Precipitation chemical composition and atmospheric nitrogen deposition in the lake Victoria catchment (East Africa)

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Abstract

In the framework of the CASAQUE and INMS projects, measurements of the precipitation chemical composition were initiated in 2017 over a two-year period in Mbita (Kenya). This work emphasized that the nitrogenous contribution is predominant and represent about half of the total precipitation chemical content. The annual nitrogen wet deposition flux is about 6 to 8 kgN.ha^{-1}.yr^{-1}. This study constitutes a unique database for the INMS demonstration region of East Africa documenting for the first time the nitrogen deposition in the lake Victoria basin.

Keywords: precipitation chemistry, nitrogen wet deposition, lake Victoria basin, Kenya, East Africa

1. Introduction

In Africa it is expected that Nitrogen (N) deposition to ecosystems will increase by 50% by 2100, especially through wet deposition, due to changes in climate, land uses and atmospheric concentrations. Currently, experimental studies conducted in the African continent remain scarce and scattered. Furthermore, the impact of nitrogen management and nitrogen deposition in Africa has become a major societal challenge related to food security, global change and biodiversity loss.

2. Context of the study and Site description

Precipitation sampling was initiated at the site of Mbita (Kenya: 0.44°S, 34.18°E) in may 2017 witin the framework of the CASAQUE and the INMS projects. This site is part of the east African demonstration area of INMS and is representative of the lake Victoria basin including natural grasslands and agricultural soils.

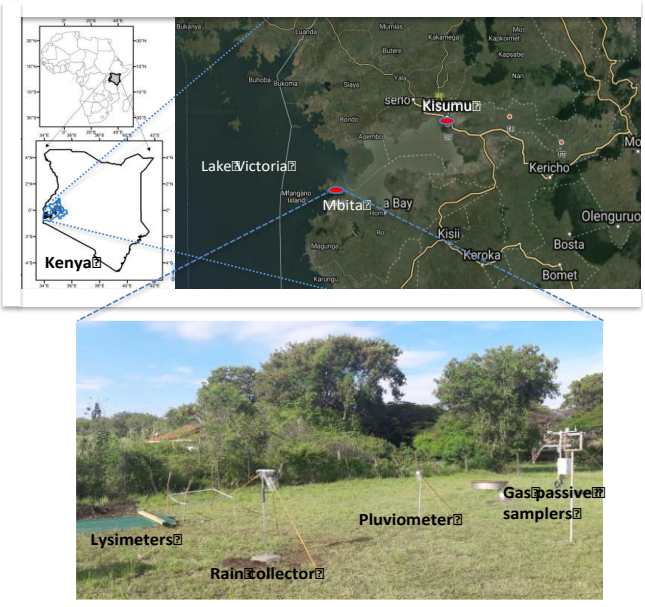

Fig. 1: Mbita site –ICIPE campus (Kenya)

Annual mean rainfall is about 1100 mm (2017-2018) with two wet seasons, a main one from February to May and a minor one from October to December.

3. Precipitation chemical composition and N wet deposition

Rain samples were collected evently over a two year period 2017-2019 accounting for a total of about 200 samples. Major ionorganic and organic ions were determined by ionic chromatography according to the reference protocols of the International Network to study Deposition and Atmospheric chemistry in AFrica (INDAAF).

The nitrogen contribution represents about 42% of the total: 33% as reduced form (NH_4^+) and 9% as oxidized form (NO_3^-), followed by the terrigeneous contribution represented by calcium, magnesium and potassium (25%). Annual wet deposition of inorganic nitrogen was estimated to be 6 to 8 $kgN.ha^{-1}.yr^{-1}$. The N deposition budget will be completed with on-going measurements of dissolved organic nitrogen.

4. Discussion and conclusion

The impact of nitrogen management and deposition in Africa is mostly unknown. The lake Victoria basin supports one of the densest and poorest rural populations in the world, with a total population of 30 million inhabitants. It is thus a key issue to infer a regional N budget in this region to improve N management and reduce its environmental impacts. This study provides for the first time a measured N wet atmospheric deposition, which was a major gap in the estimation of the N budget in the region.

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