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Wind erosion in Western Sahel : Quantifying the impact of land use and land management

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It is currently estimated that around 15% of the global mineral dust load comes from the Sahel. In this area, rainfed agriculture and livestock grazing play a crucial role in the livelihood of its rapidly growing population. Cropland is likely to be a main source of anthropogenic dust emissions in this region, as this land use type can favor wind erosion if land management deprives the soil of vegetation cover.

Yet, *in situ* measurements of wind erosion fluxes are scarce in the Sahel, and usually monitor only one type of land use and an associated land management (eg. whether or not to harvest crop residues, intercropping, etc.). Thus, there is room to improve the assessment of the Sahelian anthropogenic contribution to the global dust load, especially through a regional modelling approach relying on field measurements.

In this study, we combined *in situ* measurements from Sahelian Senegal with a modelling approach to estimate the effect of the main Sahelian land uses on wind erosion. Furthermore, we monitored contrasting land management per land use, representative of the last decades (1960-2020). Here we present the results for one groundnut field over two years (2020-2021), four different fallowed fields over one year (2022/2023), four millet fields over one year (2023/2024). All 1ha-plots were located near the town of Bambey in central Senegal (Groundnut Basin). The observations included sand-traps monitoring (for each 1ha-plot, 5 masts of 5 « Modified Wilson

And Cooke » or MWAC sand traps each; collected every 2 weeks), meteorological data (e.g., wind and temperature profiles, and rainfall; at 5-minutes resolution) and vegetation monitoring (aboveground biomass, surface cover, height; weekly to monthly).

For each land use and land management, we estimated the aerodynamic surface roughness length and the wind friction velocity to simulate the horizontal flux of aeolian sediments using a dedicated model (the Dust Production Model – DPM). We then combined the wind erosion model (DPM) with vegetation models (STEP for fallows and STICS for crops) to simulate the vegetation growth and the associated horizontal flux of aeolian sediment. These simulations are compared to the *in situ* monitoring from the sand traps. Finally, we used ERA5 meteorological time series from the ECMWF to simulate the horizontal flux for the 1960–2020 period over a typical plot from the study area, for different realistic scenarios of land uses and land management.

Our study revealed the variability of wind erosion horizontal flux for the main Sahelian land use types (400 kg/m/yr for bare soil, 200 kg/m/yr for cropland, less than 10kg/m/yr for fallows), as well as slighter differences related to land management for a same land use. These results help to understand the link between wind erosion and agropastoral practices in Sahelian conditions over multi-decadal periods of time.