Principal Investigator: Prof. Dr. Jana Sillmann

Title of Project: **Climate Statistics and Climate Extremes**

This project overarching aim is to provide relevant information for decision making regarding the risks from climate extremes. Comprehensive research focusing on data exploitation is now urgently needed, as vast amount of data is becoming available from climate models and observations, to analyze climate extremes in a seamless and coherent manner (i.e. in time and space).

In this project we will exploit the ability of large global and regional climate model ensembles as well as high-resolution models to simulate weather and climate extreme events (such as heatwaves, heavy precipitation, extreme winds) based on current process understanding and incorporation of observations. This will involve applying advanced statistical methods, including machine learning and AI techniques. Particular attention is drawn on the role of natural variability determining the occurrence and intensity of extreme events. To quantify and understand uncertainty, we will use large ensembles from multi- and single-model climate simulations to assess very rare events in the context of natural variability and climate change. Important drivers of climate extremes (large-scale circulation and land-surface feedbacks) will be investigated in terms of the models' ability to capture robustly the relationship with climate extremes as basis for conditional statements to be used for high-resolution model simulations with a convection-resolving Earth system model (ICON). Perturbed physics and other experiments will be conducted with the high-resolution model to gain process understanding and to further develop the model with respect to improved simulation of extreme events.