TP1h, 10WS

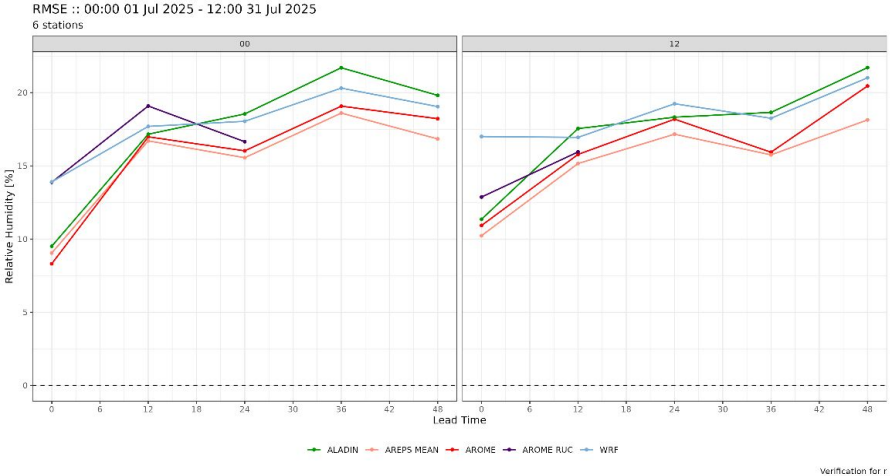
Validation of ALARO-EPS at 700 m by using HARP



Operationalization of verification on pressure levels with HARP (Hungary)

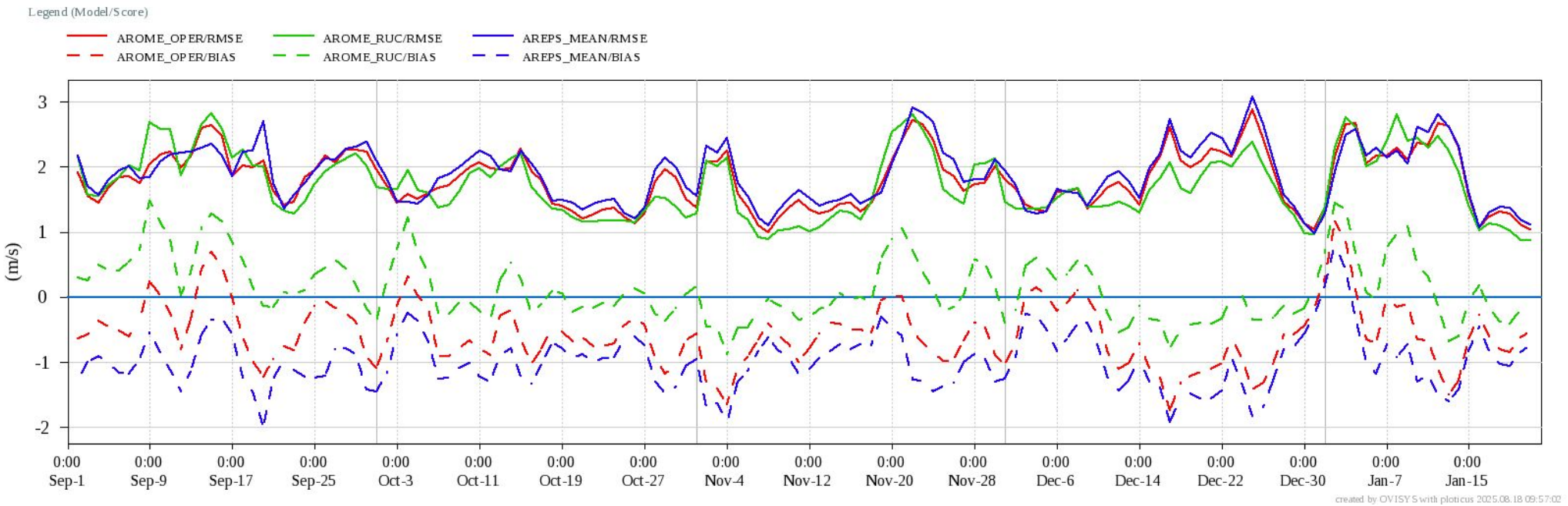
- operationalization of the 28 pressure level location verification
- TEMP observations of 6 stations within the AROME/HU domain





- developing an automatic and objective method:
  - the daily maximum wind gust
  - for a given location
  - by interpolation of station measurements onto a fine grid
  - with background information from high-resolution numerical weather predictions
  - for spatial interpolation the MISH (Meteorological Interpolation based on Surface Homogenized data basis) method:
    - developed by the Hungarian Meteorological Service specifically for meteorological purposes
  - forecasts of AROME, AROME-RUC and AROME-EPS (the mean values)
  - verification period: 1 September, 2024 to 21 January, 2025

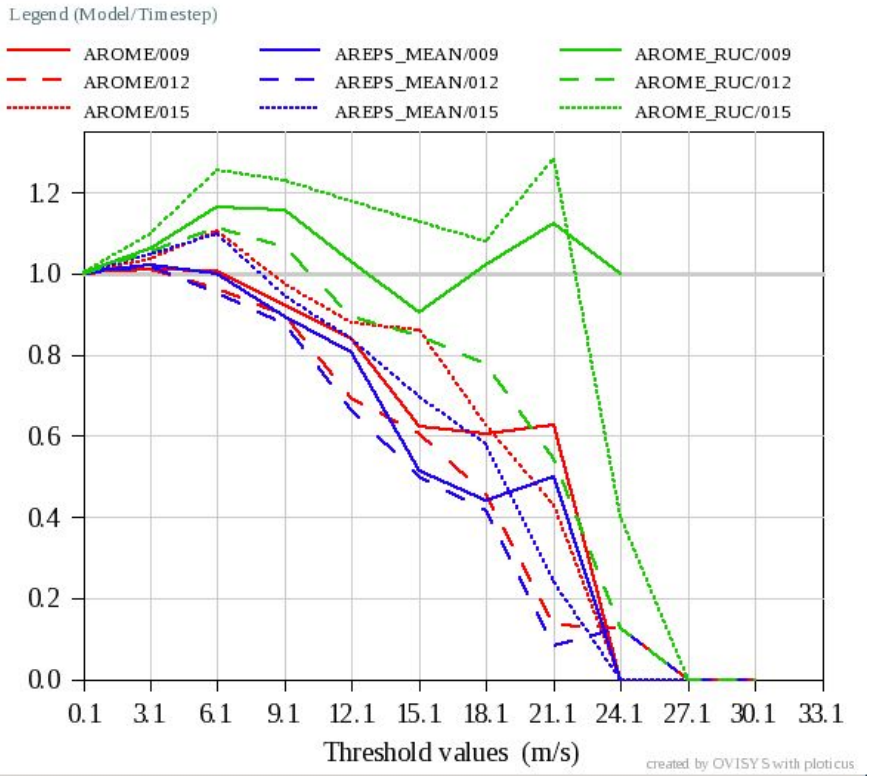
Verification of wind gust forecasts of AROME, AROME-RUC and AROME-EPS for development of a wind hazard product



- **AROME**
- **AROME-RUC**
- **mean of AROME-EPS**

Verification of wind gust forecasts of AROME, AROME-RUC and AROME-EPS for development of a wind hazard product

- wind gust in the 9- (solid line), 12- (dashed line) and 15-hour (dotted line)
- 00 UTC runs



- **AROME**
- **AROME-RUC**
- **mean of AROME-EPS**

Pre-Operational tests of CY46T1 (Poland)

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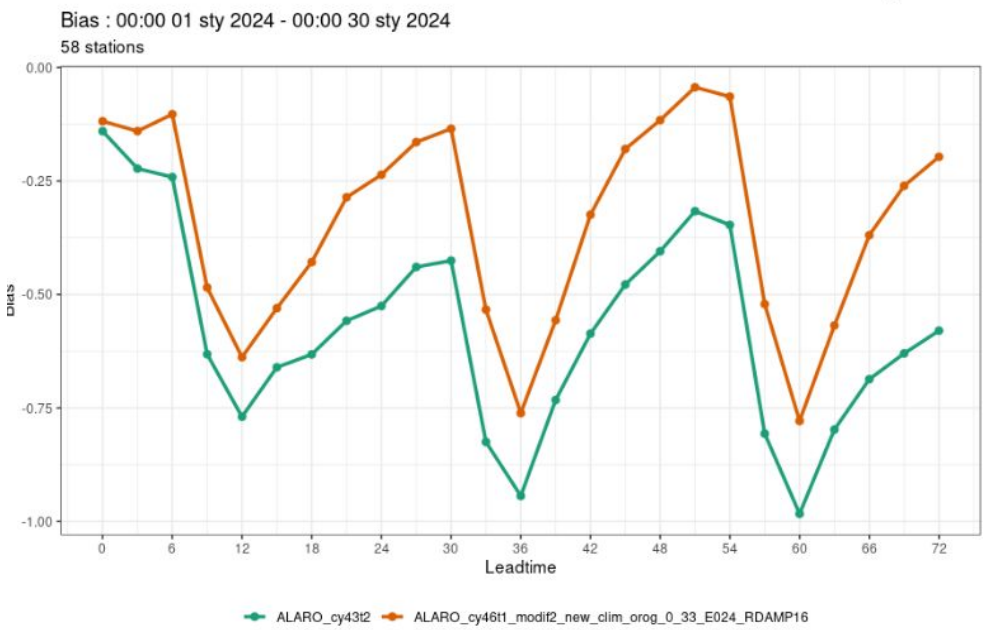
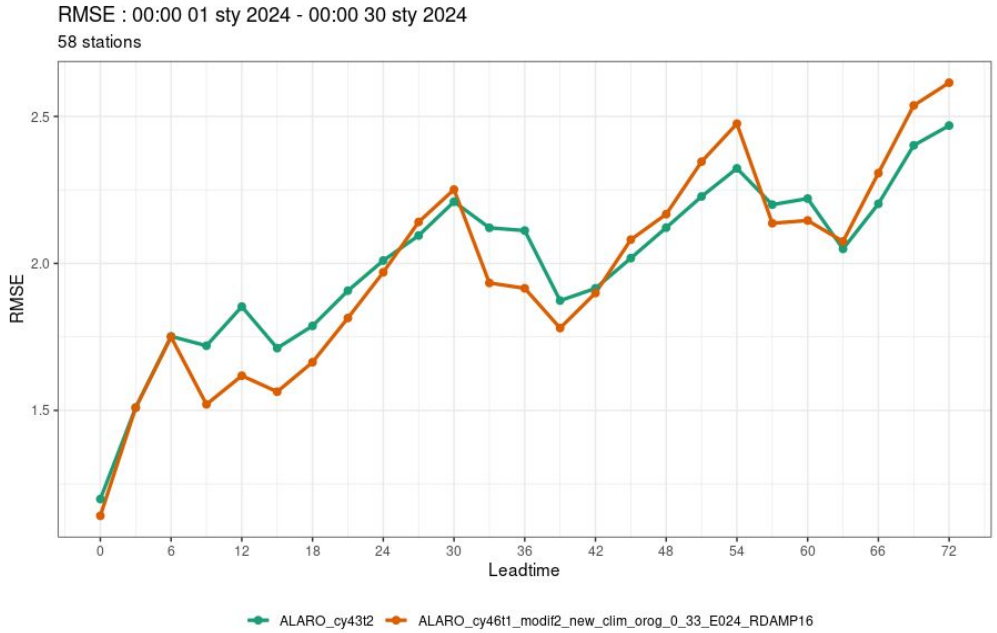
January, 2024 - T2m





ALARO-cy43t2 **ALARO-cy46t1** ❖ **2.45 km** ❖ **70 vertical levels** ❖ **90s**

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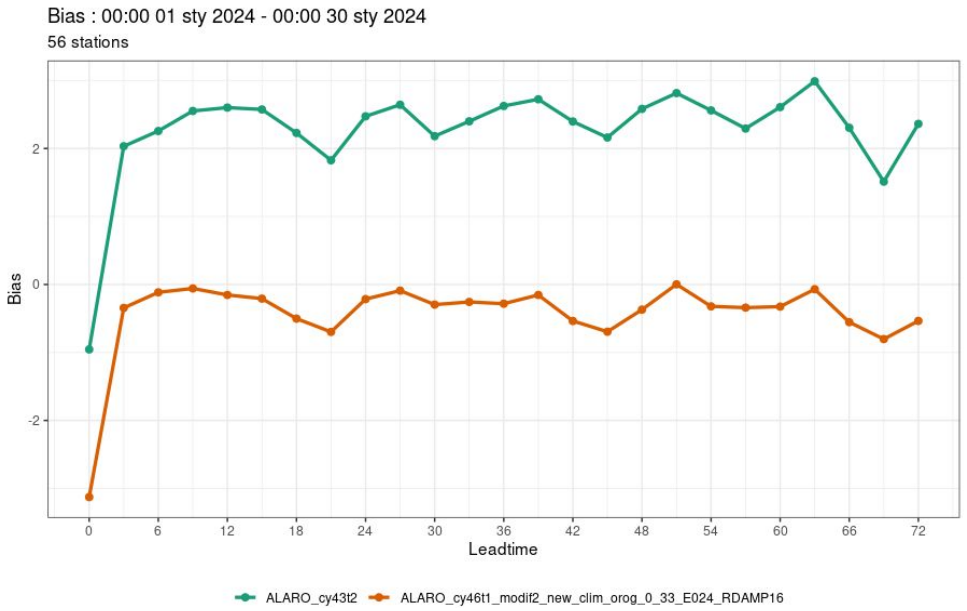
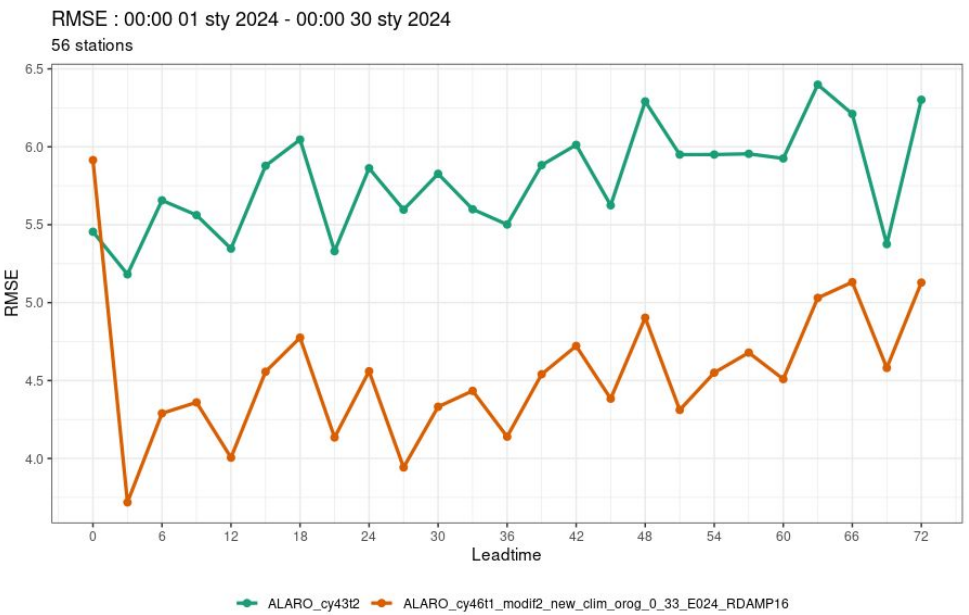
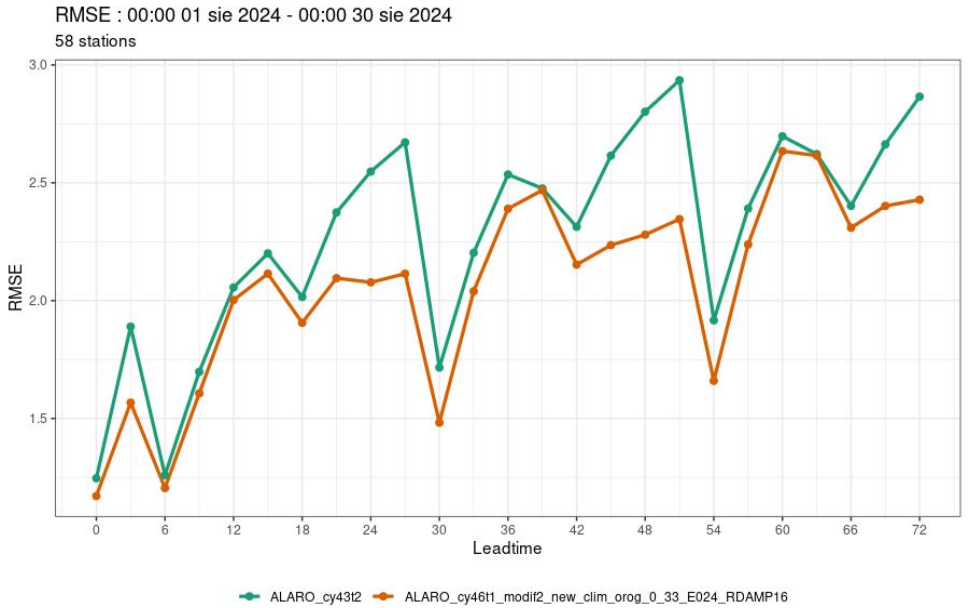
January, 2024 - wind gust

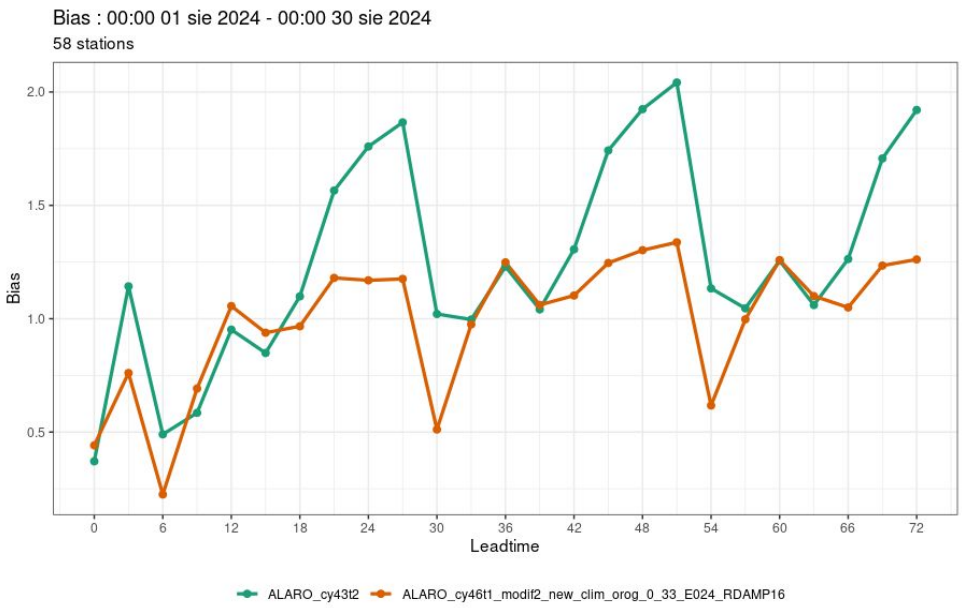




ALARO-cy43t2 **ALARO-cy46t1**

August, 2024 - wind gust

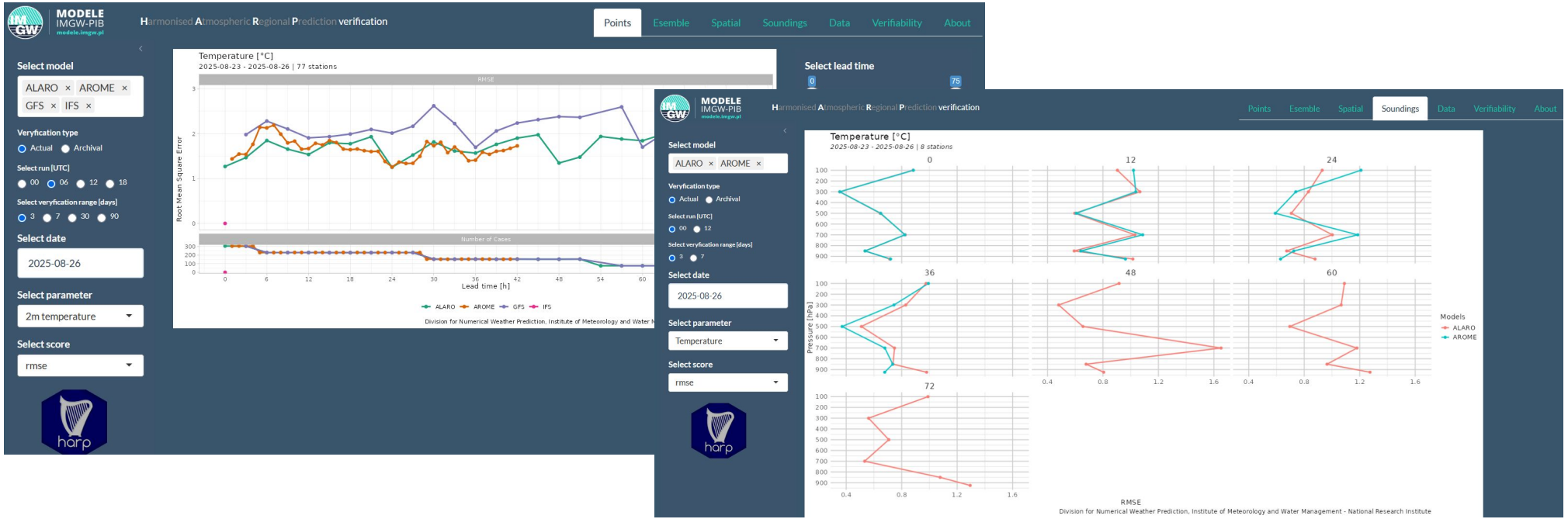




ALARO-cy43t2 **ALARO-cy46t1**

Implementation of new version of HARP (Poland)

- a new version of HARP was installed locally
- for ALARO, AROME, IFS and GFS



Testing improvement possibilities of AROME-EPS EMOS postprocessing for radiation (Hungary)

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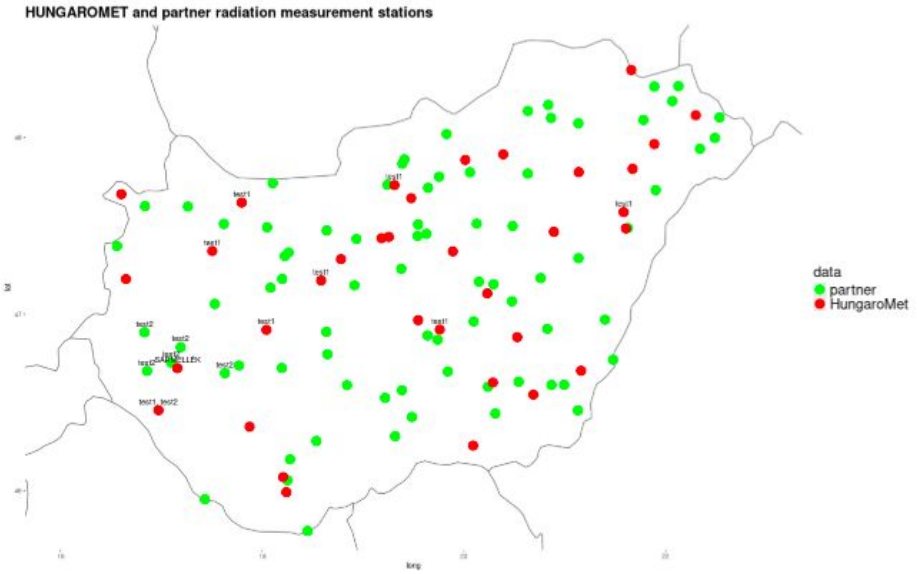
- AROME-EPS EMOS postprocessing
- by using radiation measurements from:
  - a private company for more than hundred stations
  - 35 HungaroMet stations
- test experiments were run for three target locations



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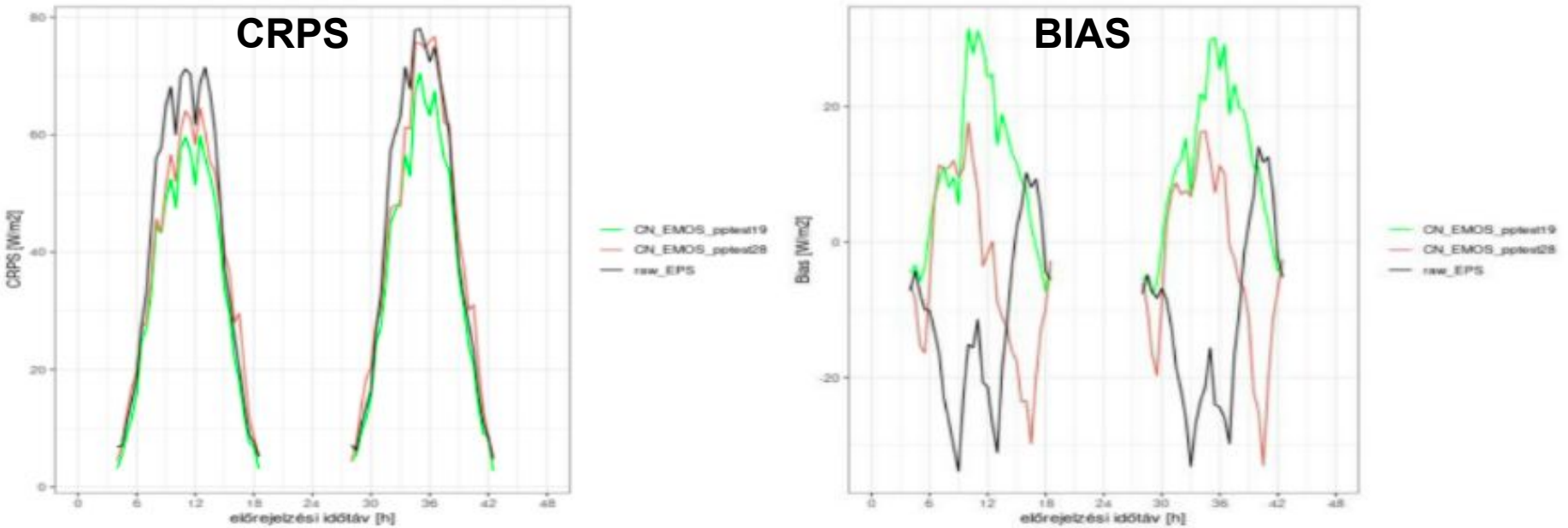
Testing improvement possibilities of AROME-EPS EMOS postprocessing for radiation



- raw EPS
- EMOS - best
- EMOS - best

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Thank you for your attention.

GeoSphere Austria
DHMZ
Czech Hydrometeorological Institute
HungaroMet Hungarian Meteorological Service
IMGW
METEO ROMANIA
SHMÚ
ARSO METEO Slovenia