What are climate models and how can we improve their accuracies for climate impact studies?

Background

Climate models, sometimes called the general circulation models (GCMs) illustrate energy and matter interaction in different parts of the ocean, atmosphere and land using mathematical equations. After a climate model is initiated, it undergoes a testing phase. This is done by assessing the model performance and accuracy from the current time backwards into the historical time based on the observed climate and weather conditions. GCMs are used to project the future climate based on different scenarios e.g. land use change, human population growth, economy evolution, and the atmospheric greenhouse gases emissions.

However, these GCMs have coarse resolutions and regional biases which make it difficult to meet the requirement of many users demanding high-resolution outputs to produce regional to local-scale climate projections as well as climate impact studies. Therefore, there is a need to accurately correct these biases inherent in GCMs and examine the abilities of these correction techniques in replicating the observed climate change signals at the local scale.

A univariate bias-correction (BC) method corrects biases in individual climate variables at a time. However, the dependencies and correlation between the different variables are disregarded. In multivariate BC, multiple climate variables are corrected concurrently either by considering the whole multivariate dependence structure or assuming stationarity in the temporal sequence of model variables.

Climate model biases and uncertainties: challenges in bias-correcting climate models for reliable climate impact studies

This study assesses the performance of two univariate and three multivariate bias-correction (BC) methods in reproducing the observed maximum temperature distribution as well as the temperature variability over the basin using eight climate
Based on Journal Article: “Multiple bias-correction of dynamically downscaled CMIP5 climate models temperature projection: a case study of the transboundary Komadugu-Yobe river basin, Lake Chad region, West Africa”

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