The Chair for Nexus Research is offering an opportunity to write your **master thesis** in cooperation with the Munich Re. The topic is

Climate change impacts on return periods of extreme drought and rainfall events in the U.S. Corn Belt.

Background

- Extreme weather events such as droughts or excessive rainfall pose significant threats to agricultural producers, leading to reduced crop yields and financial instability.
- To mitigate these risks, many farmers (especially in the US) use agricultural insurances as a crucial risk management strategy.
- For agricultural insurances to be sustainable and effective, (re)-insurers need detailed knowledge about current and future return periods of the insured extreme weather events.
- This knowledge allows (re)-insurers to set accurate premiums, ensuring coverage for claims and contributing to better risk management and resilience in the agricultural sector.

Goals

1. Identify historic return periods of one to two predefined extreme events:
   - Large scale drought in the U.S. Corn Belt.
   - Prevented planting event (due to excessive rainfall) in the U.S. Corn Belt.
2. Assess the impacts of climate change on return periods of the above-mentioned events:
   - What are the current best estimates of return periods?
   - Are there trends indicating an increase or decrease in return periods historically?
   - How are return periods projected to change in the future assuming a certain CO_2 emission path, and how do they compare to current and historic return periods?

Recommended Research Approach

- Definition and identification of extreme events based on indices using e.g., temperature, precipitation, evapotranspiration, and soil moisture data (e.g., NOAA data). Events based on drought intensity comparable to the one of 2012 and rainfall intensity/amount comparable to the one of 2019.
- Analysis of correlations between extreme event definition and agricultural yield shortfalls.
- Analysis of the moment in time of an extreme event, as it is crucial to its potential harm for a crop (growing phase vs. pollination period of corn) based on literature reviews and data from Munich Re for most relevant crop types (e.g., corn and soybean).
- Sensitivity analysis regarding definition of extreme event and return period.
- Investigating different climate models (>3 ensemble) and emission scenarios (e.g., RCP 4.5) to derive current and future (specifically in 2030, 2040, and 2050) return periods of defined extreme events and their robustness.
- Identification of trends in historic, current, and future return periods.

Benefits

This master thesis is in collaboration with Munich Re. The academic supervision is by Prof. Dr. Marianela Fader and Dr. Christoph Jörges. Munich Re offers a **monthly remuneration of 1.300,00 Euro (gross)**. You will have a fully equipped working space at Munich Re in Munich and you will have the chance to gain an insight into the work of a reinsurance company and get to know people in the working group. For computationally expensive calculations, you can use the Linux computational cluster of the chair for nexus research.

Contact

If you find this offer interesting or in case of questions, please contact Prof. Dr. Marianela Fader (M.fader@lmu.de). Before submitting your official application, please first connect with Prof. Dr. Fader and the Chair for Nexus Research to receive the initial approval to move forward.

As a next step, please submit **your official application latest by October 31st, 2024**. You can apply via this link: https://career55.sapsf.eu/sfcareer/jobreqcareerpvt?jobId=6098&company=mnchenerrc&st=D12AAC02324E08 5A02525783A6827EA426549AA1

Please submit your **CV and all transcripts** (A-Levels, academic studies, and employer certificates, if applicable) in the application.