Climate impact analysis and adaptation strategies to climate change on peanut in Senegal

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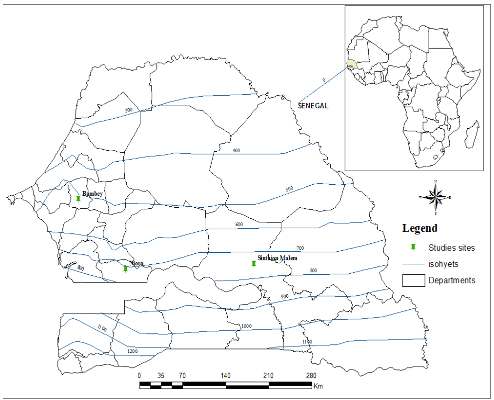
Background and Methodology

Introduction

- In Senegal, agriculture supports 70% of the rural population.
- Peanut constitutes the principal source of agricultural incomes for farmers.
- Climate change is projected to bring drought, together with higher temperature and increased CO_2 (Roudier et al., 2011).
- This study assessed the impacts of climate change on peanut yield and proposed adaptation strategies for Senegal.

Data and methods



The study was conducted in two different locations: **Senegal** in two different locations: ***Bambey***, located at 14°42N and 16°29W and ***Nioro,*** located at 13°45N and 15°46W.

Figure 1. Study area

❖Observed data: Bambey (1981-2014) ; Nioro (1981-2014).

❖Four regional climate models (RCM) used: DMI-HIRHAM5, KNMI-RACMO22T, CLMcom-CCLM4-8-17, SMHI-RCA4.

❖Corrected input:

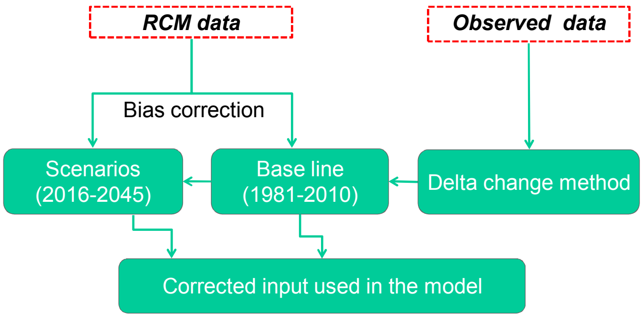


Figure 2. Bias corrected RCMs output used for climate change impact analysis

❖SIMPLACE< Lintul5,DRUNIR,CanopyT, HourlyHeat> was used to simulate daily growth and development for peanut in Senegal.

❖Peanut cultivar: Fleur 11.

❖Evaluation of canopy temperature (Tc) versus air temperature (Ta) to account for interaction of heat stress and crop water status adopted the Monin-Obukhov Similarity Theory method (Webber et al., 2016).

Conclusion

- Climate change may have positive impact on peanut yield in Senegal due to elevated CO_2 levels.
- Interactions between heat stress, drought and elevated CO_2 are still uncertain and need consideration in modelling assessments.
- Current sowing date led to improved yield levels under climate change. Furthermore, short season varieties can be recommended as adaptation strategy to cope with the impact of early rain cessation.

Acknowledgements

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Results

Climate change signal for RCP4.5 and RCP8.5

❑ Decreased precipitation with a high inter-annual variability (Figure 3a).
❑ Increased temperature with a clear difference between RCP4.5 and RCP8.5 from 2050 for the RCMs ensemble (Figure 3b).

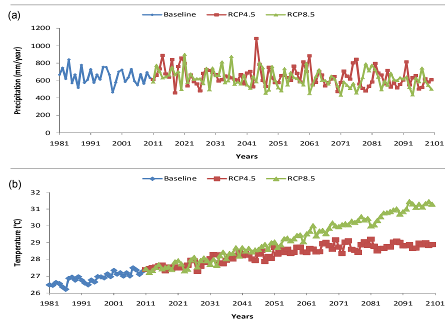

Figure 3. Inter-annual variability of precipitation (a) and temperature (b) (1981-2100) averaged over the RCM ensemble

Effect of CO_2 elevation on simulated yield under dry season

- Maximum yield change went up to -42.1% for RCP4.5 and -55% for RCP8.5 when Ta is used under dry season (Figure 4).
- Positive yield change resulted from the increase in CO_2 concentration. This caused an increasing yield from 9.6% for RCP4.5 to 13.2% for RCP8.5 (Figure 5).

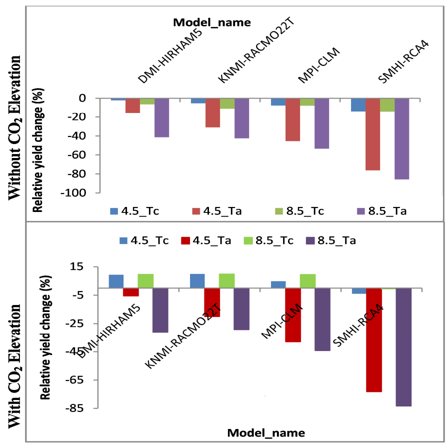

Figure 4. Relative yield change under dry season (irrigation) condition without and with elevation CO_2

Effect of CO_2 elevation on simulated yield under rainy season

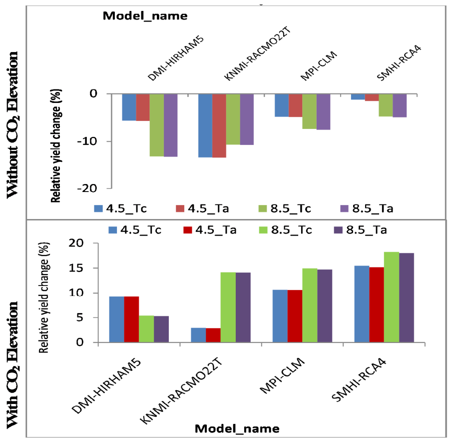

Figure 5. Relative yield change under rainy season condition without and with elevation CO_2

- Negative effects of climate change were greater in dry season than during rainy season.
- Tc should be used instead of Ta to account uncertainty in assessing the impacts of heat in dry season where maximum Ta is above 35°C.

References

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Webber, H., Ewert, F., Kimball, B., Siebert, S., White, J., Wall, G., Ottman, M., Trawally, D., and Gaiser, T. (2016). Simulating canopy temperature for modelling heat stress in cereals. *Environmental Modelling & Software* **77**, 143-155.

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