



Supplement of

A deep learning framework for gridding daily climate variables from a sparse station network

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Abstract

This supplement contains daily time-series comparisons for the 25 held-out test stations across Romania during the year 2023 not included in the main manuscript. The figures demonstrate model performance and uncertainty quantification for daily mean air temperature and daily total precipitation across diverse topographic regions.

Supplementary Material

This document presents daily time-series evaluations for the 25 held-out test stations across Romania during the evaluation year 2023. For each station, the panels show:

- **(a) Daily mean air temperature (°C):** Observed station records compared with predictions from Regression Kriging (RK), SMACNP (Global), and SMACNP (Localized). Inset values indicate the Mean Absolute Error (MAE) achieved by each model.
- **(b) Daily total precipitation (mm):** Observed daily amounts compared with predictions from the three models.

Shaded bands represent the nominal 95% predictive intervals for each model's prediction. The inset map on each page indicates the geographic location of the test station within Romania.

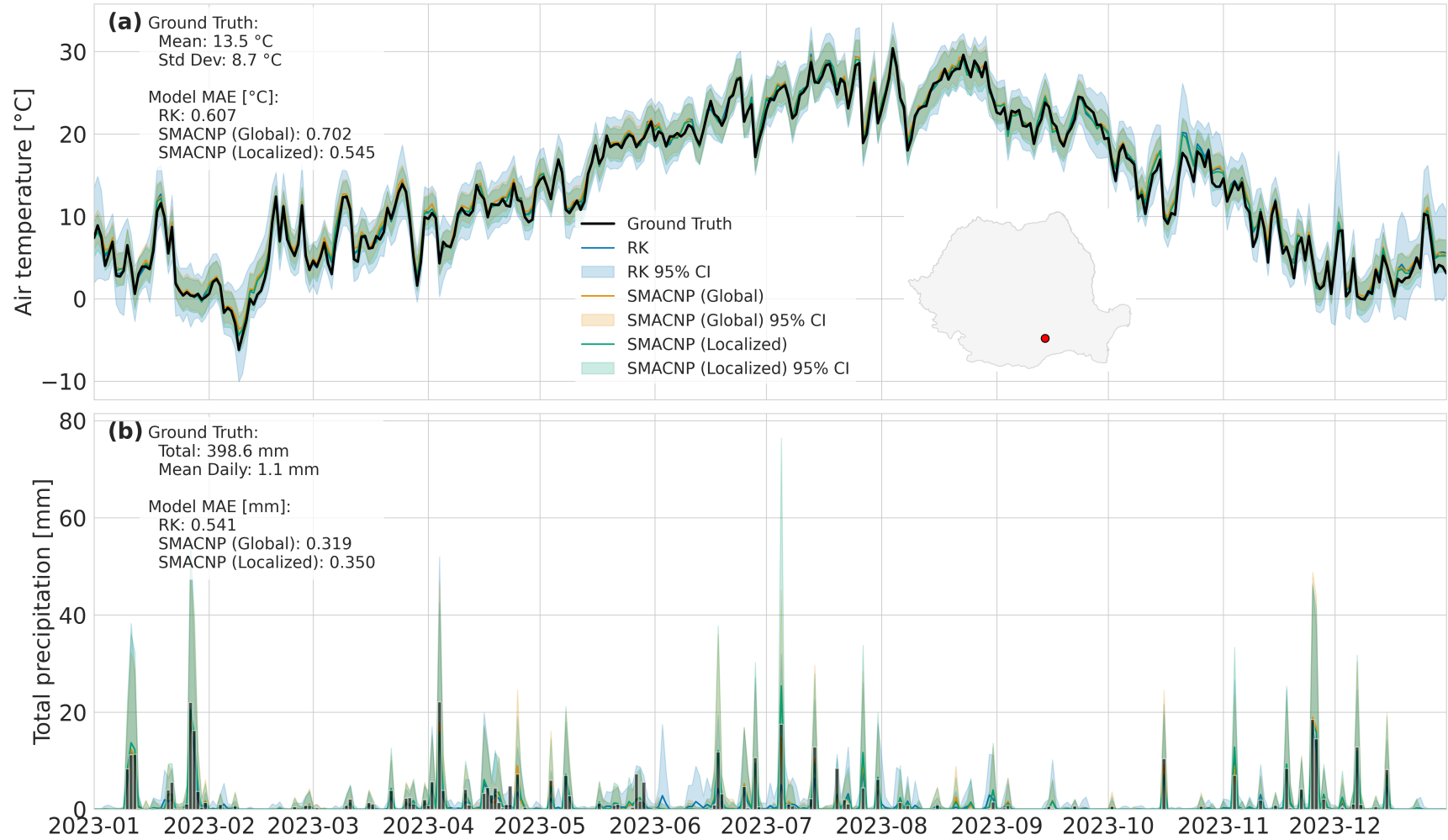


Figure S1. Model performance and uncertainty at **Baneasa** station (90 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

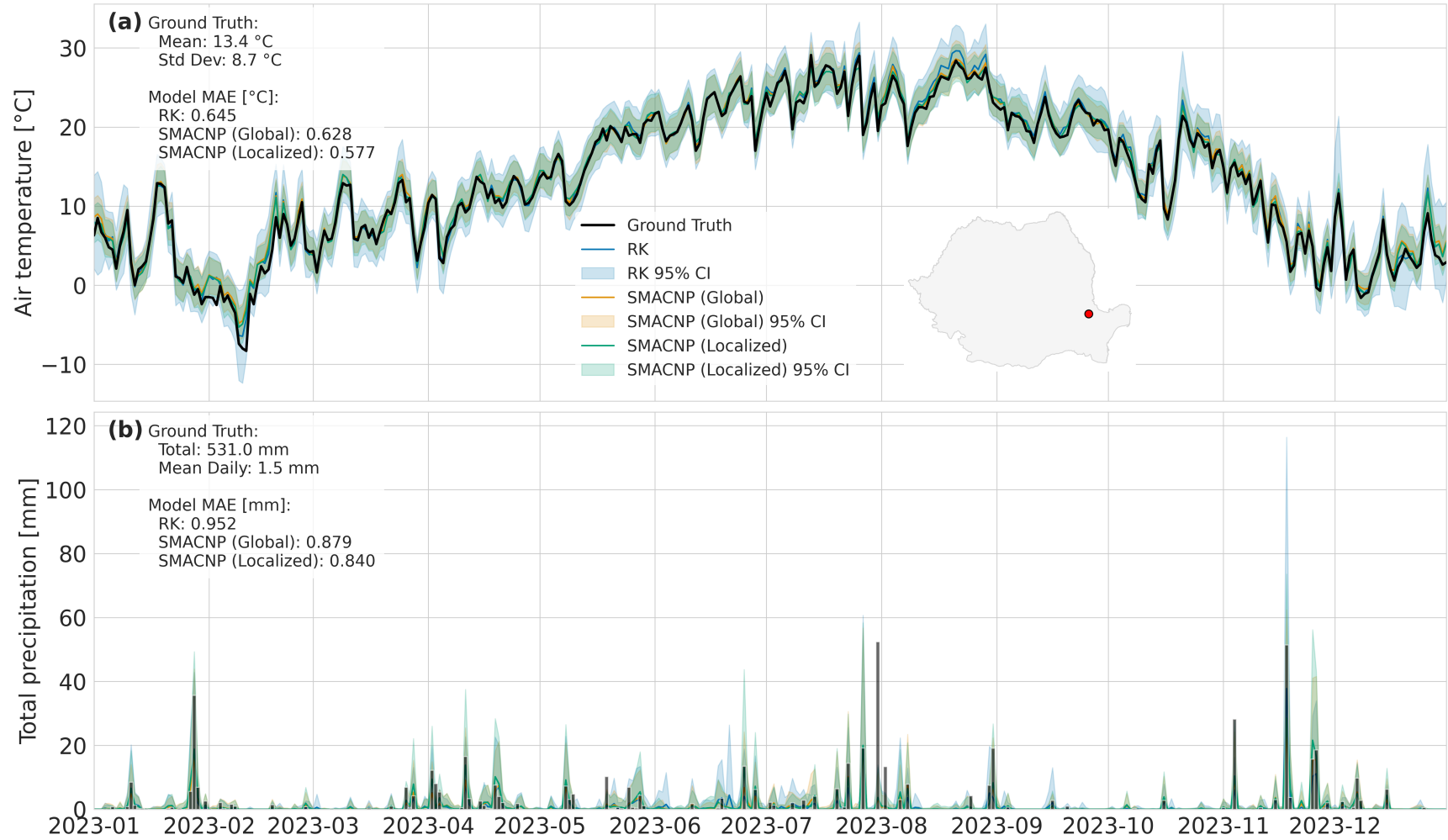


Figure S2. Model performance and uncertainty at **Braila** station (15 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

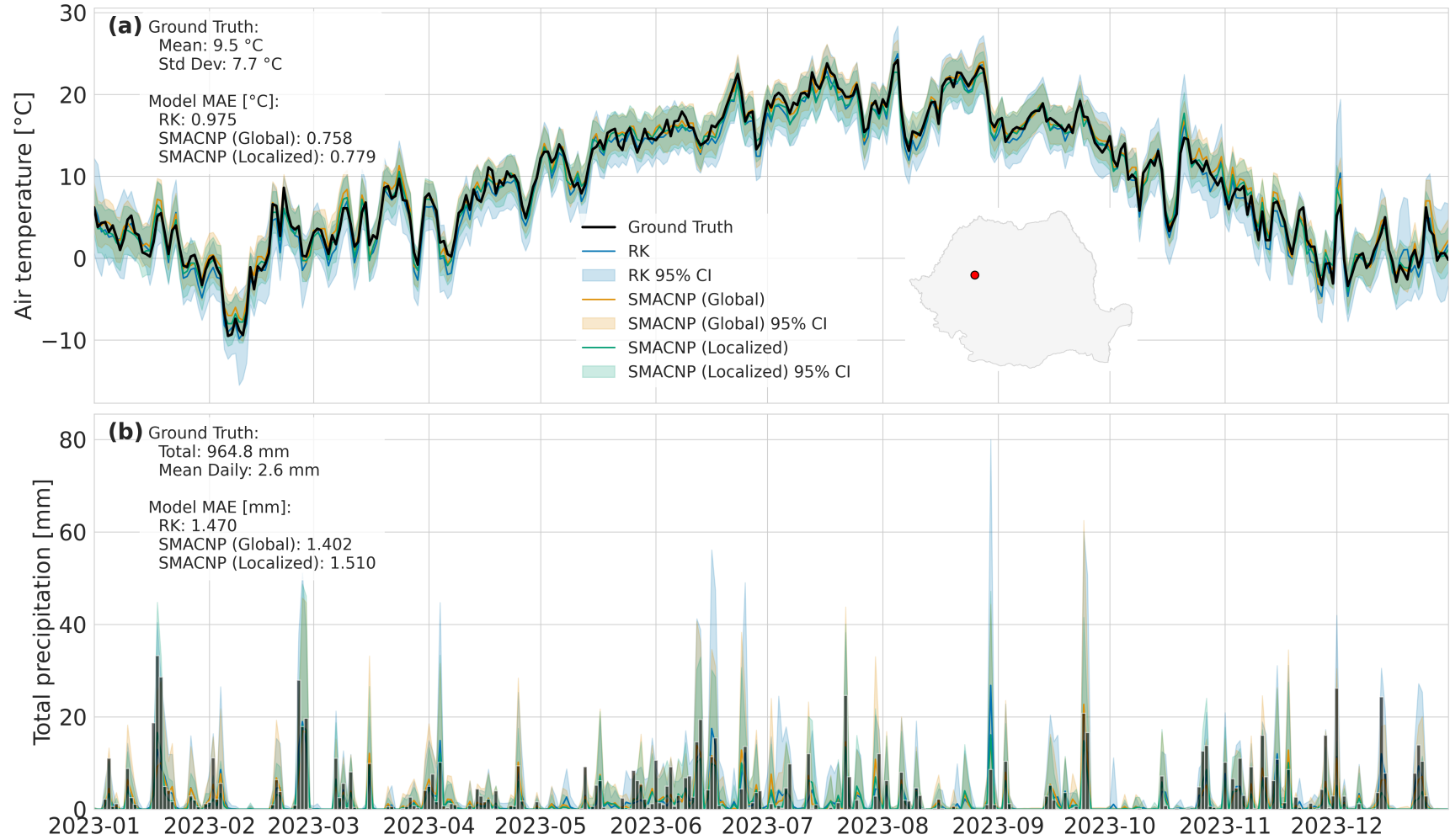


Figure S3. Model performance and uncertainty at **Campeni** station (591 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

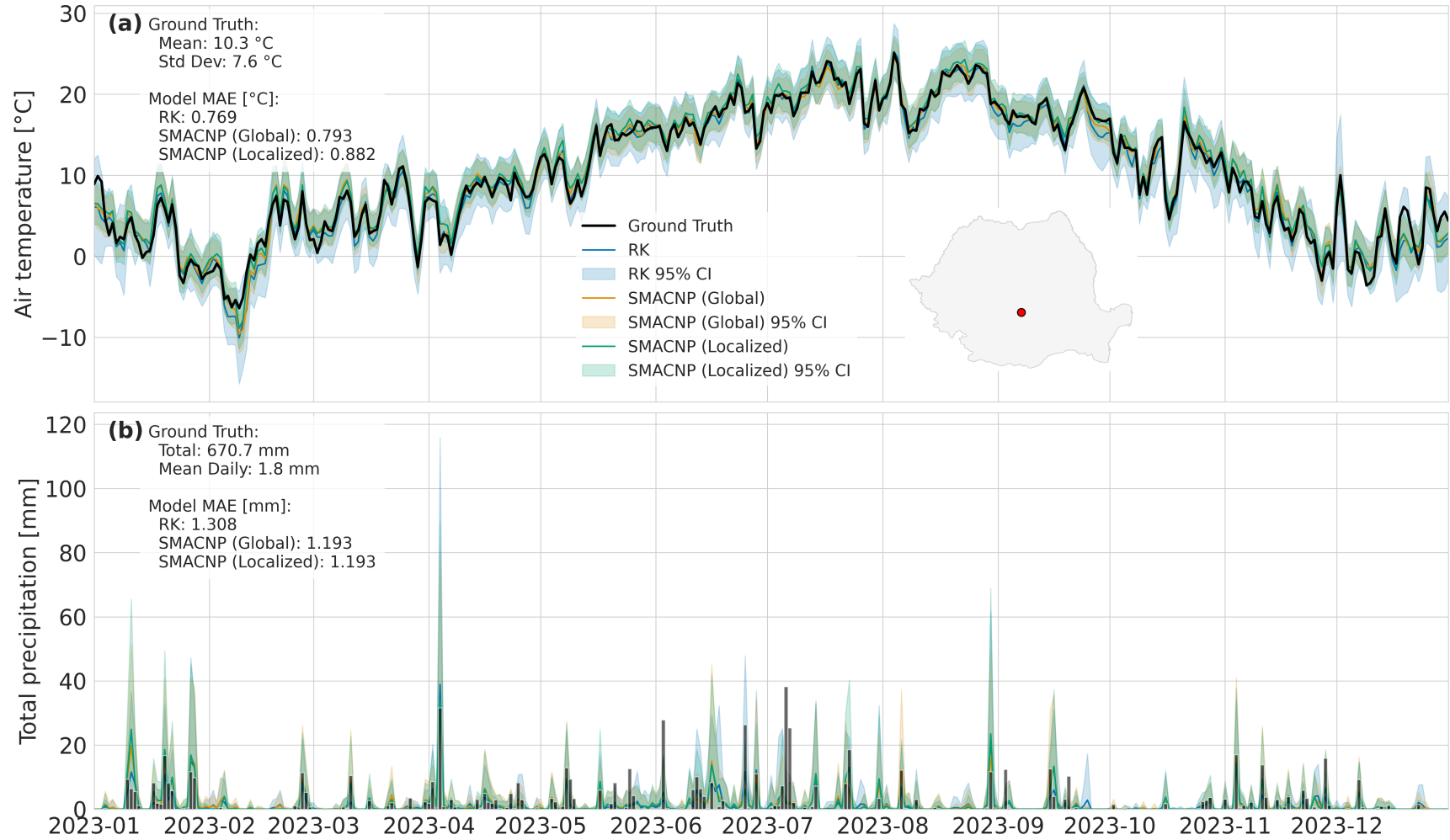


Figure S4. Model performance and uncertainty at **Campulung-Muscel** station (681 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

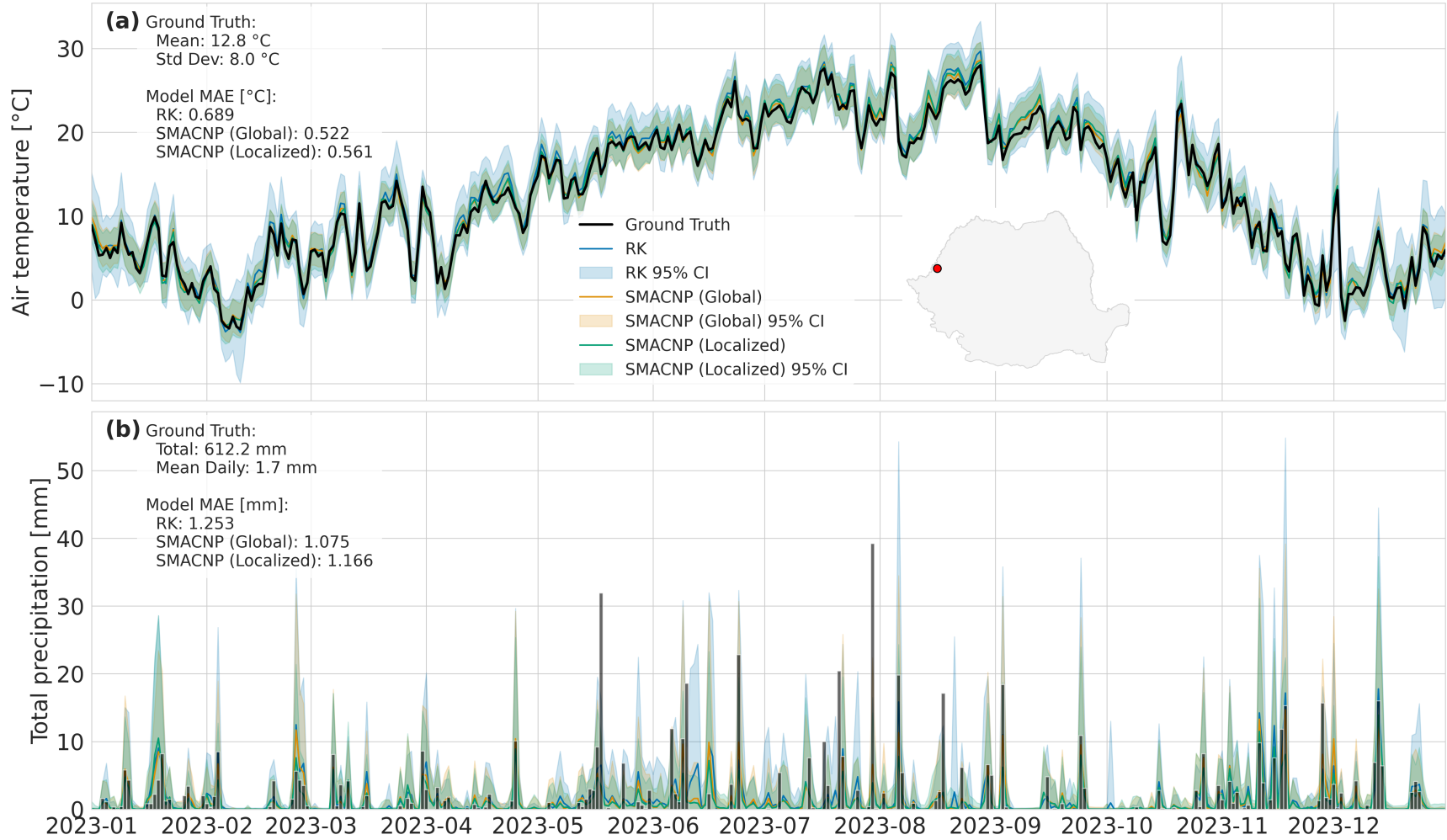


Figure S5. Model performance and uncertainty at **Chisineu-Cris** station (96 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

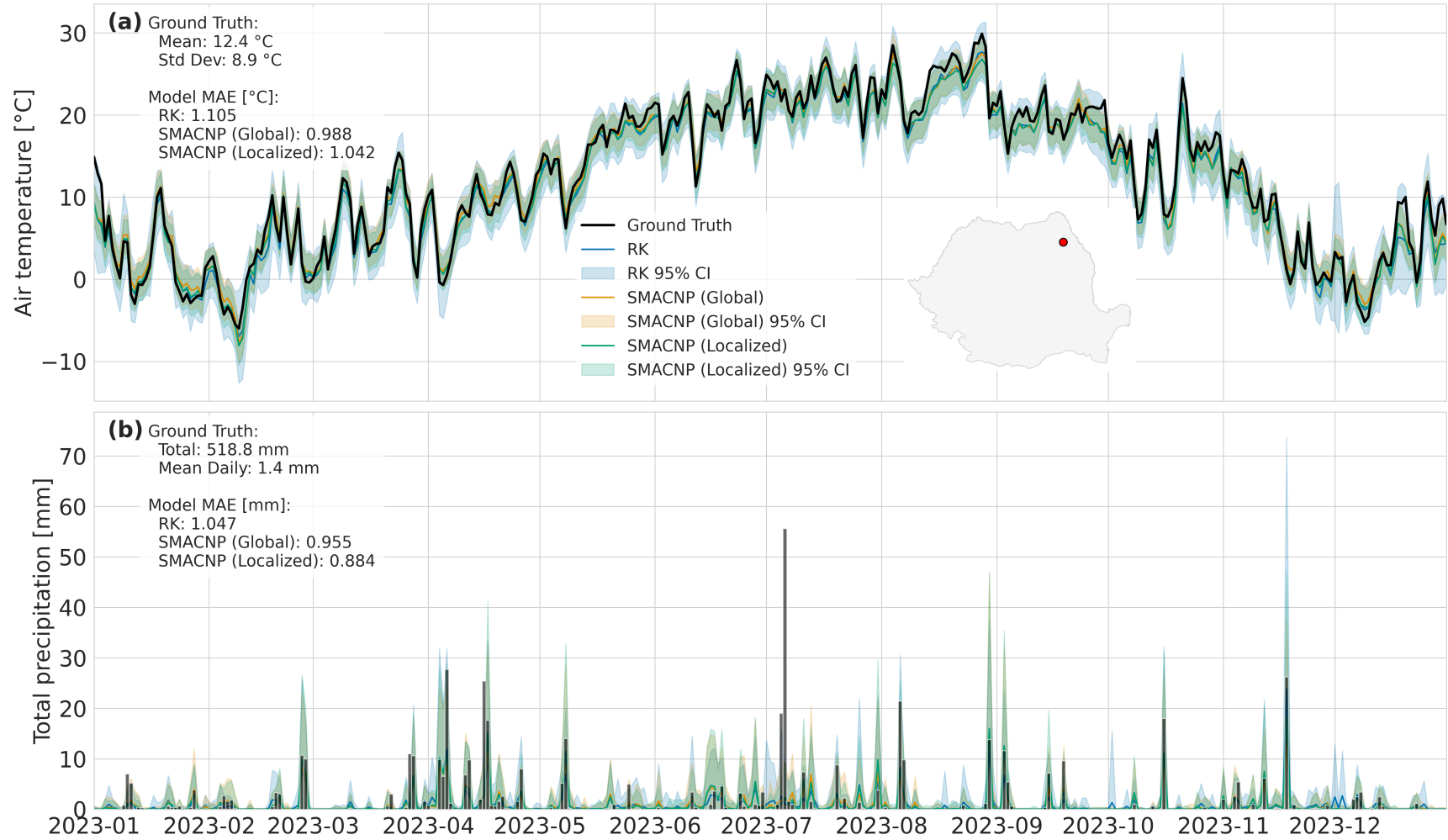


Figure S6. Model performance and uncertainty at **Cotnari** station (289 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

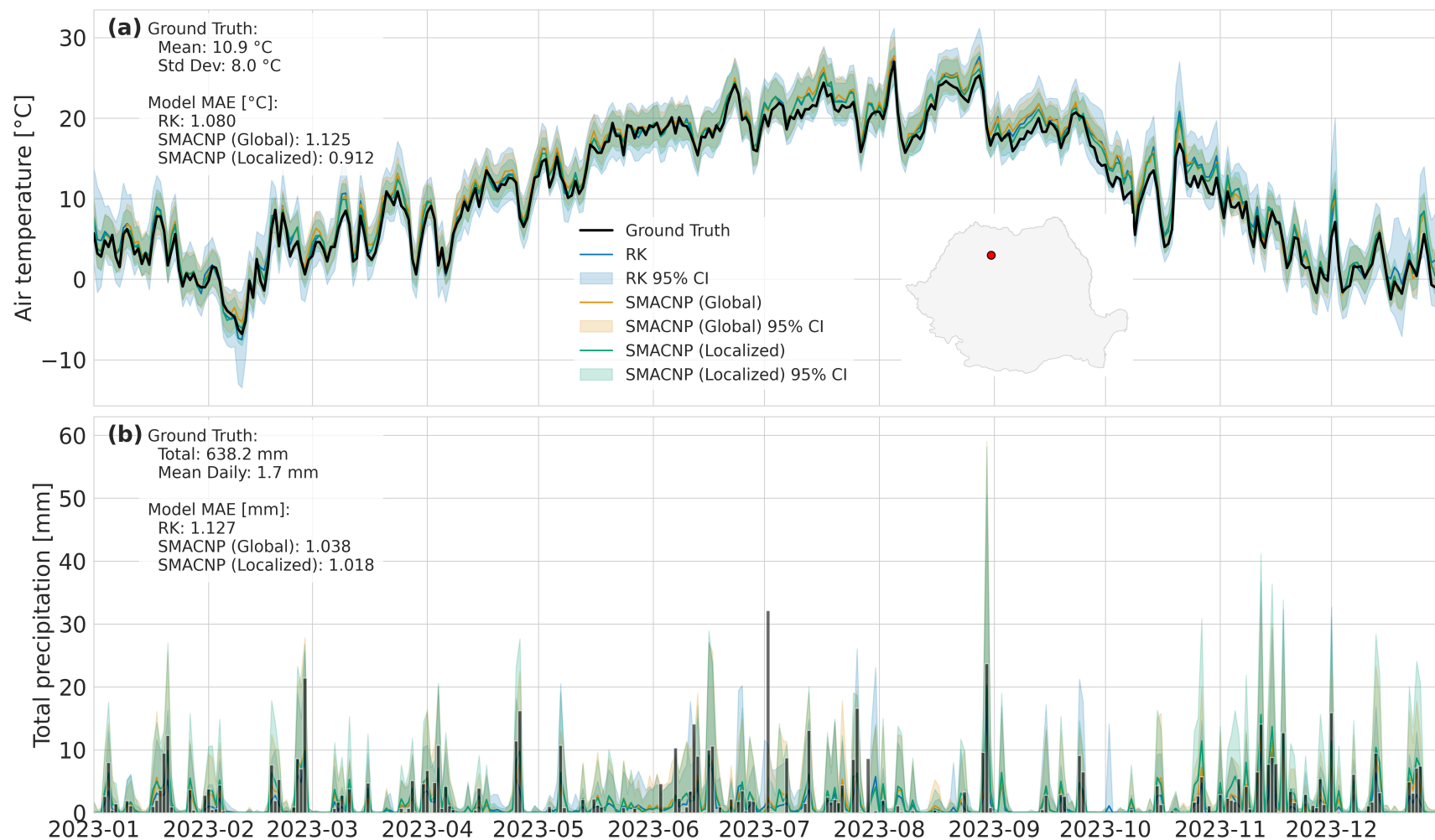


Figure S7. Model performance and uncertainty at **Dej** station (232 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

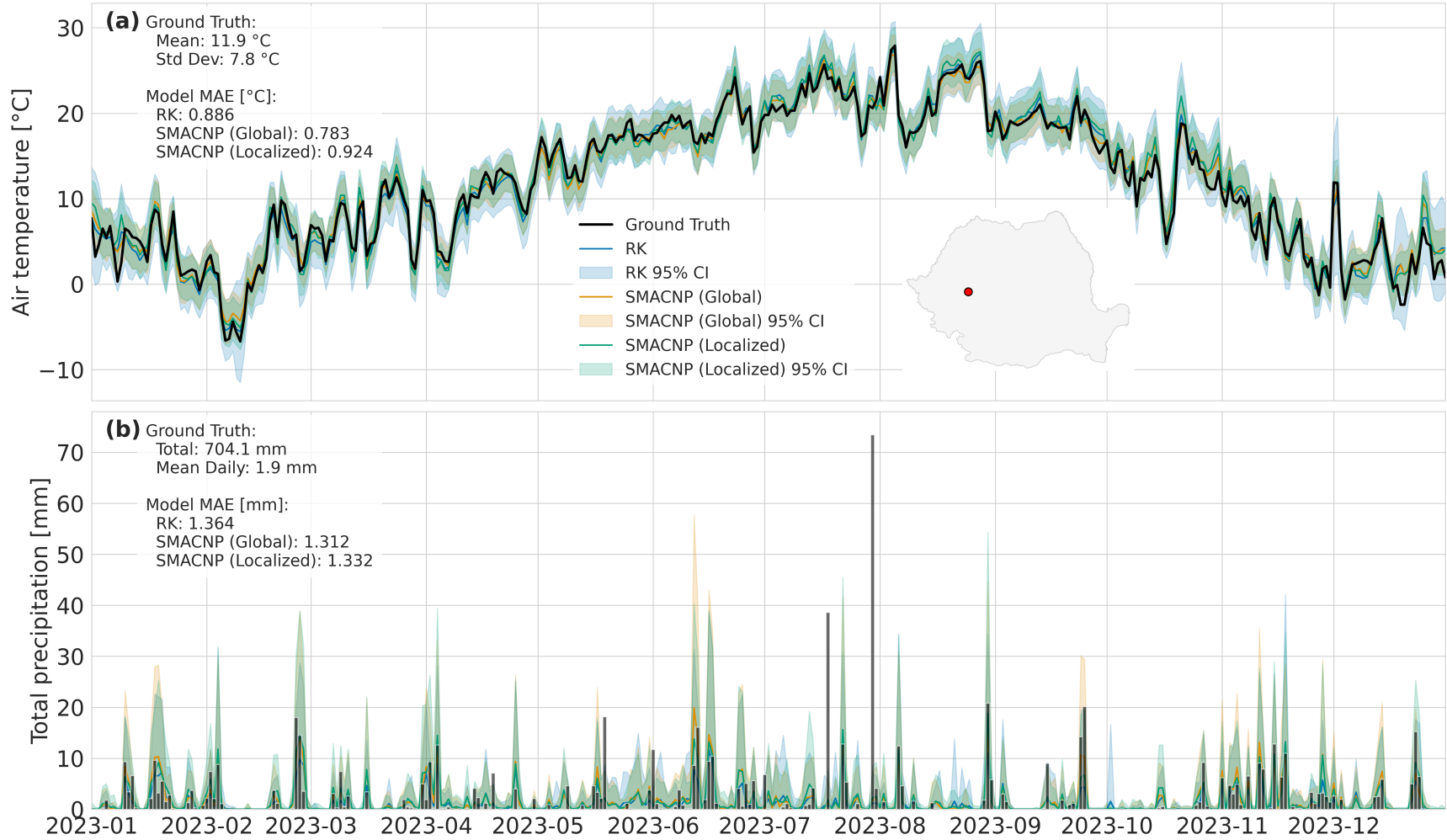


Figure S8. Model performance and uncertainty at **Deva** station (240 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

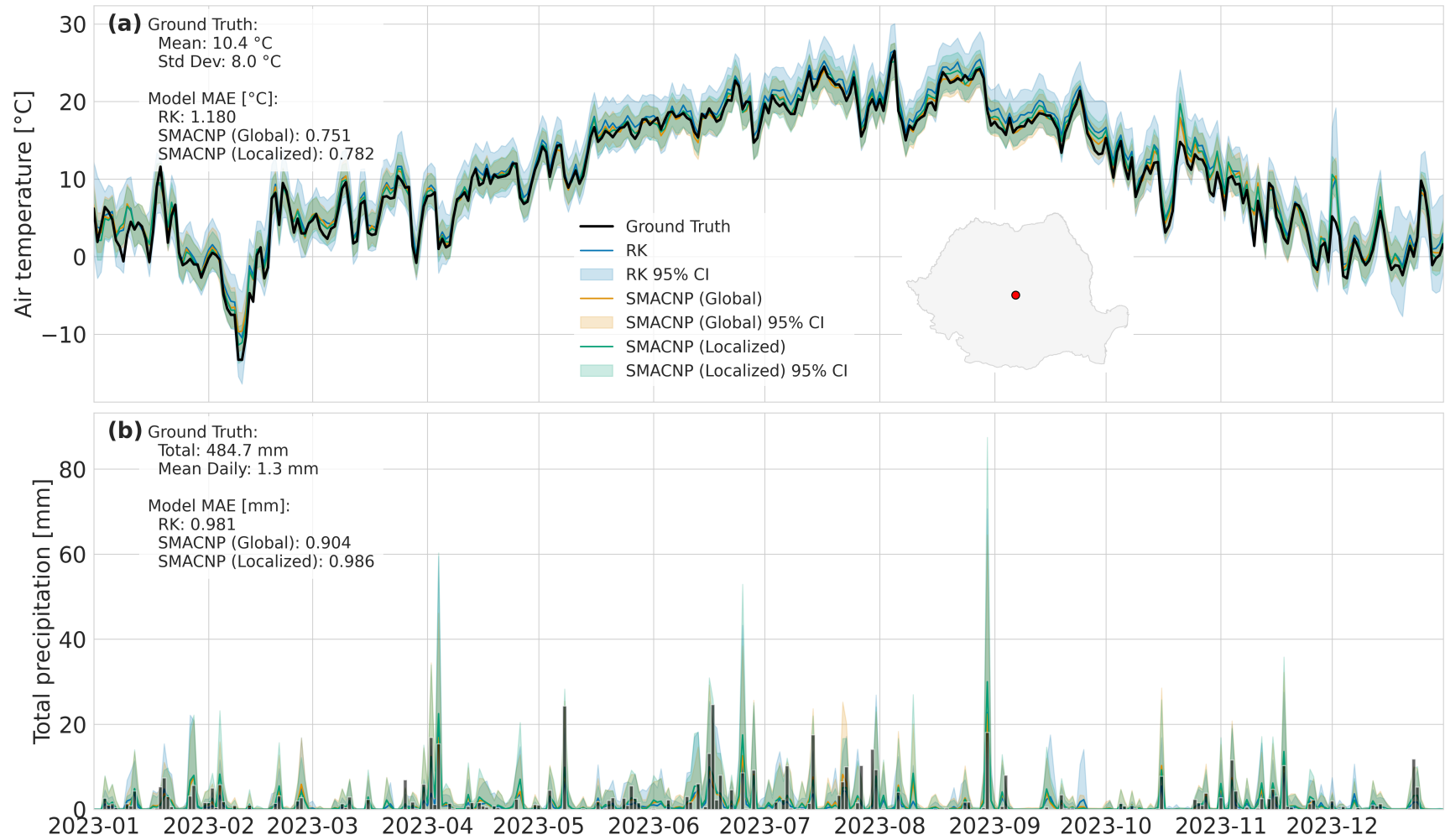


Figure S9. Model performance and uncertainty at **Fagaras** station (428 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

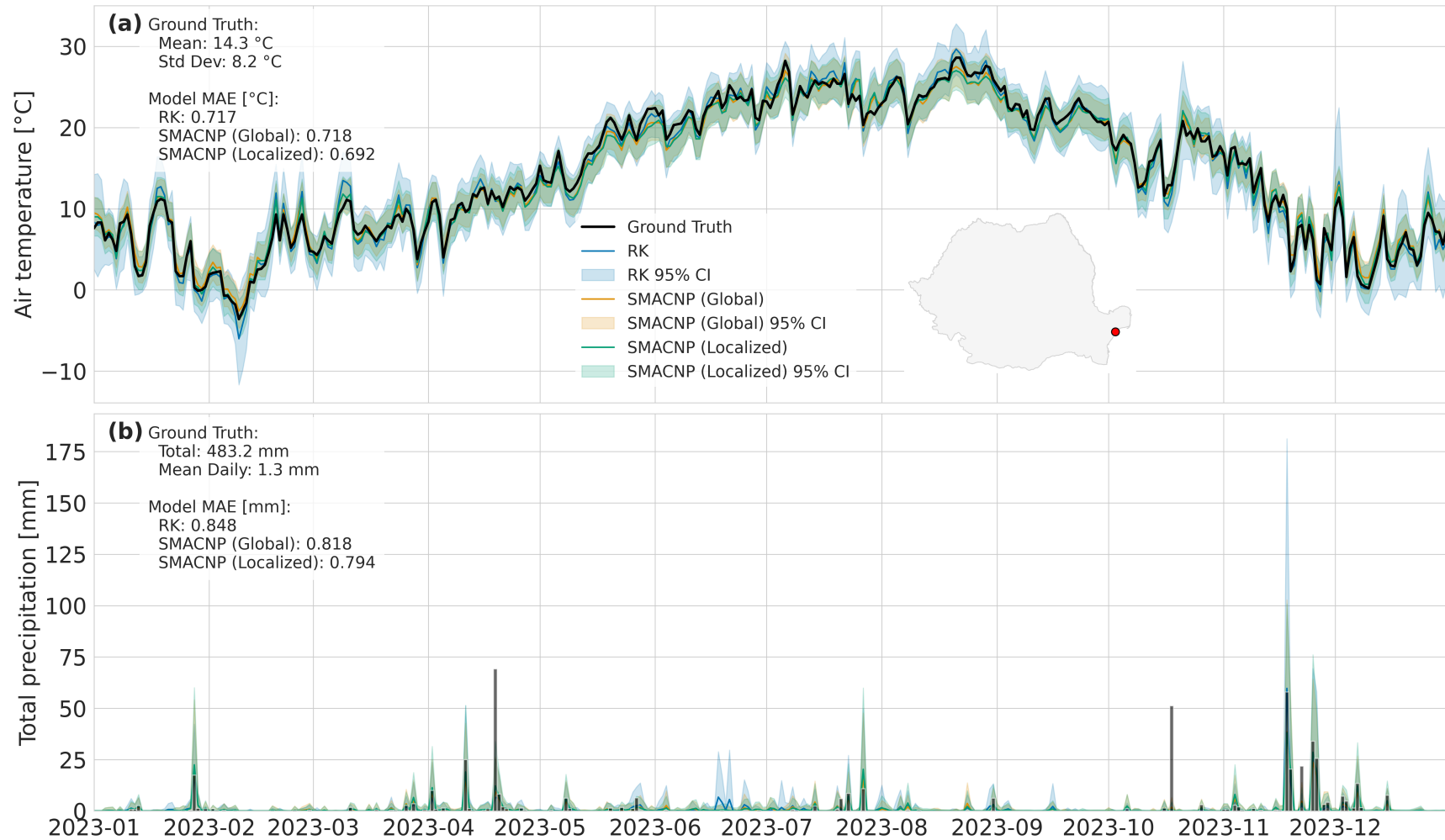


Figure S10. Model performance and uncertainty at **Gura-Portitei** station (2 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

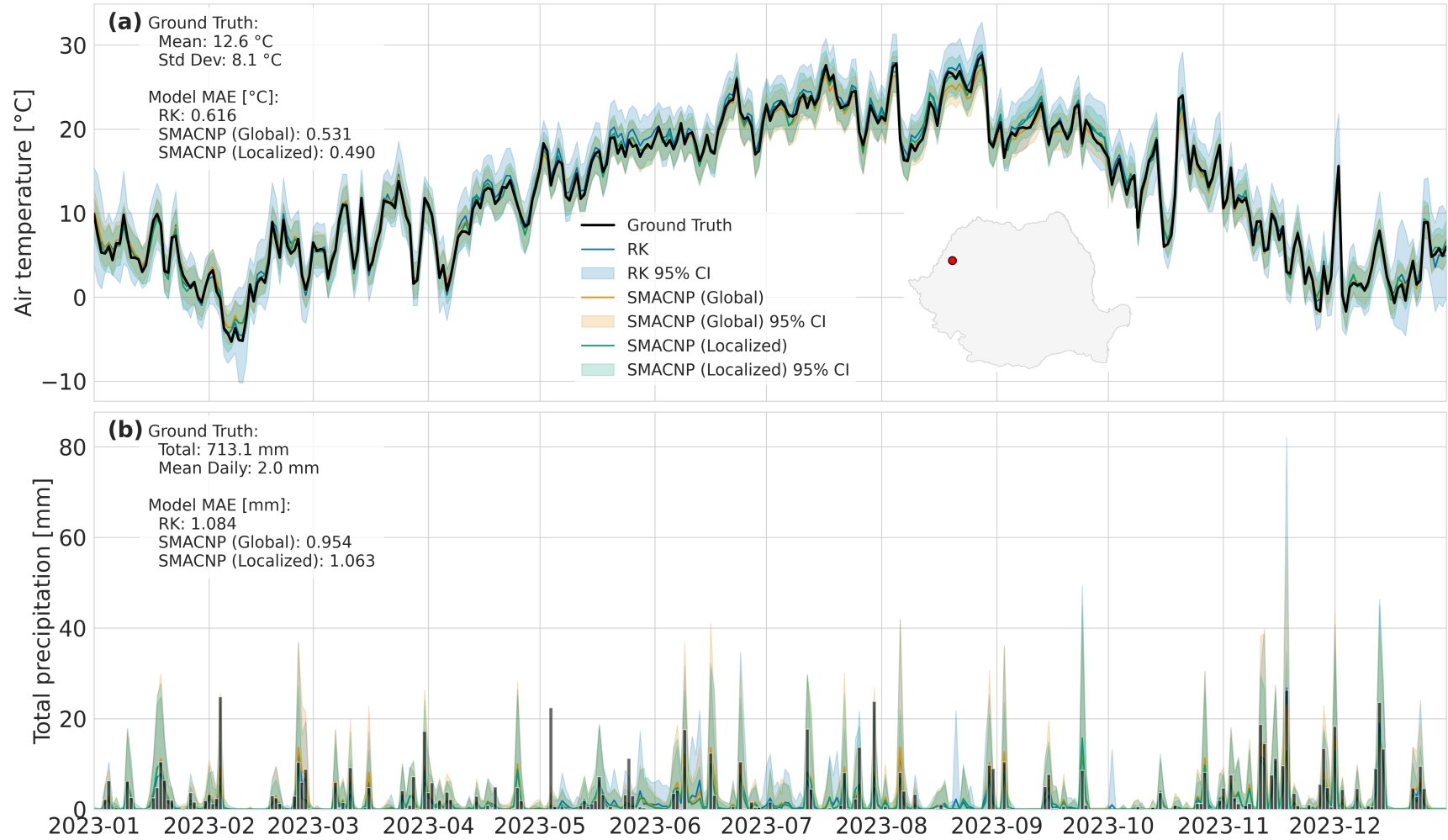


Figure S11. Model performance and uncertainty at **Holod** station (163 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

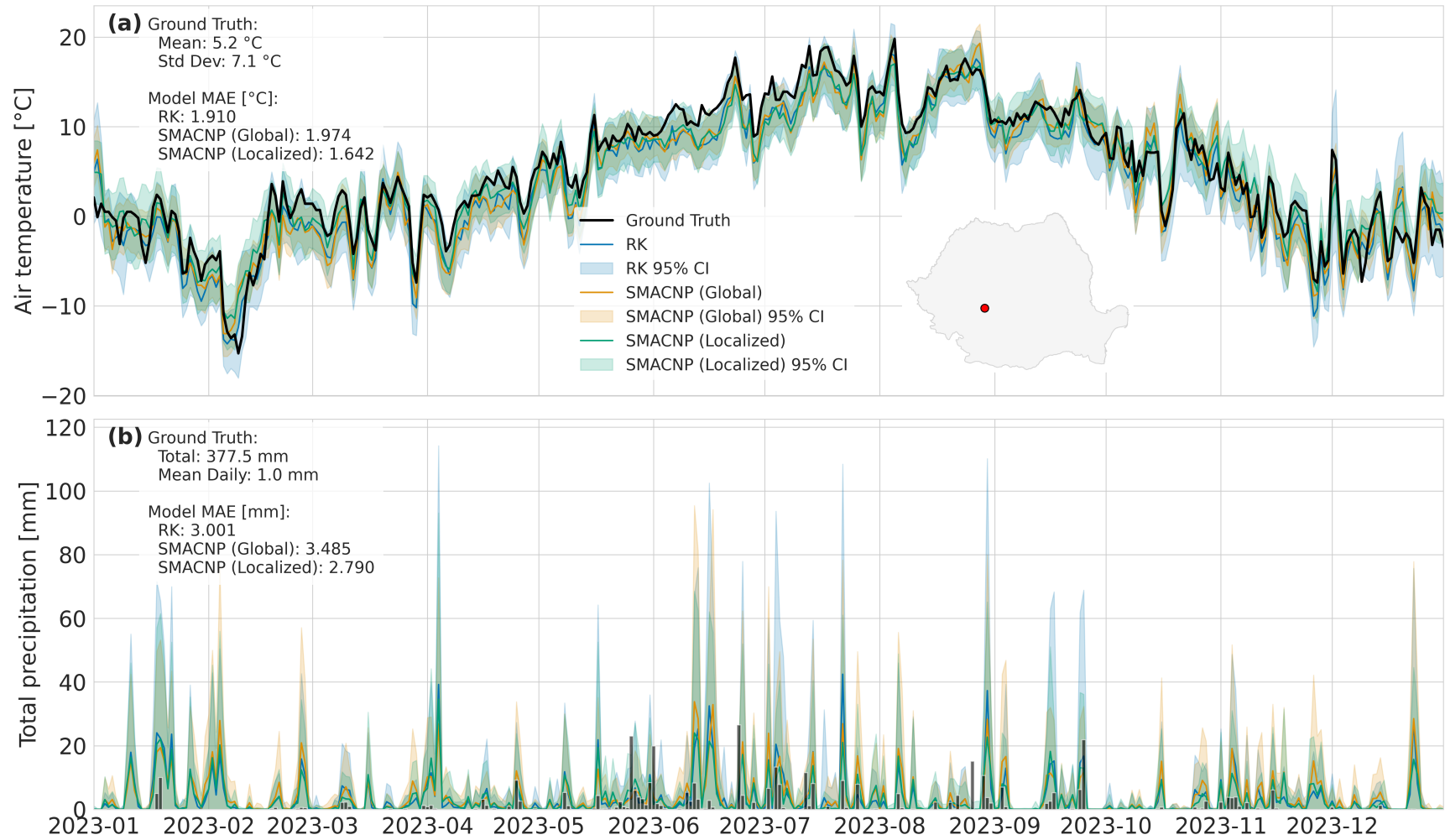


Figure S12. Model performance and uncertainty at **Obarsia-Lotrului** station (1348 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

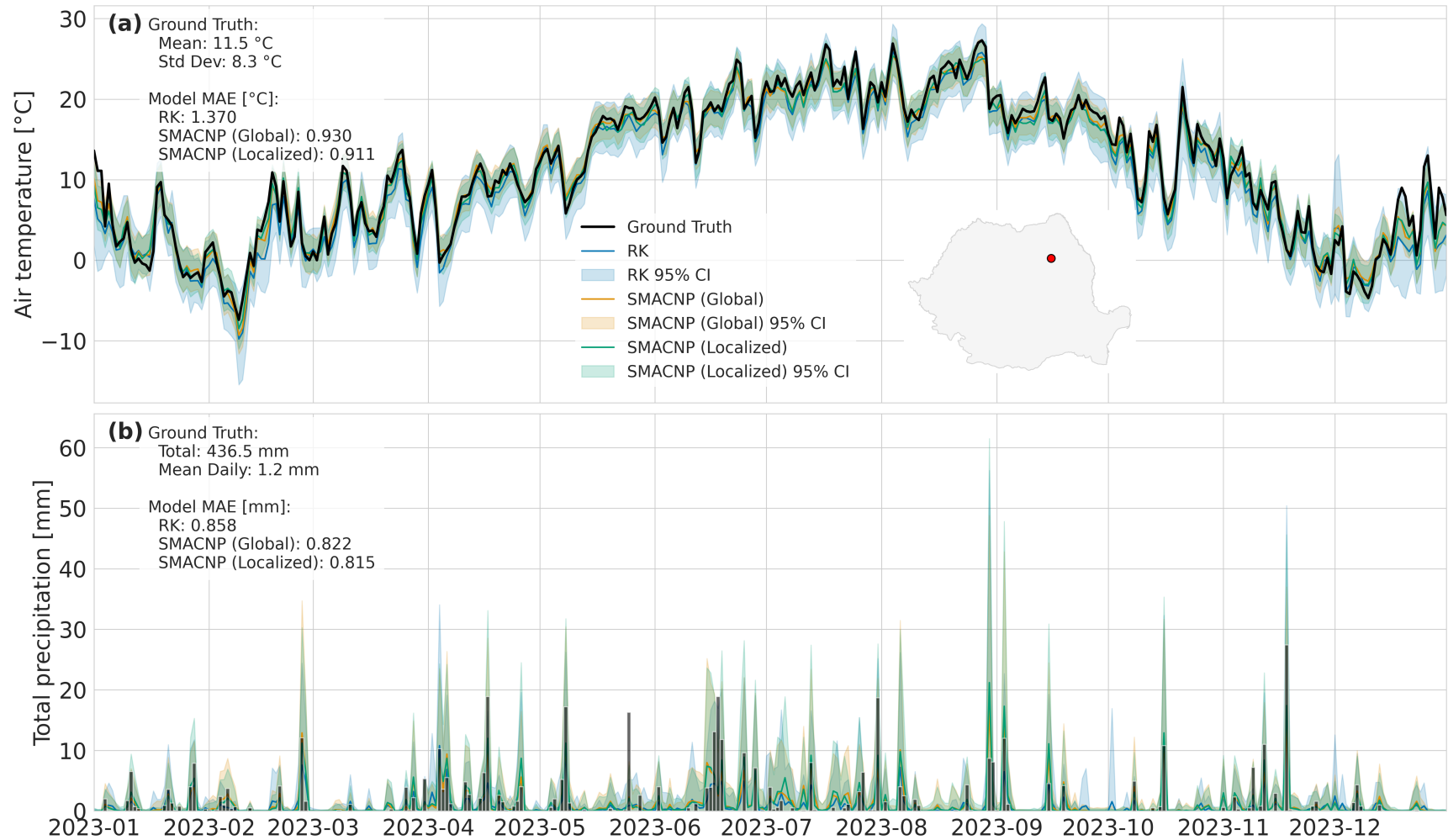


Figure S13. Model performance and uncertainty at **Piatra-Neamt** station (360 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

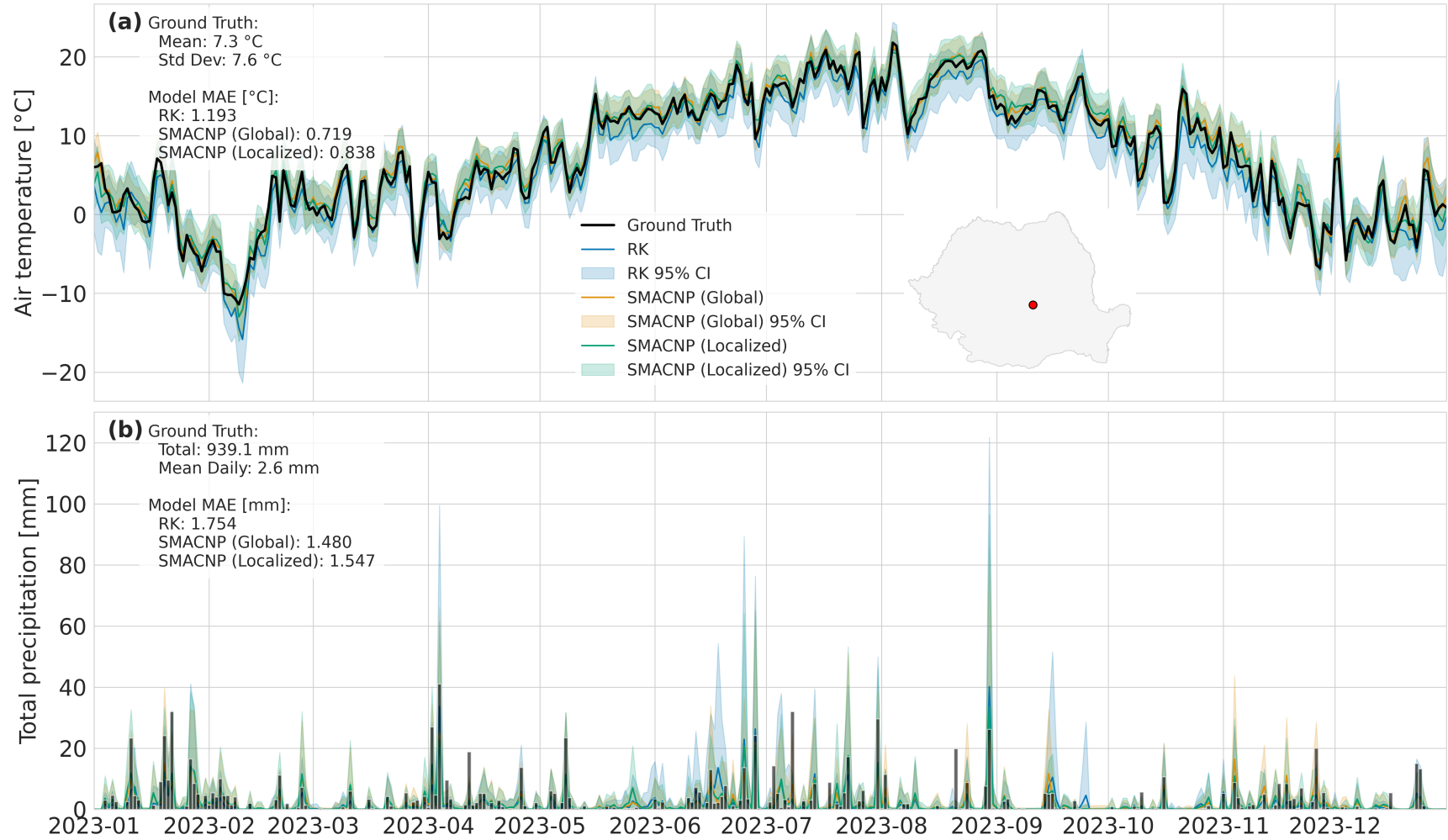


Figure S14. Model performance and uncertainty at **Predeal** station (1090 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

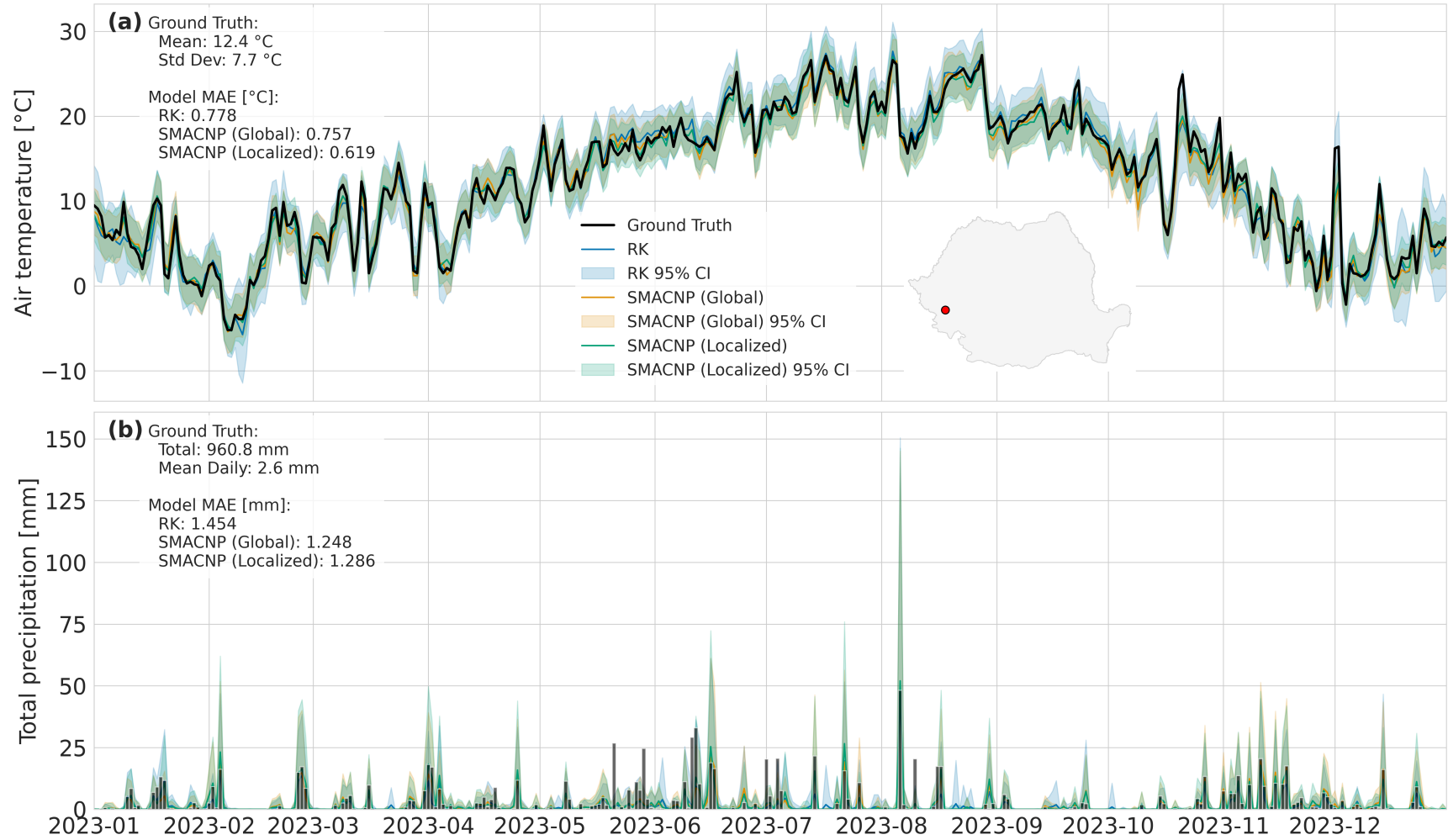


Figure S15. Model performance and uncertainty at **Resita** station (279 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

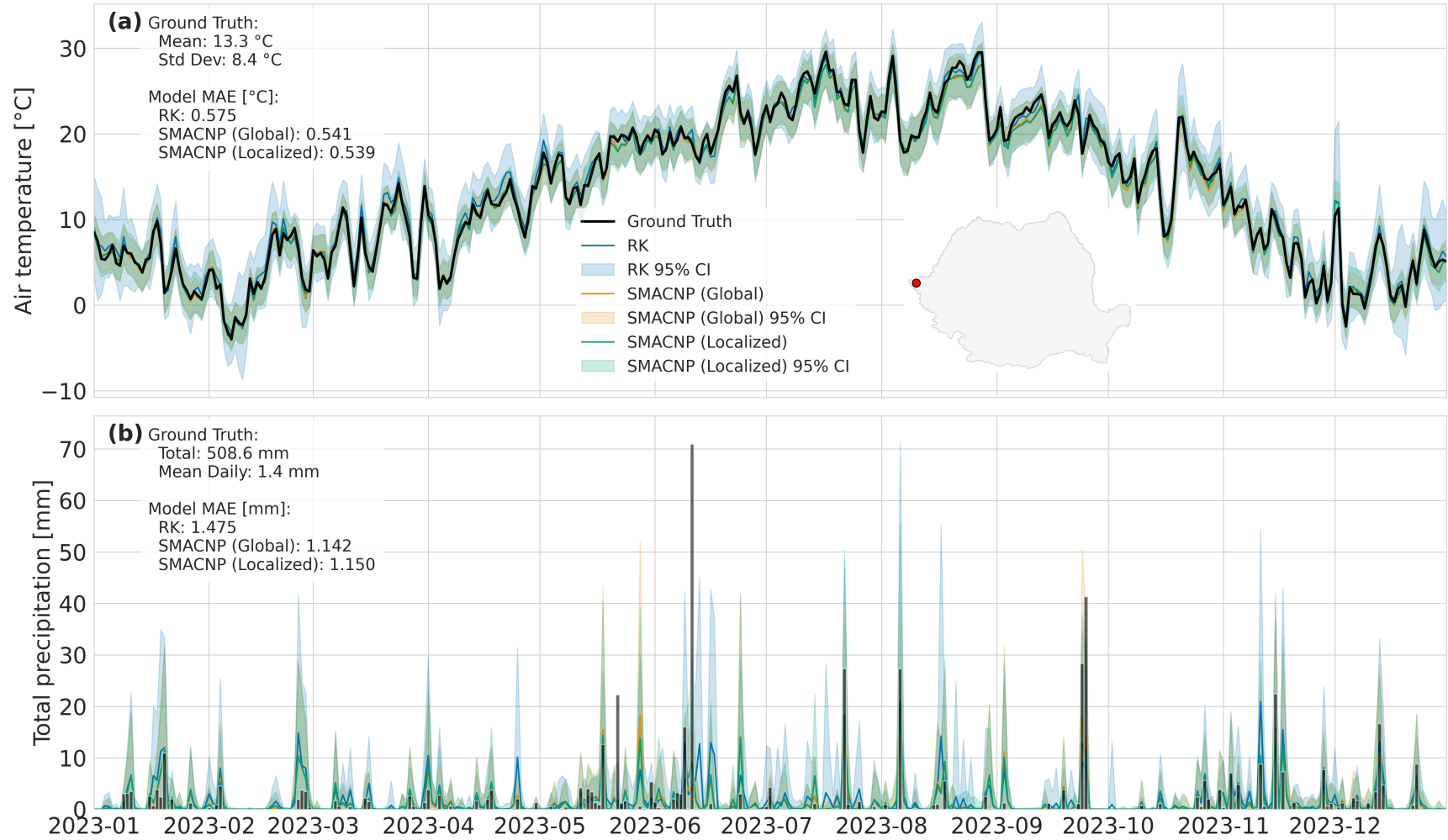


Figure S16. Model performance and uncertainty at **Sannicolau-Mare** station (85 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

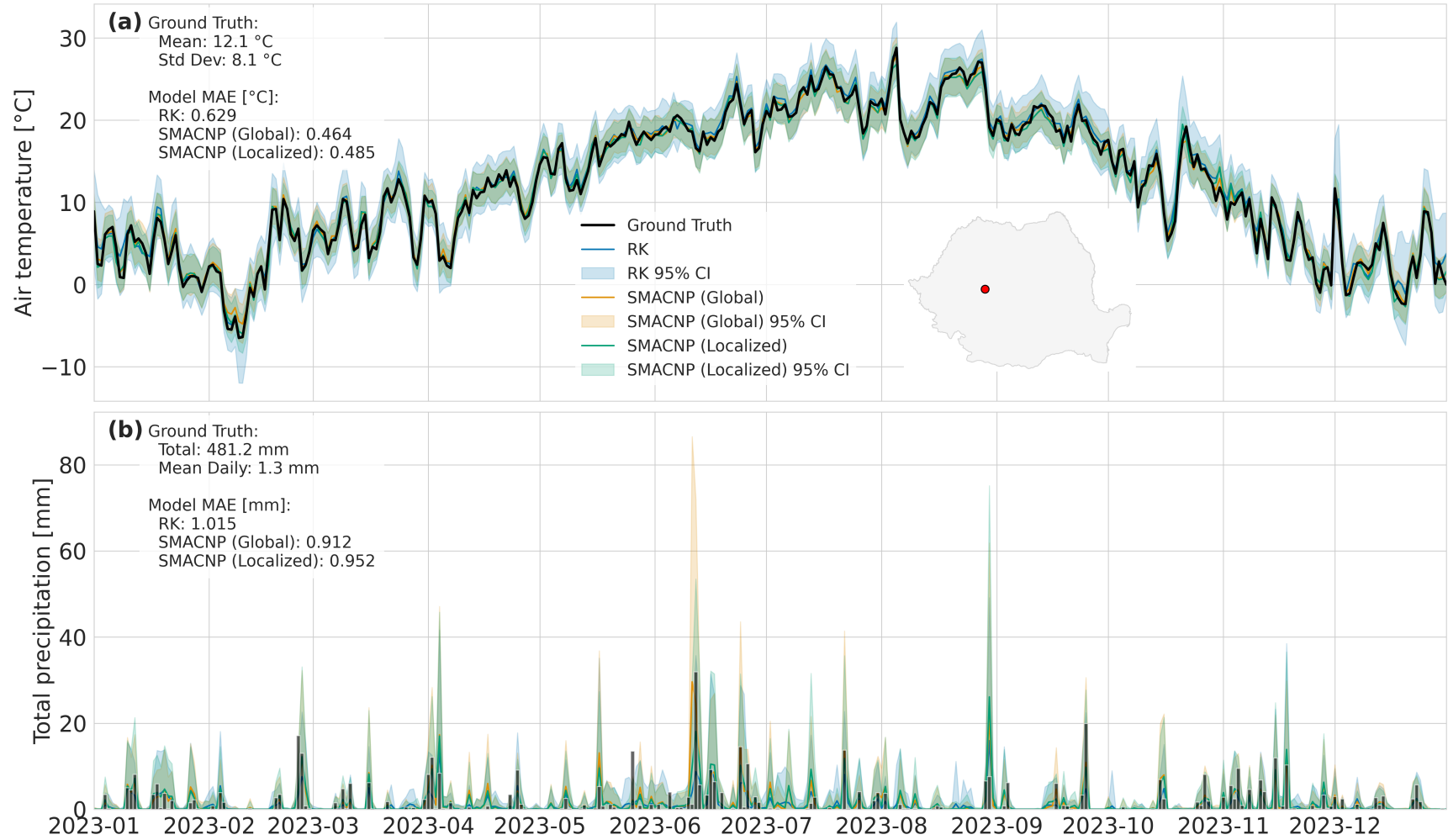


Figure S17. Model performance and uncertainty at **Sebes** station (271 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

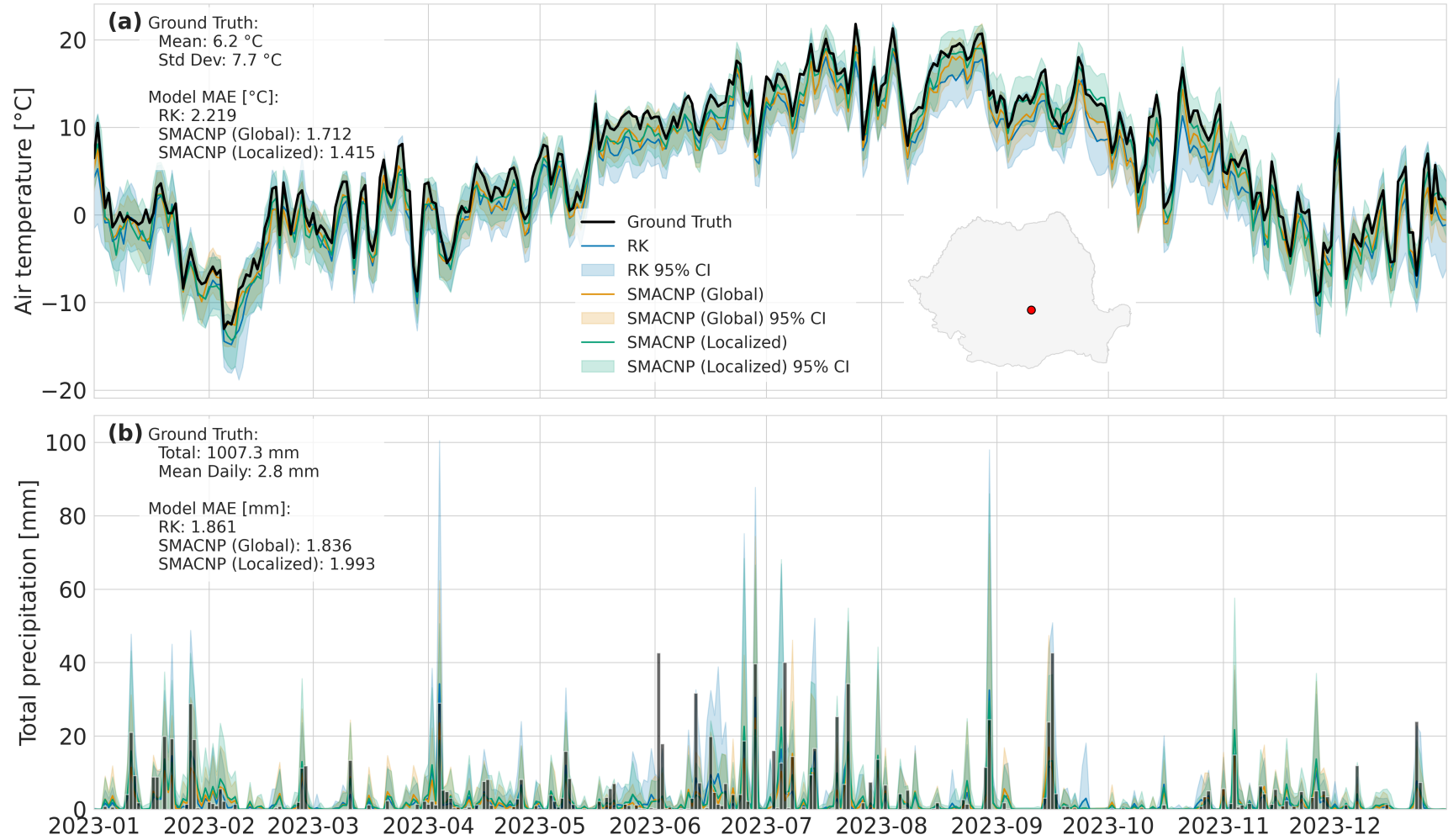


Figure S18. Model performance and uncertainty at **Sinaia-1500** station (1510 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

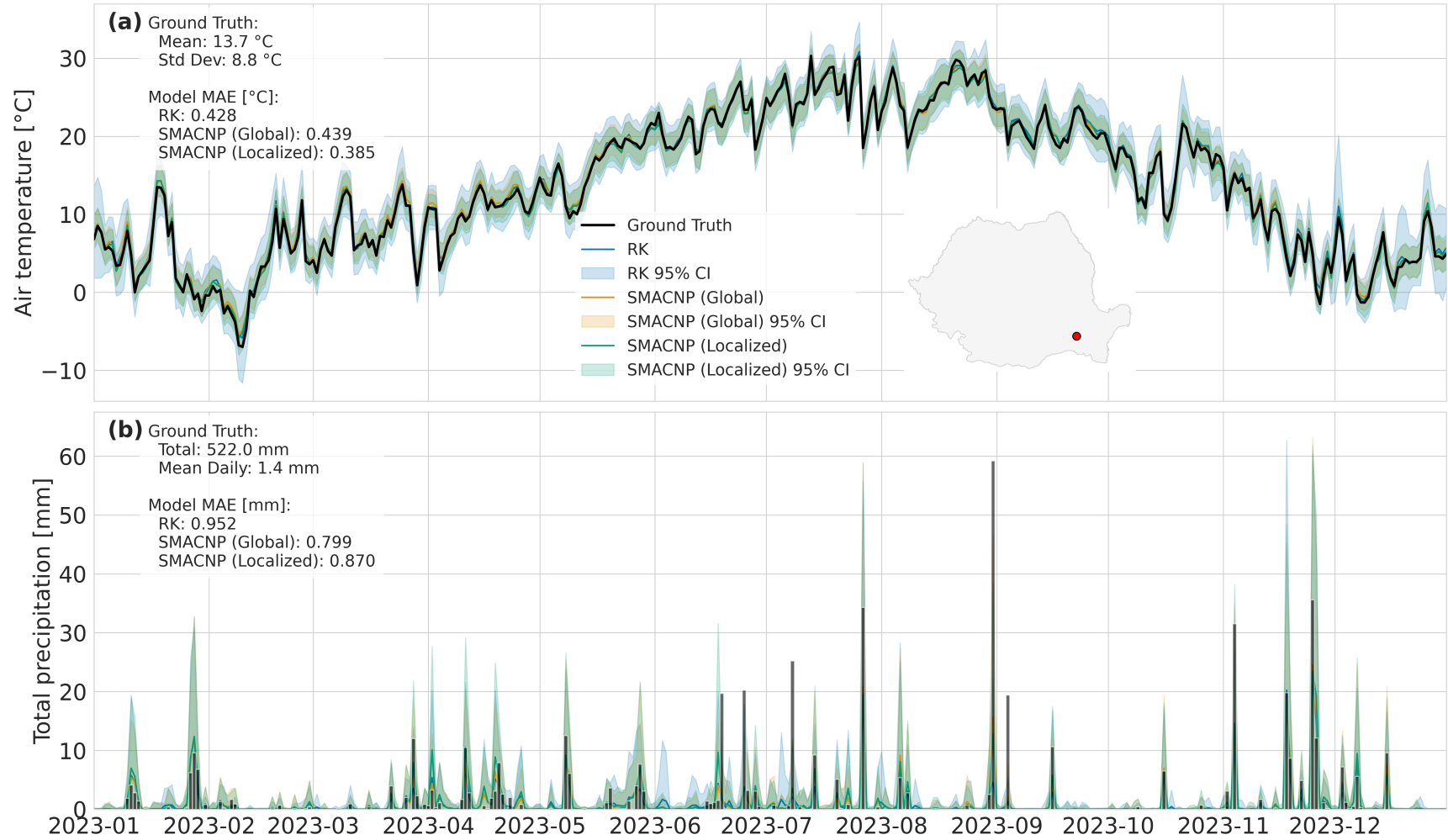


Figure S19. Model performance and uncertainty at **Slobozia** station (51 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

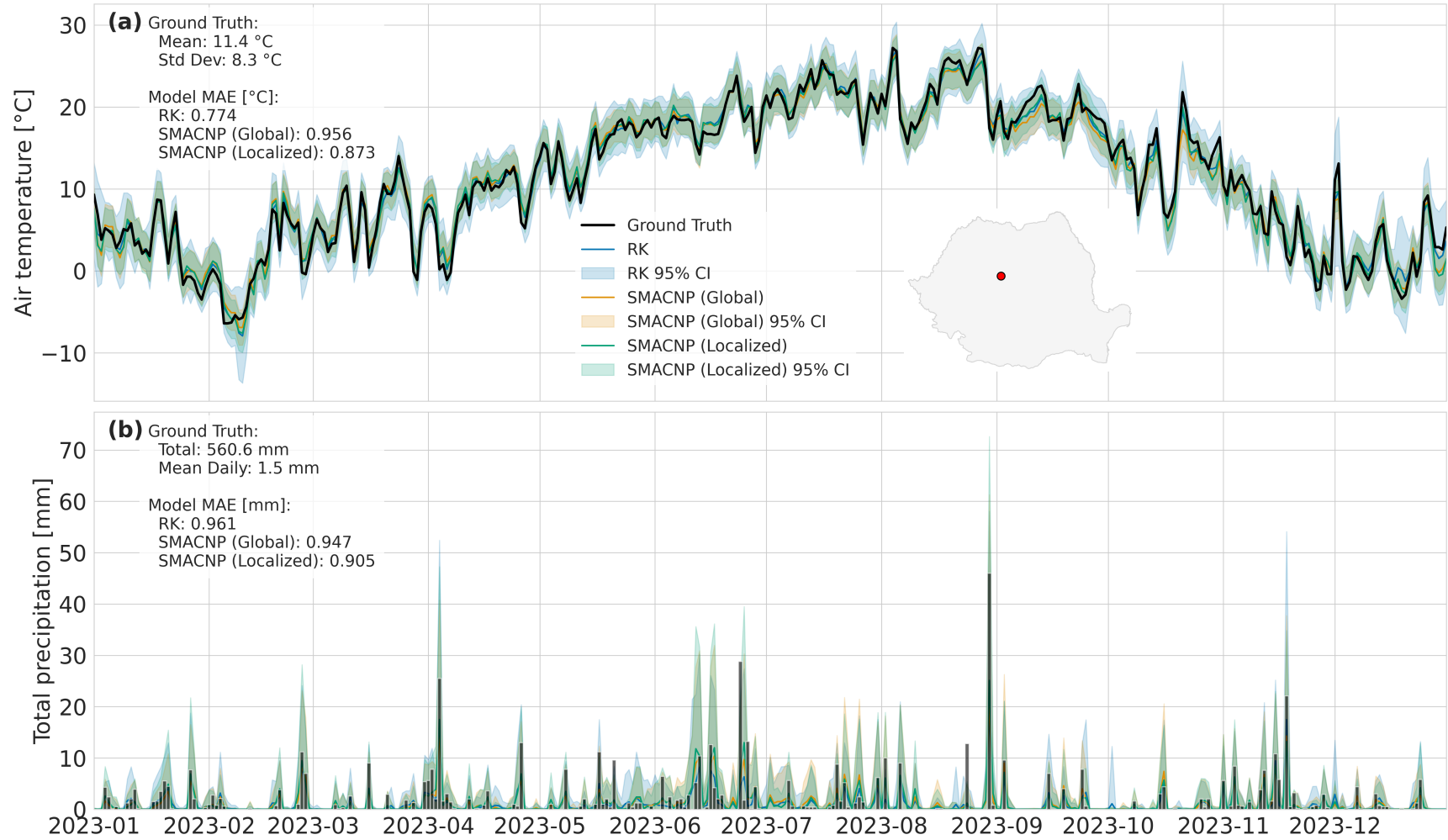


Figure S20. Model performance and uncertainty at **Tarnaveni** station (523 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

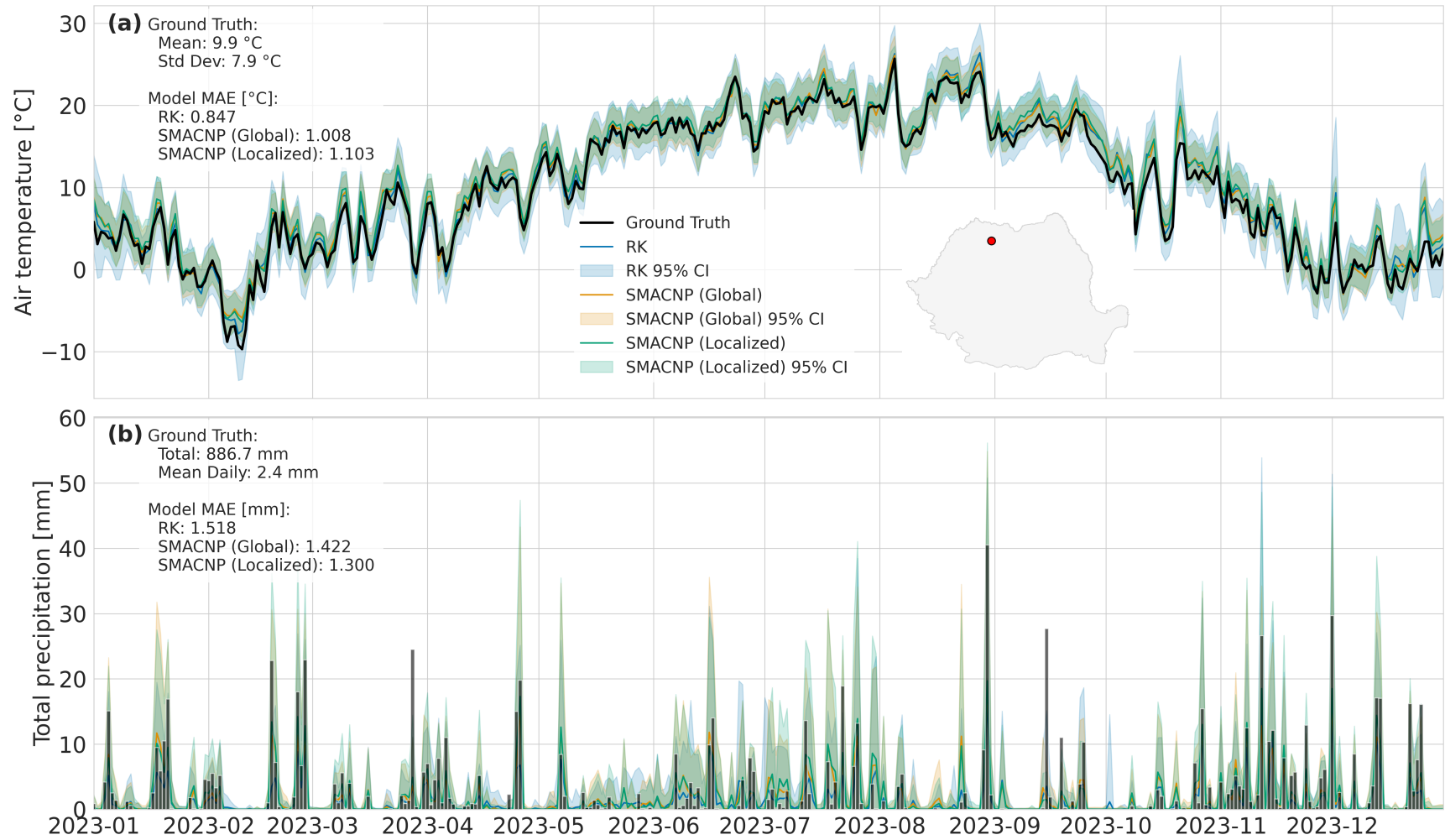


Figure S21. Model performance and uncertainty at **Tg.-Lapus** station (363 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

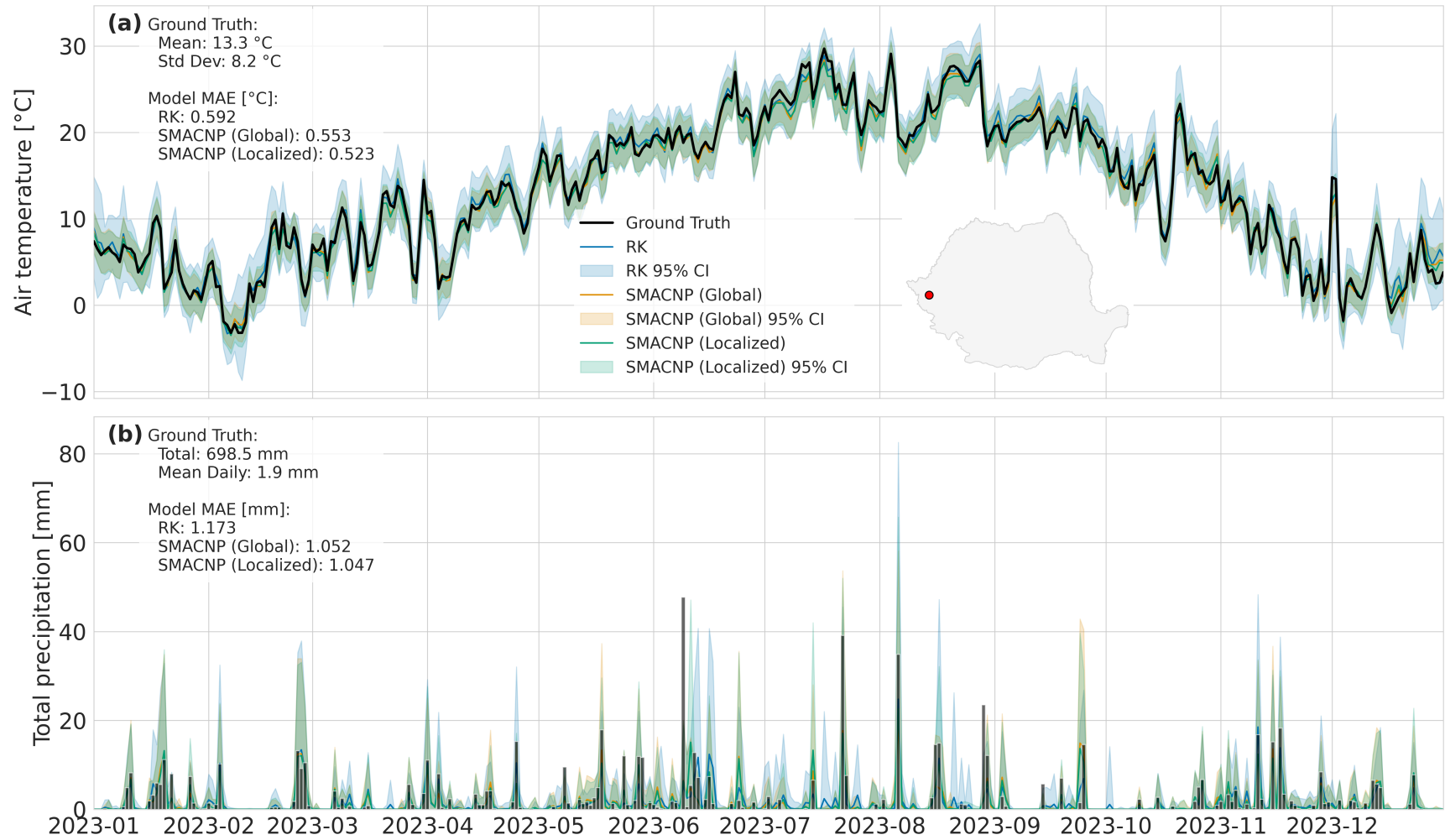


Figure S22. Model performance and uncertainty at **Timisoara** station (86 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

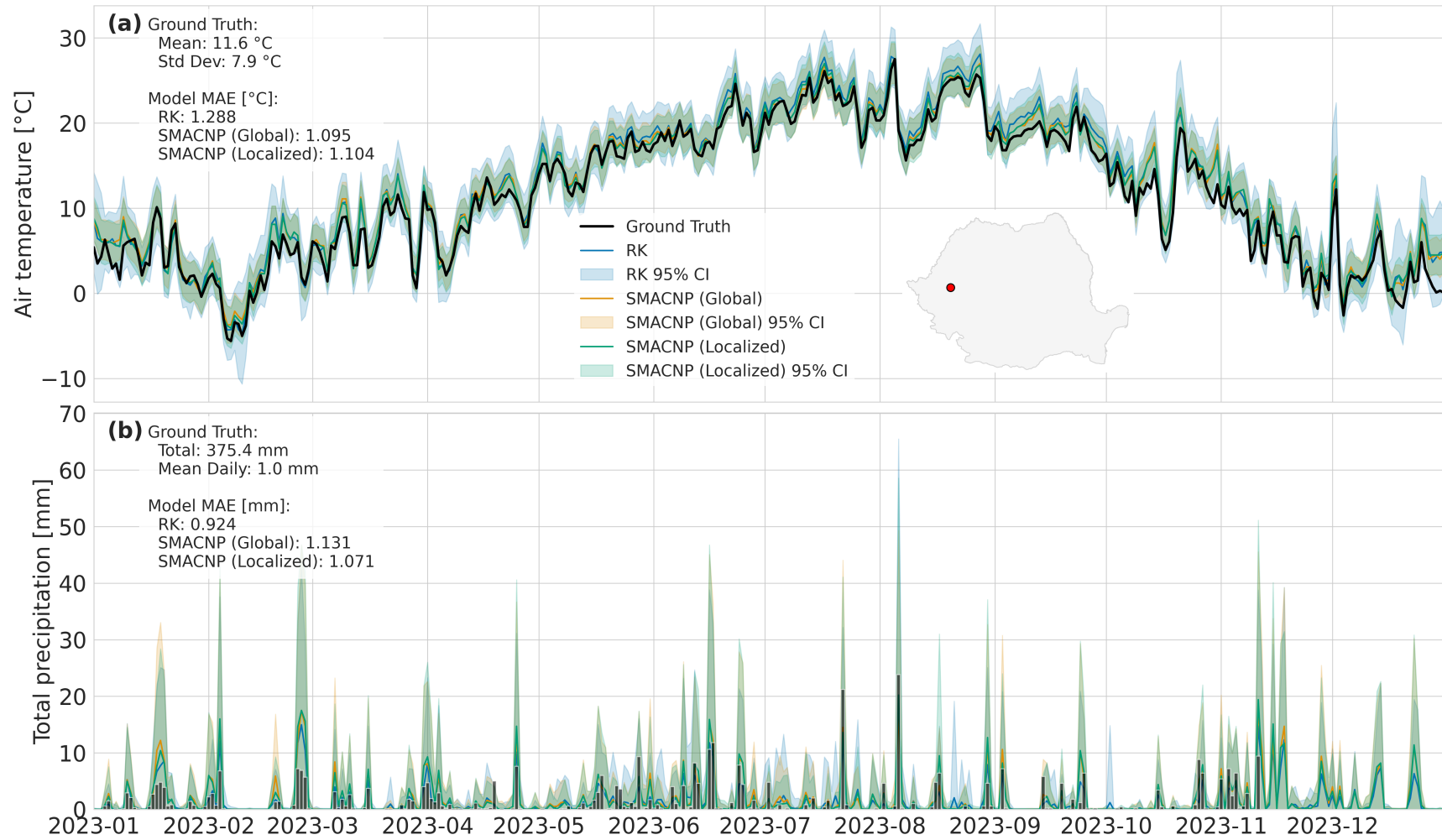


Figure S23. Model performance and uncertainty at **Varadia-de-Mures** station (156 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

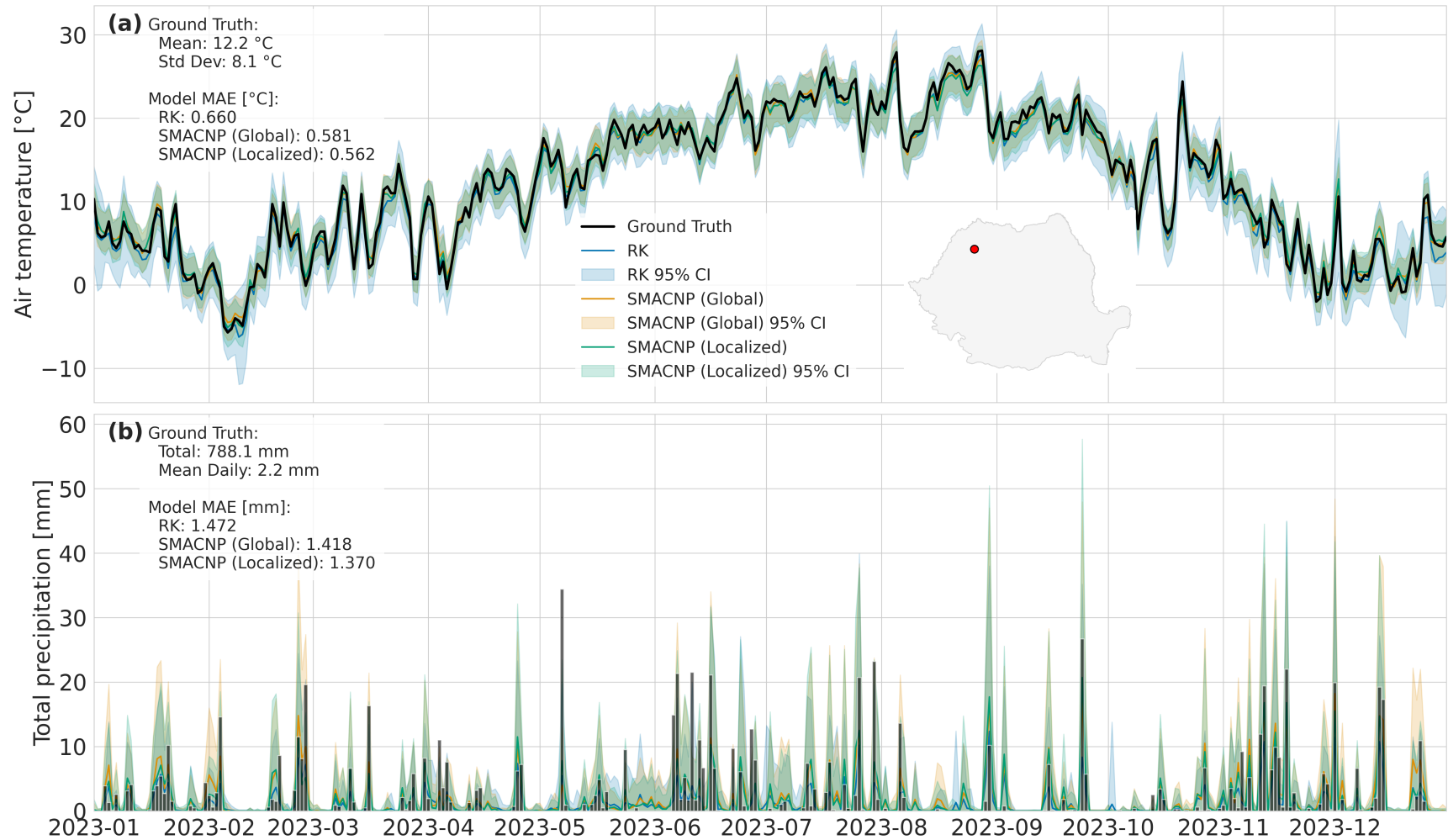


Figure S24. Model performance and uncertainty at **Zalau** station (295 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.

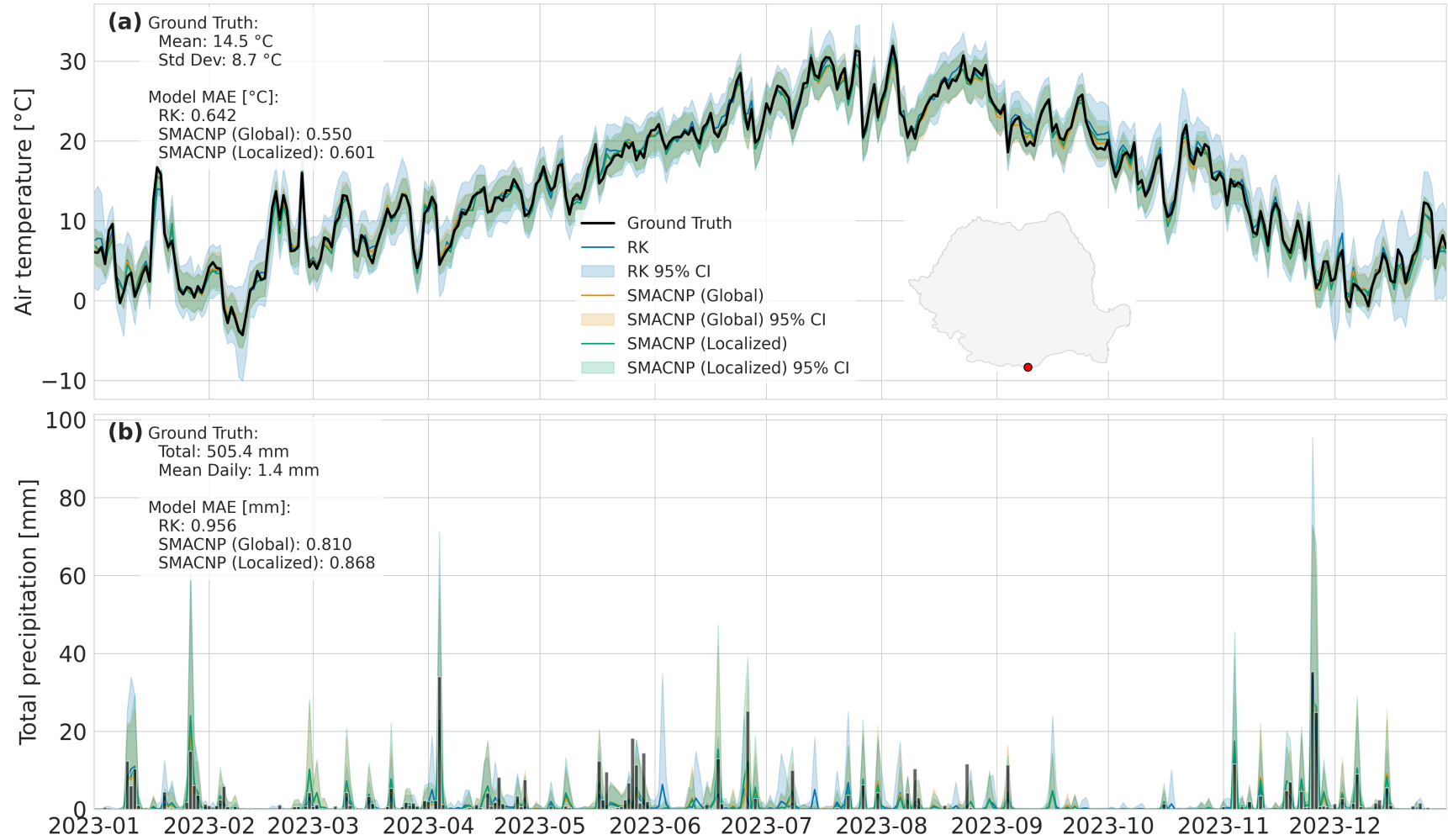


Figure S25. Model performance and uncertainty at **Zimnicea** station (34 m a.m.s.l.). Time series comparison of (a) daily average temperature and (b) daily total precipitation for the year 2023. Shaded areas represent the 95% predictive interval for each model's prediction. The inset map shows the location of the station within the study area, marked by a red dot.