

**University of Stuttgart**  
Germany

Department for Stochastic Simulation  
and Safety Research for Hydrosystems (LS<sup>3</sup>)

## Project / B.Sc. / M.Sc. Topic

In this project, we are investigating the impact of climate change on water demand in southern Germany by utilizing real-world data provided by regional water suppliers for the period between 2010 and 2020. Recent advancements in artificial intelligence and machine learning offer unprecedented potential for modelling complex, nonlinear relationships that are often beyond the scope of conventional statistical models. Currently, no established models exist to reliably predict future water consumption under varying climate conditions, making this a critical area of research.

Current research efforts have primarily focused on linear regression and Gaussian Process Regression (GPR) techniques. An established model in the field of hydrology is the Seasonal AutoRegressive Integrated Moving Average with Exogenous Variables (SARIMAX) model. SARIMAX incorporates multiple components, including autoregressive properties, moving averages, seasonal adjustments, and the integration of exogenous variables, allowing it to capture both temporal dependencies and external influences effectively. In this thesis, the individual and combined contributions of these SARIMAX components will be systematically analysed. The model will be trained and validated using real-world data from regional water suppliers. Additionally, the scope and focus of the project can be tailored based on the student's interests, skill set, study program and type of thesis.

### Prospective tasks

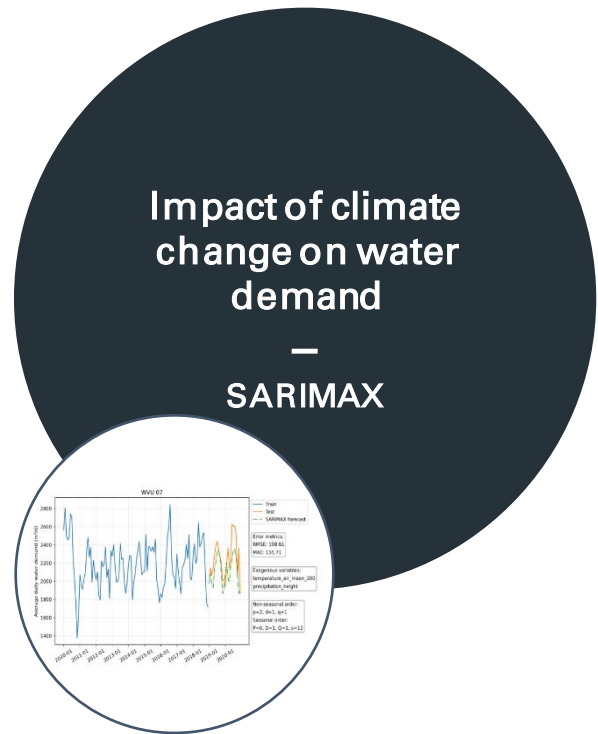
- Literature research and review on SARIMAX models
- Implementation of a SARIMAX model based on the statsmodels package
- Parameter tuning and selective deactivation of model components
- Evaluation of the model performance by comparison to existing models

### General Information

- Advisor: Philipp Hofmann
- Examiner: Dr. Jochen Seidel

### Desirable Skills

- Solid understanding of mathematical and statistical concepts
- Experience with programming in Python
- Interest in application of machine learning to real world problems



**Apply now!**

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