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Outstanding Student & PhD candidate Presentation contest

Koninklijk Nederlands Meteorologisch Instituut
*Ministerie van Infrastructuur en Waterstaat*

VU VRIJE UNIVERSITEIT AMSTERDAM

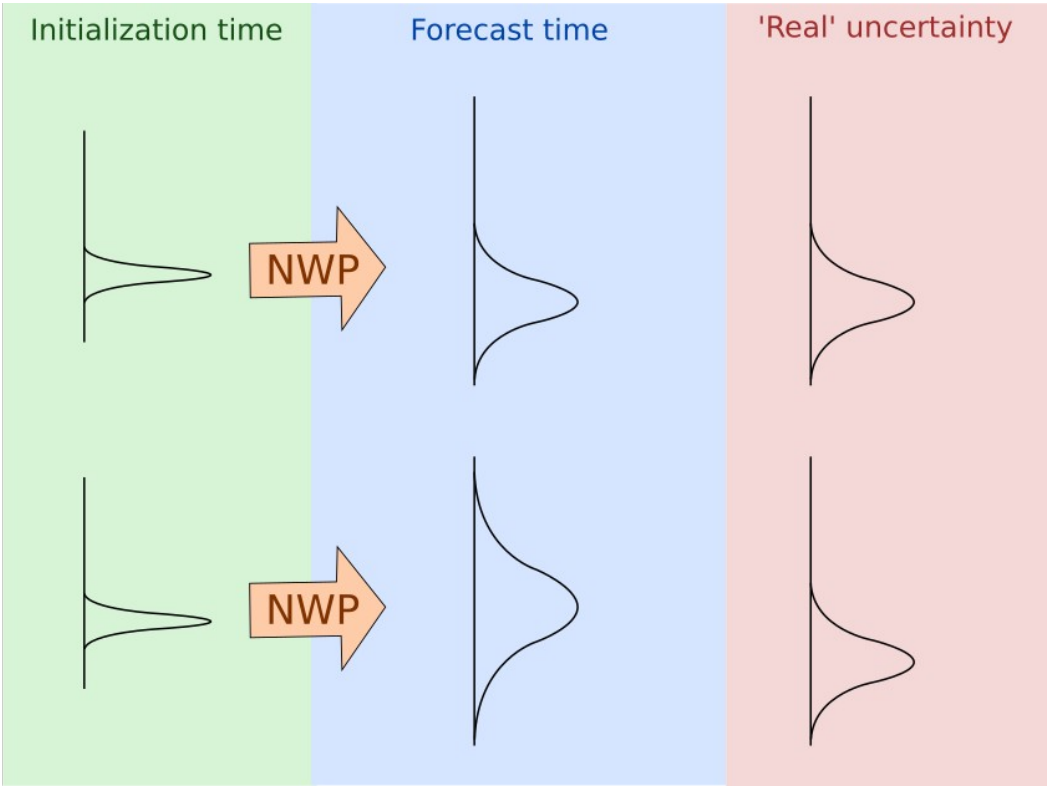
# Improving sub-seasonal temperature forecasts by correcting missing teleconnections using ANN-based post-processing

**Chiem van Straaten**, Kirien Whan, Dim Coumou, Bart van den Hurk, Maurice Schmeits

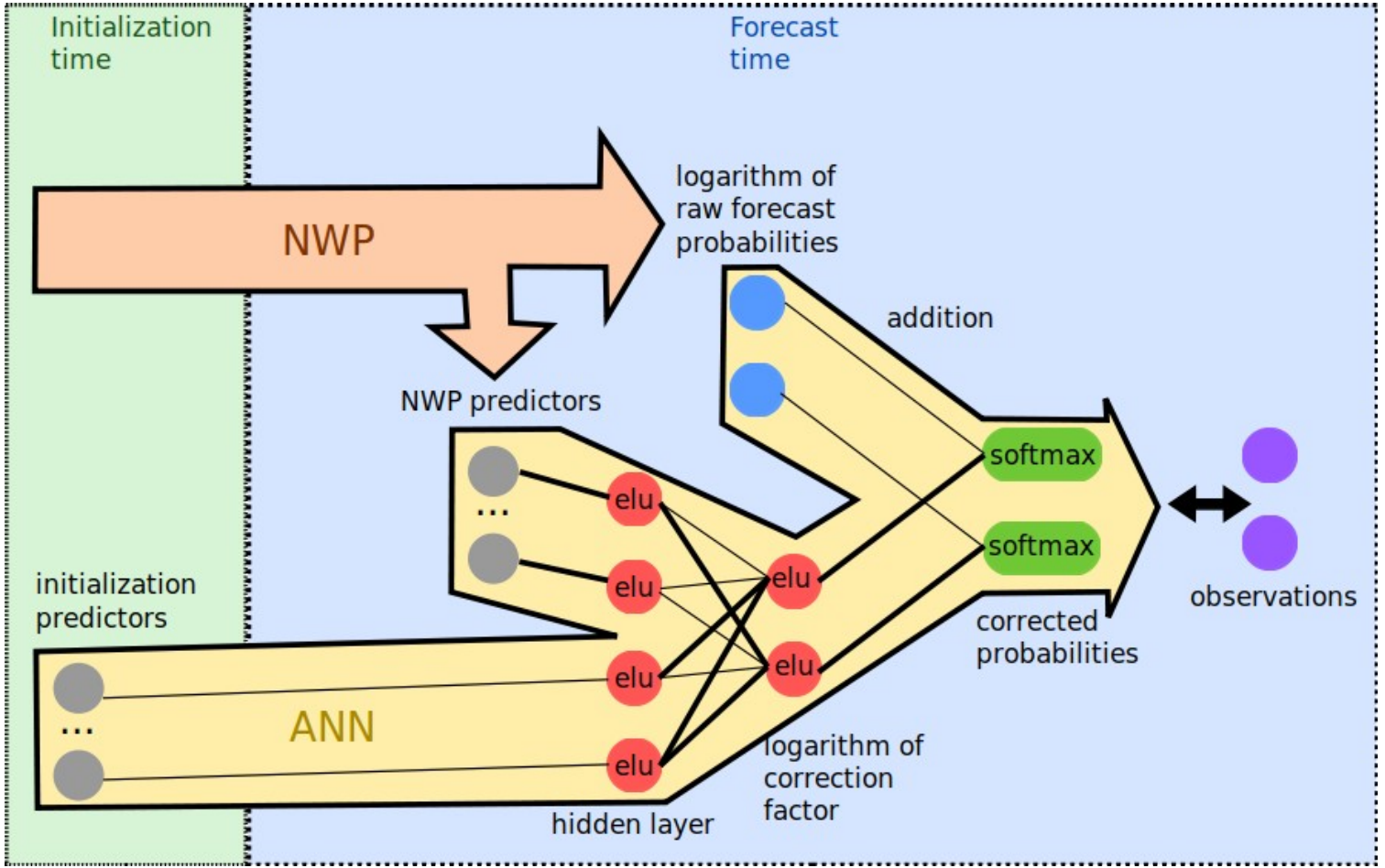
# Missed opportunities in sub-seasonal forecasting

1) Forecast of opportunity

2) Missed opportunity



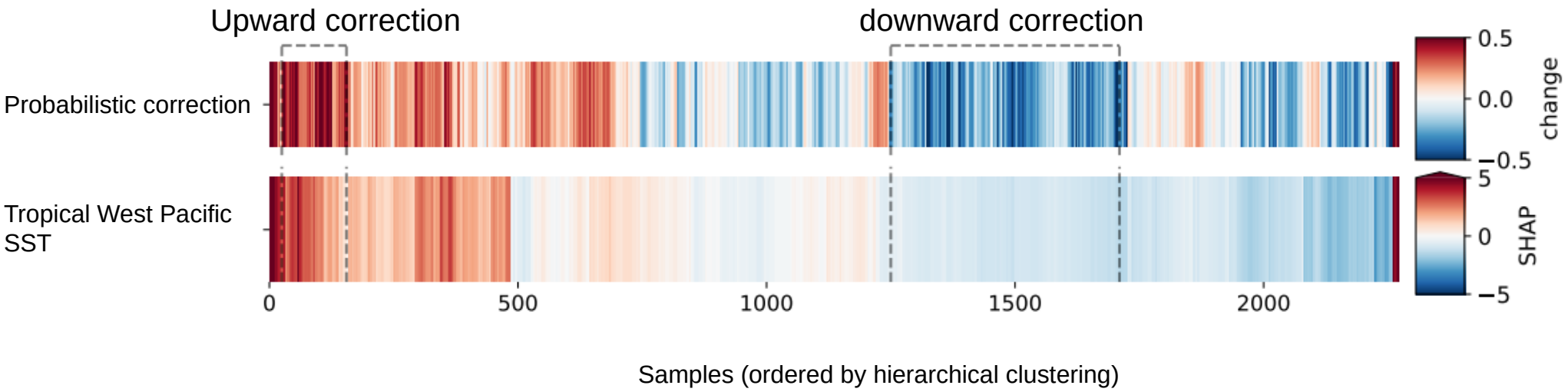
# ANN-based post-processing




Inspired by Scheuerer et al. (2020)

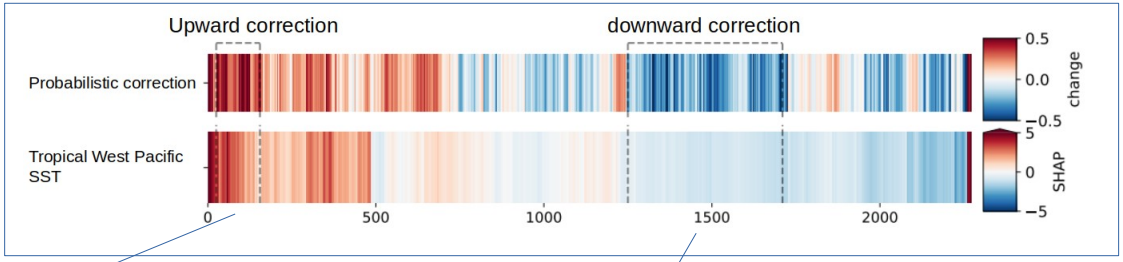
# Correcting conditional errors

Target: monthly temperature in western Europe > 0.5 quantile
Lead time: 12-15 days

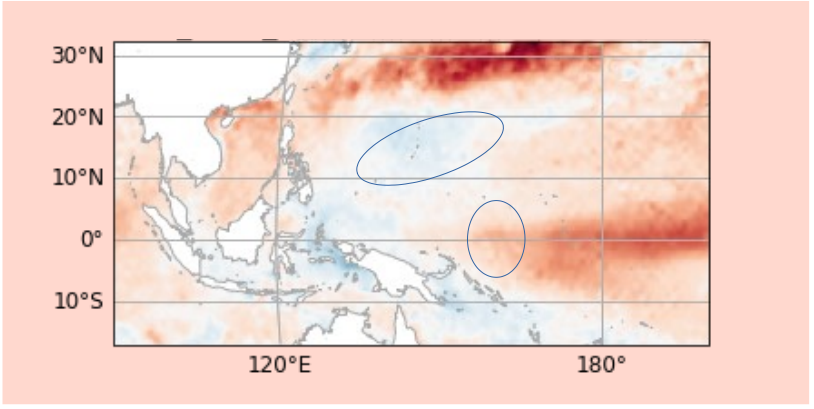


# SST pattern explains conditional errors

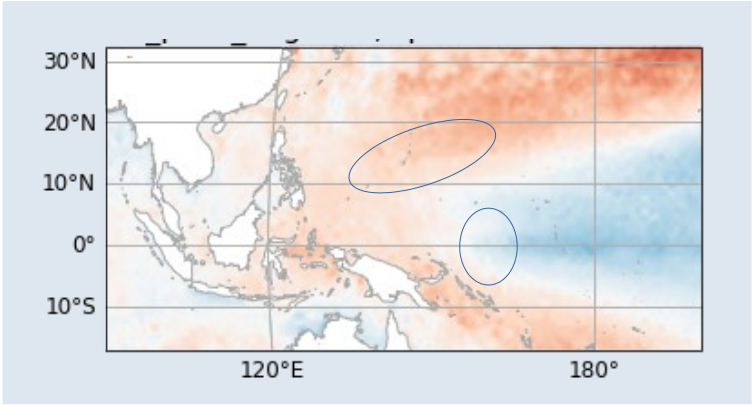
Target: monthly temperature in western Europe > 0.5 quantile
Lead time: 12-15 days

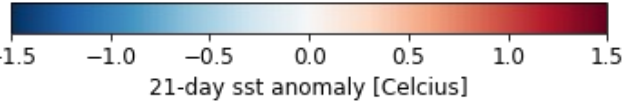



Upward




Downward

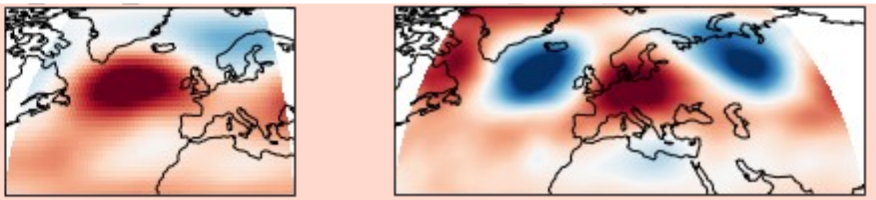


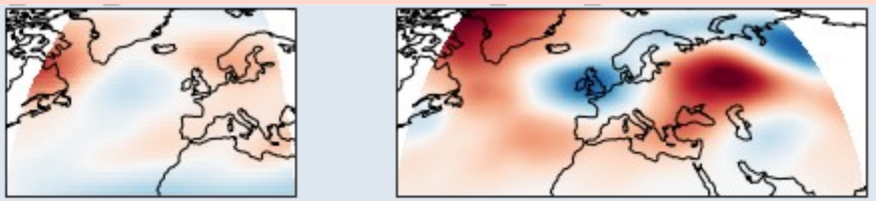
# SST pattern predicts missed atmospheric wave

31 day z300 anomalies

Upward correction



Downward correction



Forecast

Observed

# Summary

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Contact

The ANN architecture provides:

- an alternative way forward

- corrections that improve forecast skill

- an XAI explanation of the missed opportunity

References:

Scheuerer, M., Switanek, M. B., Worsnop, R. P., & Hamill, T. M. (2020). Using artificial neural networks for generating probabilistic subseasonal precipitation forecasts over California. Monthly Weather Review, 148(8), 3489-3506. https://doi.org/10.1175/MWR-D-20-0096.1

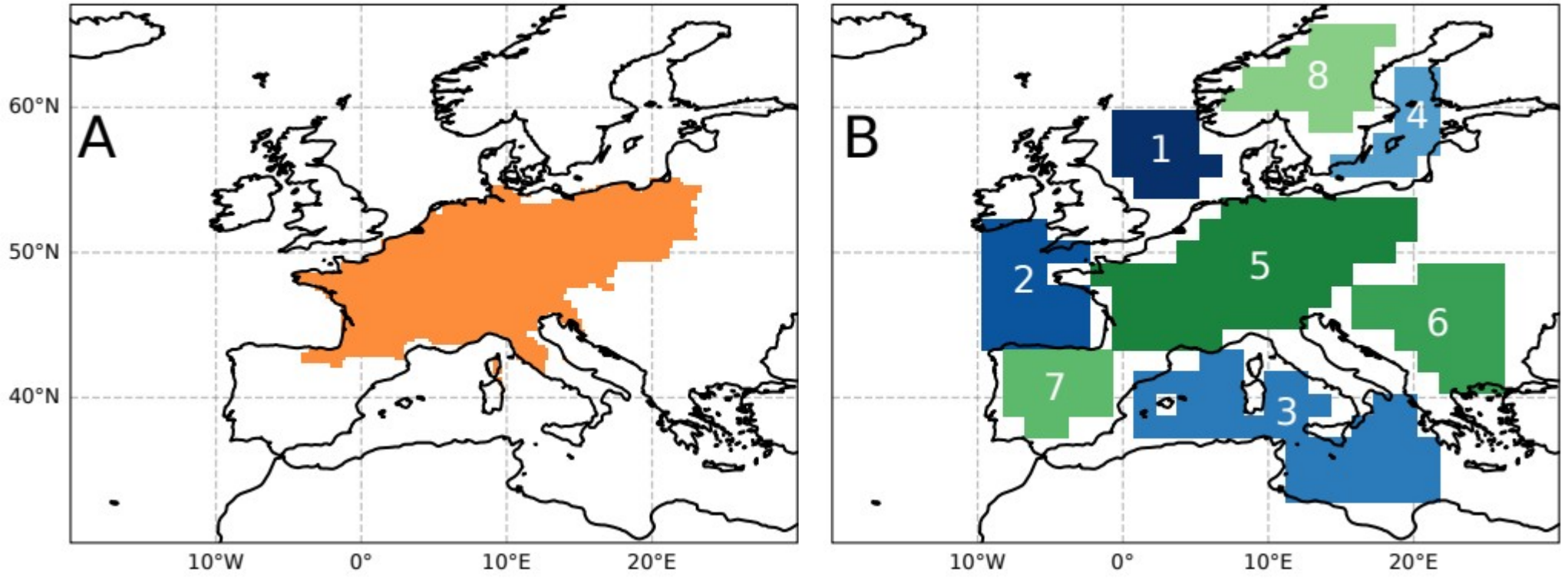
van Straaten, C., Whan, K., Coumou, D., van den Hurk, B., & Schmeits, M. (2022) Improving sub-seasonal forecasts by correcting missing teleconnections using ANN-based post-processing (in preparation)

van Straaten, C., Whan, K., Coumou, D., van den Hurk, B., & Schmeits, M. (2022). Using explainable machine learning forecasts to discover sub-seasonal drivers of high summer temperatures in western and central Europe. Monthly Weather Review. 150(5) https://doi.org/10.1175/MWR-D-21-0201.1

Paper describing predictors from initialization

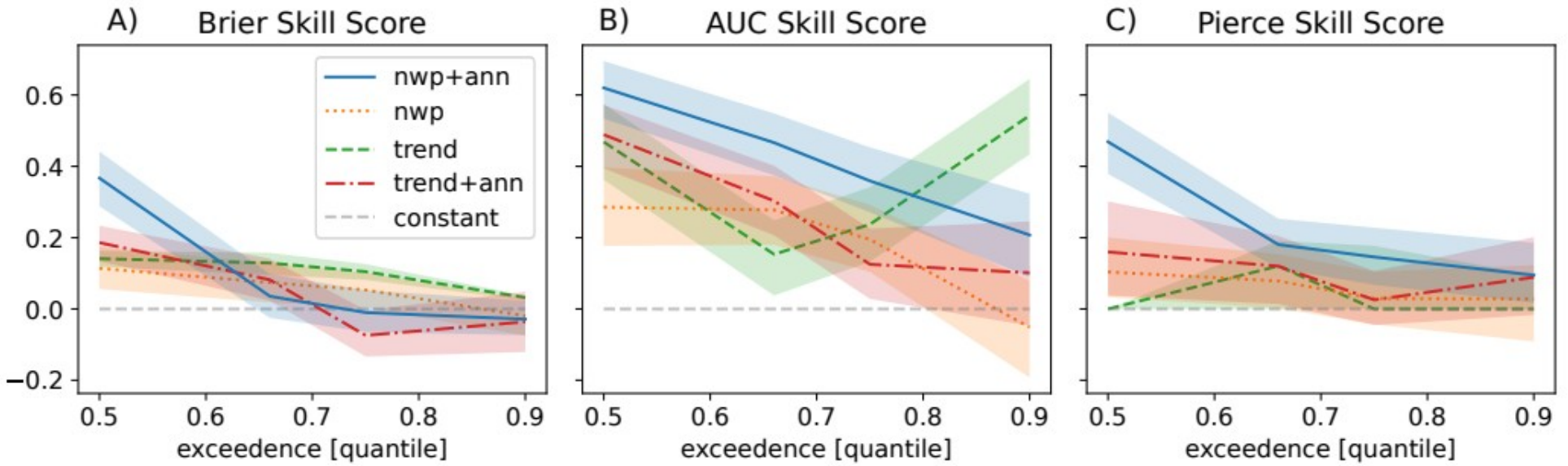
# Supplementary material

## Regional averages



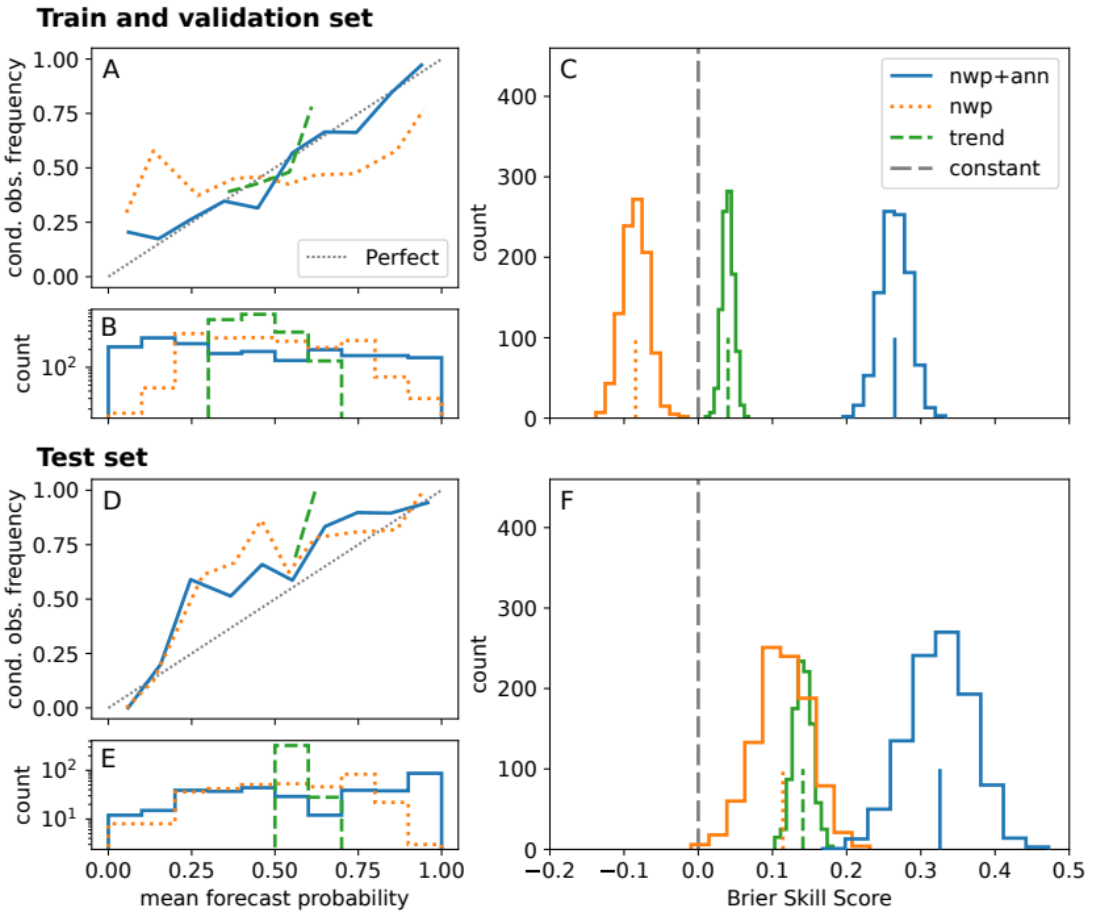
**Additional verification**

Target: 31-day average temperature in western europe > ...quantile
Lead time: 12-15 days



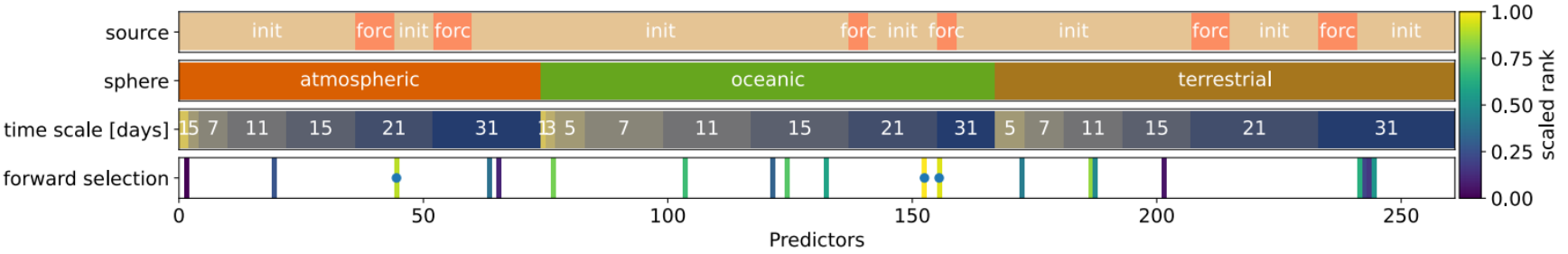
## Additional verification

Target: 31-day average temperature in western europe > 0.5 quantile
Lead time: 12-15 days



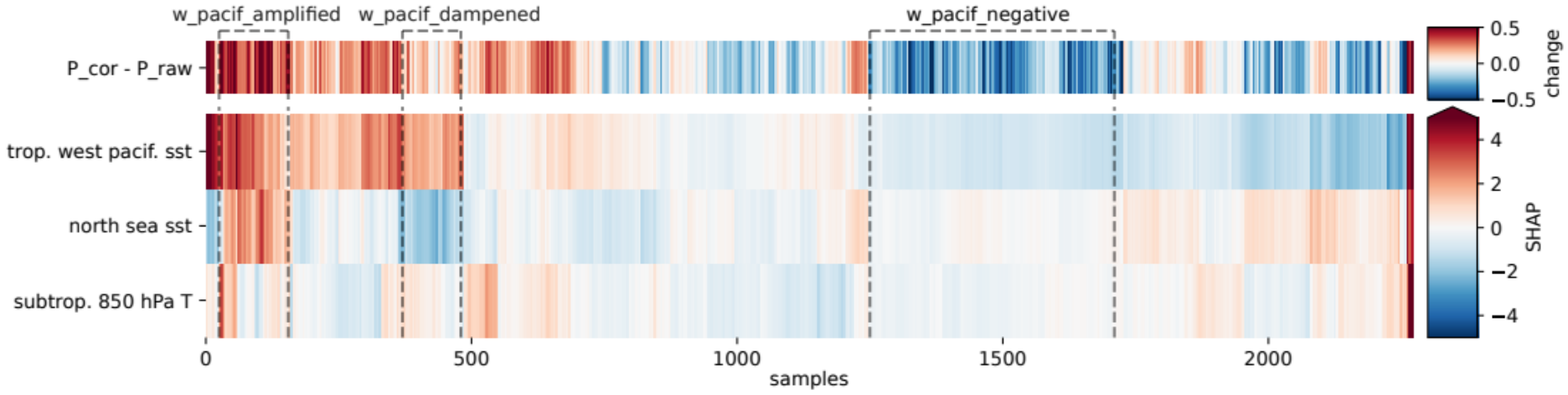
## Selected Predictors

Target: 31-day average temperature
in western europe > 0.5 quantile
Lead time: 12-15 days

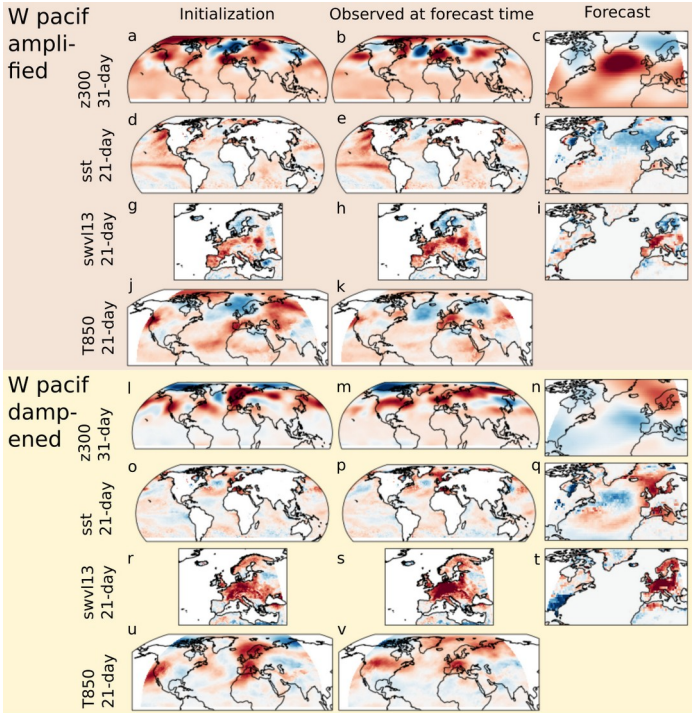


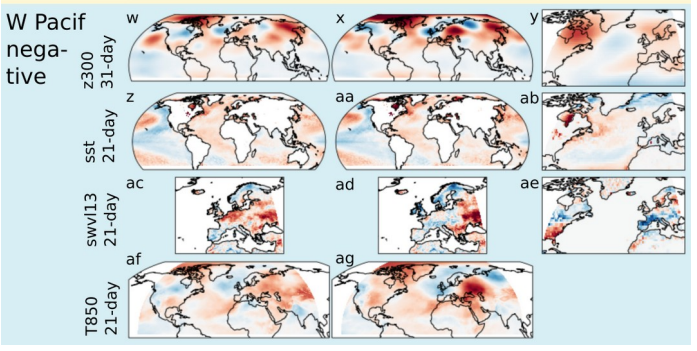
## Conditional corrections, top 3 predictors

Target: 31-day average temperature
in western europe > 0.5 quantile
Lead time: 12-15 days

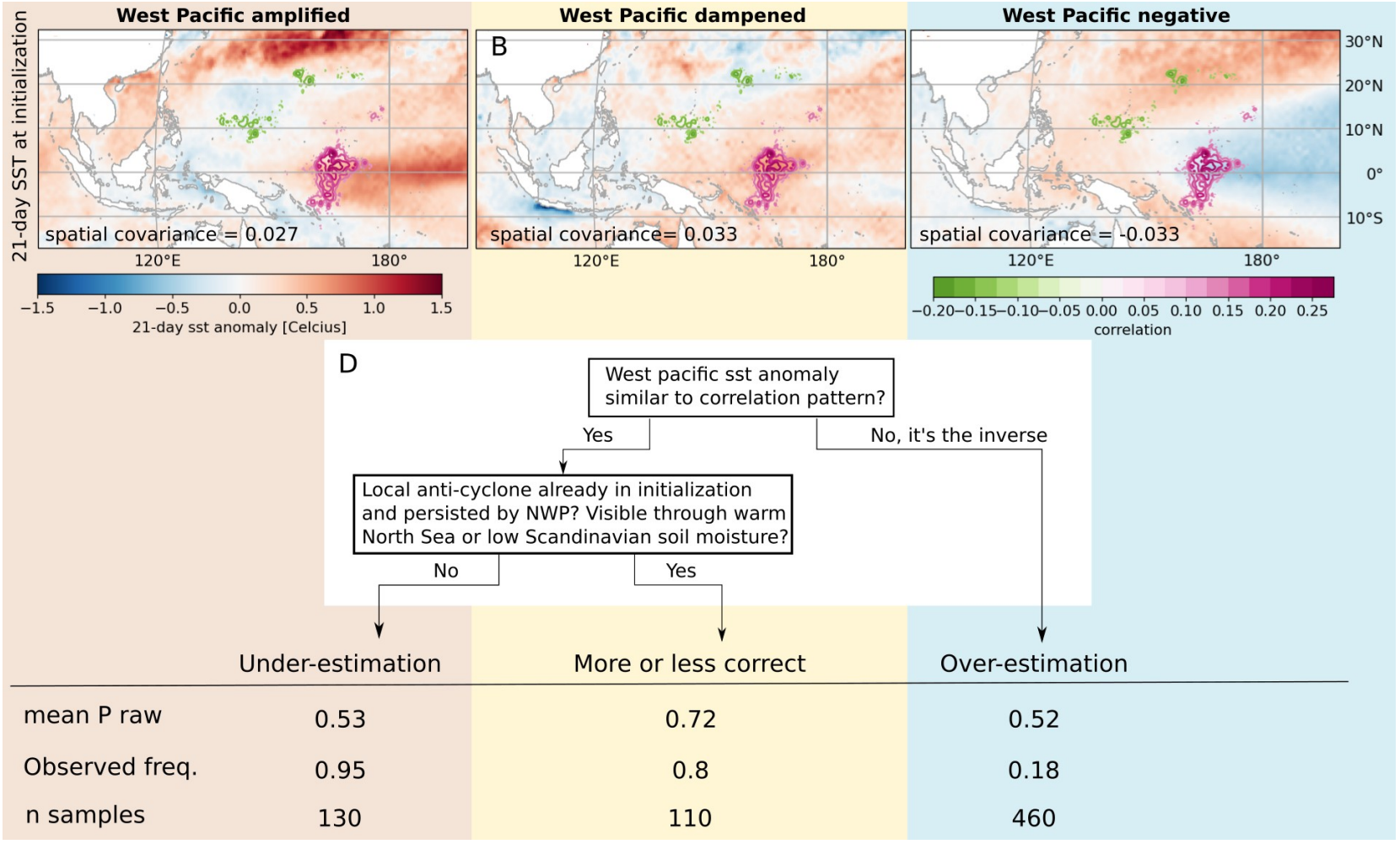


# Situational composites



# Interpretation of corrections




| | Under-estimation | More or less correct | Over-estimation |
|---|---|---|---|
| mean P raw | 0.53 | 0.72 | 0.52 |
| Observed freq. | 0.95 | 0.8 | 0.18 |
| n samples | 130 | 110 | 460 |

# Explainable AI