Research Application Summary

Assessment of spatio-temporal redistribution of major crops and livestock mobility due to climate change and variability in Uganda

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Abstract

Considering how climate will change over the years offer important insight into how the challenges as result of climate change (CC) and variability can be responded to. Modeling and descriptive studies are being conducted in Uganda to generate information to guide activities geared towards building resilience of agro-pastoralist communities in adapting to and mitigating present and future climate change and variability impacts. Specifically, the study is assessing the performance of different global climate models (GCMs) in the MAGICC/ Scengen tool with the view to obtain the best combination to be used for downscaling and projecting climate change and variability in Uganda, document the past and current responses in most vulnerable farming communities' and to identify the appropriate adjustments to cope with climate related stress. Modeling, focus group discussions and individual interviewing were the main data collection methods used. Data collected were subjected to reduction and development of themes for analysis. The preliminary results show ECHO-G and UKHADCM3 as the best projectors of climate change and variability in Uganda. Furthermore analysis is required to project the likely redistribution of major crops and map the potential pastoral migratory routes under different climate change scenarios.

Key words: Adaptation, climate impacts, climate parameters, livestock mobility, projections, regional models, Uganda

Résumé

Considérant le changement climatique au fil des ans, ceci offre des indications importantes sur la façon dont les défis résultant du changement climatique (CC) et la variabilité

peuvent être résolu. Les études de modèle et de la description sont menées en Ouganda pour générer des informations pour orienter les activités visant à renforcer la flexibilité des communautés agro-pastorales dans l'adaptation et l'atténuation de présents et futurs changements climatiques et la variabilité des impacts. Plus précisément, l'étude est d'évaluer la performance des différents modèles climatiques globaux (MCG) dans l'outil MAGICC / SCENGEN en vue d'obtenir la meilleure combinaison qui sera utilisé pour réduire l'échelle et la projection des changements climatiques et la variabilité en Ouganda, faire la documentation les réponses passées et actuelles dans la plupart des communautés agricoles vulnérables et d'identifier les ajustements nécessaires pour faire face aux stress climatiques connexes. La modélisation, des discussions en groupes visés et des interviews individuels étaient les principales méthodes de collecte de données utilisées. Les données recueillies étaient soumises à la réduction et au développement de thèmes pour l'analyse. Les résultats préliminaires montrent que ECHO-G et UKHADCM3 comme le meilleur des projecteurs du changement climatique et de la variabilité de l'Ouganda. De plus l'analyse est nécessaire pour des projets de redistribution probable des grandes cultures et la carte des potentialités pastorales routes migratoires dans les différents scénarios de changement climatique.

Mots clés: Adaptation, impacts des changements climatiques, les paramètres climatiques, la mobilité du bétail, des projections, des modèles régionaux, l'Ouganda

Background

Though the IPCC and GEC reports (IPCC, 2007) indicate that there is now increasing confidence in predictions of climate change at global level, there is still great uncertainty at regional to local levels, where information is required by policy makers, farmers and other stakeholders to better cope with climate variability and change and devise mechanisms for the latter to overcome growing adaptation deficit (Burton, 2004). For example the entire Uganda is represented by four grids under the GCM outputs as vulnerable yet different agro-ecological zones are experiencing different weather patterns and trends for the last twenty years. It was against this background that this study was undertaken to refine climate vulnerability maps for Uganda in relation to global climate change and variability trends, by integrating local trends imposed by anthropogenic factors, to enhance our understanding on potential impacts of climate change and variability, document the past and current trends in

most vulnerable farming communities' responses to climatic variations and to identify the appropriate adjustments to cope with climate related stress.

Literature Summary

Significant number of studies report that many ecosystems in Uganda essentially face man-induced treats compounded by climate change resulting in a wide range of effects. These effects might work to frustrate efforts to achieve the national Millennium Development Goals focus and thus contribute to the increased entropy of the open cycle poor management-degradation -poverty (Parry *et al*., 2007, Morton, 2007; Brown and Funk, 2008).

In Uganda, both crop cultivation and livestock rearing are largely rain-fed and heavily dependent on the water availability. Therefore, negative climate change and variability impacts are likely to influence the suitability of major crops and livestock mobility patterns and productivity in the country (Twinomugisha, 2005). This is going to aggravate the already fragile conditions of the farmers using degraded natural resource base, and may exacerbate conflicts especially among herding communities. Recent drought in western Uganda, for example, prompted pastoralists to move to Tanzania in search of grazing areas, almost threatening trans-border security. However, the situation can be eased if for the more likely vulnerable communities, ex ante adaptation strategies in mitigating the foreseen impacts are identified and implemented.

Study Description

This study was conducted in Uganda. Uganda is a landlocked country located in East Africa astride the Equator between 4° North and 1° South and stretching from 29.5° to 35.5° East. It has a total area of 241040 km^2, a north-south extent of about 650 km and a maximum east-west extent of about 500km. There are 36 weather observing stations located in different parts of Uganda that provide available data and can be supplemented by satellite data.

Selection of best GCMs projectors for Uganda and data collection. Twenty GCMs within the MAGICC/Scengen software were evaluated based on the precipitation parameter and greenhouse gases as a factor affecting CC. Outputs of individual and combinations of models were spatially and statistically analysed based on the ensemble mean output contribution, root mean square and biasness.

Preliminary Results

Modeling analysis. The best GCMs projectors are CCMA-31, MRI-232A, ECHO-G and UKHACM3. However, ECHO-G and UKHADCM3 are the most relevant to the East African region and Uganda in particular. GCMs are projecting the same general increasing precipitation towards the west by 2050 (see Fig. 1).

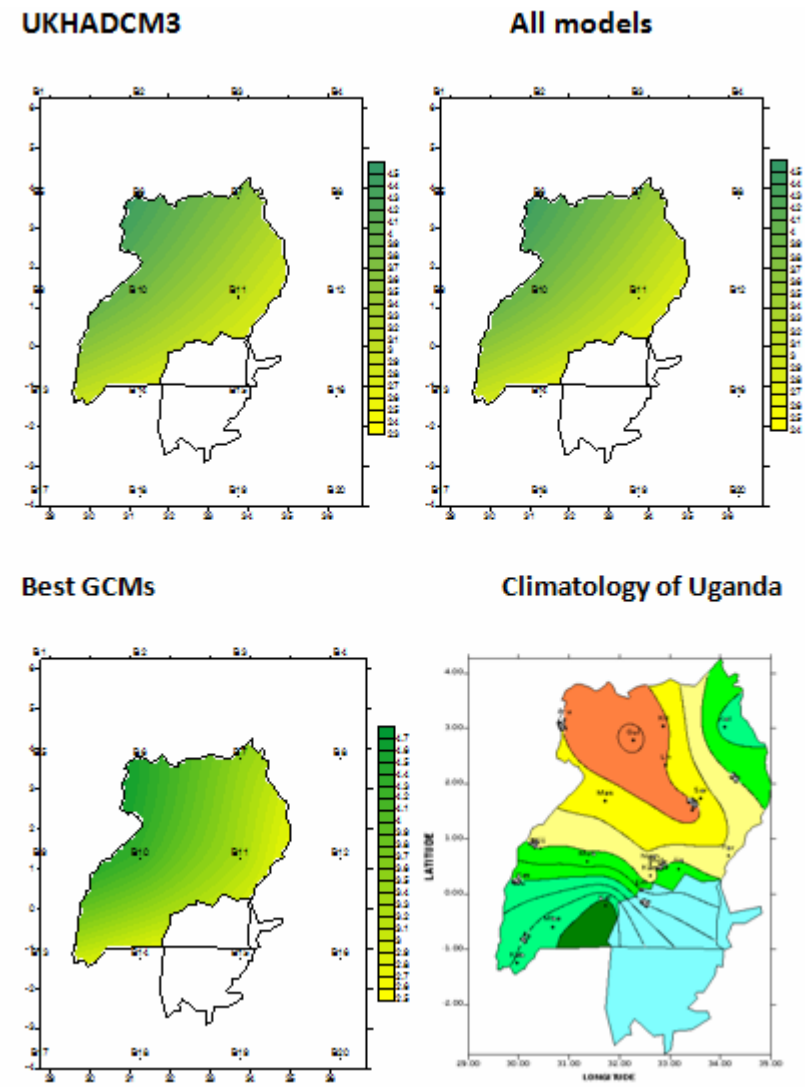

Figure 1. Different precipitation patterns.

Major findings from the preliminary analysis indicate that prolonged and recurrent drought had induced increased trends in trans-boundary diseases among the agro-pastoralists in Uganda. respond to the prolonged drought that render water and grass unavailable, the pastoralists resorted to construction of communal wells and dams, movement from one place to

another, and raring local breeds. Efforts to map the re-distribution of major crops and map the current and simulate the future migratory routes are still underway.

Research Application

The outputs of this research can be used to:

- analyze the future impact to water resources
- Assess inter-annual regional climate variability and predictability.
- Study anomalous regional climate events (floods, droughts, etc.)
- Study water and energy cycles

Recommendation

There is need to:

- enhance local and regional orographic resolution in order to capture all drivers of change in climate and develop accurate model physics for regional and local scales,
- develop new GCMs with flow-dependent anisotropic grids for both regional and global simulations;
- develop forcing products for high resolution atmospheric chemistry, hydrologic, and biosphere models.
- Integrate future impacts and vulnerabilities with socioeconomic data.

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