Master- und Bachelorarbeiten Arbeitsgruppe Erdsystemmodellierung Reinecke

Anfang: jederzeit

Interessenbekundung an: reinecke@uni-mainz.de

The use of machine learning to fill global data gaps

Global datasets are critical for assessments and models as they provide a comprehensive view of the Earth's systems and enable us to make informed decisions about how to manage and protect our planet's resources. These datasets allow for the identification of patterns and trends in environmental variables, such as temperature, precipitation, and biodiversity, and support the development of models that can be used to make predictions and inform policy decisions. A literature analysis could be conducted with the goal of assessing how and where machine learning techniques, such as random forest, are used to extrapolate in-situ environmental data and build global datasets. Such an analysis would involve reviewing the existing literature on machine learning and environmental data, focusing on studies that have used random forest or similar techniques to predict environmental variables over large spatial scales. The analysis could investigate the strengths and limitations of these techniques, identify the most successful applications, and highlight gaps in current knowledge and research directions. By synthesizing the existing literature, this analysis could provide a comprehensive overview of the current state-of-the-art in machine learning and environmental data and help guide future research and data-driven decision-making efforts.

From Food-Water-Energy Nexus to Food-Groundwater-SurfaceWater-Energy Nexus

The food-water-energy nexus is a concept that refers to the interdependence and interconnections between food production, water use, and energy generation. These three resources are crucial for human development and have complex interactions with each other, with changes in one affecting the availability and quality of the others. A potential research topic could involve analyzing how groundwater is considered in current and past food-water-energy nexus research. Groundwater is an essential resource for agriculture and food production, as well as for many other industries and human activities, yet it is often overexploited or poorly managed, leading to depletion, contamination, and conflicts. The analysis could involve reviewing the existing literature on the food-water-energy nexus and examining the extent to which groundwater has been included and integrated into the conceptual frameworks, indicators, and models used in these studies. The analysis could identify gaps, challenges, and opportunities for incorporating groundwater into more integrated and sustainable approaches to the food-water-energy nexus.

Complex models for a complex world

Earth system models are complex, interdisciplinary tools that integrate various components, such as the atmosphere, ocean, land surface, and biogeochemistry. The complexity of these models can affect their accuracy and performance, making it crucial to quantify and understand the sources and nature of complexity in Earth system models. The thesis could focus on reviewing existing complexity metrics, such as algorithmic complexity, information entropy, and network analysis, and adapting and applying them to Earth system models. The analysis could provide insights into the relationships between complexity and model performance and help identify areas for model improvement.