Large Scale Biosphere-Atmosphere Experiment in Amazonia

III Scientific Conference

Validation of a soil moisture model for pasture in Rondônia, Brazil.

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ABSTRACT

The objective of this study is to validate the soil moisture model using the field data obtained during the LBA experiment. The daily data of the soil water storage were collected at Fazenda Nossa Senhora (10°45'S e 62°22'W), Ji-Paraná, Rondônia, Brazil, during the period 2000 - 2002. Based on this data, the mean monthly soil water storage for the experimental location was estimated and compared with the model results. The correlation coefficients between the model results and the observation for the year 2000, 2001, and 2002 were 0.80, 0.91 and 0.96, respectively.

INTRODUCTION

Soil moisture is a key variable in soil-atmosphere transfer processes. It can be measured by direct and indirect techniques. Those methods are time consuming and impractical over large areas, such as Brazil. For this reason, Rossato (2001) developed water balance model for estimating soil moisture in Brazil based on the supposition that soil moisture is a function of water storage in the soil, available for the plants, the precipitation and the potential evapotranspiration of the vegetative cover. To estimate the mean monthly water balance for the period 1971 - 1990, the pedological and meteorological information was interpolated by using different spatial and temporal resolutions.

OBJECTIVE

- The objective of this work is to validate the soil moisture model using the field data obtained during the LBA experiment. The daily data of the soil water storage were collected at Fazenda Nossa Senhora (10°45'S e 62°22'W), Ji-Paraná, Rondônia, Brazil, during the period 2000 – 2002.

MATERIAL AND METHODS

1. Soil moisture model

$$S_{t+1} = S_t + PRE_t - ETR_t$$

A = water storage in the soil, available for the plants (mm),

PRE = precipitation (mm)

ETR = real evapotranspiration vegetative cover (mm).

t = time.

1.1 Water soil storage

The soil water storage in the soil was calculated from the field capacity and wilting point using pedo-transfer functions (PTFs). PTF allows the estimation of soil hydraulic properties from basic soil data (Figure 1), such as texture , organic carbon and bulk density.

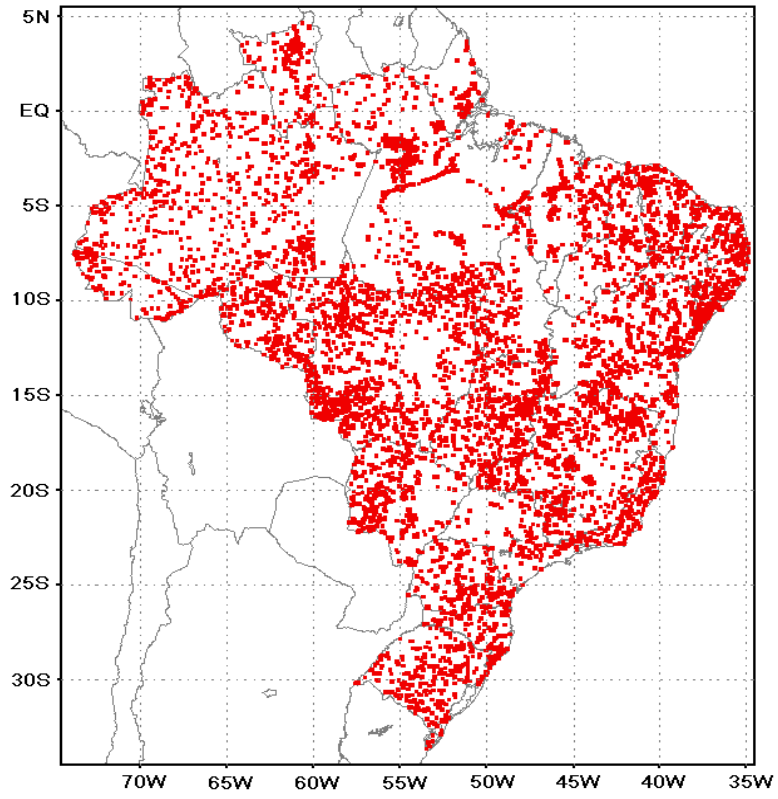


Fig. 1: Localization of the soil properties in the Brazil.

1.2 Precipitation Data

- The precipitation data was extracted from the ANEEL, SUDENE, DAEE e SIMEPAR (Figure 2).

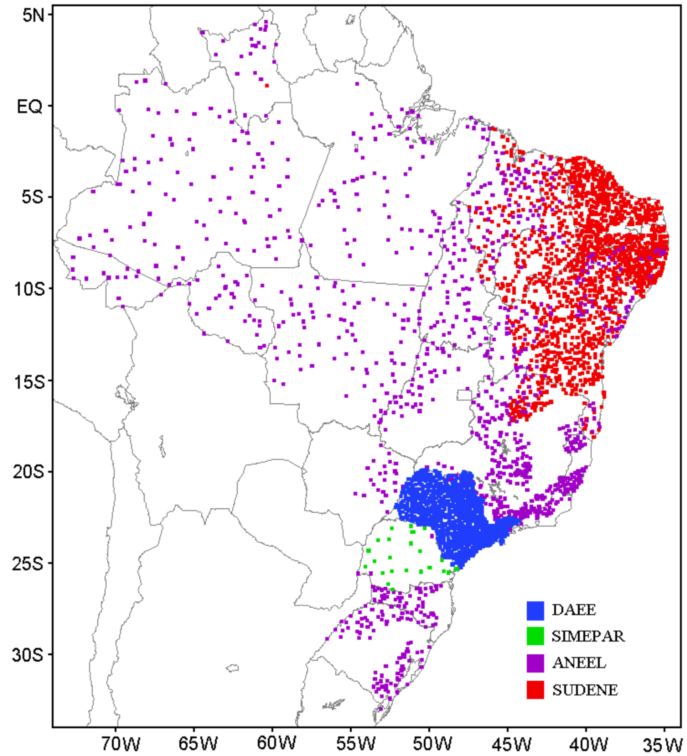


Fig. 2: Localization pluviometrics stations.

1.3 Evapotranspiration

The evapotranspiration was estimated using the Penman-Monteith method. Based on the vegetation parameters provided by the SiB model, the potential evapotranspiration was calculated for the main Brazilian biomes, as defined in SSiB (Figure 3).

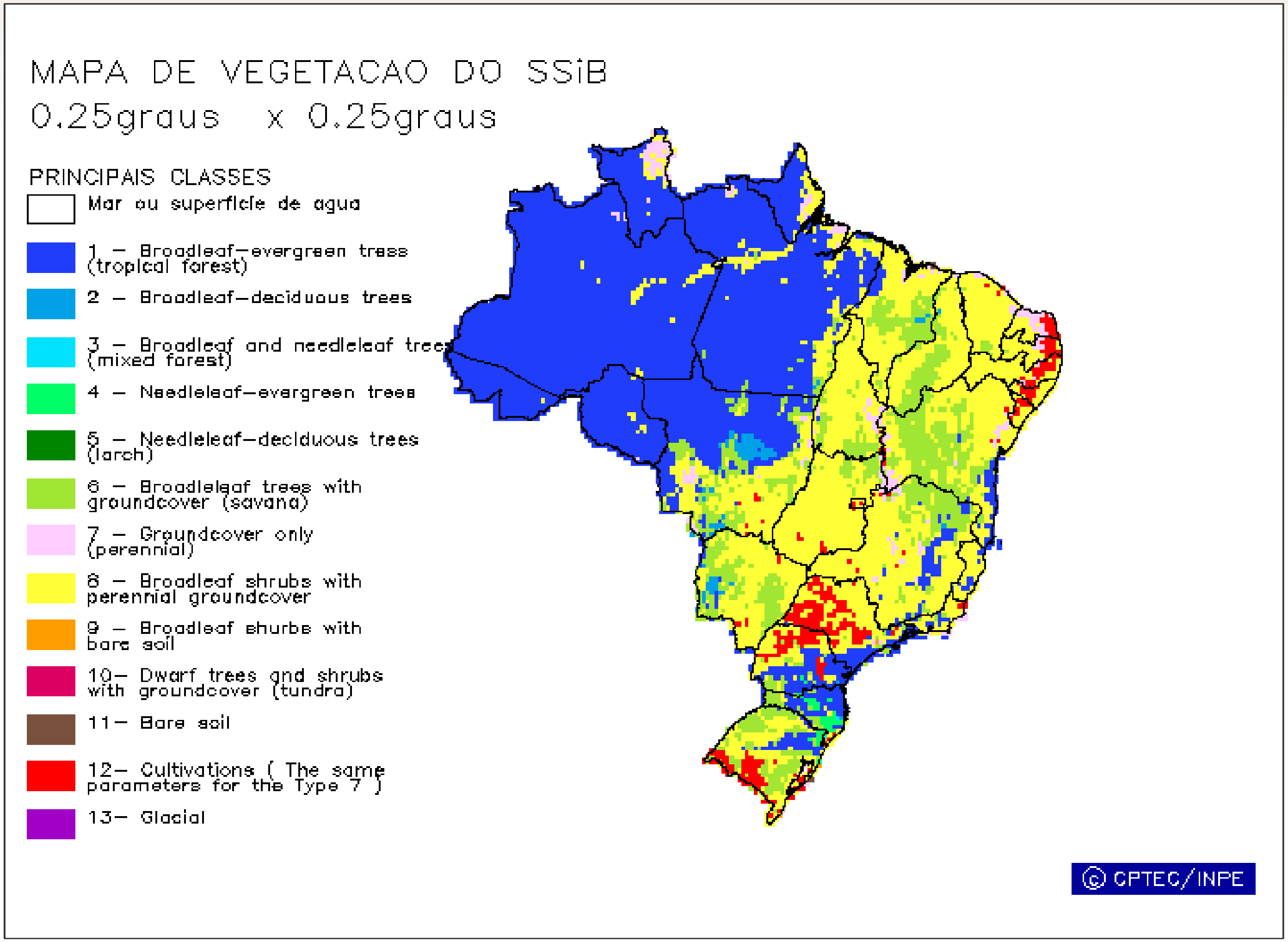


Fig. 3: Vegetation map SSiB.

2. Validation of the soil moisture model

- The soil moisture model was validated considering the daily data of the soil water storage were collected at Fazenda Nossa Senhora (10°45'S e 62°22'W), Ji-Paraná, Rondônia, Brazil (Figure 4), during the period 2000-2002.

- Soil water content were measured using a neutron probe, whose readings werw made at 0.1 m, 0.2 m and at 0.2 m intervals until 2.6 m.

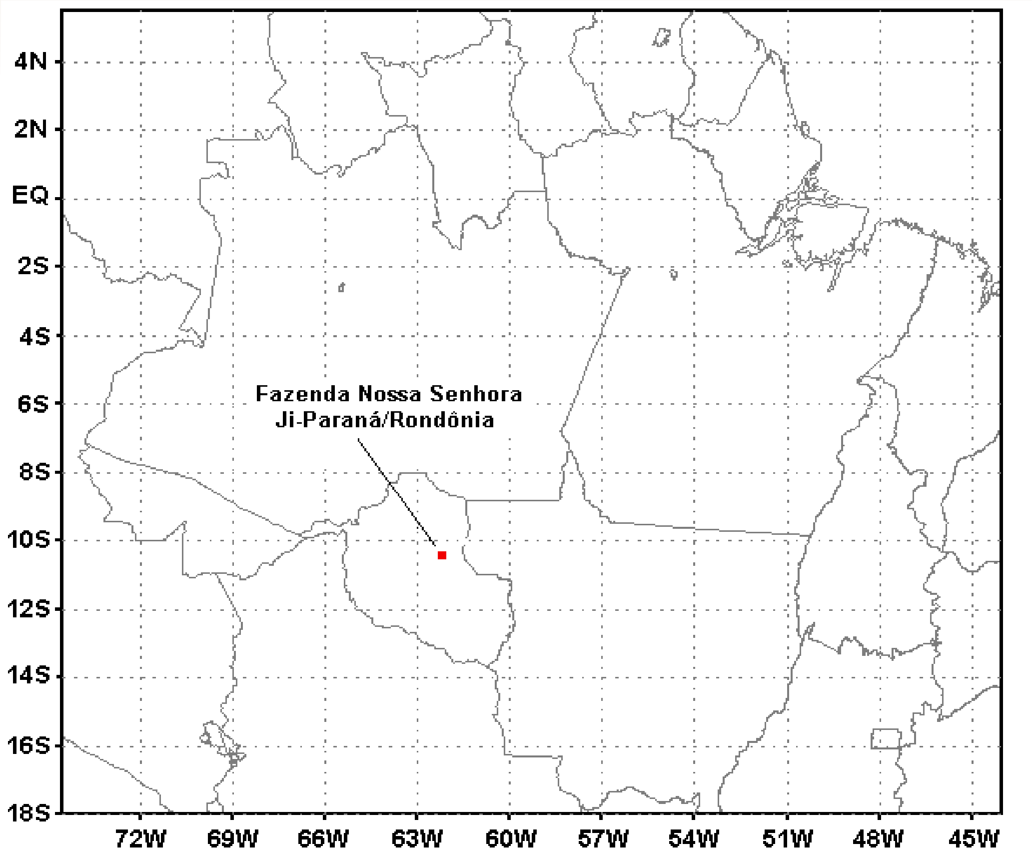
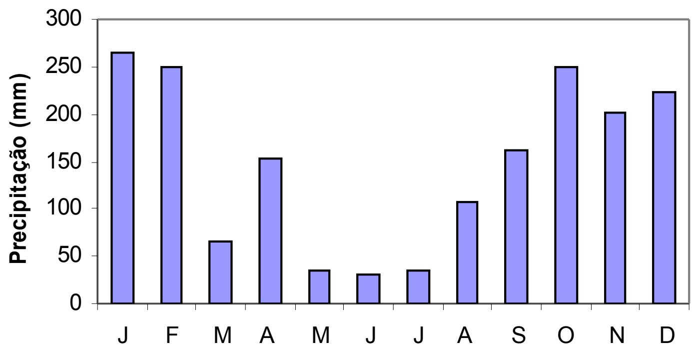


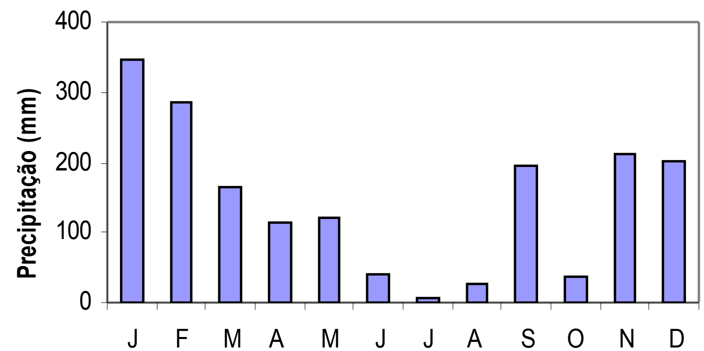
Fig. 4: Localization of the study area.

Considering that the soil moisture is the result of the precipitation and evapotranspiration, the Figure shown the rainfall change during 2000-2002.

a)



b)



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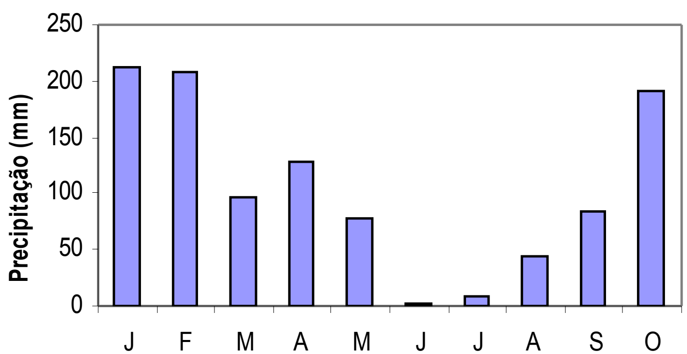


Fig. 5: Accumulated precipitation: a) 2000; b)2001 and c) 2002.

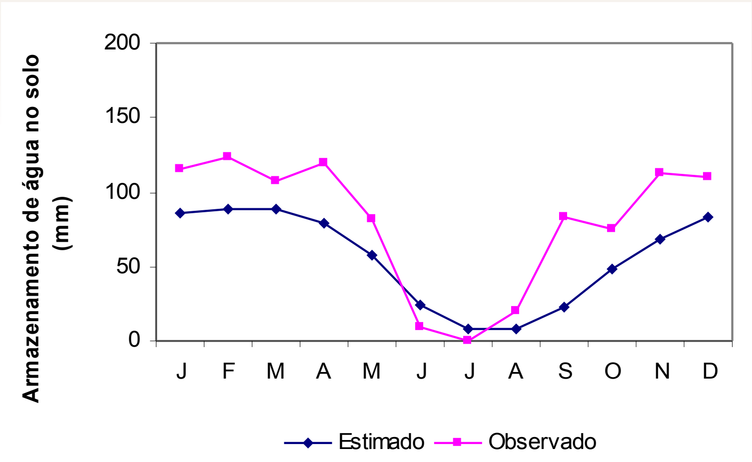
RESULTS

- The mean monthly soil water storage for the experimental location was estimated and compared with the model results;

- The Figure 6 shown the variation curve of the soil water storage estimated by the model and the field observation;

- In the pasture, the correlation coefficients between the model results and the observation for the year 2000, 2001, and 2002 were 0.91, 0.88 and 0.94, respectively.

a)



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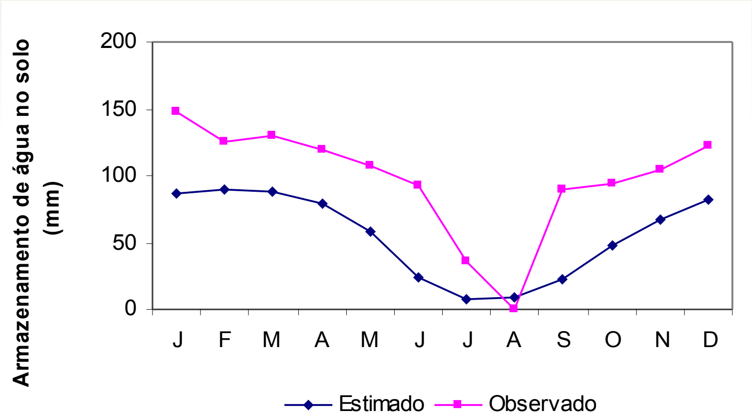

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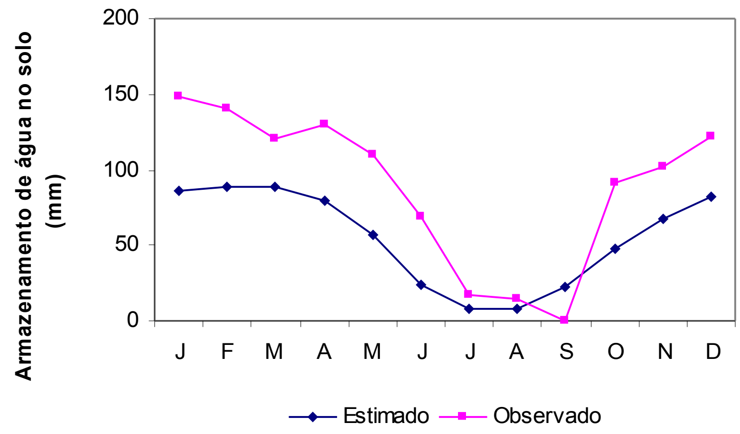

Fig. 6: Mean soil water storage estimated by the model and the field observation: a) 2000; b)2001 and c) 2002.

CONCLUSIONS

The percentage variation curve of the soil water storage estimated by the model and the field observation are quite similar and although the correlation coefficient for the year 2000 was not very high, one can conclude that the model estimates were representative of the observed soil moisture storage for the region and the period of this study.

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