Numerical Weather Prediction at NIMH

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1. Operational Suite

Two canonical configurations are run at 00, 06, 12 and 18 UTC:

ALADIN-BG (5/105)

- dx = 5km (256x200)
- lev =105
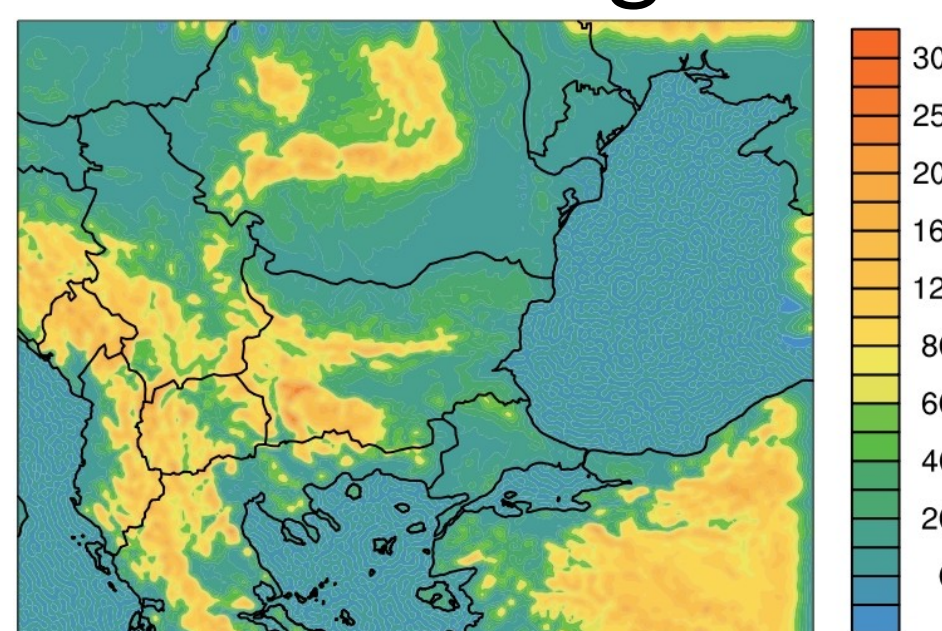- LBC from ARPEGE
- forecast range – 72 h

Fig.1. ALADIN-BG orography

AROME-BG(2.5/90)

- dx = 2.5km (320x240)
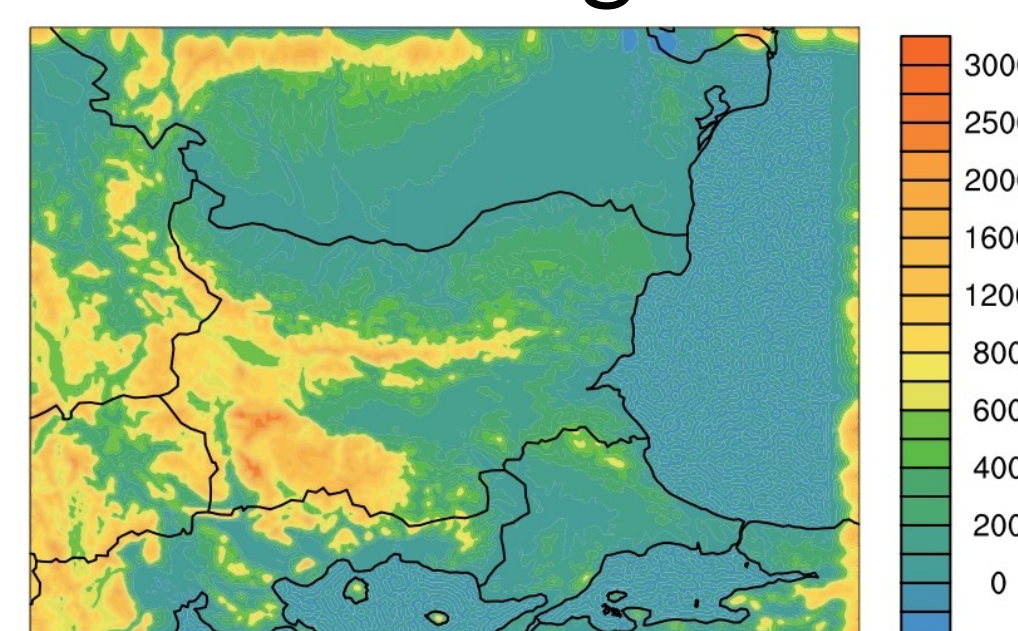- lev = 90
- LBC from ALADIN-BG
- forecast range – 48 h

Fig.2. AROME-BG orography

2. Operational Cluster

Scientists from the "Numerical Modeling" section administrate and maintain the WOLF (Weather Operational Numerical Forecast) cluster. WOLF is made up of 17 nodes, QNAP and server that hosts virtual machines hosting computing access and monitoring services. This cluster of machines is managed by a central management module for all machines, including the management server. The seventeen "nodes" communicate during operation using means for multi-processor parallel communication between the nodes (Message Passing Interface -MPI), and the distribution of resources is carried out by SLURM system.
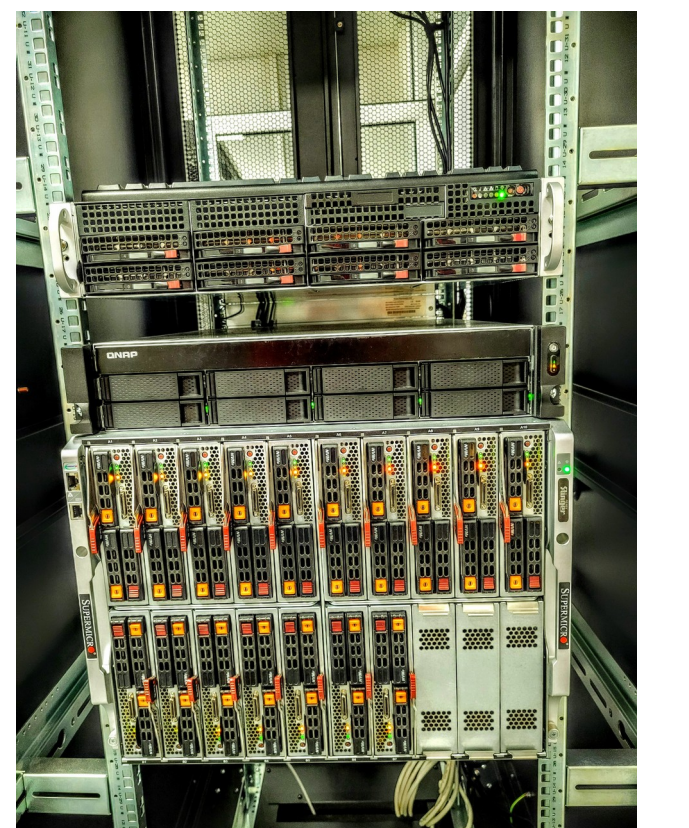
Fig.3. WOLF cluster at NIMH

3. Verification

We use our automated scheme for forecast verification of models forecast of temperature and relative humidity at 2m, wind speed and direction at 10 m, and 6h/12h precipitation based on synoptic measurements.
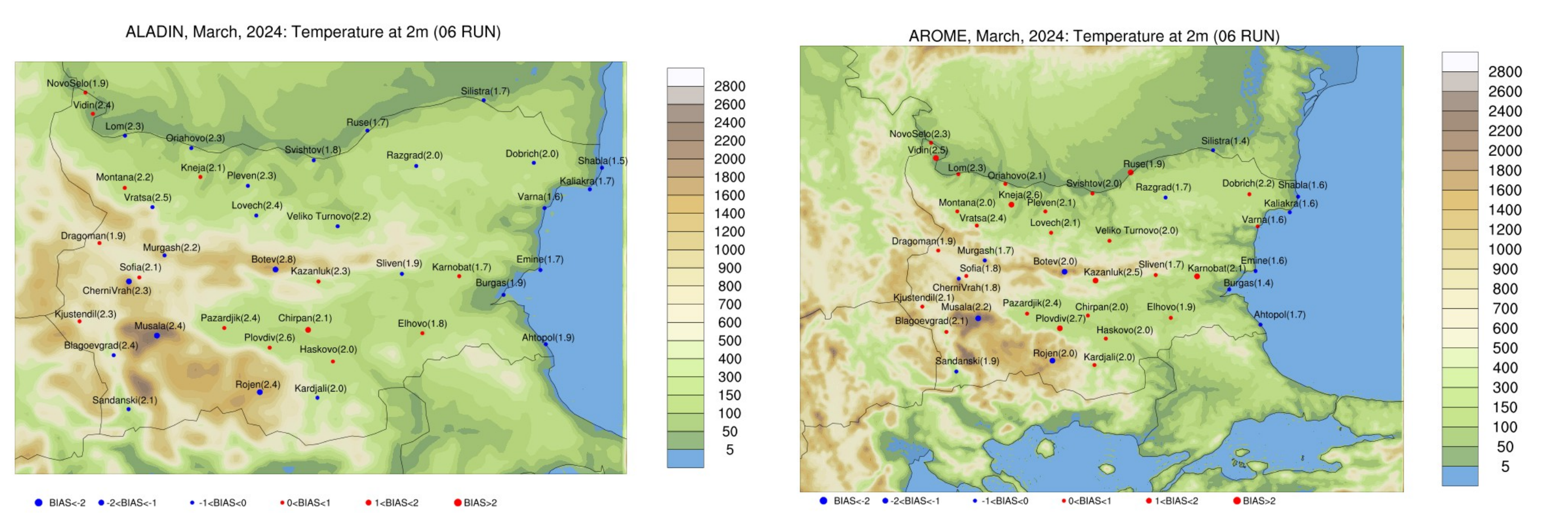
Fig.4. Mean monthly BIAS and RMSE for each synoptic station for March 2024 of ALADIN-BG and AROME-BG temperature at 2m

4. NWP Forecast End-users

The main end-users at NIMH:
forecasters, Section "Specilized and maritime forecast", Section "Hydrological forecast, Section "Agrometeorology", Section "Atmospheric Pollution Modelling",
We serve about 10 public and private enterprises as BULATSA, ELECTROHOLD, …
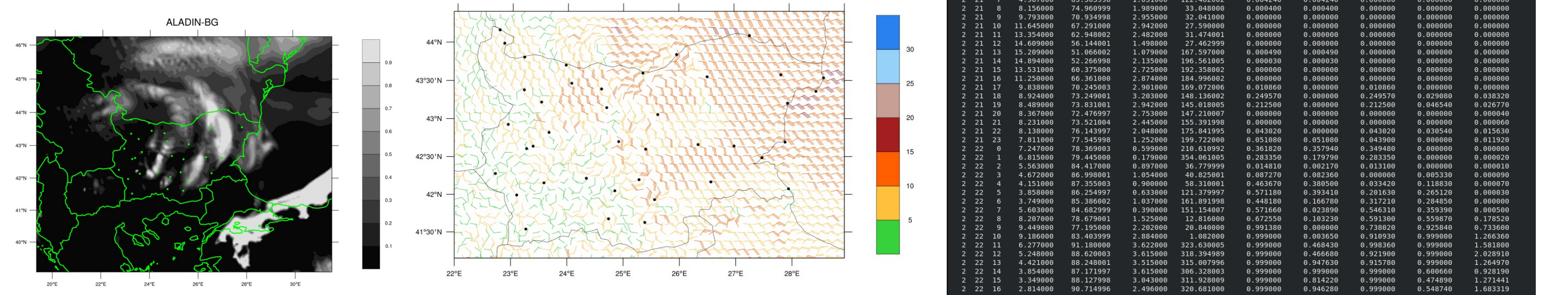
Fig.5. Some examples of operational post-processing depending of the needs of the end-users

5. Some specific NWP forecast postprocessing

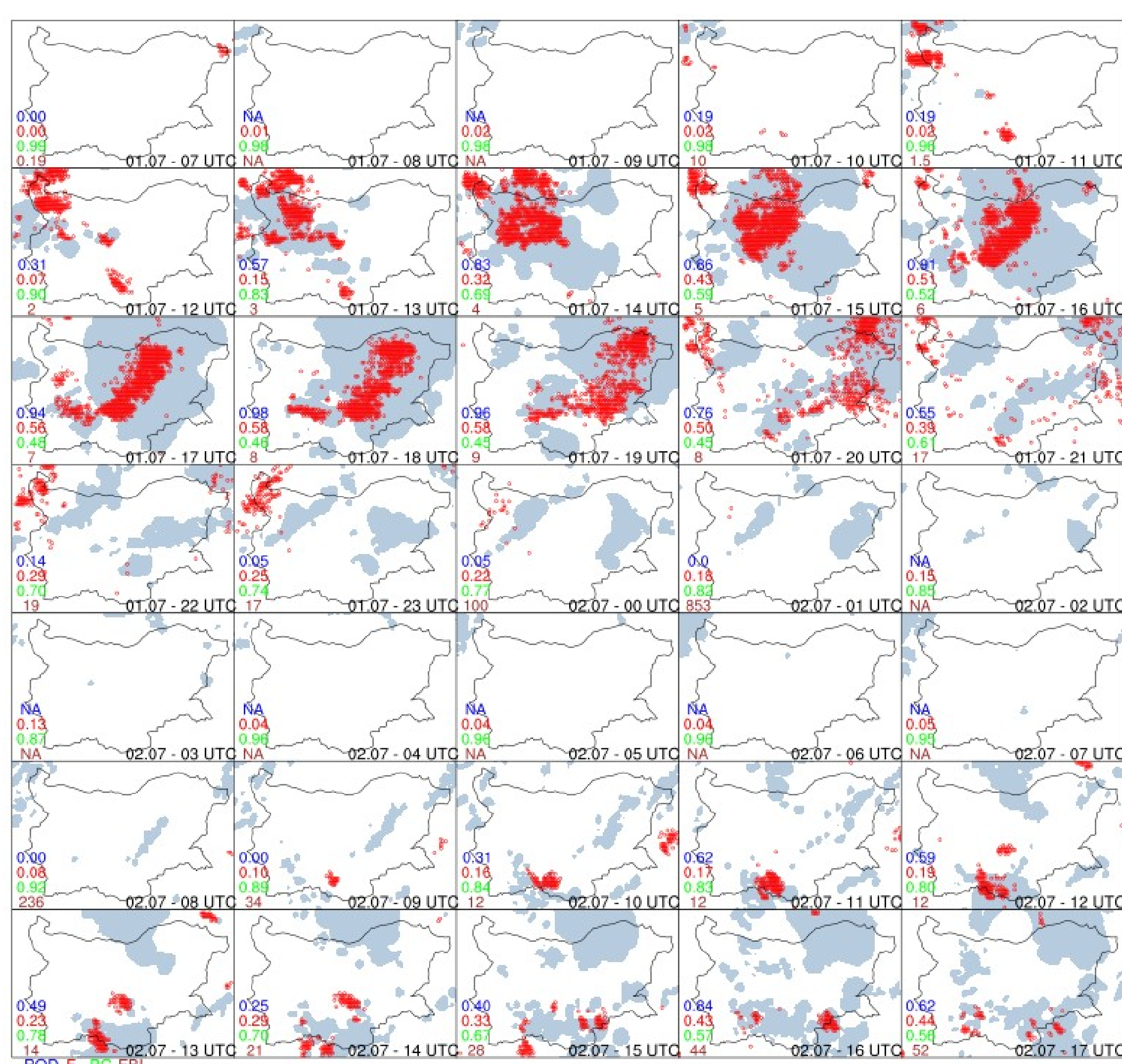- We developed a scheme for lighting probability forecast based on AROME-BG microphysics

Fig.6. Lightning probability forecast on 01/07/21 based on AROME-BG and cases with detected by ATDnet flashes (red). Respective values of POD, FAR, PC and FBI are indicated for each hour of the forecast.

- We developed a scheme for damaging frost probability forecast based on ML technique (Random Forest) using ALADIN-BG output as predictors
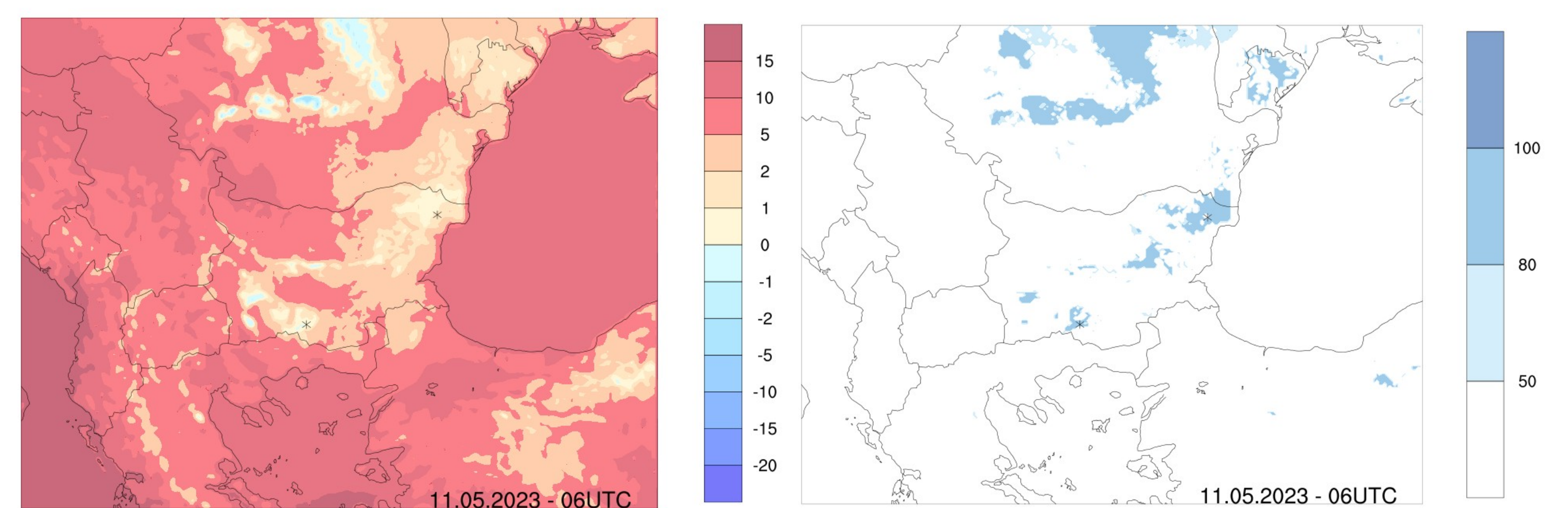
Fig.7. Tmin forecasted by ALADIN (left) and frost probability forecasted by our scheme (right) for 11/05/23. Stations with registered frost are indicated with black crosses

6. Some ongoing tests

We are running in parallel of the operational suite:
- AROME-BG using directly the LBC from ARPEGE, with 3h frequency;
- AROME-BG using LBC from IFS, with 3h frequency;
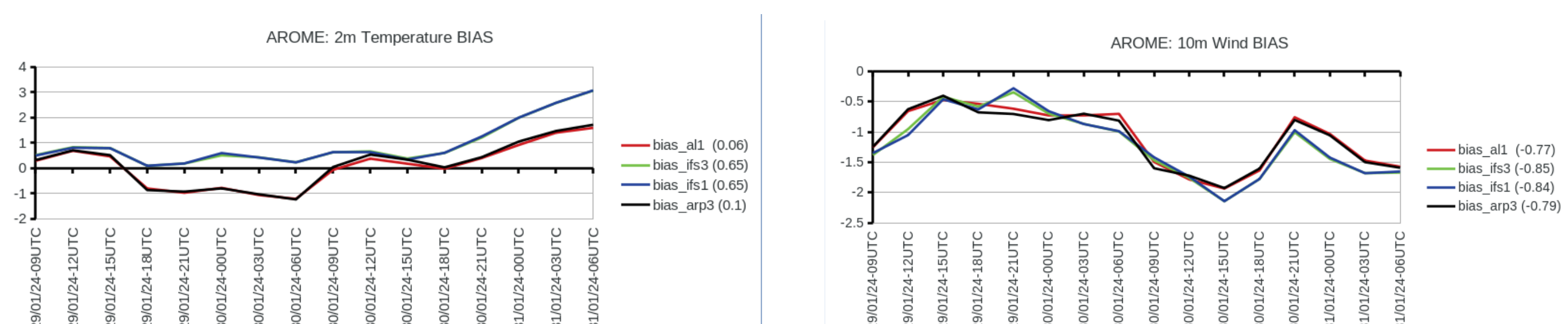- AROME-BG using LBC from IFS, with 1h frequency;

Fig.8. T2m (left) and W10m (right) BIAS as a function of forecast range of AROME-BG using different LBCs for a case study 29/01/24.
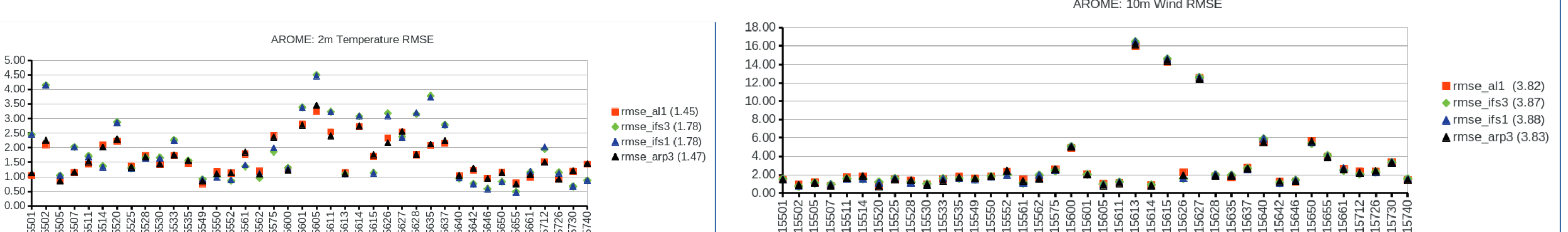
Fig.9. T2m (left) and W10m (right) RMSE for each synoptic station of AROME-BG using different LBCs for a case study 29/01/24.