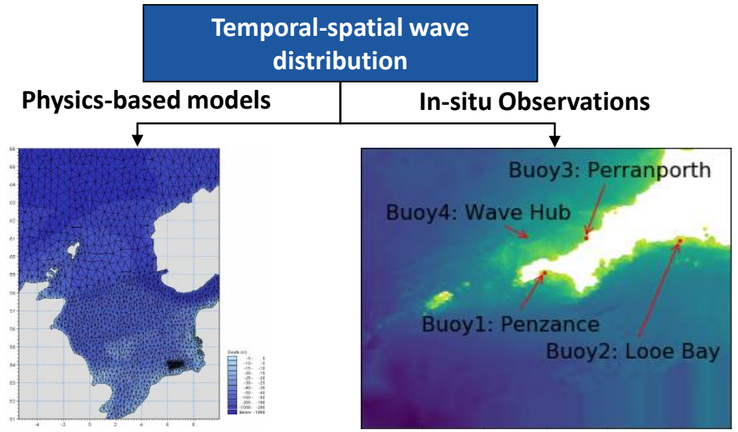
USING MACHINE LEARNING TO DERIVE SPATIAL WAVE DATA: A CASE STUDY FOR A MARINE ENERGY SITE

Jiaxin Chen, Ian G. Ashton, Ajit C. Pillai, Lars Johanning
College of Engineering, Mathematics and Physical Sciences, University of Exeter

Motivation and Objective

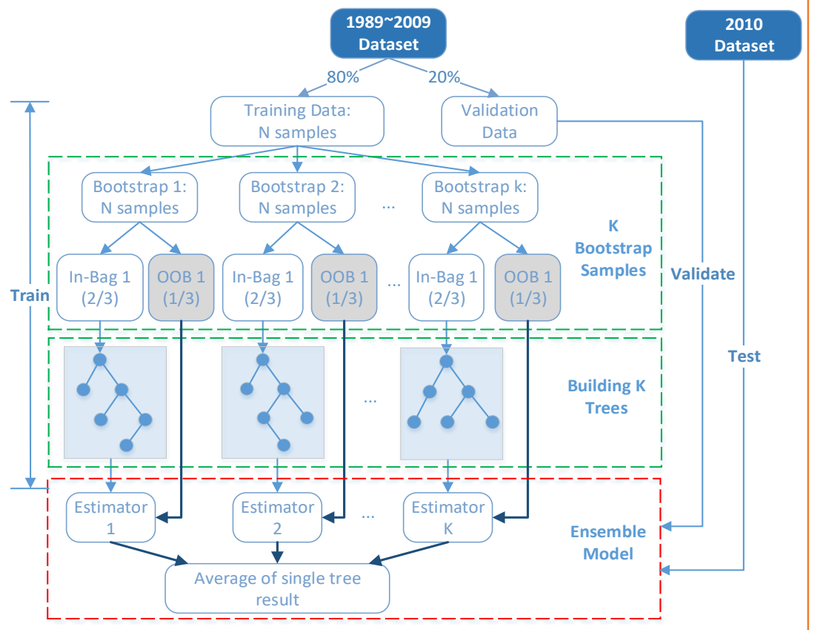


High-fidelity
High-computational cost

Relatively reliable
Sparse data set

Objective: Develop **machine learning** models to act as surrogates that learn the **nonlinear mapping** from input point wave data to spatially distributed wave data

Surrogate Model



Available Buoy Observation

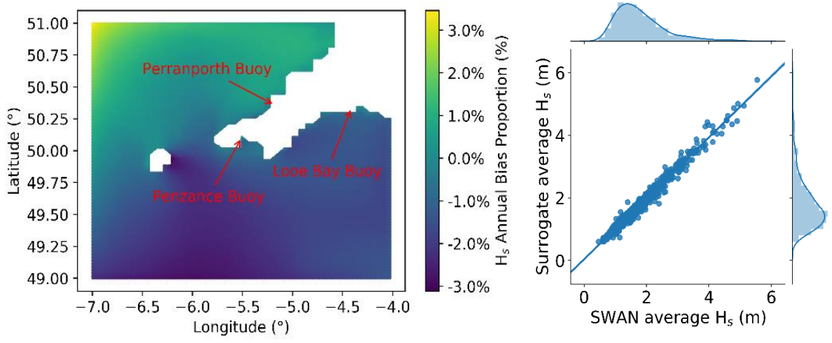
Buoy #	Name	Lon (°W)	Lat (°N)	Depth (m)	Nearest SWAN grid point		Distance to nearest SWAN grid point (km)
					Lon (°W)	Lat (°N)	
Buoy 1	Penzance	5.503	50.114	8.84	5.505	50.115	0.2835
Buoy 2	Looe Bay	4.411	50.339	10.32	4.409	50.340	0.3133
Buoy 3	Perranporth	5.175	50.354	19.97	5.176	50.358	0.5330
Buoy 4	Wave Hub	5.614	50.347	35.85	5.615	50.349	0.2334

** Buoy1~3 observations as Surrogate model input, result interpolated to Buoy 4 location for Surrogate output verification.*

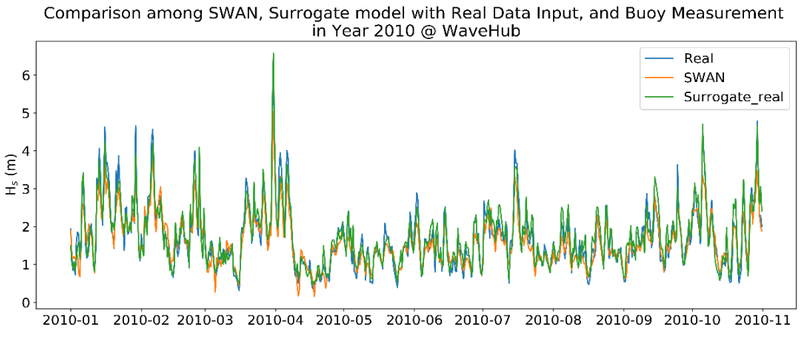
Conclusion and Discussion

- Surrogate model proposed using the Random Forest algorithm can provide an **efficient and reasonable** way to **replicate numerical** results (with less than 20 minutes to train 21 years data).
- Initial results suggest **better results** than the corresponding SWAN model (at a Marine Energy Site location).
- The model will have **potential** applications in **real-time** wave monitoring, **forecasting** for marine renewable energy sites and supporting vessel navigation.
- However, this system **relies on an accurate** spatial description of the wave conditions that does not and cannot replace the **physical modelling** itself.

Accuracy of Surrogate model



Surrogate Model Verification (@ Wave Hub)



Buoy observations are available at Channel Coastal Observatory: https://www.channelcoast.org

For further information, please contact Jiaxin Chen (jc1083@exeter.ac.uk).