Data-driven Fluid Dynamics Assignment

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Option 1: Time Series Forecasting

Goal:

Predict a system's evolution: extrapolate data points to the future.

Data:

Numerical solutions of an integral boundary layer model for a liquid film height obtained from the 3D Liquid film solver.

Method:

Gaussian process regression on data
(as in Exercise 3 in TSC Lecture 5).

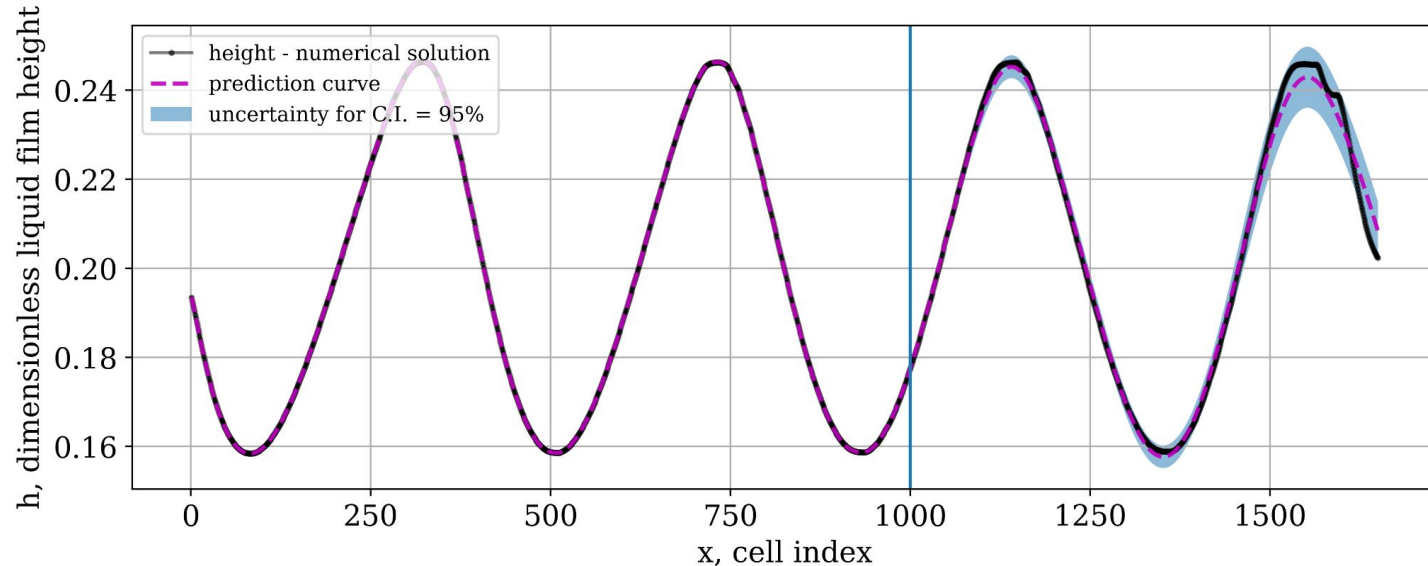# Results for the 2D OpenFOAM wave

Sinusoidal perturbations at inlet for the flow rate qx with specified wavelength and frequency.

Prediction of the liquid film height along the length x of the domain.

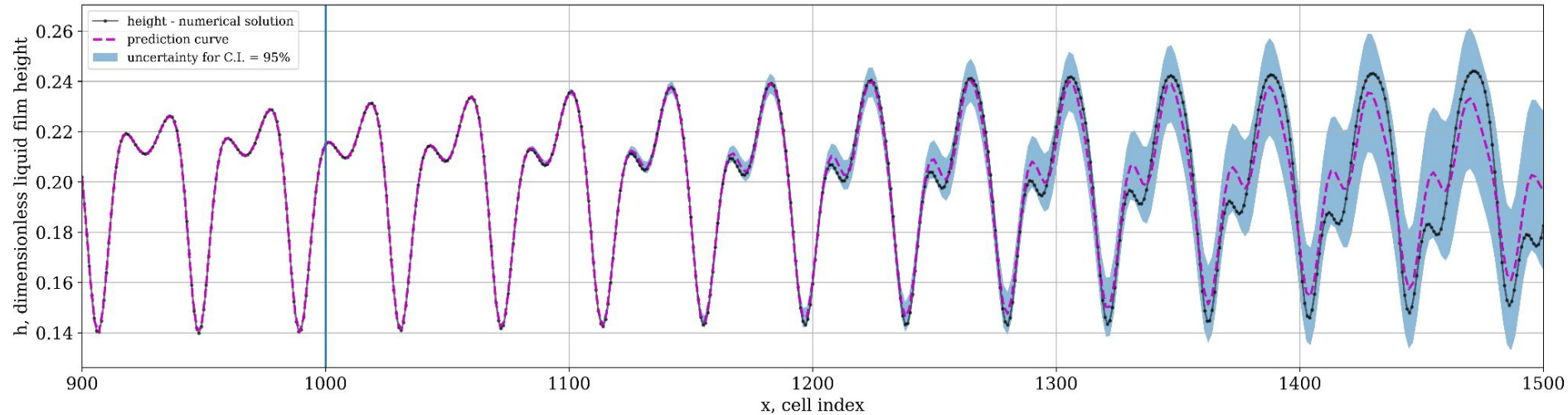Start of prediction at cell index = 1000

Results for a generated 3D wave

Sinusoidal perturbations at the inlet of the height h.
Reliable predictions: ~until cell 1300; this is 18% of the total domain length.

Prediction of the liquid film height along the length x of the domain.

Start of prediction at cell index = 1000

direction of wave propagation

Results for a generated 3D wave

Sinusoidal perturbations at the inlet of the flow rate qx along the stream-wise direction x.
Reliable predictions: ~until cell 1400; this is 24% of the total domain length.

Prediction of the liquid film height along the length x of the domain.

Start of prediction at cell index = 1000
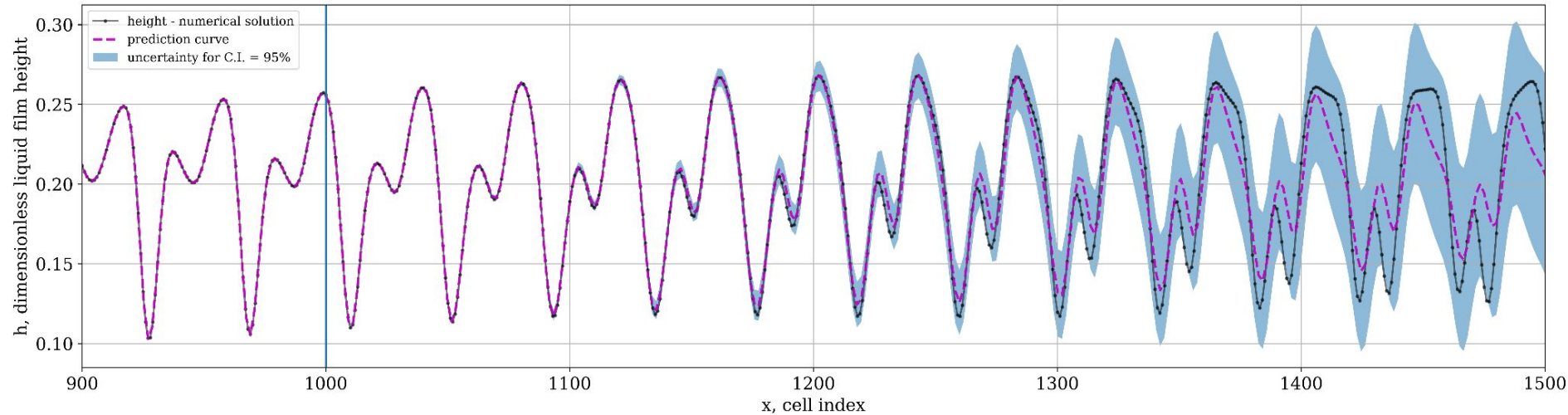
direction of wave propagation

Summary

Gaussian processes are useful for prediction of such kind of generated waves and these tools will be used in the RM project.

References and resources from DDFM + TSC lectures.

Thank you!
Discussion?