Wave forecasting and its use for real-time wave energy device control

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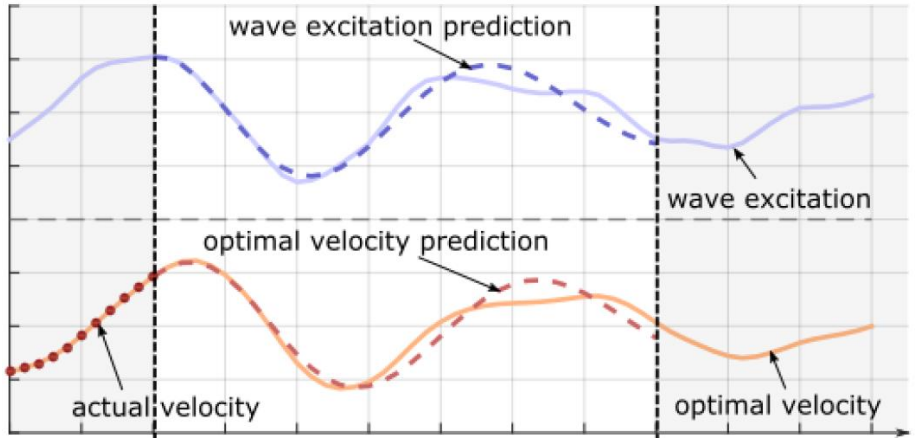
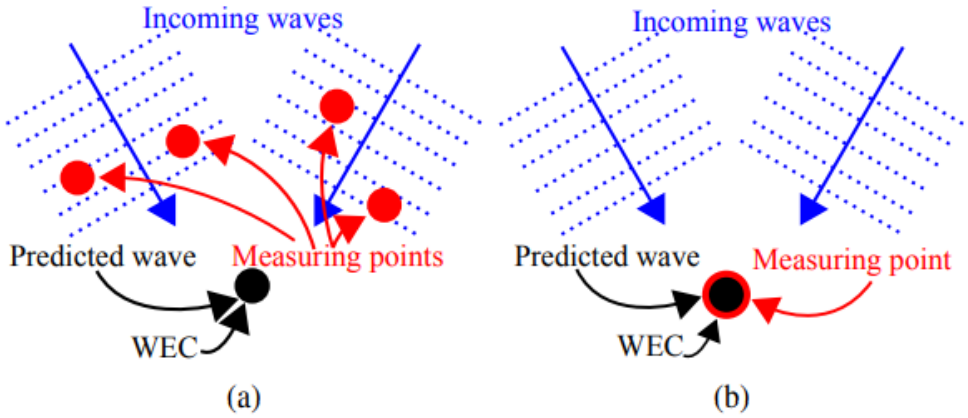
Short-term wave forecasting: why?

Maximise wave energy absorption through real-time control

⟹ **Requires real-time prediction of the next incoming waves!**



Short-term wave forecasting: how?



Up-wave approach versus **time-series** approach

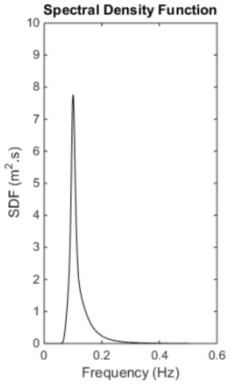
Physical model	Statistical model
Time horizon ++	Time horizon --
$$$	$

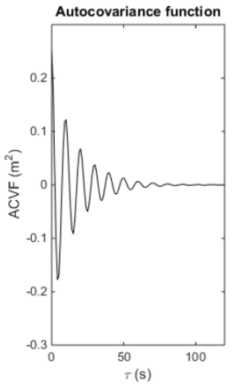
- Unlike existing approaches we make use of the **statistical information** contained in the **wave spectrum**
- Statistical model that can be used either in an up-wave or time-series configuration

Using the wave spectrum for wave elevation forecasts

- From the wave spectrum we compute how wave measurements and predictions are correlated to each other
- From there we get the best possible predictor

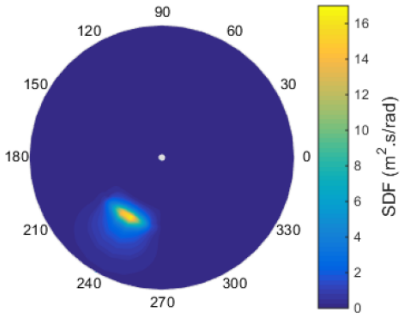
Time series

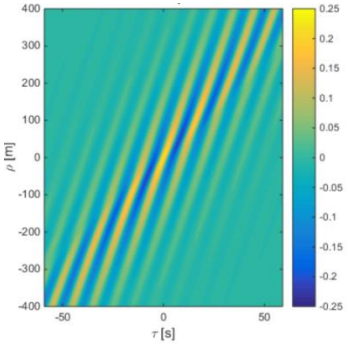




Optimal predictor

Up-wave

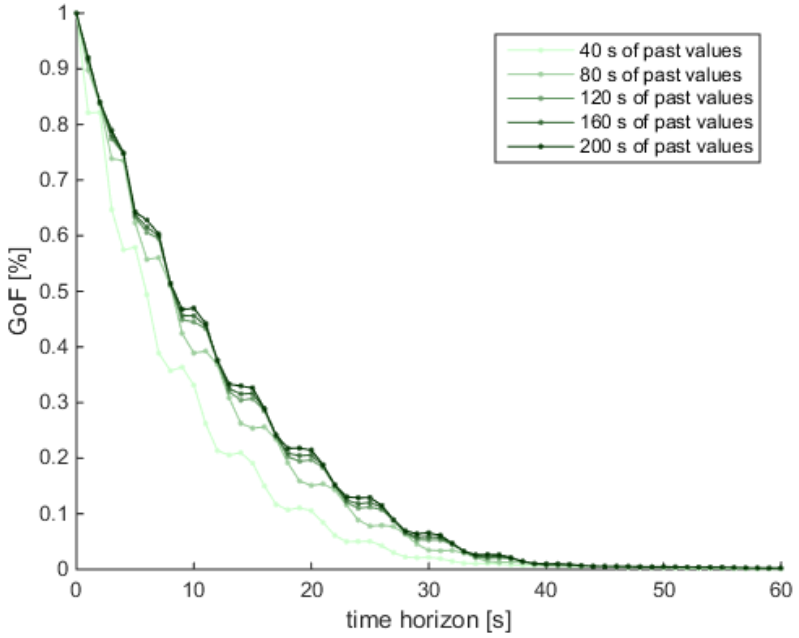




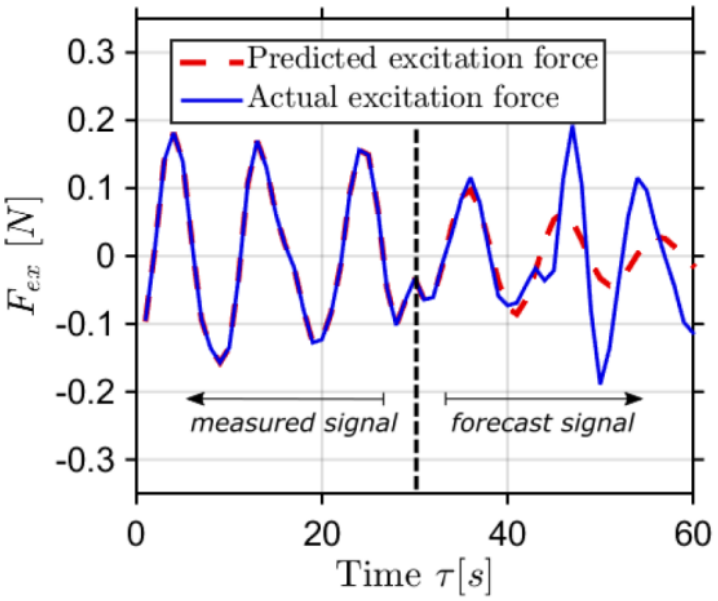
Optimal predictor

Examples: time-series approach

- Even the optimal time-series approach performs quite poorly!



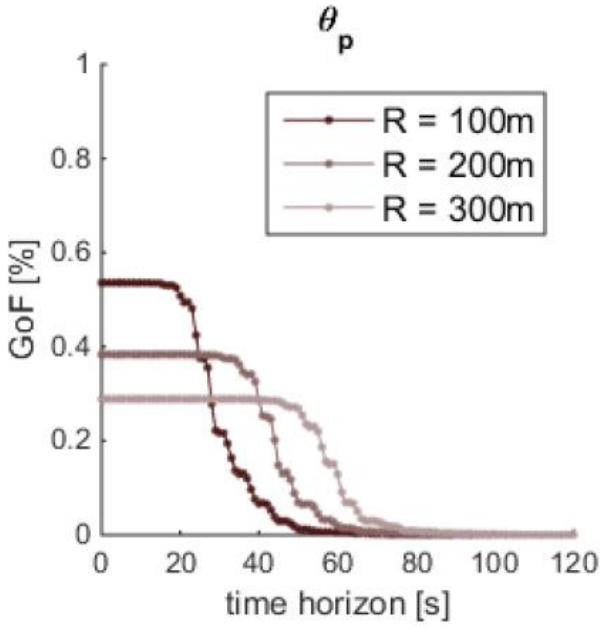
Forecast accuracy



Actual *vs* forecast signal

Examples: up-wave approach

- Using only one up-wave probe at different distances

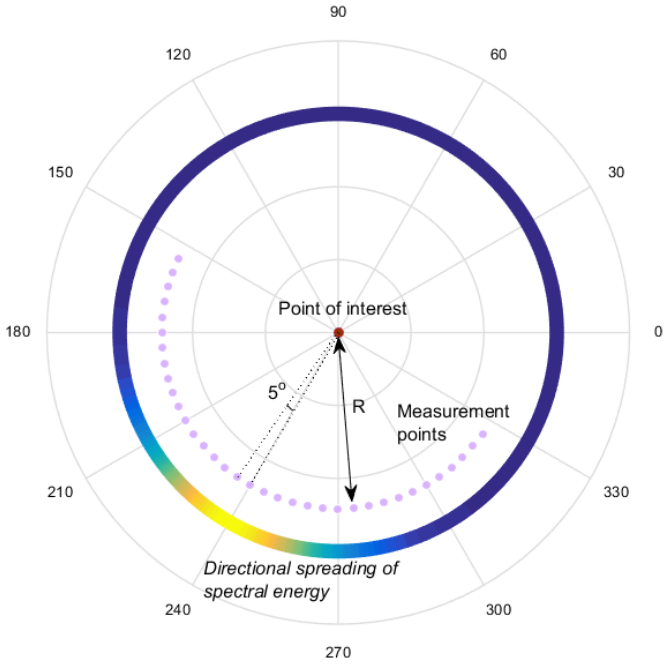


Forecast accuracy

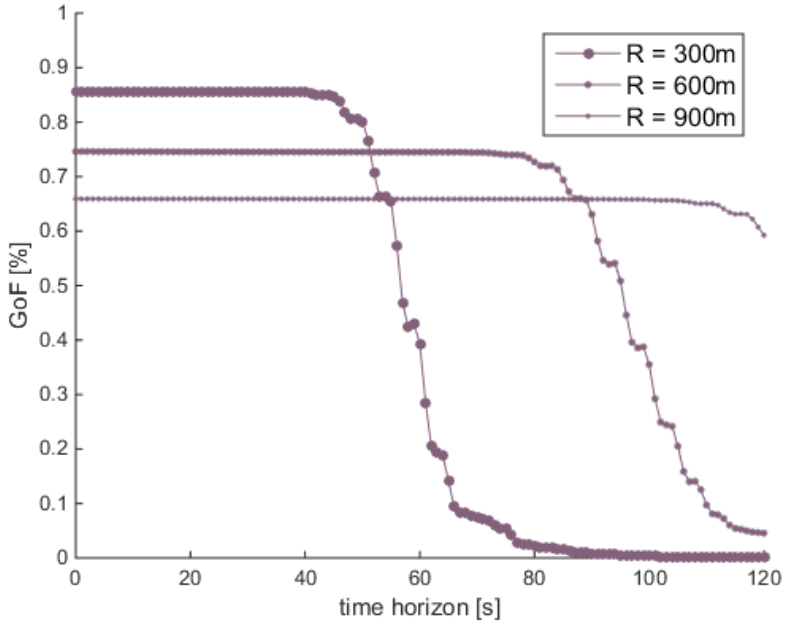
- Long up-wave distance is good for the forecasting horizon
- Wave directional spreading is bad
- Wave directional spreading is worse for longer up-wave distances

Examples: up-wave approach

- Many more probes shall be used!



Measurement layout



Forecast accuracy

What measurement technology???

THANK YOU

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