Tropentag, September 19-21, 2012, Göttingen - Kassel/Witzenhausen

"Resilience of agricultural systems against crises"

Resilience of Rainfed Farming Systems under Changing Climate

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Abstract

Climate change is a phenomenon that affects resiliences of agricultural systems against crisis. Adaptation approaches are required to increase/maintain resiliences in the near future. Without the implementation of suitable adaptation options, climate change is expected to negatively impact food production, food availability and food access. Food security is at risk especially among subsistence farmers in the tropics and sub-tropics.

Modelling agricultural systems is one approach to understand and identify future agricultural vulnerabilities against climate change at the one hand, and adaptation options on the other hand. Recent studies on future climate impacts on agriculture production emphasised on mean climate change patterns. Vulnerabilities to annual climate fluctuations have rarely been considered, although, they affect food security in general and food stability/persistency in particular.

We assume that climate change impacts are underestimated when relying only upon analysis of mean climate changes. For that reason, our study focuses on changes in the year-to-year crop yield fluctuations due to changing climate variability. We compare these trends with trends in mean yields. Since such impact assessments are strongly influenced by the climate scenario input, we additionally analyse the effect of the large disparities among global circulation models (GCM), emission scenarios and bias correction methods on the crop yield calculations. Therewith, we consider climate uncertainties in the calculation of future agricultural resiliences.

In the study, we apply three state of the art climate models, two emission scenarios and two bias correction methods to drive the dynamic vegetation model LPJmL for the computation of crop yields. From the gridded yield series, we analyse changes in the standard deviation of crop yields (and their means) between the baseline (1971–2000) and the 2050s (2041–2070). We analyse the crop signal robustness (agreement) over the different sets of model runs. Finally, we classify regions in respect to the potential changes of agricultural resiliences. This classification is spatially differentiated and considers the different natures of climate impacts (changing means and changing variability).

The study results can contribute to more effective and efficient adaptation planning to promote resilient farming systems in the future.

Keywords: Climate uncertainty, climate variability, crop modelling, food security

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