Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Infrastructuur en Waterstaat

VU VRIJE UNIVERSITEIT AMSTERDAM

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

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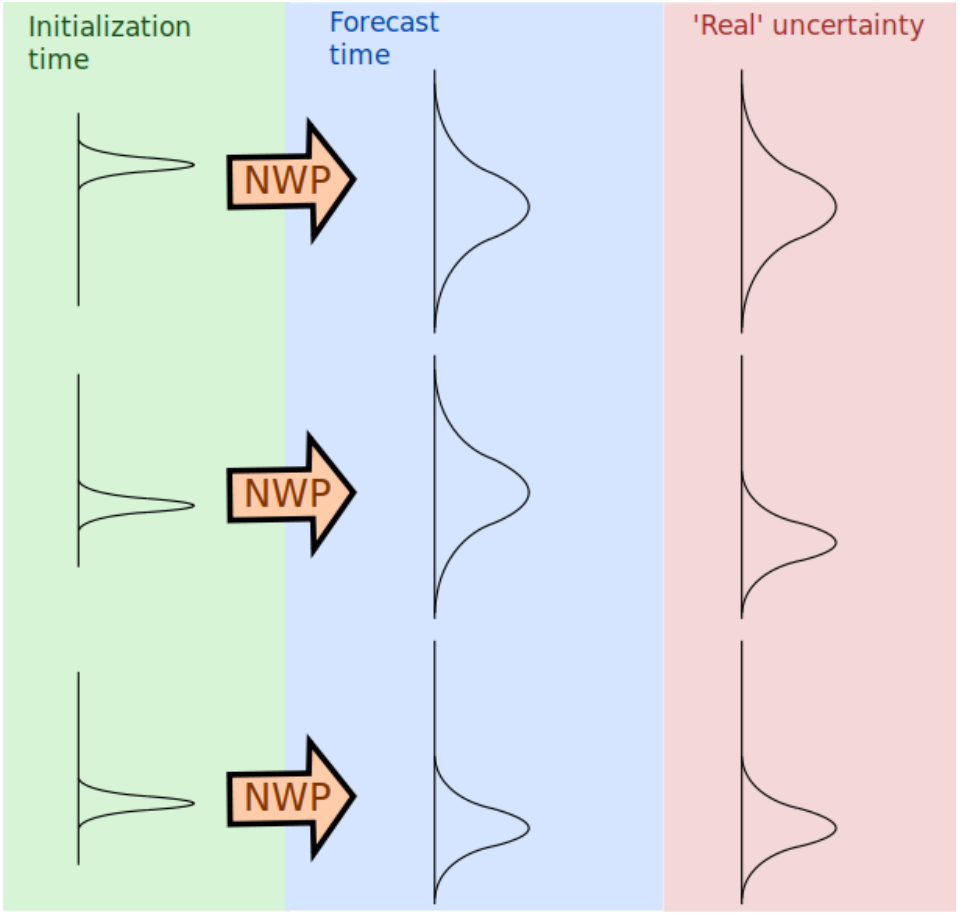
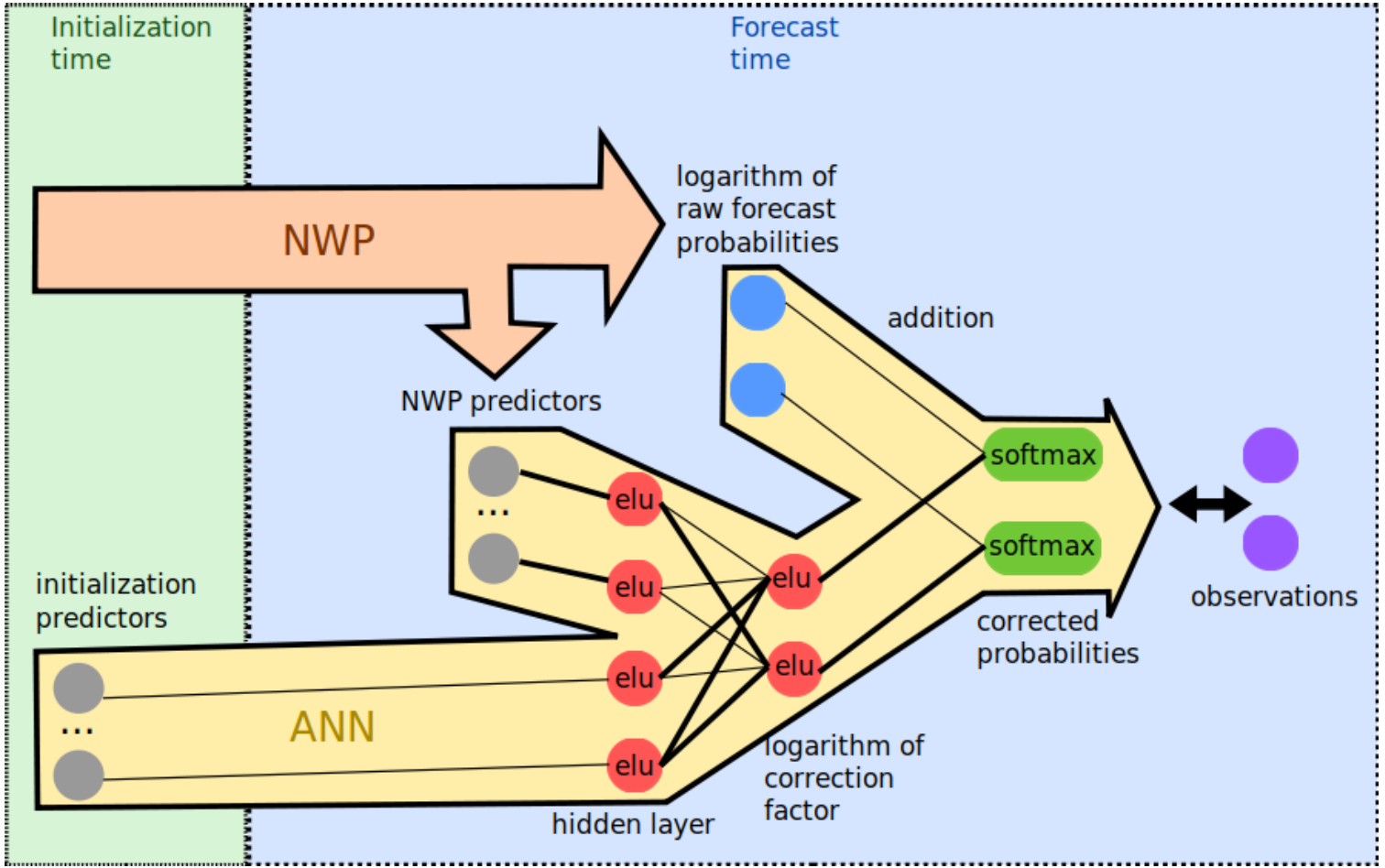
Framework



Goal:
find 2's that look like 1's
and make them 3's

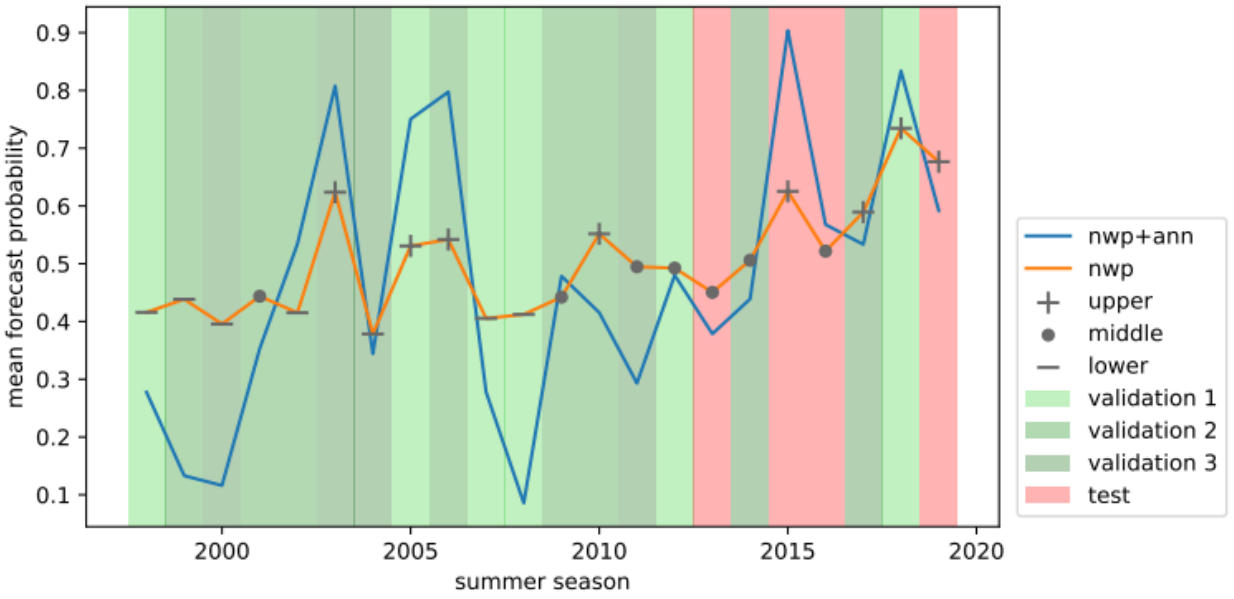
ANN-based post-processing



Inspired by Scheuerer et al. (2020)

ANN training

Cross-validation

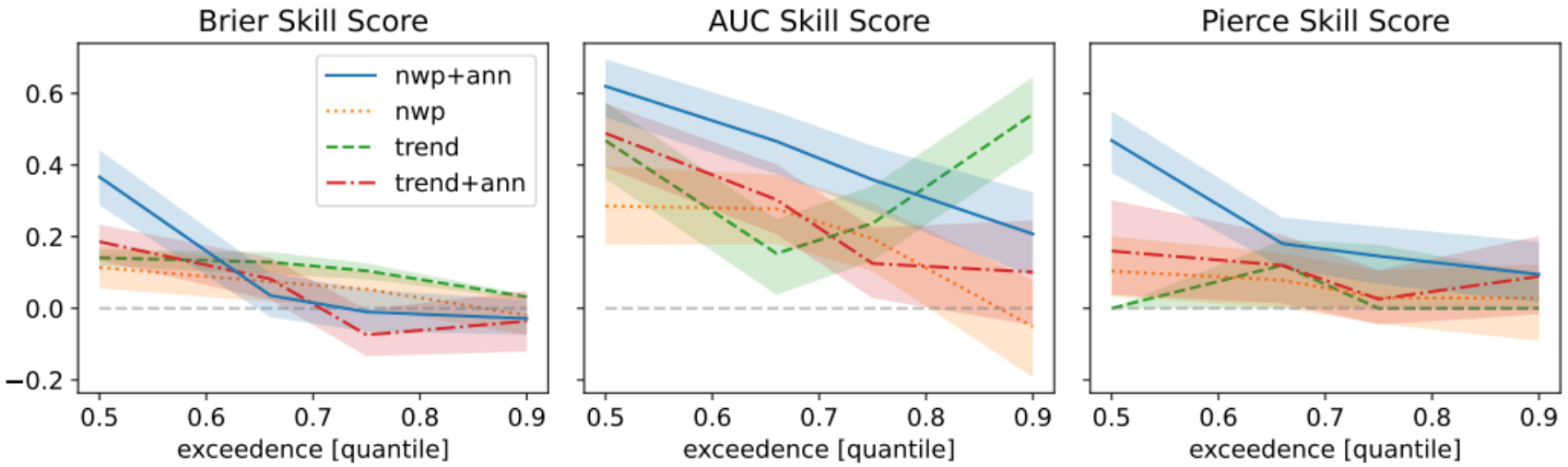


Hyper parameters

param	value
batch size	32
early stop patience	7
epochs	200
learning rate	0.0014
n hidden layers	1
n hidden nodes	4

Scoring and benchmarks

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

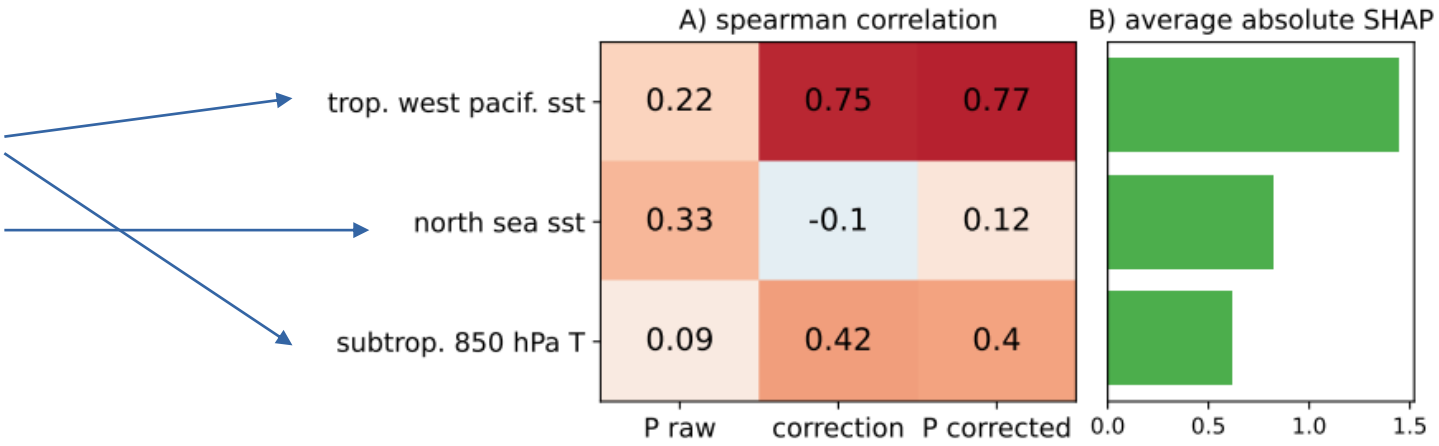


Selected predictors

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

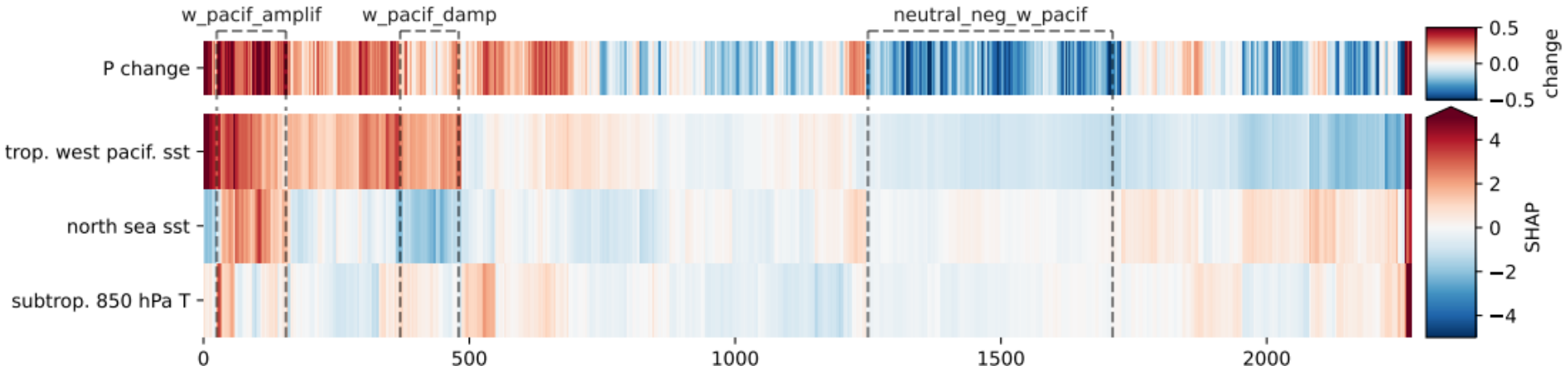
Predictors from:

- Initialization
- Forecast time



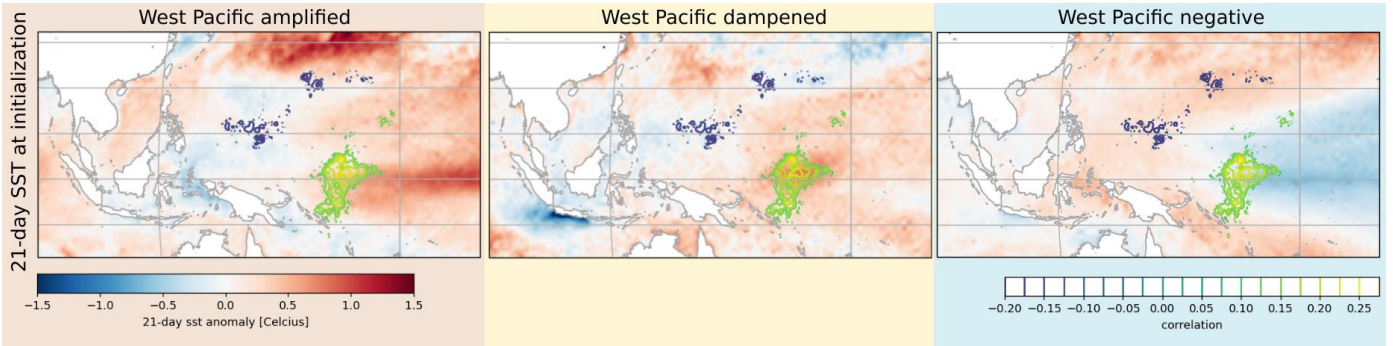
Missed opportunities

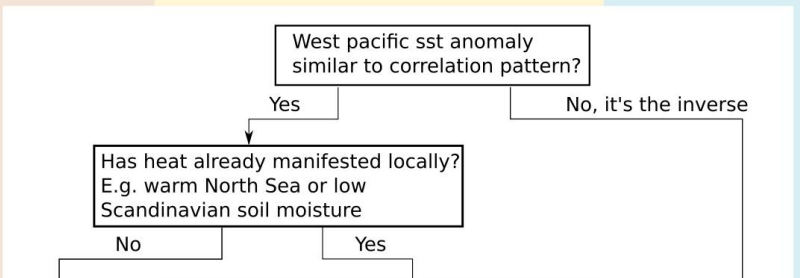
Target: monthly temperature in western Europe > 0.5 quantile
Lead time: 12-15 days



Samples (ordered by hierarchical clustering)

Missed opportunities





	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

Summary

- ANN gives missing processes an alternative way forward

- Corrections improve model skill

- eXplainable AI shows ‘situations requiring the same correction for the same reason’

- We learn a lot about conditional NWP errors

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Contact me

The end

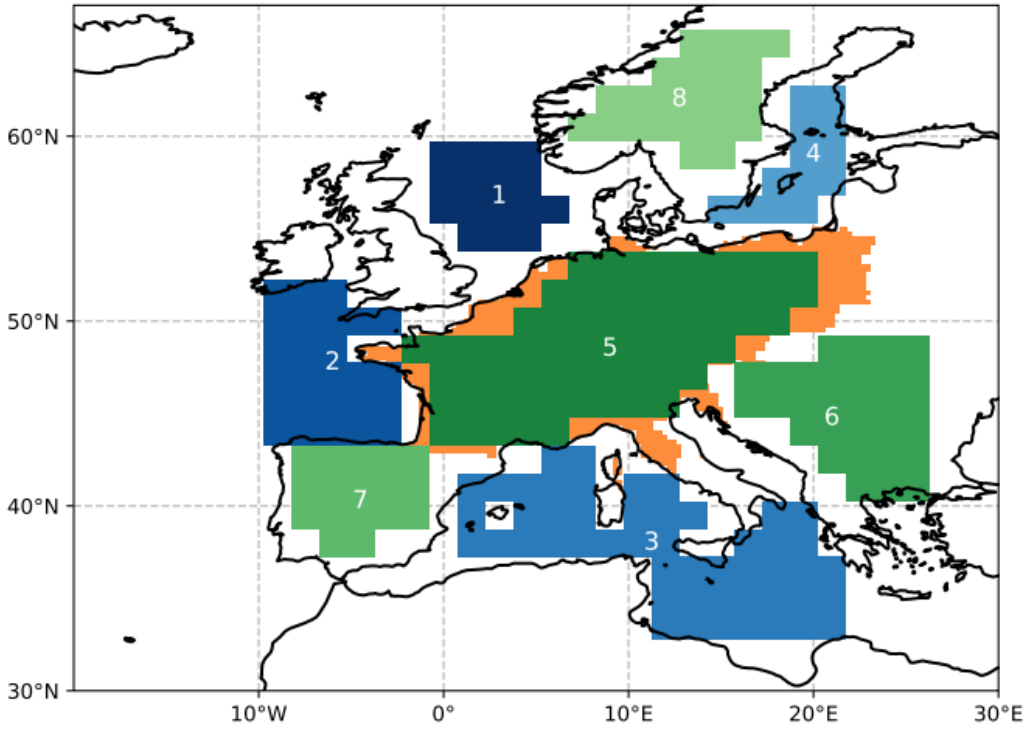
References:

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). Using explainable machine learning forecasts to discover sub-seasonal drivers of high summer temperatures in western and central Europe. Monthly Weather Review. https://doi.org/10.1175/MWR-D-21-0201.1

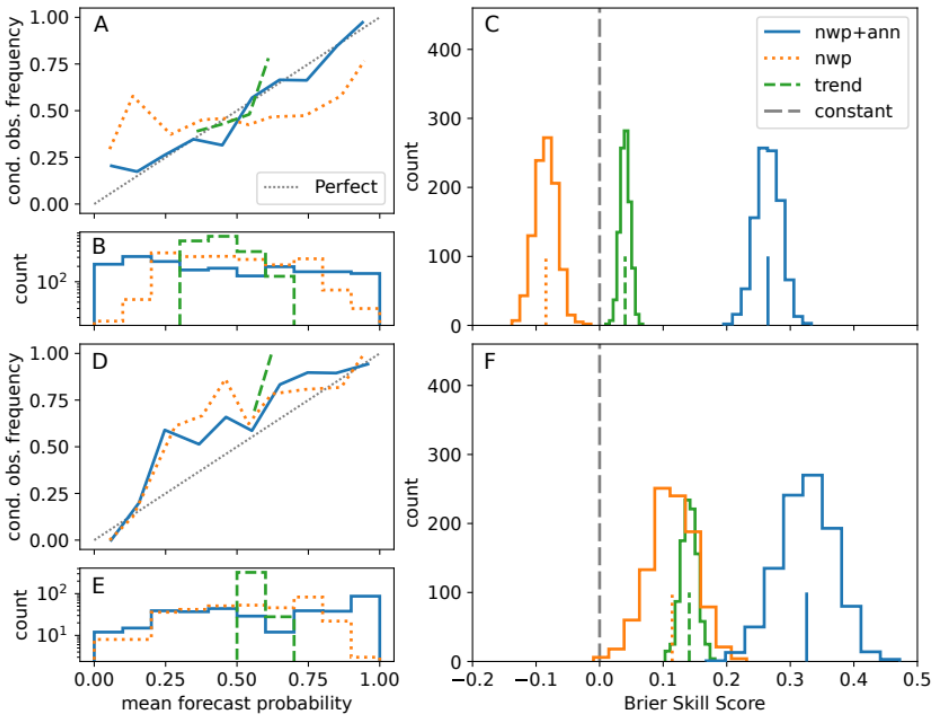
Paper describing predictors from ERA5

Regional averages

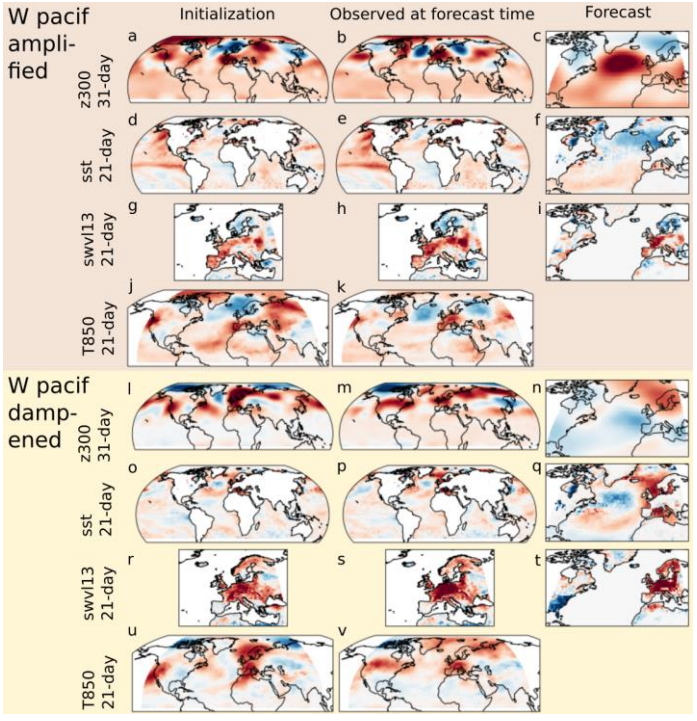


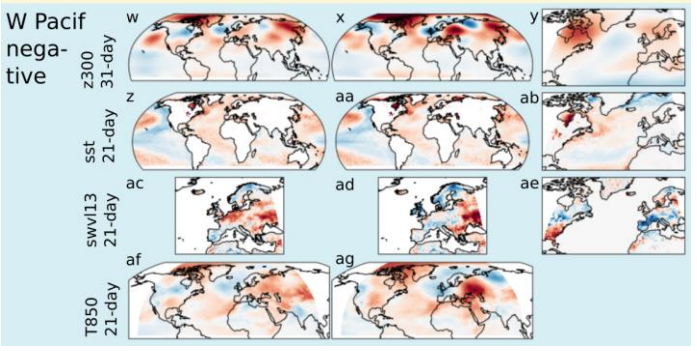
Additional verification

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



Situational composites





Explainable AI