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Impact of Climate Variability and Land Cover Changes on Agriculture, Biodiversity, and Human Health in West Africa

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Abstract

The vulnerability of West African countries to climate and environmental changes is likely to increase within the next decades as demands on resources continuously rise in association with rapidly growing populations. In addition, there has been a growing awareness of the fact that human-induced environmental changes also raise the risks to human health. In recognition of the societal need for improved prediction of the current and the expected future climate change, and to develop strategies to reduce the socio-economic impact, interdisciplinary research is required. Thus, an integrative multiscale monitoring concept was designed within the framework of the GLOWA Volta and BIOTA West Africa scientific research networks, funded by the Federal German Ministry for Science and Education (BMBF) in cooperation with several counterparts from Burkina Faso, Ghana, Benin, and Côte d'Ivoire. The instrumental monitoring system, described as "Biophysical Observation Network" (BON), combines important features of biophysical ground measurement and remote sensing techniques. The multiscale data collection from the experimental sites is progressively incorporated into a web-based GIS database. The sites are used for comprehensive ground-truth surveys, essential for the assessment of accuracy of classified satellite imagery. Additionally, they serve to build capacity in the region by providing training opportunities for local students and research scientist. This paper presents results and perspectives regarding the impact of weather fluctuations and climate variability on ecosystems, biodiversity, and human health in West Africa. Different scales are considered since the spectrum of processes determining weather conditions in West Africa ranges from the propagation of planetary Rossby waves on the global scale to small-sized changes in land cover on the regional to local scale. Land degradation is associated with changes of biophysical surface properties such as albedo or roughness. These modifications again lead to surface cooling, lowered atmospheric heating rates and reduction in convection. The resulting diminution of surface pressure decreases within the equatorial trough in turn weakens the African monsoon flow and the associated moisture flux convergence finally causing a pronounced decrease in rainfall and evaporation.

Keywords: African monsoon, biodiversity, BIOTA , climate variability, GLOWA Volta, scaling issues

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