

TOWARDS RAPID SURGE PREDICTIONS

EXPLORING THE
CAPABILITIES OF DEEP
LEARNING FOR GLOBAL
SURGE PREDICTIONS.

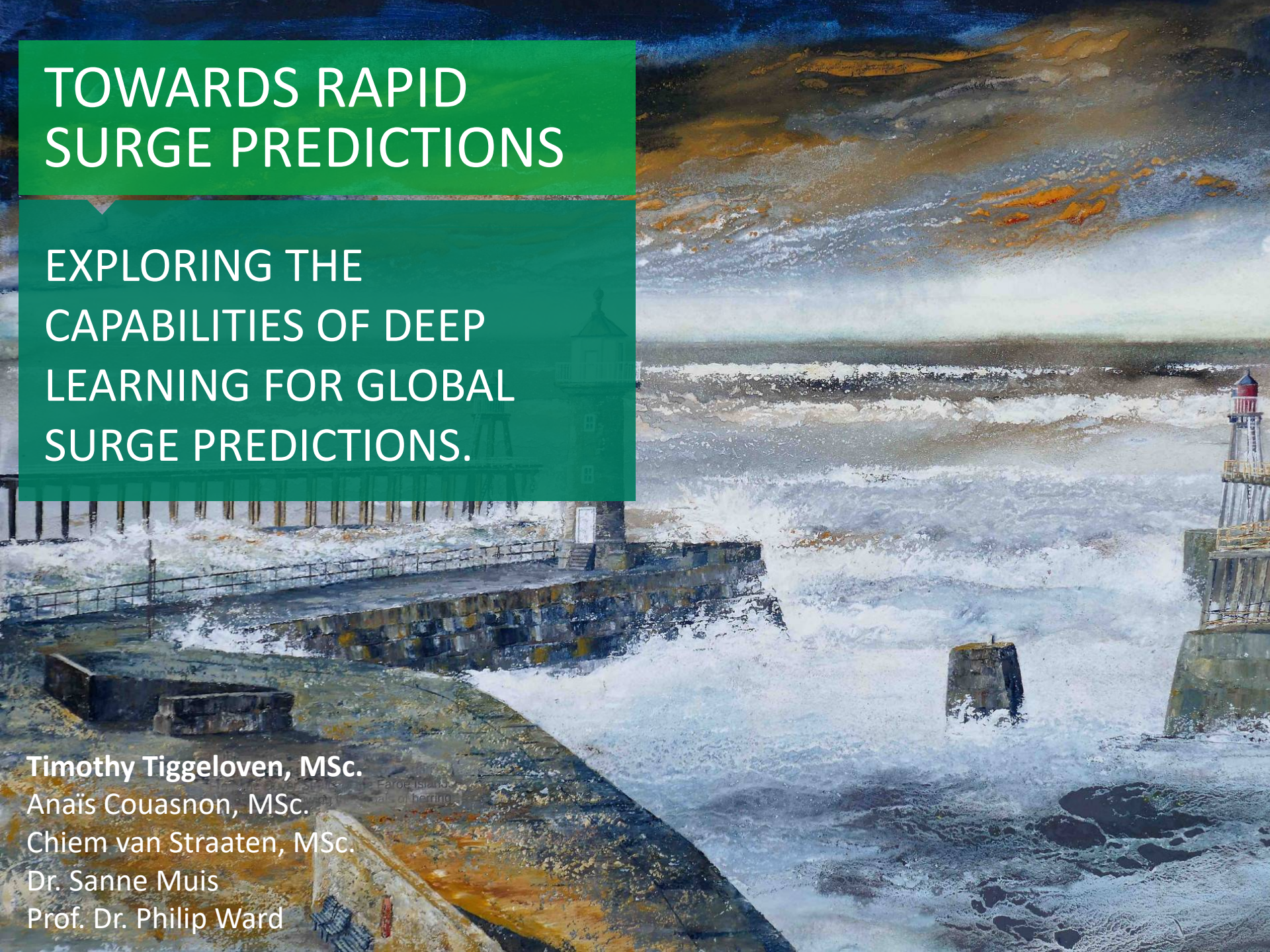
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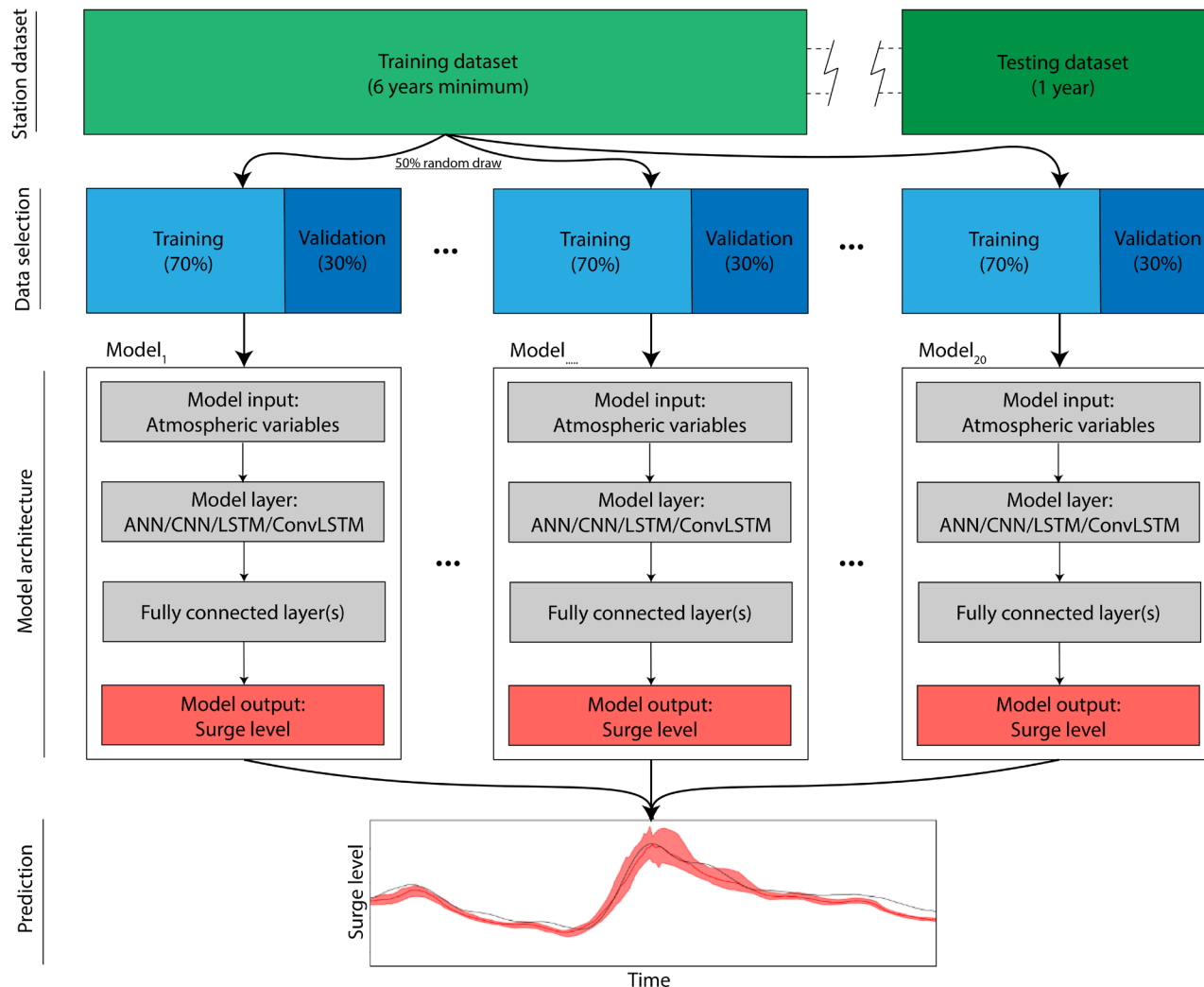
Need for rapid surge predictions

- Improve coastal adaptation and reduce disaster risk
- Critical to better understand and predict the characteristics of sea levels
- Importance of temporal variation and magnitude

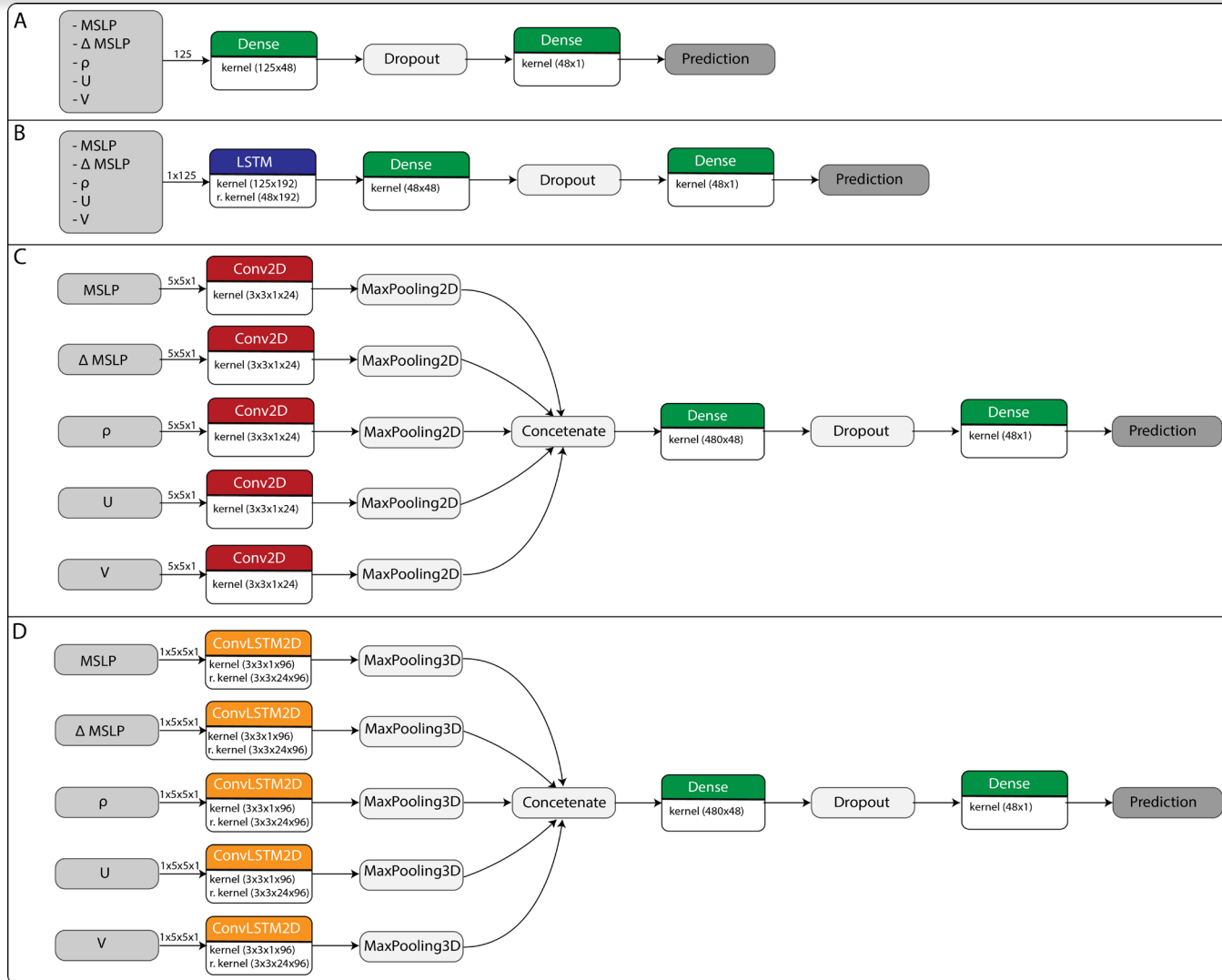
Surge prediction using Deep Learning

- Predictand: surge levels (derived from GESLA-2 dataset)
- Predictors: MSLP, gradient of MSLP, zonal and meridional wind speed, and wind magnitude (ERA5)
- Four NN methods: ANN, LSTM, CNN, CNN-LSTM
- Ensemble prediction
- CRPSS as skill metric

Ensemble of NN models



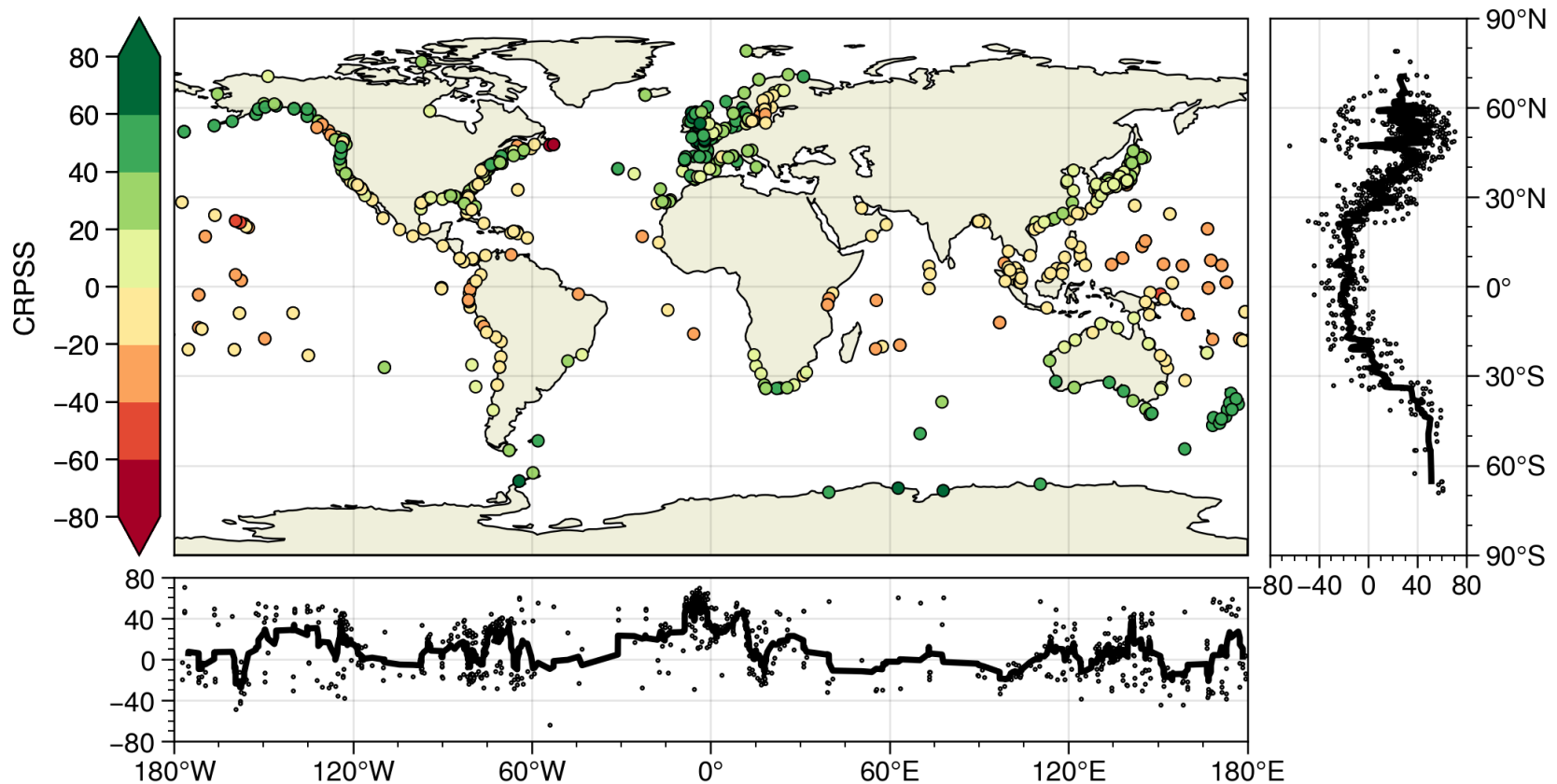
NN schematics



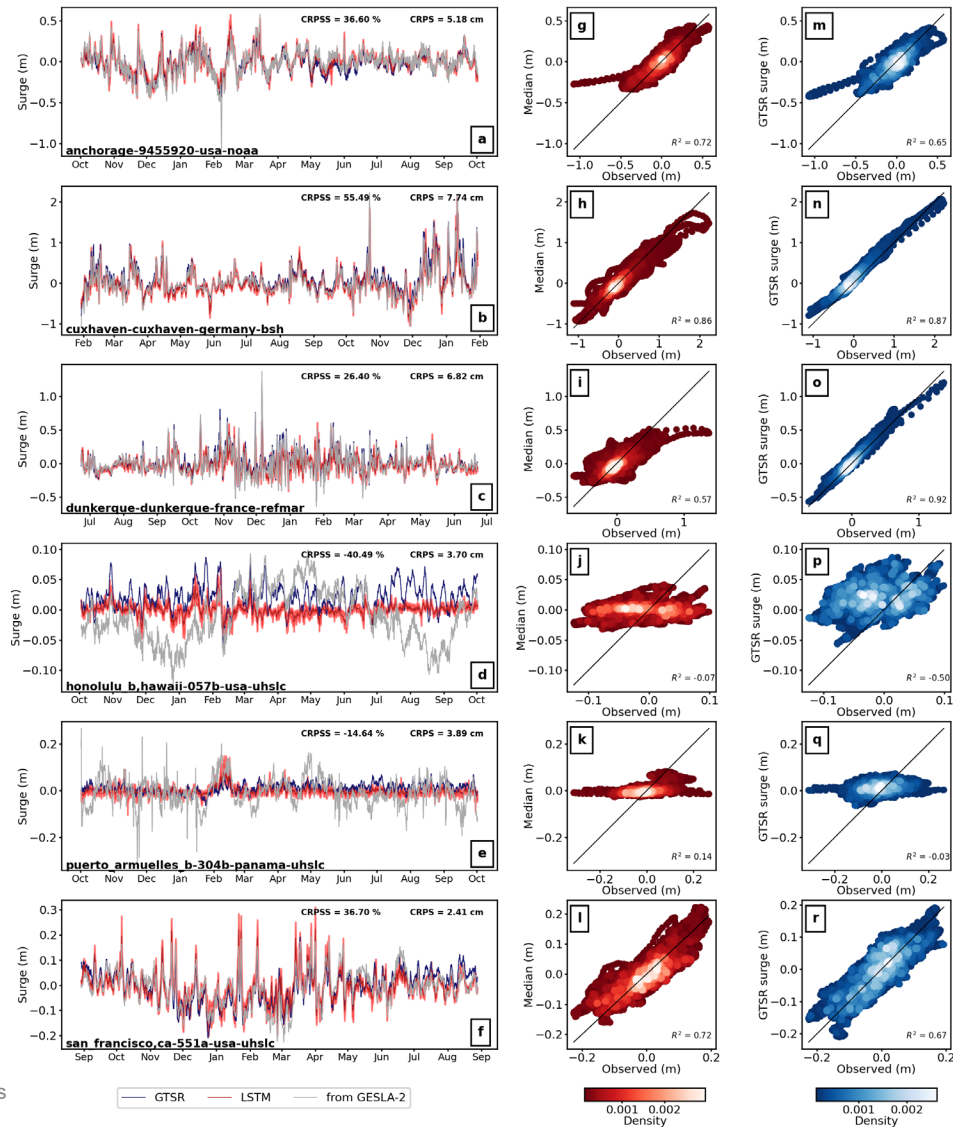
Skill metric

- CRPSS: increase in skill of NN ensemble referenced to a simple climatological model.
- Positive values mean increase in skill
- Negative values mean overall distribution of observed values is better captured by the distribution of the simple climatological model
- However, there can still be increase in skill for negative CRPSS values in the average ensemble spread and behaviour of observed outliers

Global results

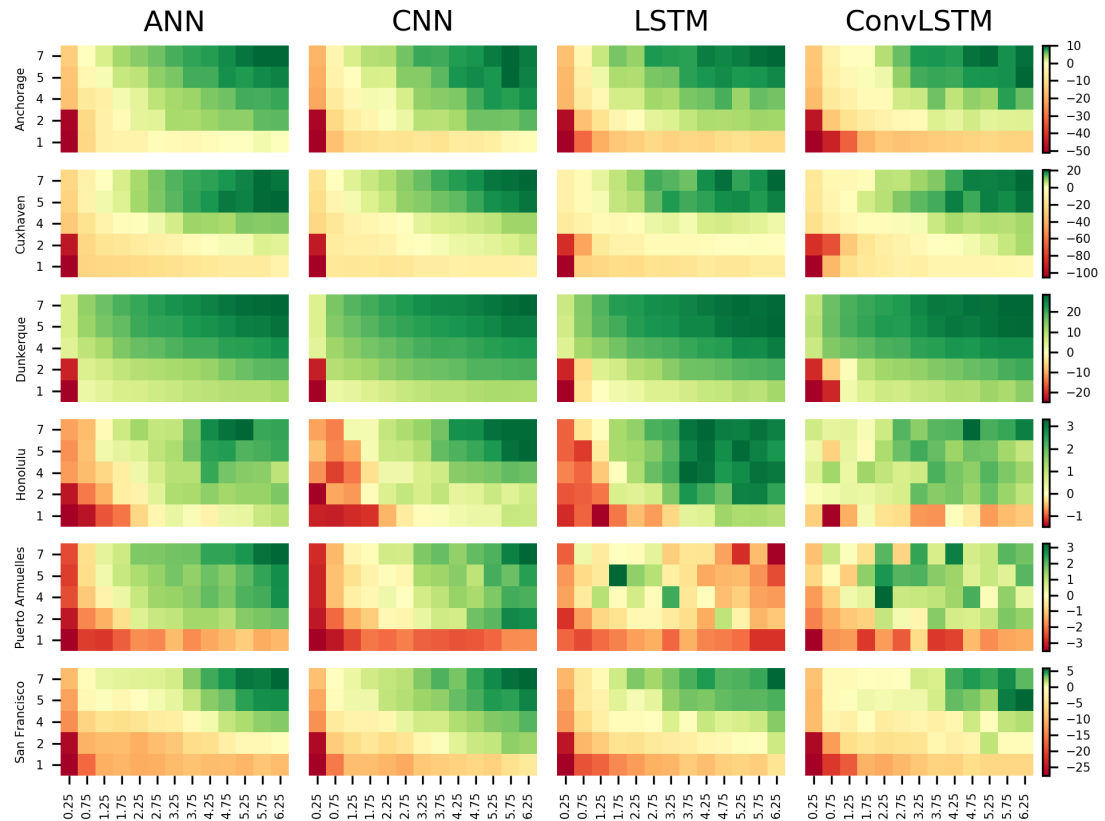


Local results



Increasing spatial footprint

- Y-axis: number of predictor variables
- X-axis: Spatial footprint
- Values: CRPSS



Conclusion

- Neural Network (NN) models at 736 tide stations globally
- NN models are able to capture temporal evolution of surges and outperform large-scale hydrodynamic models
- Tide stations around the equator generally do not outperform the simple climatological model
- Model performance generally improves with increasing the size of the spatial footprint for the selection of the predictor variables
- We foresee that the deep learning models developed here could be adapted and tailored for specific coastal applications