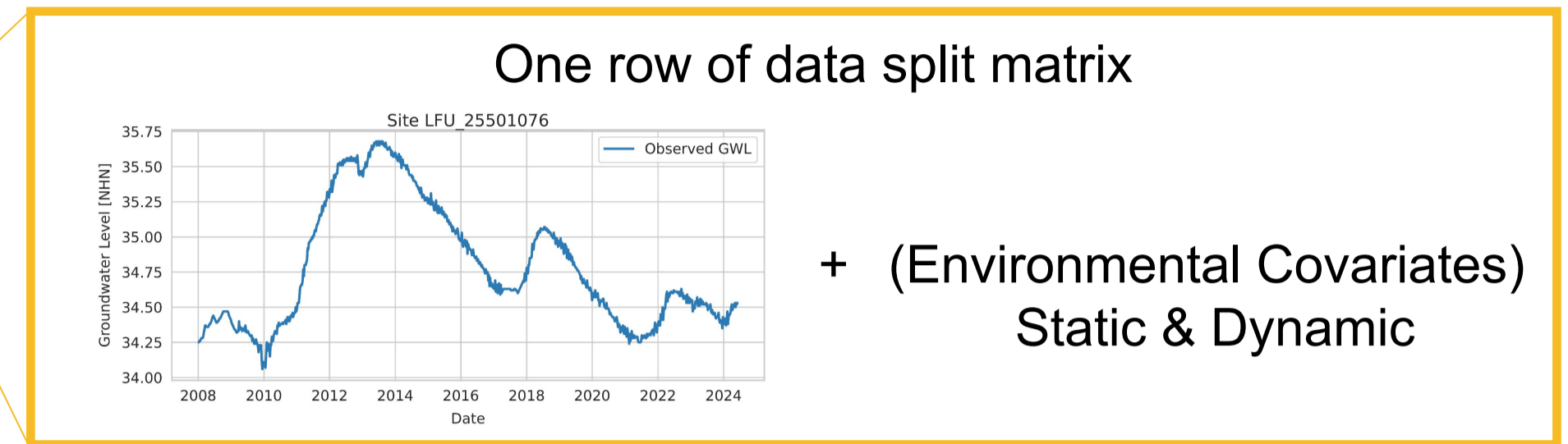
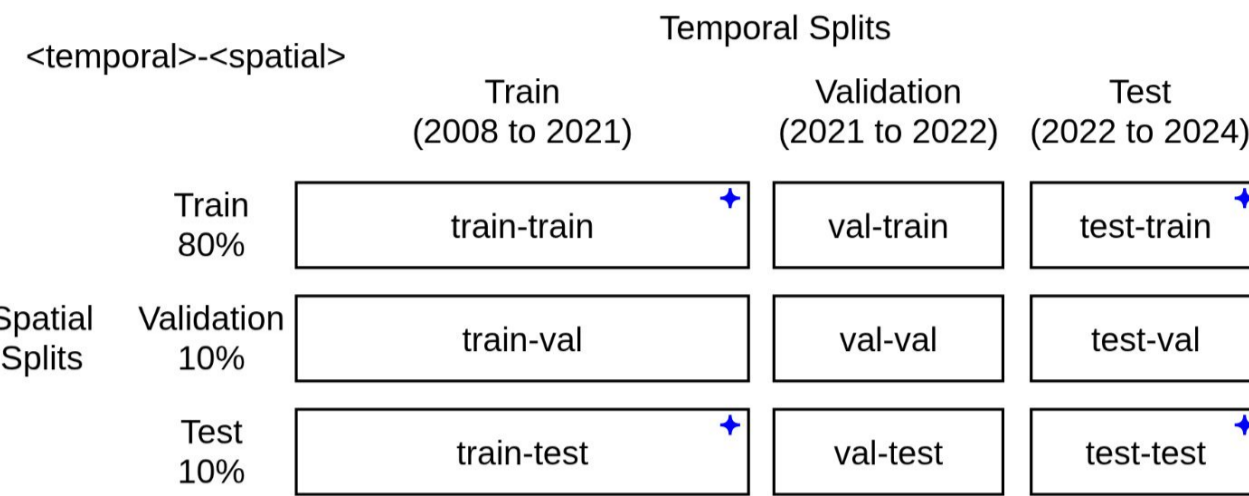
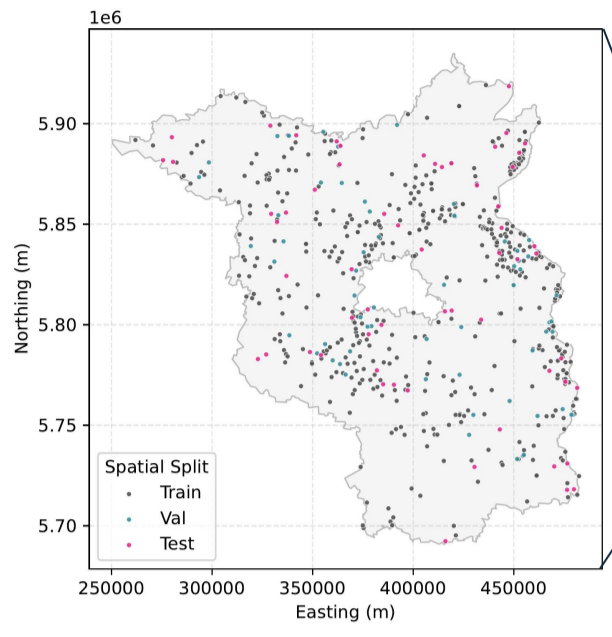


Introduction & Data

- **The Problem** - Develop a model to forecast GroundWater Levels (GWL) in Brandenburg, Germany at sites without monitoring wells.
- **What has been done?** - Forecasting GWL at sites with monitoring wells; spatial interpolation of GWL at unmeasured sites using historical data.
- **What do we have?** - Historical GWL at sites with monitoring wells, geological information about all locations in Brandenburg.



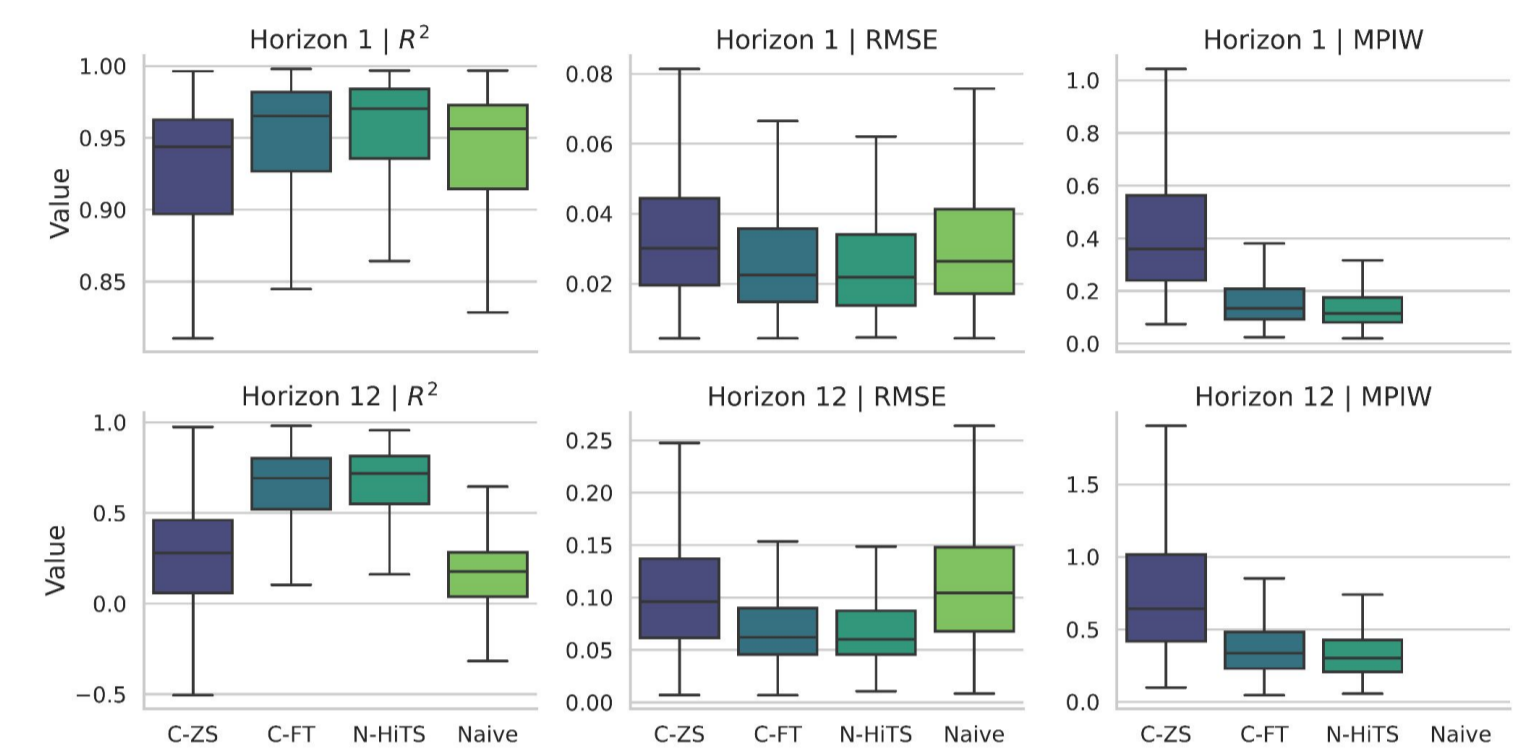
Temporal Models

Model Types

- **Chronos2 Zero Shot**
 - A T5 architecture modified for forecasting
- **Chronos2 Fine Tuned**
 - Chronos2 with full parameter updates
- **N-HITS**
 - A neural forecaster used in Kunz et al.
- **Naive Forecast**
 - $\hat{Y}_t = Y_{t-h}$

Evaluation Information

- **Training Data:** train-train set
- **Evaluation Data:** val-train set
- **Historical Context:** 52 weeks
- **Forecast Horizons:** 1 & 12 weeks



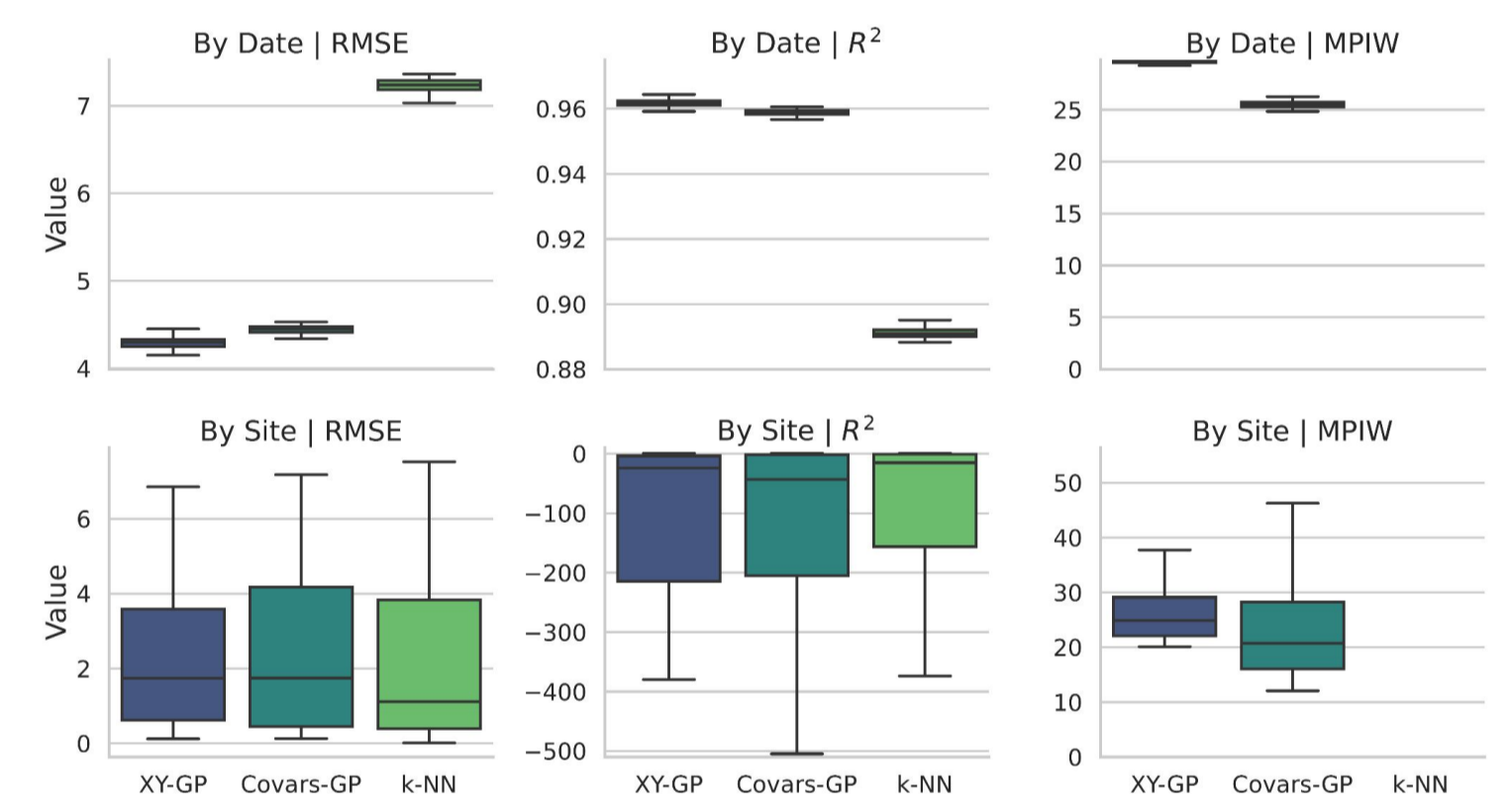
Spatial Models

Model Types

- **K-Nearest Neighbor Regression**
 - ML Model that averages neighbors
- **Gaussian Processes (XY-GP)**
 - Nonparametric model fitting a distribution of functions given the data
 - This version only uses coordinates
- **Gaussian Processes (Covars-GP)**
 - Same configuration as XY-GP but with covariates and coordinates

Evaluation Information

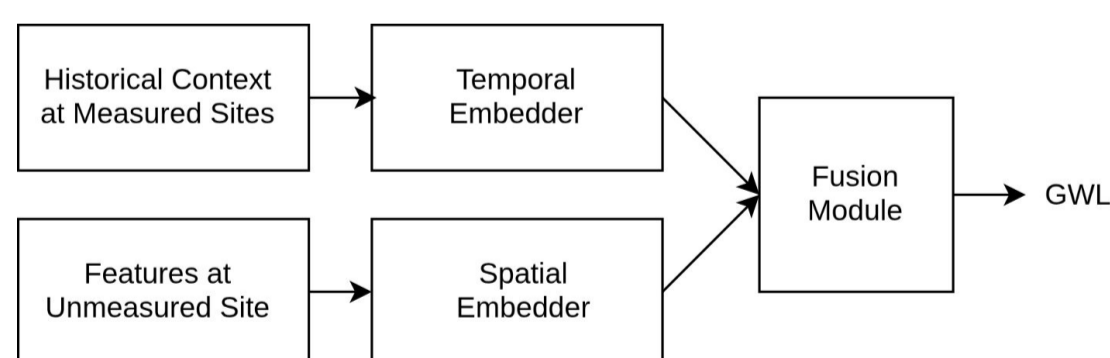
- **Training Data:** train-train set
- **Evaluation Data:** train-val set
- **KNN Hyperparameter:** 2 neighbors
- **GP Kernel:** Matern 5/2 kernel



Spatiotemporal Models

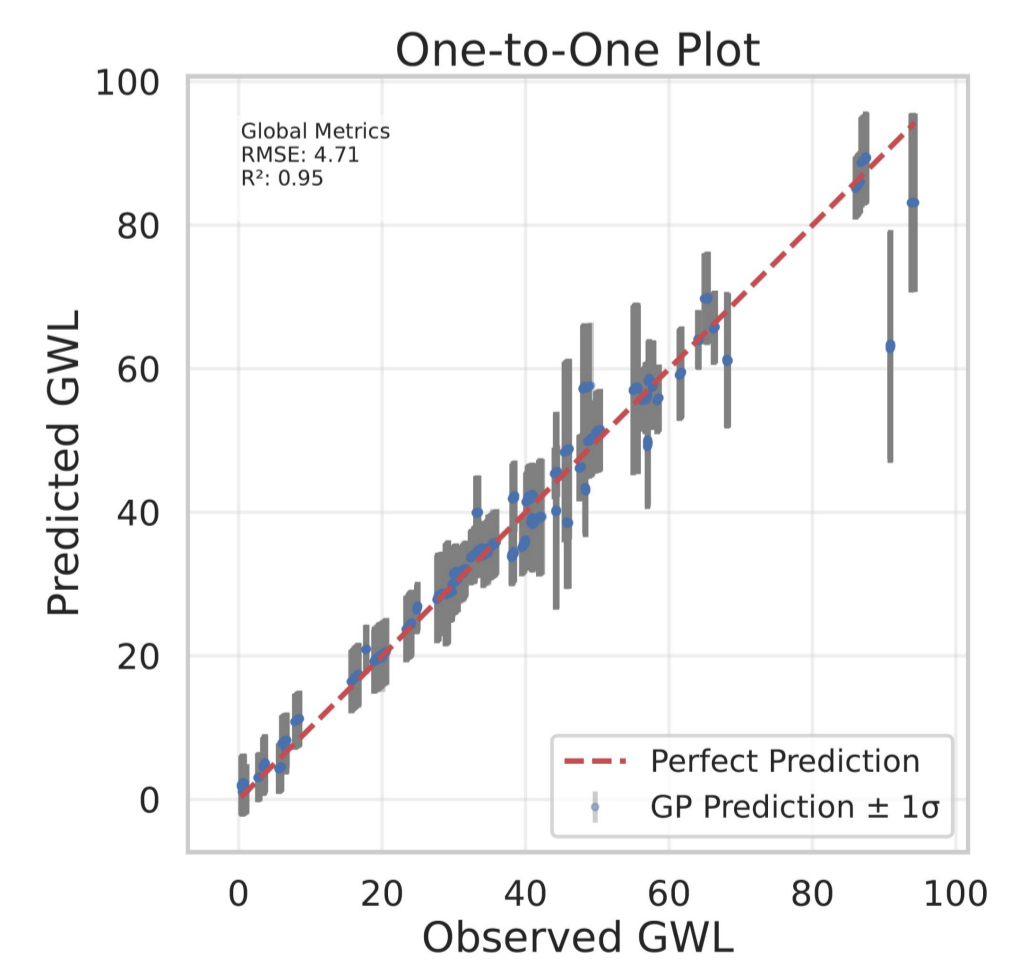
Model Types

- **Decoupled**
 - Apply a spatial model to forecasted values
- **Coupled (In-Development)**
 - Fusion of temporal and spatial information



Evaluation Information

- **Model Evaluated:** Decoupled model
- **Training Data:** train-train set
- **Evaluation Data:** val-val set
- **Temporal Model:** N-HITS
- **Spatial Model:** XY-GP



Analysis, Conclusion, & References

Analysis

- **Temporal:** N-HITS is the most performant.
- **Spatial:** By-date aggregation puts XY-GP at the top, KNN is best when done by-site.
- **Spatiotemporal:** Preliminary results appear decent but the computed metrics are dominated by the easier forecasting task.

Conclusion

- The time series forecasting task is well-explored, as in Kunz et al.
- The spatial task is well explored by BGR but our performance could be improved.
- The spatiotemporal task is where most of the research potential lies, the coupled model appears to be promising.

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