

Scientific summary: Climate Change Impacts on Agricultural Vegetation
in Sub-Saharan Africa by Katharina Waha

Agriculture is one of the most important human activities providing food and more agricultural goods for seven billion people around the world and is of special importance in sub-Saharan Africa. The majority of people depends on the agricultural sector for their livelihoods and will suffer from negative climate change impacts on agriculture until the middle and end of the 21st century, even more if weak governments, economic crises or violent conflicts endanger the countries' food security. The impact of temperature increases and changing precipitation patterns on agricultural vegetation motivated this thesis in the first place. Analysing the potentials of reducing negative climate change impacts by adapting crop management to changing climate is a second objective of the thesis.

As a precondition for simulating climate change impacts on agricultural crops with a global crop model first the timing of sowing in the tropics was improved and validated as this is an important factor determining the length and timing of the crops' development phases, the occurrence of water stress and final crop yield. Crop yields are projected to decline in most regions which is evident from the results of this thesis, but the uncertainties that exist in climate projections and in the efficiency of adaptation options because of political, economical or institutional obstacles have to be considered. The effect of temperature increases and changing precipitation patterns on crop yields can be analyzed separately and varies in space across the continent. Southern Africa is clearly the region most susceptible to climate change, especially to precipitation changes. The Sahel north of 13° N and parts of Eastern Africa with short growing seasons below 120 days and limited wet season precipitation of less than 500 mm are also vulnerable to precipitation changes while in most other part of East and Central Africa, in contrast, the effect of temperature increase on crops overbalances the precipitation effect and is most pronounced in a band stretching from Angola to Ethiopia in the 2060s.

The results of this thesis confirm the findings from previous studies on the magnitude of climate change impact on crops in sub-Saharan Africa but beyond that helps to understand the drivers of these changes and the potential of certain management strategies for adaptation in more detail. Crop yield changes depend on the initial growing conditions, on the magnitude of climate change, and on the crop, cropping system and adaptive capacity of African farmers which is only now evident from this comprehensive study for sub-Saharan Africa. Furthermore this study improves the representation of tropical cropping systems in a global crop model and considers the major food crops cultivated in sub-Saharan Africa and climate change impacts throughout the continent.