

Are dew measurements relevant for forest litter interception on a Cerrado woodland forest?

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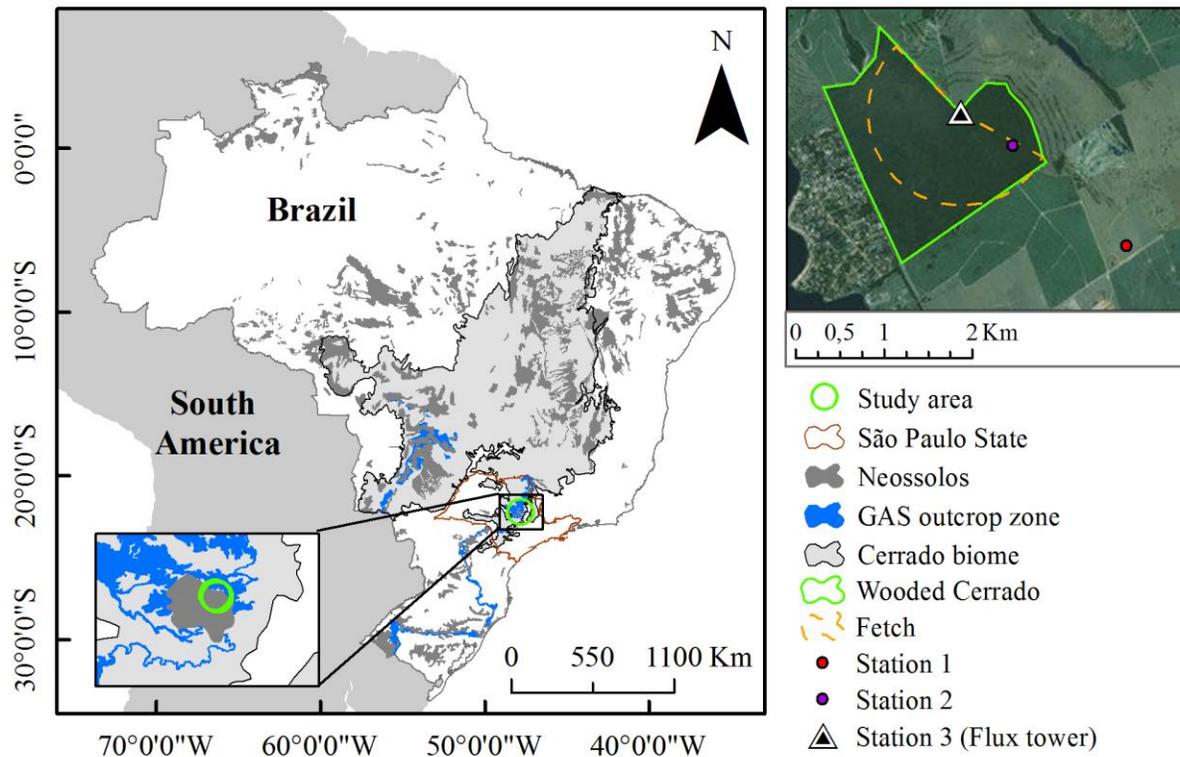
Session HS10.3 Water, isotope and solute fluxes in the soil-plant-atmosphere interface: Investigations from the canopy to the root zone



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Study area

To improve the water balance for Cerrado woodland areas the interception process has been studied in the study area since 2017.



The field monitoring includes the forest litter interception measures through a device developed such measurements.

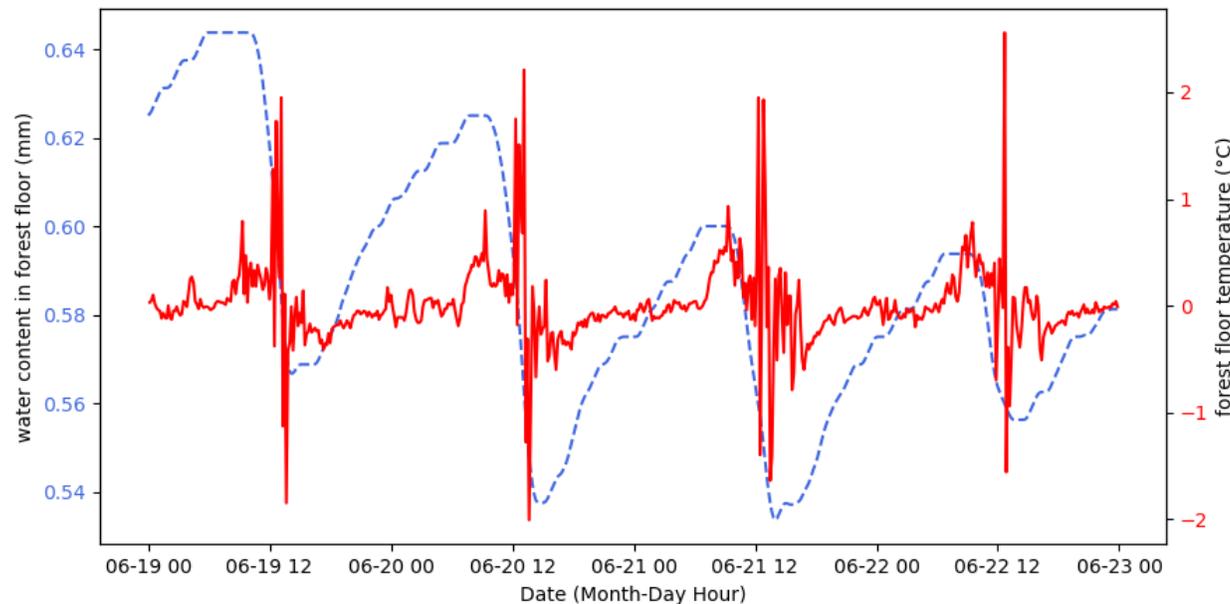


Two devices were installed in the study area and measures of the weight of forest floor samples are collected each 10 min. These devices allow monitoring the water loss (evaporation) and the water gain (water stored in rainfall events or the litterfall deposited).

Motivation

The monitoring results indicated a recurrent water gain during the night periods and sometimes some small infiltration records (water drained from the forest litter sample on the device)

The load cell error due to temperature's effect was tested in the laboratory ($\pm 3 \text{ g}/10^\circ\text{C}$) and it doesn't explain the total weight gained in some night periods.



As it could be dew happening and falling over the forest floor, we verified this hypothesis.

We used some meteorological data and the data of the water content in the forest litter among July/2017 up to June/2019 to check if the increased weight observed occurred when the dewpoint temperature was reached.

Approach

- Air temperature (°C) and relative humidity (%) above the canopy: sensor HMP45C
- Forest litter temperature (°C): a thermocouple installed in the middle of a forest litter sample
- Rainfall (mm): one pluviograph Hydrological Services TB4
- Solar radiation (MJ/m²): Kipp & Zonen CMP3 sensor

Dew analysis

Step by step of the calculus:

1) Calculate the T_d (°C) for each 10 min

$$RH = \frac{e}{e^*} \quad e = 611 \cdot \exp\left(\frac{17.27 T_d}{T_d + 237}\right)$$

e^* : Saturation vapor pressure; e : Actual vapor pressure;
 T_d : Dewpoint temperature

2) Separation of dataset according to sunrise and sunset times

3) Checking if T_d was reached from compare to the forest floor temperature (T_f)

The following condition was assumed:

$$\text{abs}(T_f - T_d) < 3$$

4) Other conditions:

- If a storm event happened the storm period plus 3h forward was disregarded in this analysis;
- For the night period in analysis, if between the start and the end of the night period the T_f's oscillation was greater than 8 °C, this night period was disregarded.

Forest floor storage capacity

The forest floor storage capacity (S_f) was determined from a plot of gross rainfall versus throughfall for individual storms greater than 1.5 mm (Gash and Morton, 1978).

The S_f values obtained were used to estimate the average values of mean and maximum values for each season of the year.

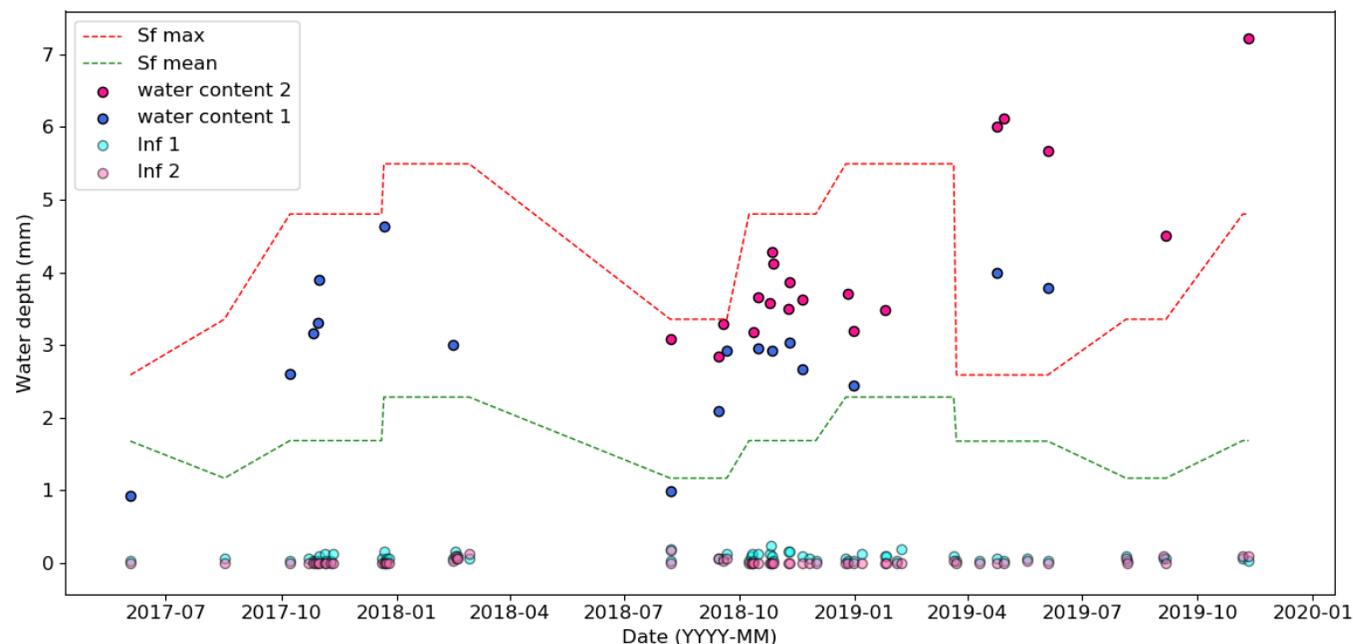
Results

Period	Dew volume (mm)	Forest litter evaporation (mm)	Dew volume related to forest litter evaporation (%)	Total rainfall (mm)
2017-07 : 2018-06	3.64*	160.87*	2.2	1091.67
2018-07 : 2019-06	5.94 (± 0.17)	135.61 (± 9.17)	4.3	1171.98

*Data from one device only.

Average Sf values for each season of the year

Season	Mean values of Sf (mm)	Maximum values of Sf (mm)
Autumn	1.675	2.587
Winter	1.166	3.353
Spring	1.683	4.802
Summer	2.282	5.492



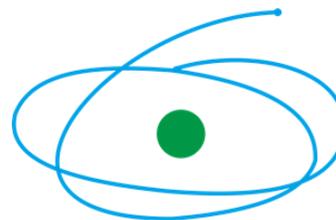
Sf max and Sf mean: Average values of the maximum and mean storage capacities for each season year. Inf 1 and 2: correspond to the infiltration monitored into two devices. Water content 1 and 2: the water retained in the forest litter plus the dew volume to the two devices installed in the field.

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