TEMPORAL SOIL MOISTURE CHANGES UNDER DIFFERENT LAND USES IN THE BRAZILIAN CERRADO

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ABSTRACT

Soil moisture is a key component of the hydrological cycle, which determines runoff generation and groundwater recharge. For the past decades, the Brazilian cerrado has experienced significant loss of its natural landscapes due to pressures of food and energy production (e.g. sugarcane and pasture). Understanding the impacts of such activities on soil moisture is paramount. In this context, three soil moisture sensors were installed in a 30 cm depth in an experimental area. The instruments were placed in different land covers: natural cerrado, pasture and sugarcane. Thus, this study aimed to verify the influence of land cover on the soil moisture monitoring scheme by using observations collected during a period of two years in an experimental area inside Brazilian cerrado biome.

Keywords: land cover, soil moisture, sugarcane, pasture.

RESUMO

A umidade do solo é componente chave do ciclo hidrológico, podendo determinar a geração de escoamento superficial e permitir a recarga de aquíferos. Nas últimas décadas, o cerrado brasileiro vem perdendo áreas significativas de paisagens naturais por causa da pressão causada pela produção de alimentos e energia. (ex. cana-de-açúcar e pastagem). É fundamental que os impactos causados por essas atividades sejam melhores compreendidos. Neste contexto, três sensores de umidade do solo foram instalados numa profundidade de 30 cm numa área experimental. Cada instrumento foi colocado numa cobertura do solo diferente: cerrado natural, pastagem e cana-de-açúcar. Assim, o objetivo deste trabalho foi investigar a influencia da cobertura na umidade do solo através de observações realizadas num período de dois anos.

Palavras-chave: cobertura do solo, umidade do solo, cana-de-açúcar, pastagem.

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1. INTRODUCTION

Monitoring soil moisture is very important as it can be considered in studies involving agronomic, hydrological, pedological and environmental issues. Thus, the variability of vegetation and land use can influence the soil moisture dynamics both directly and through the interaction with soil properties, mainly when intermediate and dry soil moisture conditions happen [1]. In addition, the land use heterogeneity can increase the spatial variability of soil moisture [2, 3].

Besides, cerrado is a large and important economic and environmental region that is experiencing significant loss of its natural landscapes due to pressures of food and energy production (e.g. sugarcane and pasture) [4]. Hence, changes on soil moisture when natural biomes such as cerrado are replaced by pasture or sugarcane crops must be studied. Therefore, we aimed to verify the influence of land use on the soil moisture monitoring scheme by using observations collected during a period of 2 years in an experimental area inside Brazilian cerrado biome.

2. METHODS

2.1. Study area and measurements

The soil moisture measurements were carried out on three land uses (natural cerrado, pasture and sugarcane) distributed in two sites located in São Paulo central region (Itirapina municipality), southeast Brazil (Figure 1). The soil moisture sensor (Sentek, EnvironSCAN Probe) was calibrated and installed in a 30 cm depth. The monitoring period was along 2 years (2013-2014) and we performed daily soil moisture measurements.

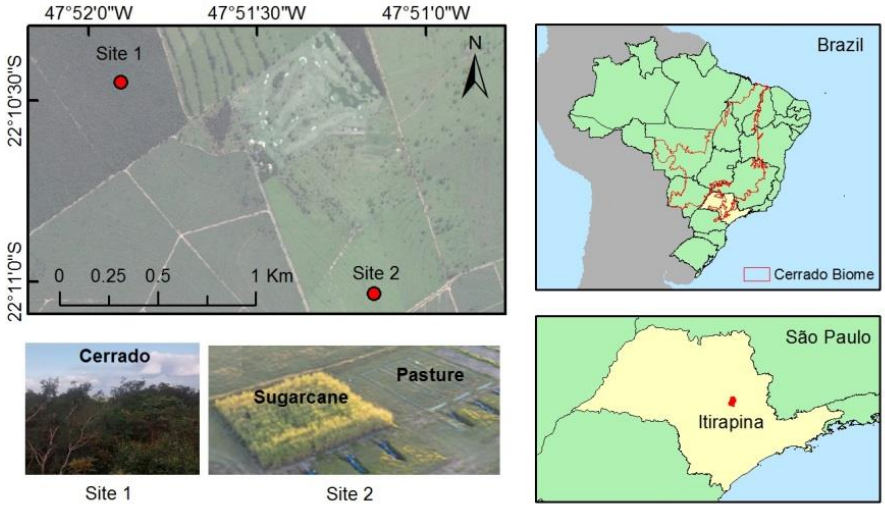

Figure 1. Study area with the location of the sampling sites.

The region is characterized by a subtropical climate, with precipitation occurring mostly in the summer period. The average annual precipitation is ~1500 mm. The soil class according to the Brazilian soil classification system is RQo (*Neossolo Quartzarênico órtico*), an entisol, with sand texture (85.7% sand, 1.7% silt, and 12.6% clay), and bulk density of 1.7 g cm^{-3} [4].

2.2. Data analysis

In statistics, we assumed that the samples were not driven by a normal distribution using a confidence interval of 95% (Shapiro-Wilk normality test). However, Brocca *et al.* [5] states that soil moisture data is usually normally distributed. In order to compare the soil moisture values measured in different land uses we used the non-parametric Kruskal-Wallis test.

3. RESULTS

In a significance level of 5%, soil moisture is different between the monitored land uses. However, in a multiple comparison approach, we observed that measurements did not showed significant difference between sugarcane and cerrado treatments. Figure 2 shows the main statistical properties of each sampling site. Cerrado showed the highest values and variation between measures and pasture the lowest ones. Brocca *et al.* [5] observed that the topography can influence in soil moisture values, and in this study, we had the same topographic condition in the three sampling points (flat areas).

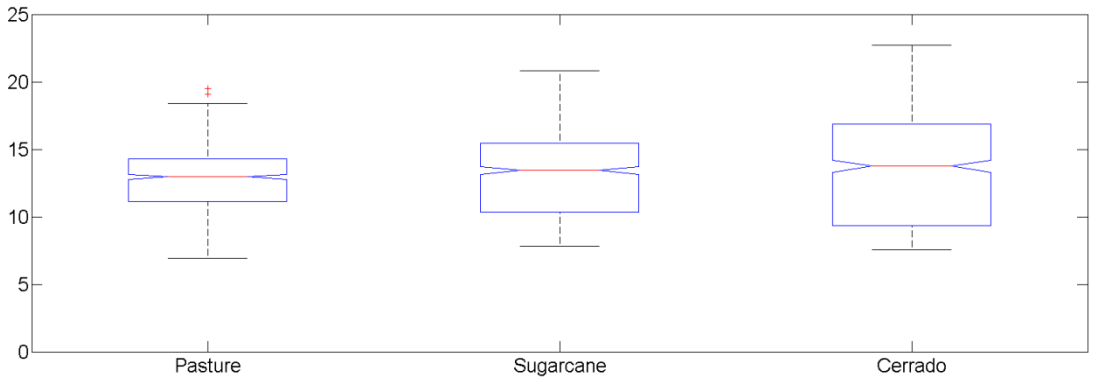

Figure 2. Soil moisture dataset box-plot.

The time series of soil moisture in each land use are shown in Figure 3. The same trend could be observed along the time series, as the site containing cerrado has almost always the highest values while pasture has the lowest. However, during the dry season (June-October), the pasture and, sometimes, sugarcane soil moisture values did not

increased after a rainfall. Different from results showed by Zucco *et al.* [2], where no trends could be observed along the monitoring period.

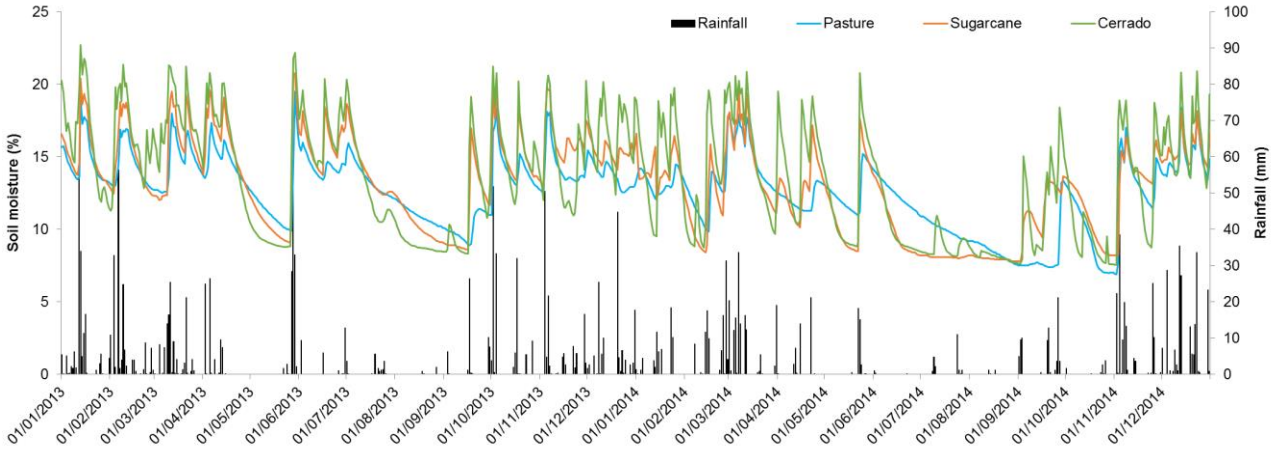

Figure 3. Time series of field daily-mean soil moisture and daily rainfall.

4. CONCLUSIONS

For the three sites analyzed in this study, the main differences on soil moisture measurements are linked to their land covers. However, sugarcane and cerrado soil moisture datasets have no statistically difference. During the dry season (June-September), the pasture and, sometimes, sugarcane soil moisture measurements do not increase with the occurrence of rainfall.

5. REFERENCES

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