



**HAL**  
open science

## Spatio-temporal analysis of soil surface hydraulic properties in a semi-arid agroforestry system of the Senegalese groundnut basin

Waly Faye, Didier Orange, Seydou Talla, Frederic Do, Christophe Jourdan, Olivier Roupsard, Abdoulaye Faty, Awa Niang, Alioune Kane, Simone Di Prima, et al.

### ► To cite this version:

Waly Faye, Didier Orange, Seydou Talla, Frederic Do, Christophe Jourdan, et al.. Spatio-temporal analysis of soil surface hydraulic properties in a semi-arid agroforestry system of the Senegalese groundnut basin. EGU General Assembly 2023, Apr 2023, Vienne, Austria. 10.5194/egusphere-egu23-16621 . hal-04485438

**HAL Id: hal-04485438**

**<https://hal.uvsq.fr/hal-04485438>**

Submitted on 1 Mar 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License



## Spatio-temporal analysis of soil surface hydraulic properties in a semi-arid agroforestry system of the Senegalese groundnut basin

**Waly Faye**<sup>1,2,3</sup>, Didier Orange<sup>3,4</sup>, Seydou Talla<sup>1,3</sup>, Frederic Do<sup>3,4</sup>, Christophe Jourdan<sup>3,5,6</sup>, Olivier Roupsard<sup>3,5,6</sup>, Abdoulaye Faty<sup>1,2</sup>, Awa Niang<sup>1,2</sup>, Alioune Kane<sup>1,2</sup>, Simone Di prima<sup>7,8</sup>, Raphael Angulo-Jaramillo<sup>7</sup>, and Laurent Lassabatere<sup>7</sup>

<sup>1</sup>UCAD, Dakar, (Sénégal)

<sup>2</sup>UMI Source, IRD, BP 1386, CP18524, Dakar (Sénégal)

<sup>3</sup>LMI IESOL, IRD, ISRA, BP 1386, CP18524, Dakar (Sénégal)

<sup>4</sup>IRD, UMR Eco&Sols, Univ. Montpellier, IRD, CIRAD, INRAe, Institut Agro Montpellier (France)

<sup>5</sup>CIRAD, UMR Eco&Sols, Univ. Montpellier, IRD, CIRAD, INRAe, Institut Agro Montpellier (France)

<sup>6</sup>CIRAD, UMR Eco&Sols, BP 1386, CP18524, Dakar (Sénégal)

<sup>7</sup>Université de Lyon ; UMR5023 Ecologie des Hydrosystèmes Naturels et Anthropisés, CNRS, ENTPE, Univ. Lyon 1, Vaulx-en-Velin (France)

<sup>8</sup>Dipartimento di Agraria, University of Sassari, Viale Italia, 39A, 07100 Sassari (Italy)

In Senegal, the groundnut basin is the main agricultural region under a semi-arid climate, heavily cultivated in an agrarian system combining agricultural rotation and agroforestry dominated by *Faidherbia albida* trees. The soils of the groundnut basin, essentially sandy, have a low water retention capacity. In this area, water is a limiting factor, and the climate variability represents an additional constraint on an already precarious agricultural production system. It is therefore essential to improve knowledge on water saving practices and soil humidity dynamics. The management of water resources in agricultural fields requires reliable information about soil hydraulic properties, which control the partition of rainfall into infiltration and runoff, and their spatio-temporal variability.

To investigate the variability of soil hydraulic parameters we have carried out infiltration measurement in open space without tree and below tree canopies. A total of 24 infiltration measurements were carried out using an automatic single-ring infiltrometer in the nearby of each plot (4 measurements × 6 plots), and after removing the first 10 cm of uncompacted sand. The infiltration tests were carried out in June, October and December, respectively before, during and after the crop season. We used the Beerkan Estimation of Soil Transfer Parameters (BEST) method to retrieve the soil hydraulic parameters from infiltrometer data and field measurements of soil porosity, initial and saturated soil water contents and soil bulk density.

The statistical analysis of the data showed a high variability during the cultivating period, both in time and space, especially of the saturated soil hydraulic conductivity  $K_s$ . However, the  $K_s$  seems higher under tree cover, around 0.186 mm/s, for 0.167mm/s without any tree canopy influence. Despite the expected homogeneity of the investigated sandy soil, the presence of the perennials

triggered a patchy distribution of soil hydraulic conditions. These preliminary results evidenced the importance of taking into account parameters variability and landscape structure when simulating soil water dynamics in the Senegalese groundnut basin.