

Forecasting Cold Winter Temperatures in Finland with the Aila AI Weather Model

Leila Hieta, Tuukka Himanka, Marko Laine, Mikko Partio, Olle Rätty (Finnish Meteorological Institute, FMI)

INTRODUCTION

Data-driven AI weather models are transforming operational forecasting, offering competitive accuracy at a fraction of the computational cost. This poster presents verification results for AILA, FMI's regional AI model trained on the LUMI supercomputer, with a focus on cold winter conditions in Finland, which represent a particularly demanding forecasting challenge due to strong temperature inversions.

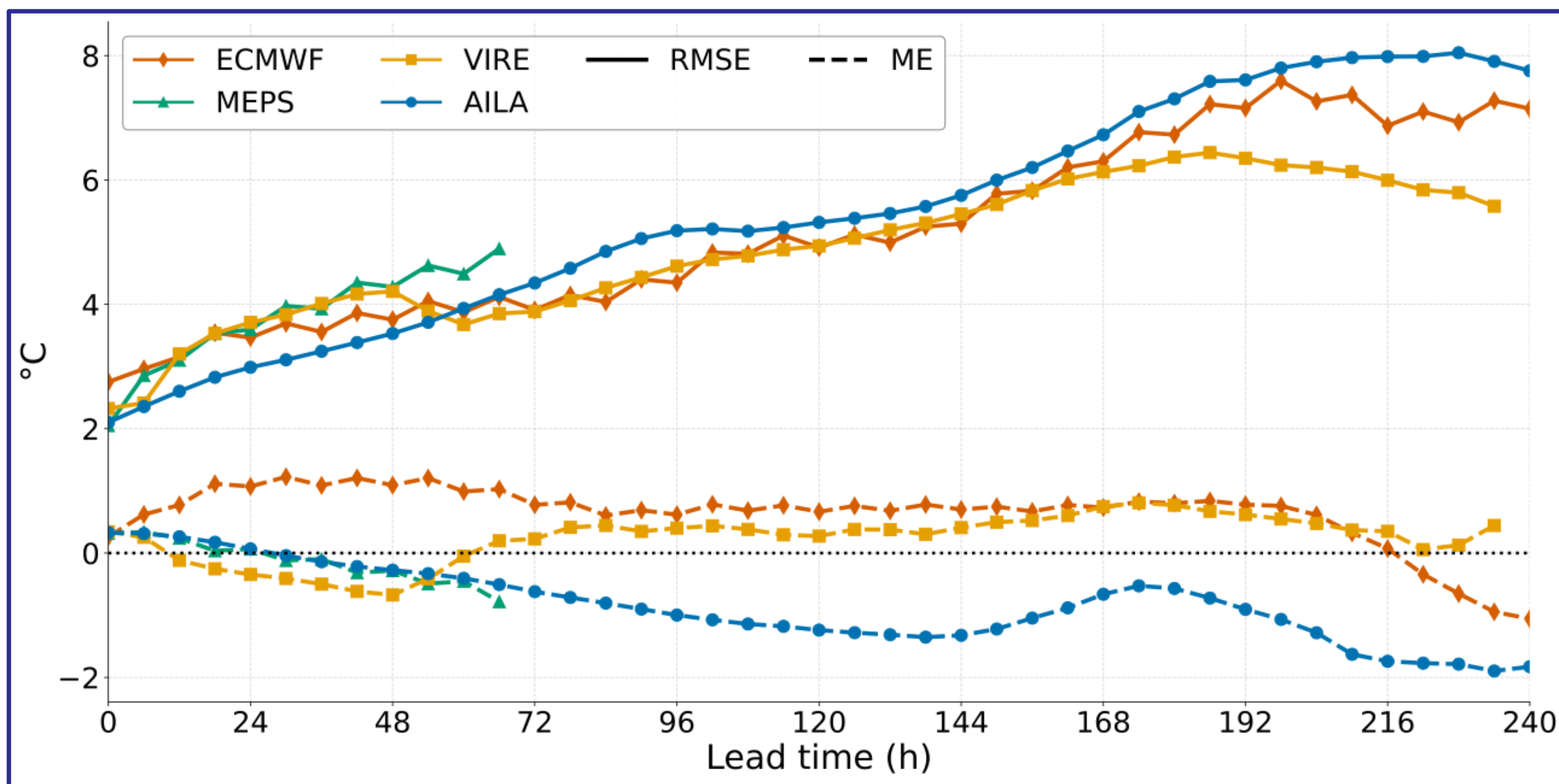
AILA MODEL

- Graph neural network with a stretched-grid approach, with higher resolution over Northern Europe
- Trained following Met Norway's BRIS [1] using the Anemoi framework developed by ECMWF and member states
- Pre-trained on ERA5, fine-tuned on MEPS and IFS analyses
- Deterministic 10-day forecast with 6-hour temporal resolution and 2.5km horizontal resolution

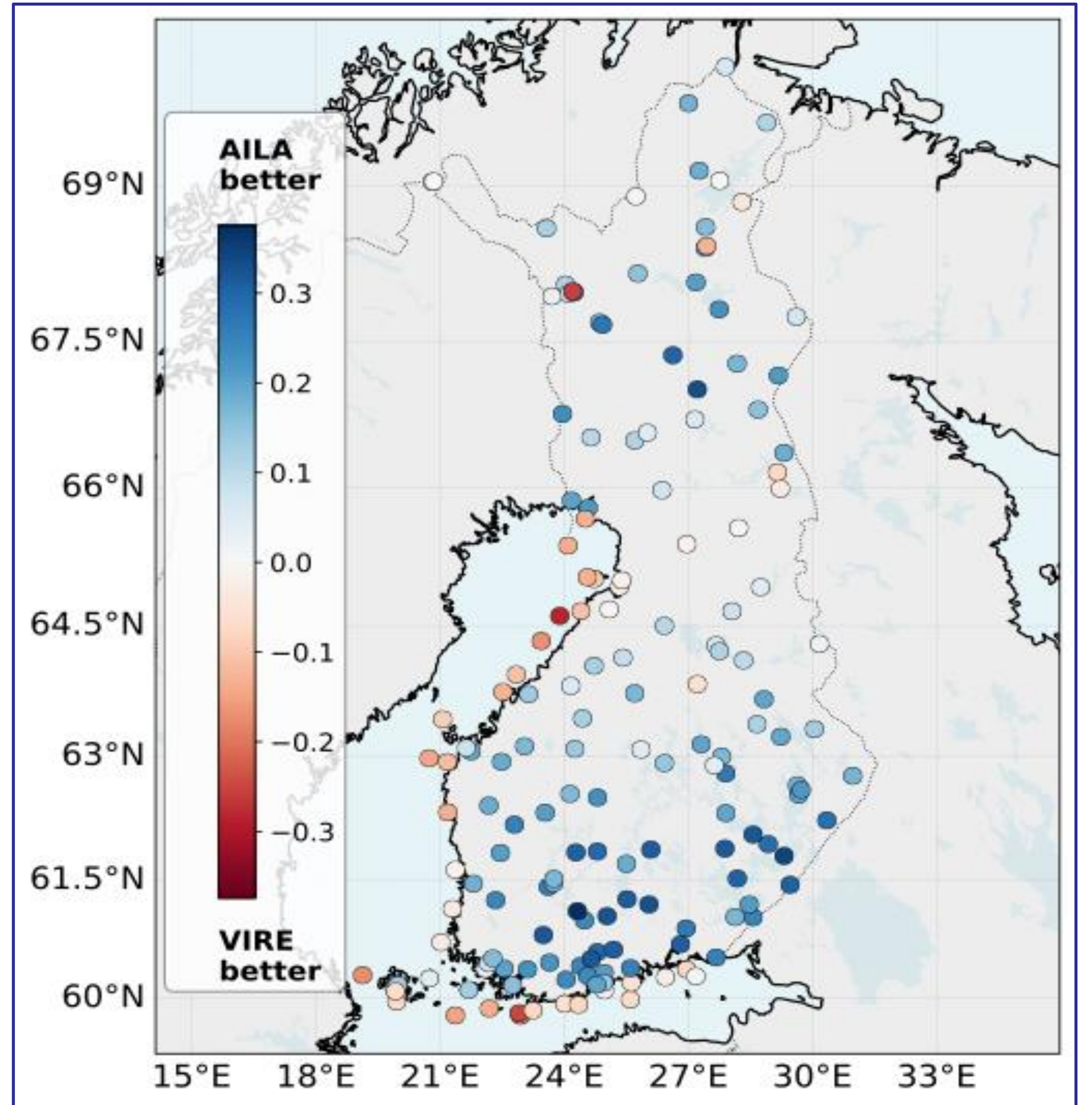
VERIFICATION SETUP

- Results for January 2026, which was colder than usual across Finland, with mean temperatures below -20°C in Lapland
- Results compared to VIRE, FMI's operational forecast based on MEPS, ECMWF and post-processing
- Verification against station observations across Finland
- Metrics: RMSE, ME (bias), MAE skill score

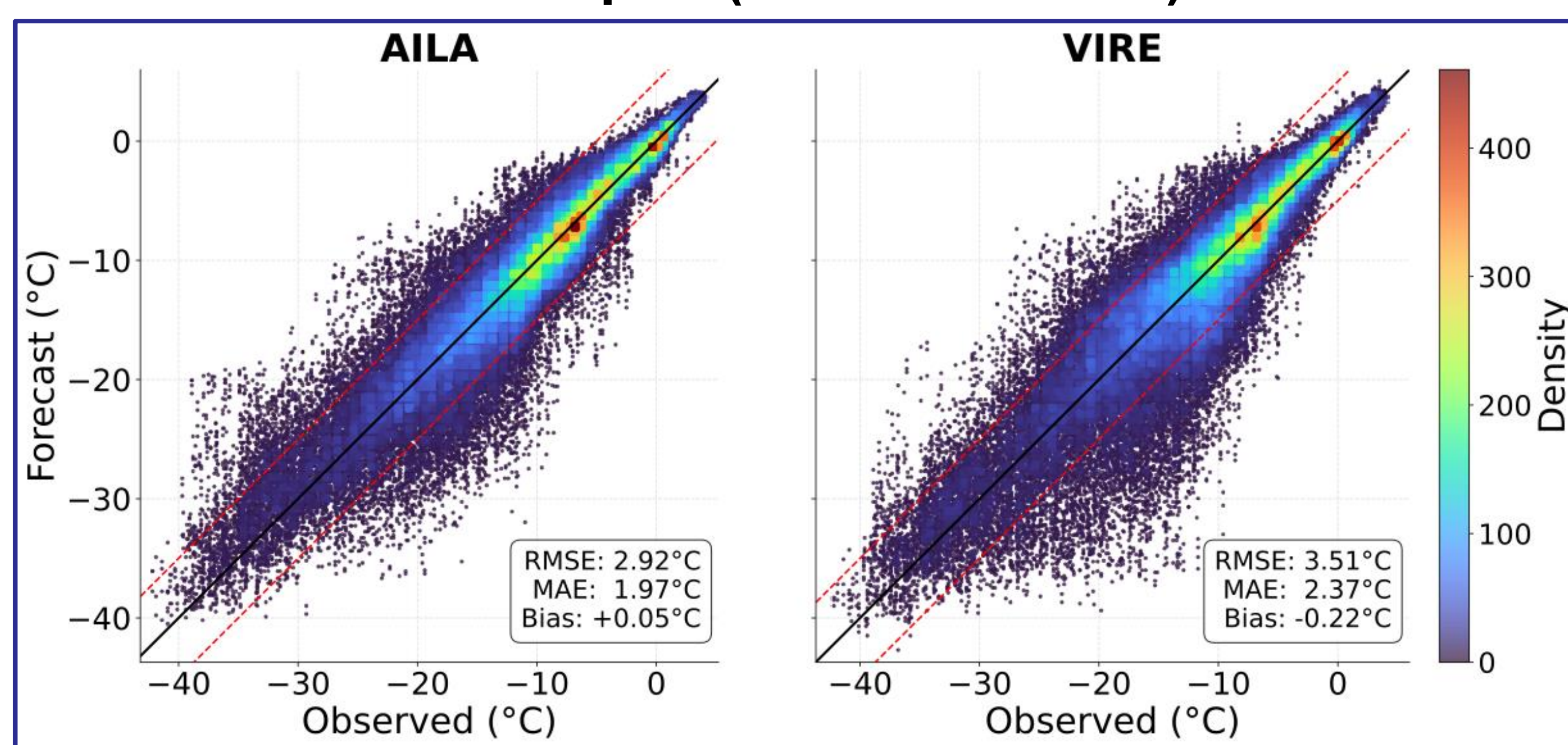
RMSE and ME by lead time



MAE Skill score (lead time < 48h)



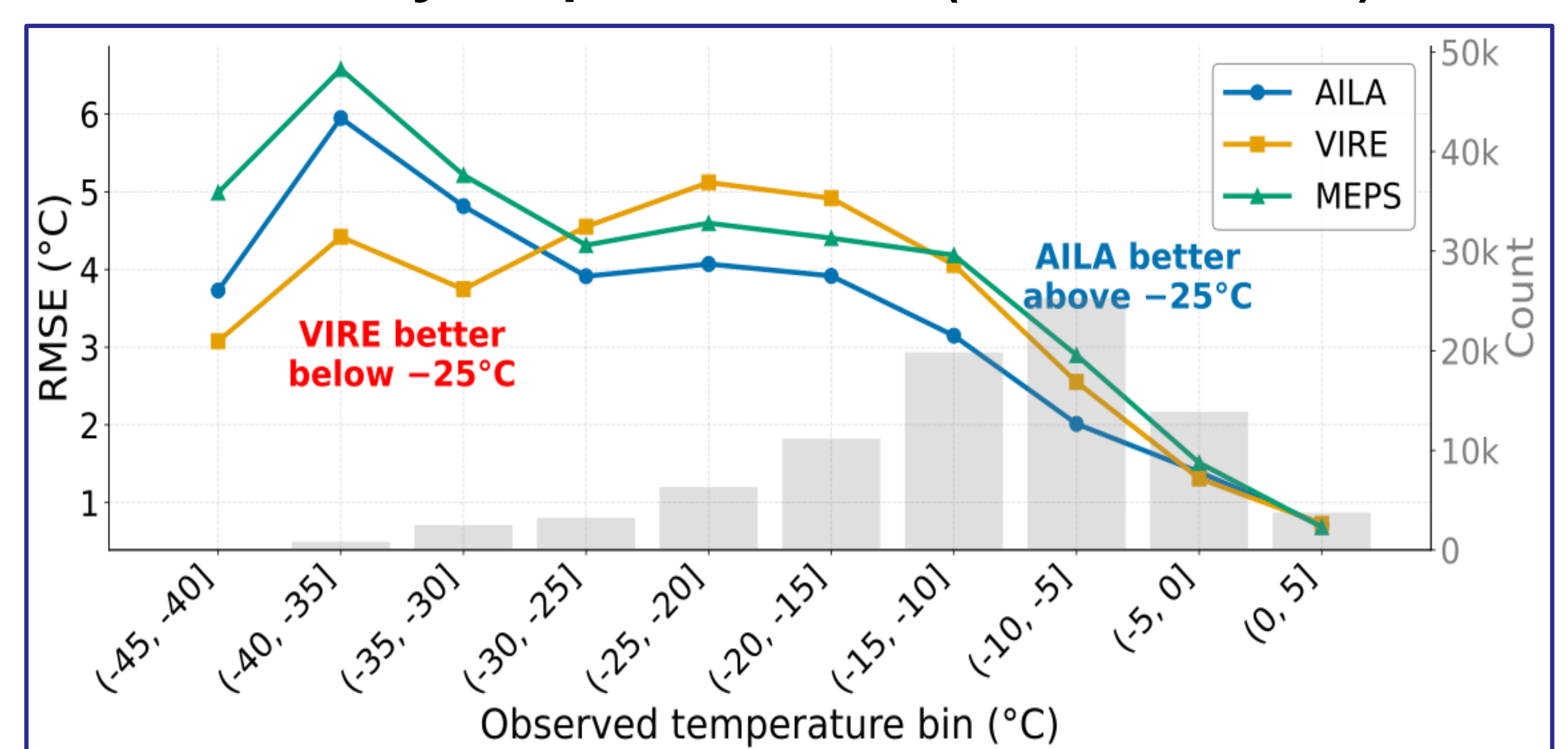
Scatterplot (lead time < 48h)



CONCLUSIONS

- AILA has the lowest RMSE < 60h, highest at longer lead times
- For lead times < 48h, AILA outperforms VIRE at most stations, except along the coastline. Improvement not so prominent in Lapland (coldest region)
- AILA shows less scatter than VIRE within 48h, but tends to overforecast in the coldest cases
- AILA improves on MEPS across all temperature bins
- Future work: improving performance for cold extremes and at 3-10-day lead times, and on exploring 1h temporal resolution
- Despite remaining gaps in cold extremes and longer lead times, AILA already demonstrates added value over FMI's operational forecast for winter cold conditions in Finland

RMSE by temperature bins (lead time < 48h)



REFERENCES & ACKNOWLEDGEMENTS

[1] Nipen, T., et al., 2025: Regional data-driven weather modeling with a global stretched-grid, *Artificial Intelligence for the Earth Systems*, <https://doi.org/10.1175/AIES-D-25-0001.1>.

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