1. Introduction

- High uncertainties remain on Africa’s terrestrial carbon budget, especially on African’s savanna ecosystems.
- Models simulating carbon dynamics need site level data for calibration and validation. With this goal, the AMMA and CarboAfrica projects had installed few flux towers in Africa, especially in Benin, in the West part of the continent.

2. Objectives

- to estimate the net ecosystem carbon exchange of a Sub-Saharan Savanna in the Western Africa.
- to determine some mechanisms and factors that control the daytime, nighttime and seasonal fluxes in the African’s Savanna.

3. Material and methods

- Cultivated Savanna
- Annual Rainfall: 1 200 mm
- Donga catchment
- 9.74°N, 1.60°E, 449 m
- No Herbs in dry season (burned by farmers).
- Slope: 2%.
- Tropical ferruginous soil

Meteorological data
- Precipitation
- Air temperature
- Relative humidity
- Radiation
- Soil moisture
- Soil temperature

CO2 and H2O fluxes
- Eddy covariance method
- Data: Twenty-one (21) months from 4 August 2007 to 15 May 2009
- Sonic at 4.95 m from ground
- Dominating species: Inventoried

where Fc is the eddy covariance flux and Sc the storage in the canopy

- All data treated following the EUROFLUX methodology (Aubinet et al., 2000).
- Night time CO2 fluxes correction: data selection criterion based on $\alpha_n$ (Acevedo et al., 2008).
- The $\alpha_n$ threshold is 0.12.

4. Results

- Meteorological conditions
  - Sudanian climate: One dry season (November to March) and one rainy season (April to October)
  - Mean annual rainfall: 1209 mm
  - Mean annual temperature: 25.3 °C
  - Inter-tropical zone: 2 maxima (and minima) PPFD
  - After rain, soil moisture decrease rapidly
  - Winds: SW about 10 months (mainly in wet season), NE in HARMATTAN (December to January)

- Diurnal courses of CO2 fluxes

  - Different responses according to the season
  - Wet season: high CO2 assimilation (max 22 µmol m$^{-2}$ s$^{-1}$)
  - Dry season: Very small CO2 assimilation (max 2 µmol m$^{-2}$ s$^{-1}$) due to the small amount of vegetation.
  - Higher Dsat, Tair, PPFD and NEE at noon than early morning and later afternoon.
  - Very low impact of Dsat and Tair.

- Response of daytime CO2 flux to PPFD

  - TERd, $A_{1000}$ and $\alpha$ are higher in wet season (5; 21; 0.08) than dry season (<1; <3; <0.01)
  - No impact of Tsoil and wind speed
  - Impact of Hour, wind direction and low of Dsat, Tair,

5. Conclusion

- Response to PPFD: PPFD controls daily variation of CO2 assimilation.
- Response to season: Water controls mainly the ecosystem dynamics at seasonal scale, assimilation being very small (< 3 µmol m$^{-2}$ s$^{-1}$) in dry season and going up to 22 µmol m$^{-2}$ s$^{-1}$ in the wet season.
- Impact: Very low impact of saturation deficit and temperature was found on CO2 flux neither in dry nor in wet seasons.
- Time of the day: An asymmetry in the flux response to PPFD was found that cannot be explained by the classical flux response to meteorological conditions.

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