HDSLEE | HELMHOLTZ SCHOOL FOR DATA SCIENCE IN LIFE | EARTH | ENERGY

PhD project: Stochastic Differential Equation Models and Inference for Wind and Solar Power Production

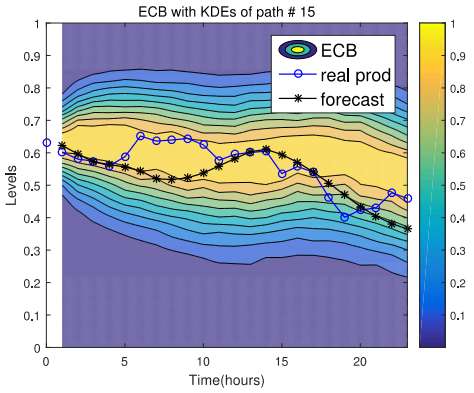
The Helmholtz School for Data Science in Life, Earth and Energy (HDS-LEE) provides an interdisciplinary environment for educating the next generation of data scientists in close contact to domain-specific knowledge and research. All three domains – life & medical sciences, earth sciences, and energy systems/materials – are characterized by the generation of huge heterogeneously structured data sets, which have to be evaluated in order to obtain a holistic understanding of very complex systems. Visit HDS-LEE at: www.hds-lee.de

Project overview

The production of energy from renewable resources such as wind, solar, and its efficient storage has been the focus worldwide in the last decades due to the limited reserves of fossil fuels and the urgent need to reduce global carbon emissions. Renewable energy sources, like solar and wind, are difficult to predict accurately and exhibit considerable variability because of the inherent volatility of atmospheric processes influencing the wind speed and direction, and cloud formation. Thus, renewable energy power sources output is usually affected by uncertainty in a short time scale, spanning just a few hours. Energy systems with significant components of renewable sources are thus challenging to operate and optimize. Often Stochastic Programming (SP) is used for model-based design and operation of such systems. Solving the SP requires the approximation of input distributions by a finite number of sample scenarios that become the universe of outcomes of the stochastic program.

The scope of this PhD project is to develop a computational framework for providing efficient probabilistic forecast models for the wind and solar power production for short up to intermediate time horizons. Here we will develop probabilistic forecasts based on Ito stochastic differential equations (SDEs), that aims to quantify the uncertainty of a given numerical prediction, which is the output of a weather model.

We will estimate the SDE model parameters based on statistical inference (both through static and data assimilation approaches) and available historical observations.



Your job:

- Develop efficient probabilistic forecast models for the wind and solar power production for short up to intermediate time horizons. Here we will develop probabilistic forecasts based on Ito stochastic differential equations (SDEs), that aims to quantify the uncertainty of a given numerical prediction, which is the output of a weather model.
- Estimate SDE model parameters based on data science techniques (both through static and data assimilation approaches) and available historical observations.
- Apply the new methodology to challenging design and operations problems

Your profile

- Excellent degree in computational mathematics/engineering, energy/process systems engineering, mechanical engineering, or a relevant discipline
- Expert knowledge of at least one programming language (preferably Python and C++)
- Expertise in modeling, numerical analysis and optimization
- Expertise in computational statistics, time-series analysis, machine learning is highly welcome
- Excellent organizational skills and the ability to work independently

- Excellent cooperation and communication skills and ability to work as part of a team
- Excellent communication skills in English are mandatory: TOEFL or equivalent evidence of English-speaking skills
- Language skills in German are not required.
- A high level of scholarship as indicated, for example, by bachelor and master study transcripts and two reference letters

Our offer

The PhD project will be located at the RWTH in the group “Mathematics of Uncertainty Quantification”. The candidate is jointly supervised by Raul Tempone. We offer

- A highly motivated group as well as an international and interdisciplinary working environment
- Unique graduate school program
- Chance of participating in (international) conferences
- Continuous scientific mentoring by your scientific advisor
- Further development of your personal strengths, e.g. via a comprehensive further training program
- 3 year position with a salary amounting to TVL 13 100%.

Apply to and contact for further information: Prof. Raul Tempone tempone@uq.rwth-aachen.de

Starting date: at the next possible date