Lothar Collatz Seminar
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A short introduction to Uncertainty Quantification

Abstract:
In this talk, I would like to introduce Uncertainty Quantification (UQ) as a part of Computational Science, assuming that the audience is not familiar with this field. We define UQ as a scientific area that supports decision making with computational models, which involve uncertainties. In particular, UQ is one of the steps to ensure model reliability.

After a general overview of the relation between UQ and Validation and Verification, I will list some important problems in UQ and will speak in some more details about two of them: uncertainty propagation and sensitivity analysis. There exist many efficient methods for uncertainty propagation and I will mention some of them. I will give some explanations on how to estimate uncertainty with the most general method, that is, the Monte Carlo method. Additionally, I will speak about the global Sobol method for variance-based sensitivity analysis, and I will underline the fact that in general one should be cautious with local sensitivity analysis methods.

I will illustrate these methods with an example of uncertainty estimation for the wind wave model SWAN. We assumed that uncertainty in the model response is due to uncertainty in the bathymetry, wind velocity, water level, and some model coefficients. The quantities of interest that we studied were the significant wave height, mean absolute wave period, and average wavelength. For each of the outputs, uncertainty and sensitivity were computed. I will conclude with some observations on how these UQ results can be employed in order to obtain a more reliable interpretation of the model prediction.

For further information please contact

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`www.c3s.uni-hamburg.de/news-events/seminar-c3s.html`