Predictability of onset and cessation of rainfall in AI-based forecasts over Southern African

Background and motivation

Southern Africa is grappling with the impacts of the 2023/2024 droughts, the worst ever in the region's history, which left millions of people going hungry and led four countries to declare a state of emergency. In this region, where most of the population relies on rain-fed agriculture for food production, accurate rainfall forecasts are crucial for improving food security. Unfortunately, the poor skill of global numerical weather prediction (NWP) systems (e.g., Vogel et al. 2020) renders forecasts unreliable, and the high costs associated with running these models, especially at the required high resolution, exacerbate the problem. However, with the recent developments in artificial intelligence (AI) and machine learning, more forecasts, with potentially better skill are being made. These AI-generated forecasts could play a key role in mitigating hydrometeorological disasters and enhancing food security.

Tasks

This master thesis aims at ascertaining the skilfulness of AI-based models at the sub-seasonal scale. Specifically, the study will evaluate the skill of the recently released ECMWF AI Forecast System (AIFS) and NeuralGCM (which is being run at IMKTRO). The performance of these AI-driven models will be compared to that of a conventional numerical weather prediction (NWP) system, the ECMWF IFS. Special attention will be given to how well these models predict the onset and cessation of the rainy season in Southern Africa, which is crucial for regional agricultural planning and food security.

Organisational information

The master thesis will contribute to ongoing efforts in the Co-Design of Hydrometeorological Information System for Sustainable Water Resources Management in Southern Africa (Co-HYDIM-SA) project, which aims at enhancing water security in the region. The student will therefore actively collaborate with researchers from a wider group of Germany and African organisations.

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