



2014 International SWAT Conference
Porto de Galinhas - PE

Impacts of using different soil databases on streamflow simulation in the Pípiripau river basin

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INTRODUCTION

- Tropical soils have peculiar hydrological characteristics

For example:

Oxisols → high ammounts of clay → high permeability



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INTRODUCTION

- Reduce inputs uncertainties improving the models physical basis

This is important for:

- Cenarious studies
- Climate change studies
- Studies on unggaged basins



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INTRODUCTION

- The purpose of this study was to analyze the influence of the soil database on streamflow simulation using SWAT model in a predominantly agricultural river basin.



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STUDY AREA

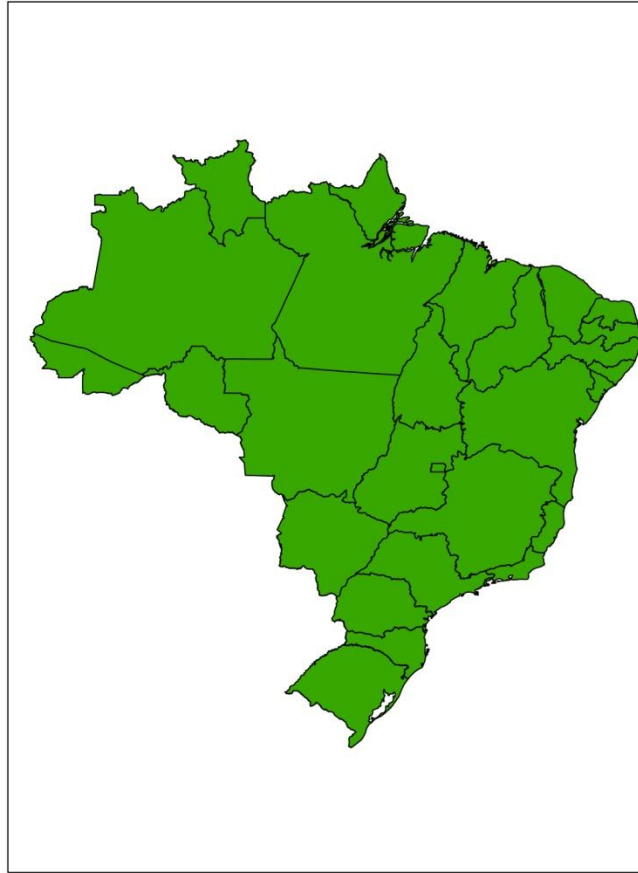
Pipiripau river basin

- An experimental rural catchment of the Brazilian savanna (Cerrado biome)
- 90% in the northeast of the Federal District
- It's upper part is in the State of Goiás
- 235km² drainage area
- The climate is typical for the Brazilian Central Plateau region
 - ➔ rainy season from October to April
 - ➔ dry weather from May to September



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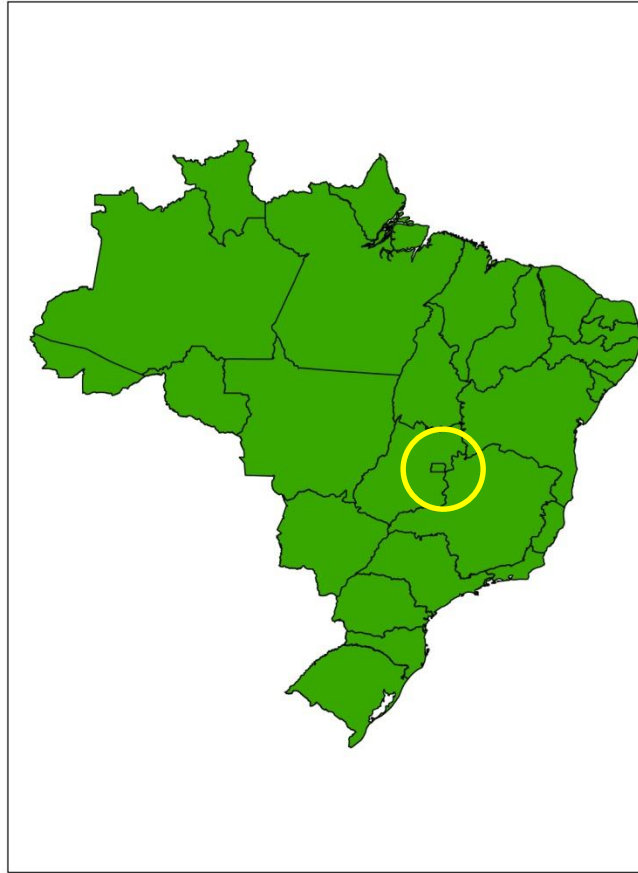
STUDY AREA





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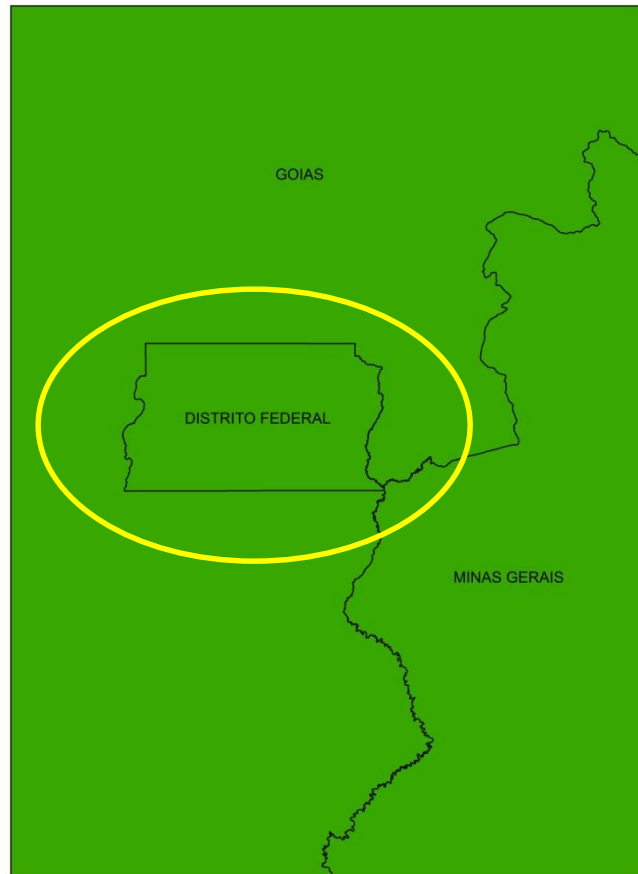
STUDY AREA





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STUDY AREA





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STUDY AREA

But first....

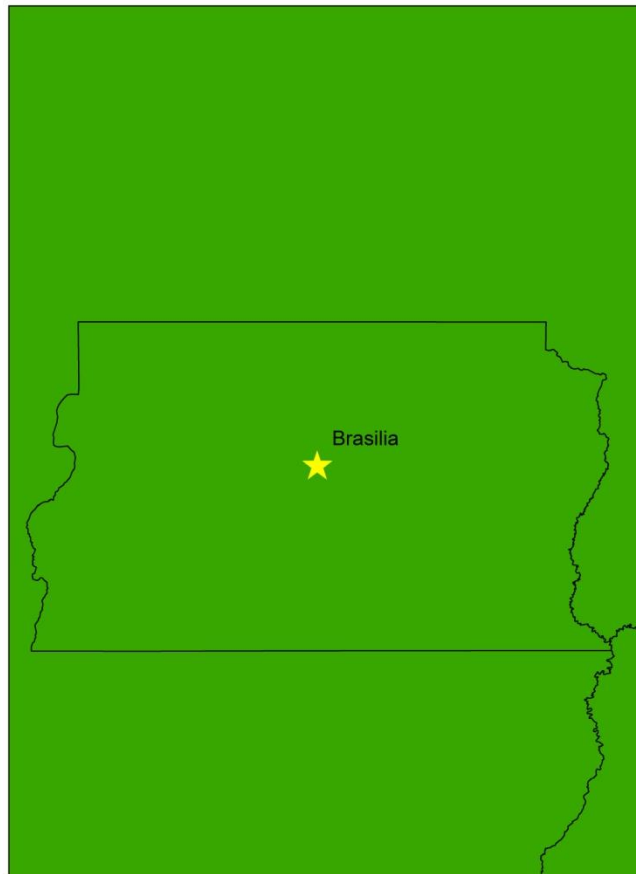


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STUDY AREA

But first....

BRASILIA!!





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STUDY AREA

But first....

BRASILIA!!

Brazil's Capital





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STUDY AREA

But first....

BRASILIA!!

Brazil's Capital





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STUDY AREA

Brasilia

→ 3 Power Square

Alvorada's Palace





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STUDY AREA

Brasilia

→ 3 Power Square

The supreme court





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STUDY AREA

Brasilia

→ 3 Power Square

National congress



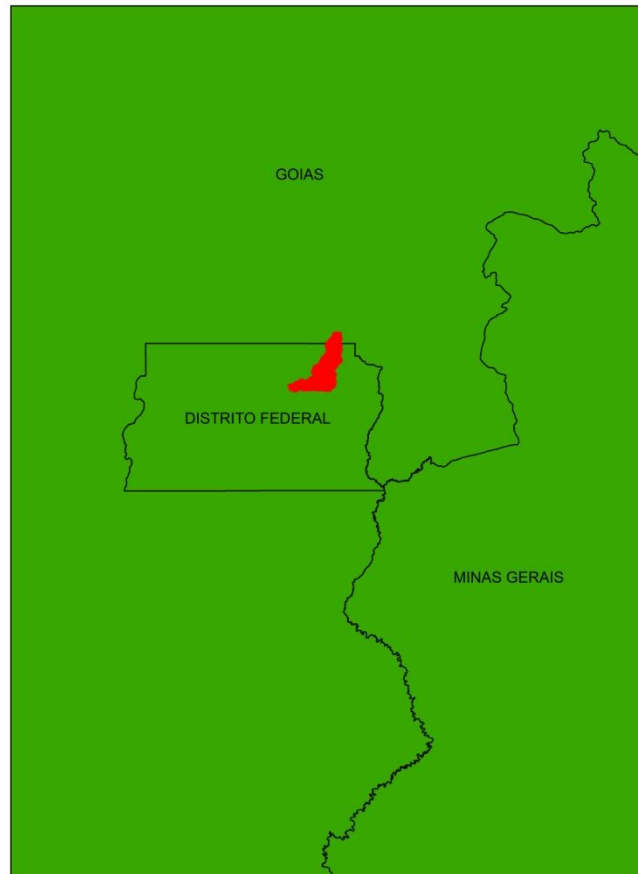


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STUDY AREA

Now ,back to...

Pipiripau's river
basin








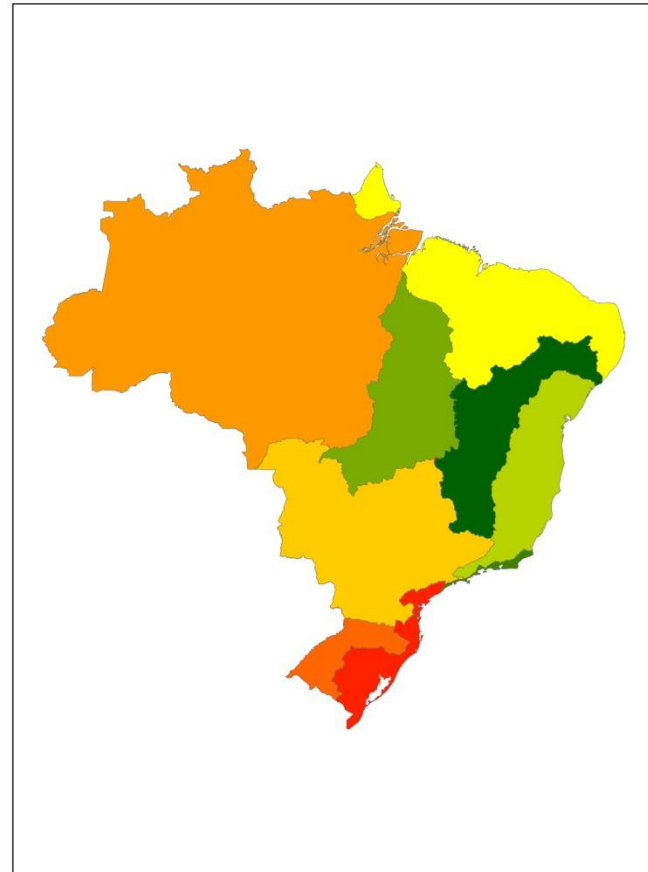


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STUDY AREA

Concerning to
the main watersheds

-  AMAZON
-  ATLANTIC (E and SE)
-  ATLANTIC (E)
-  ATLANTIC (N and NE)
-  ATLANTIC (SW)
-  PARANA
-  SÃO FRANCISCO
-  TOCANTINS
-  URUGUAI






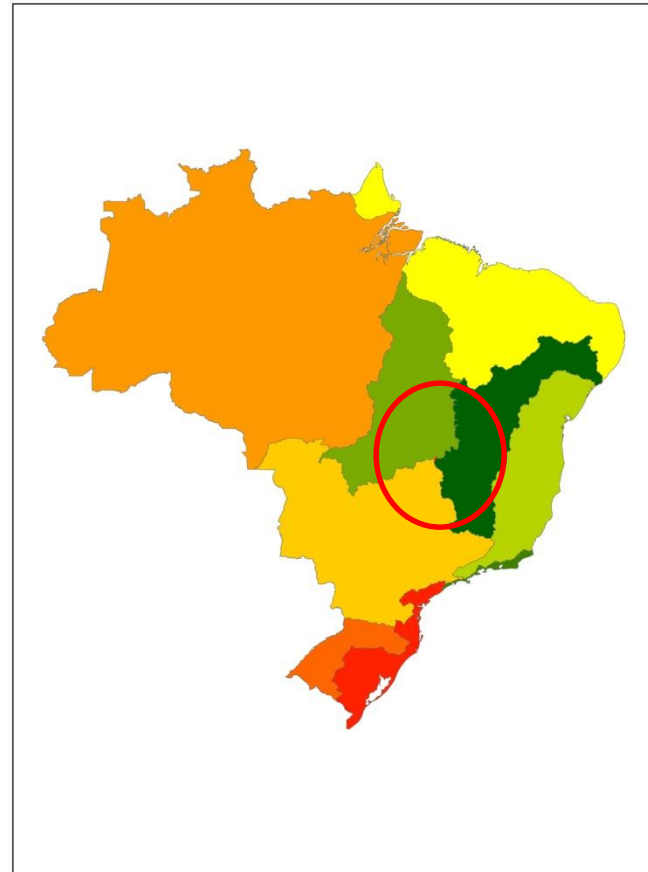


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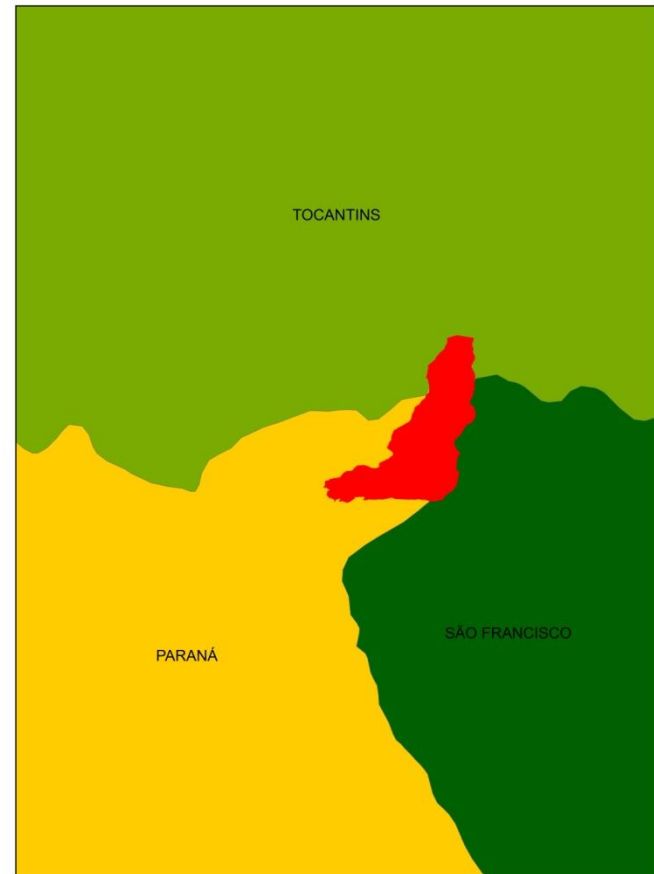


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STUDY AREA

Concerning to
the main watersheds

Pipiripau's river basin is in
the Parana's watersheds



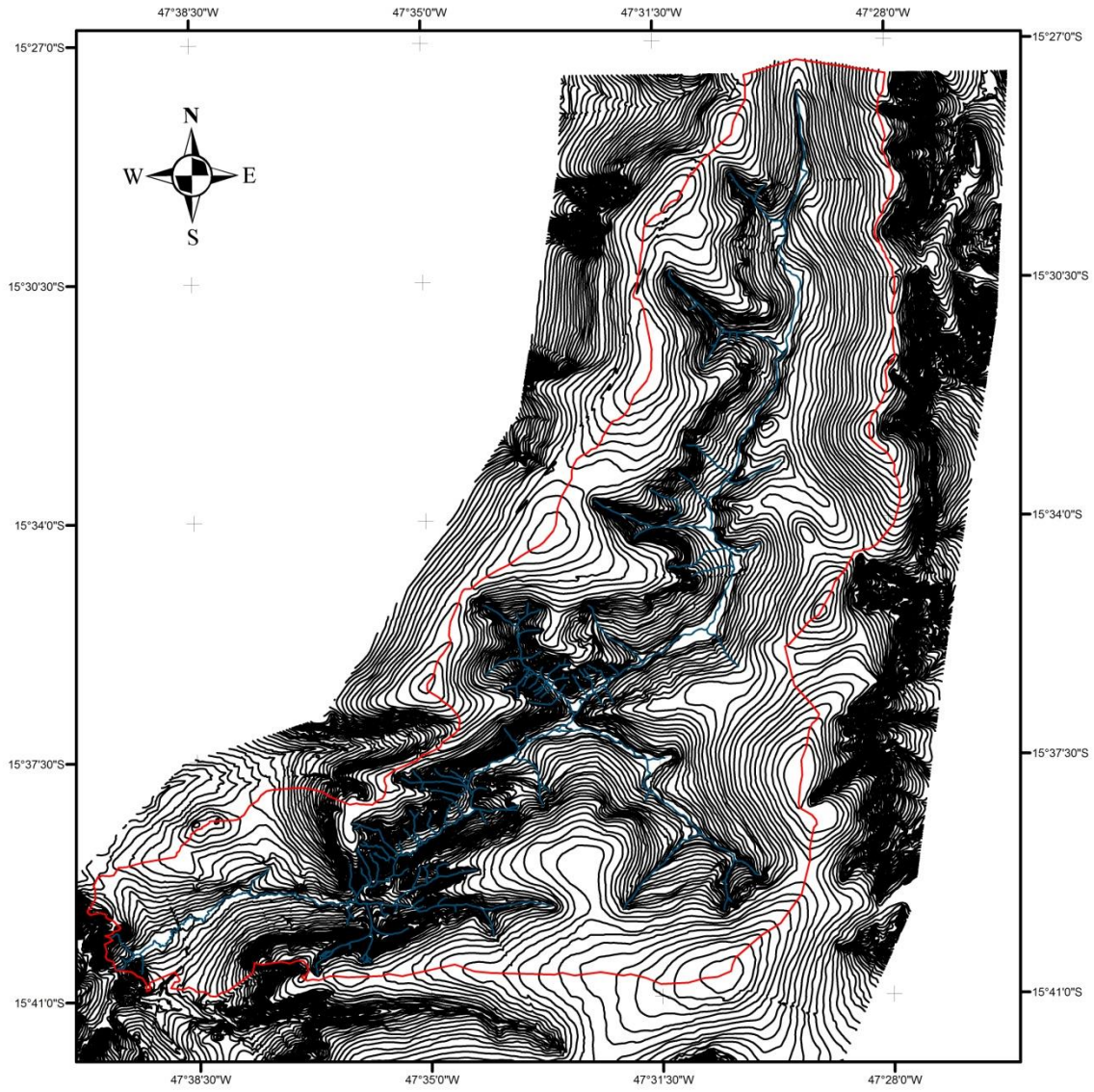


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STUDY AREA

Digital elevation model

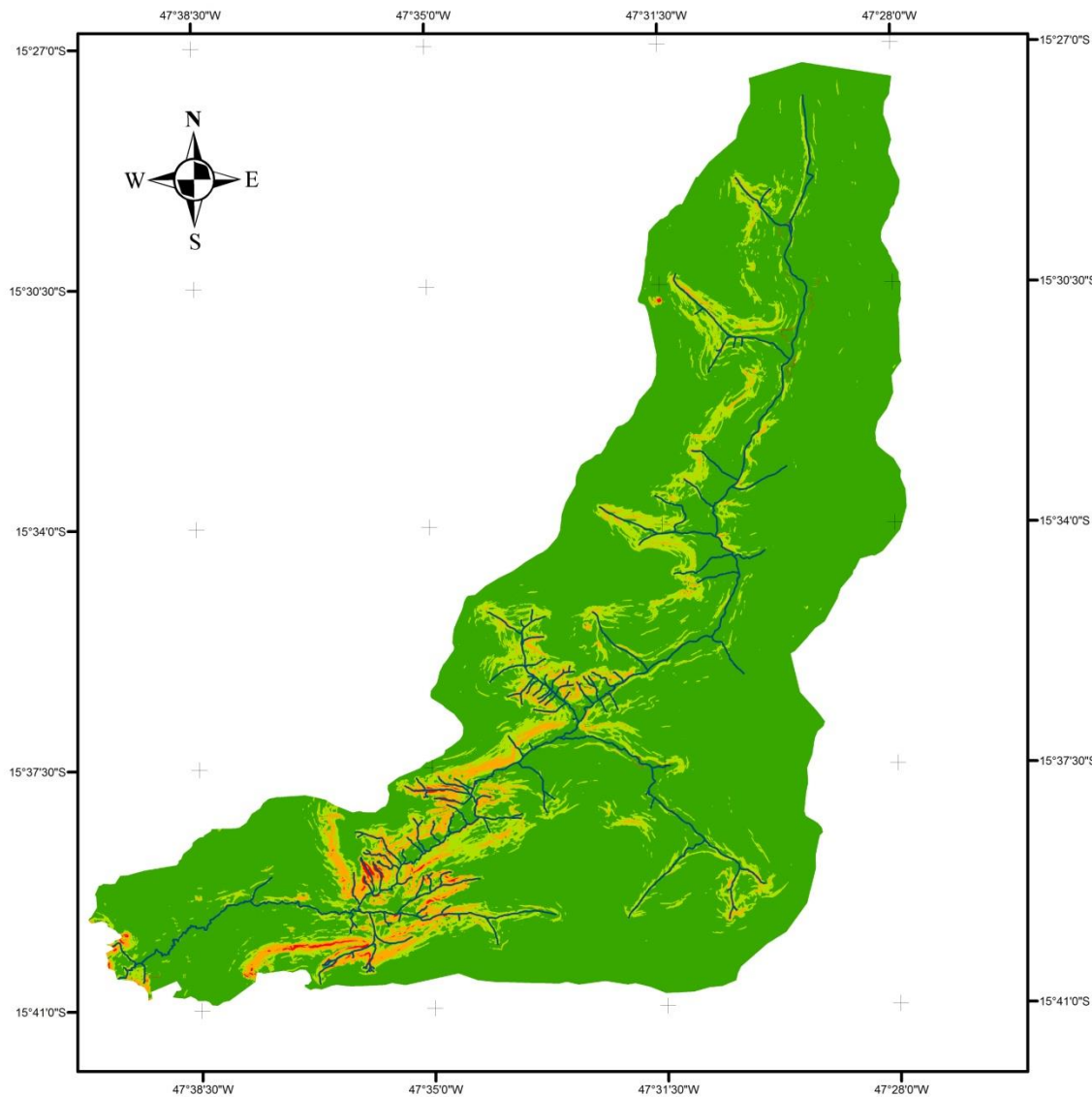
➔ 5m high distance contour lines



Legend

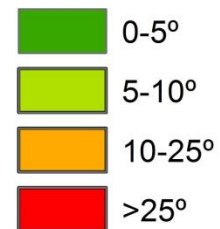
-  Pipiripau river basin
-  Contour lines (5m)





Legend

Slope

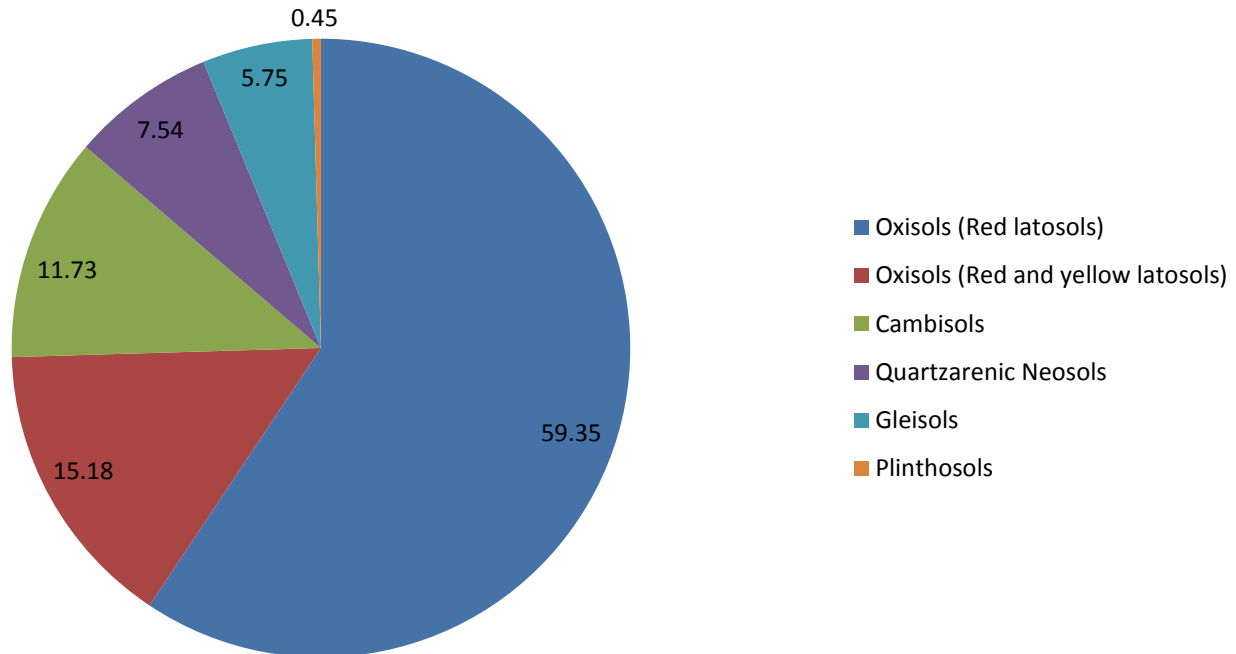


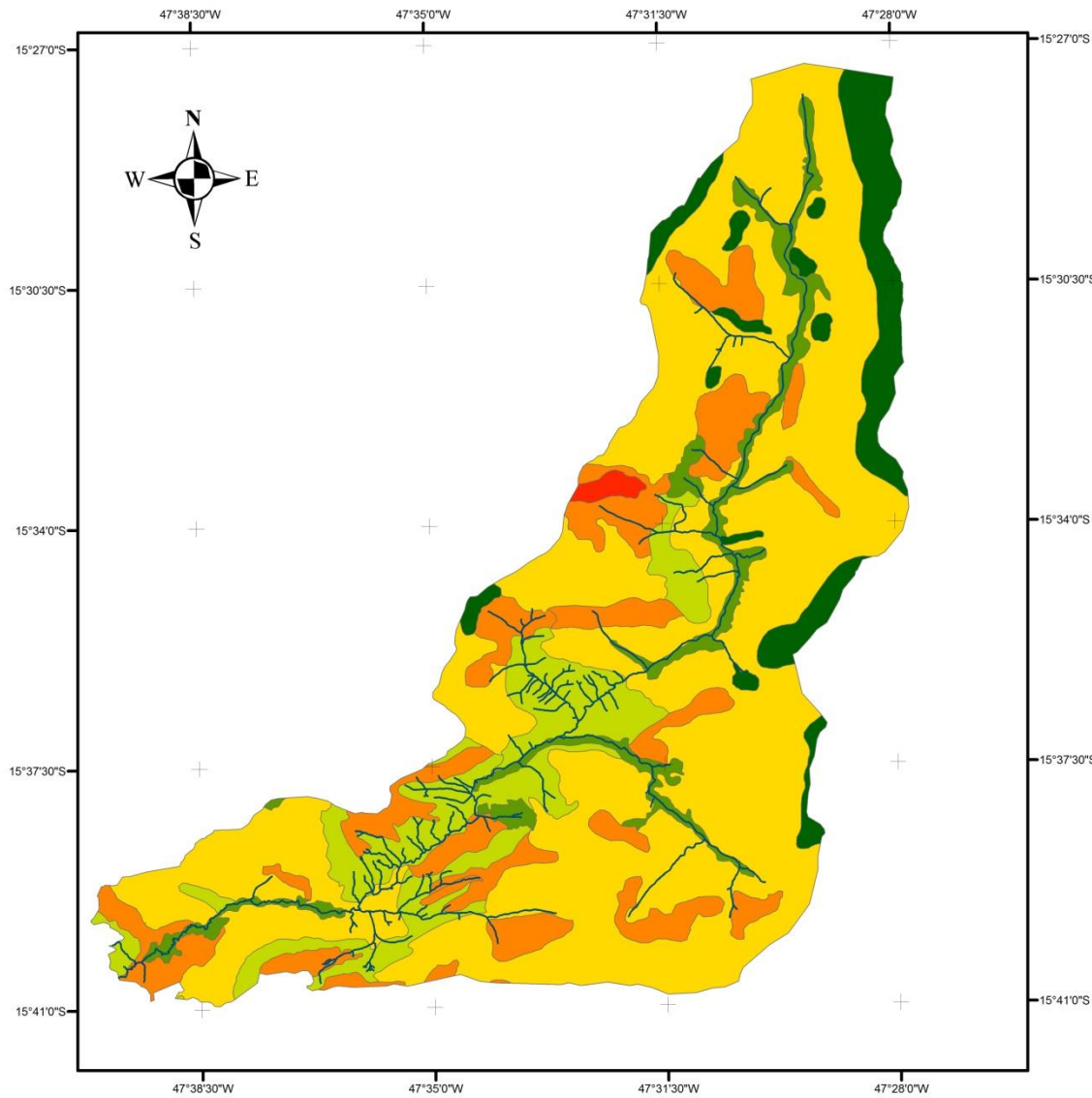


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STUDY AREA

Soil map





Legend

- Oxisols (Red latosols)
- Oxisols (Red and yellow latosols)
- Cambisols
- Quartzarenic neosols
- Gleisols
- Plinthosols

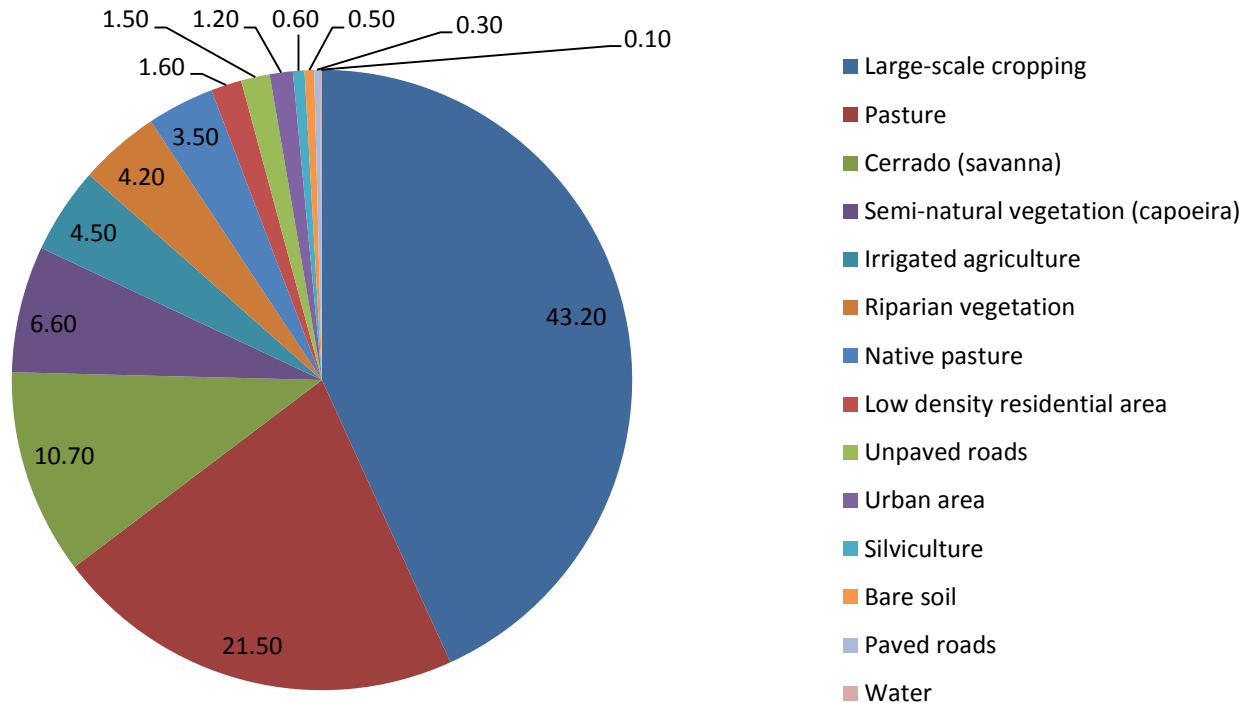


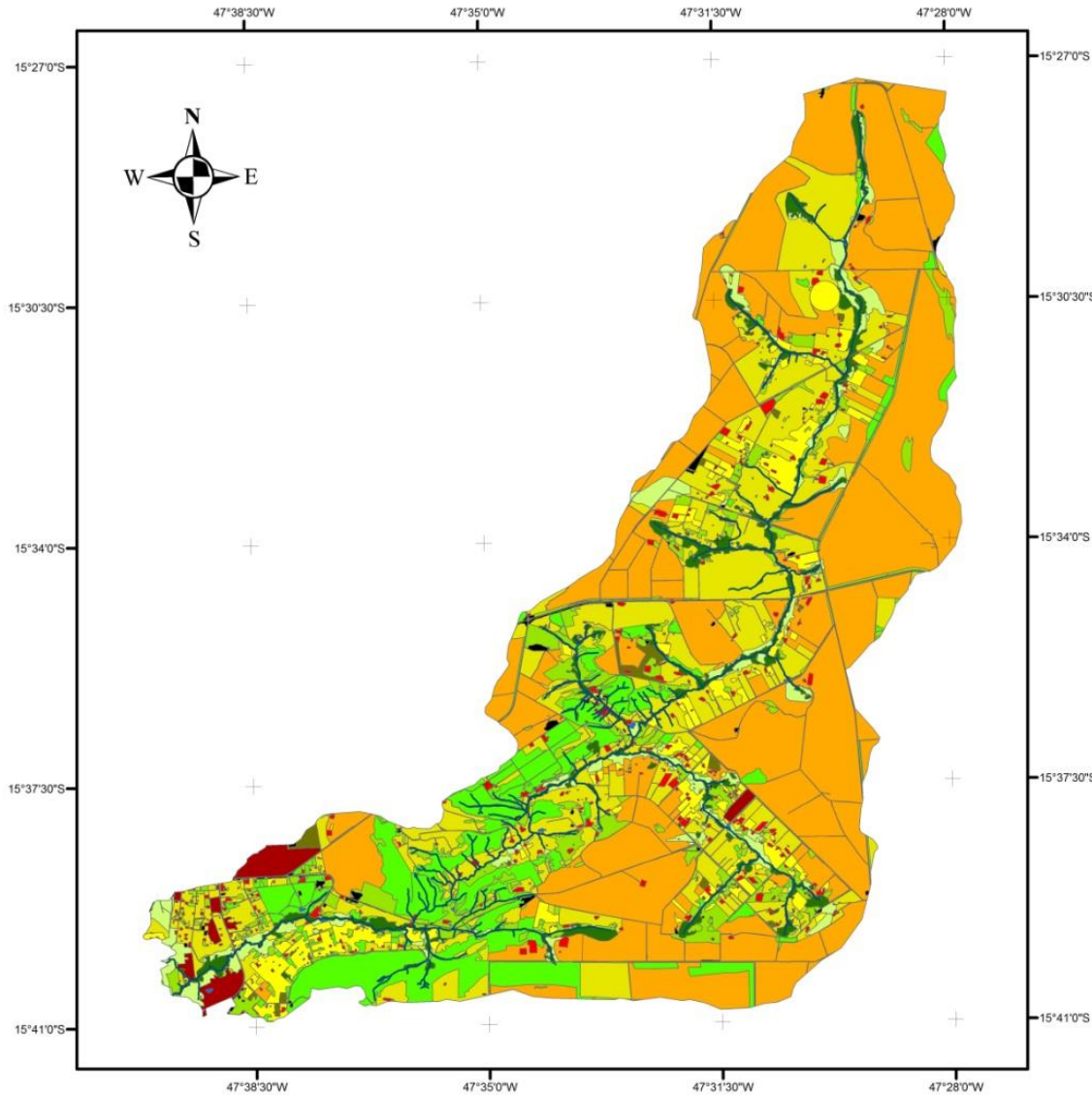


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STUDY AREA

Land use (2010)





Legend

- Large scale cropping
- Irrigated Agriculture
- Pasture
- Silviculture
- Native pasture
- Cerrado (savanna)
- Semi-natural vegetation (capoeira)
- Riparian vegetation
- Water
- Bare soil
- Unpaved roads
- Paved roads
- Low density residential area
- Urban areas





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MODEL SETUP AND EVALUATION

- 2 soil database were tested in order to analyze the influence of the soil database on streamflow simulation with SWAT model in Pípiripau's river basin

→ SDB1: Lima *et al.* (2013)

→ SDB2: Baldissera (2005)



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MODEL SETUP AND EVALUATION

- The evaluation was performed using a 10 years record of streamflow historical data (1989-1998)
- Monthly and daily basis
- The analysis was made without calibration using only SWATs first simulation.



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MODEL SETUP AND EVALUATION

- Accuracy quantification and the criteria used for evaluation of SWAT's streamflow simulation were made by ASCE (1993) and Moriasi et al. (2007) methods.
- Visual analysis and statistical evaluation
 - ➔ Hydroghps
 - ➔ Percent bias (PBIAS)
 - ➔ Nash and Sutcliffe Efficiency (NSE)
 - ➔ Adapted Nash and Sutcliffe Efficiency (ANSE)



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MODEL SETUP AND EVALUATION

- General performance ratings for recommended statistics

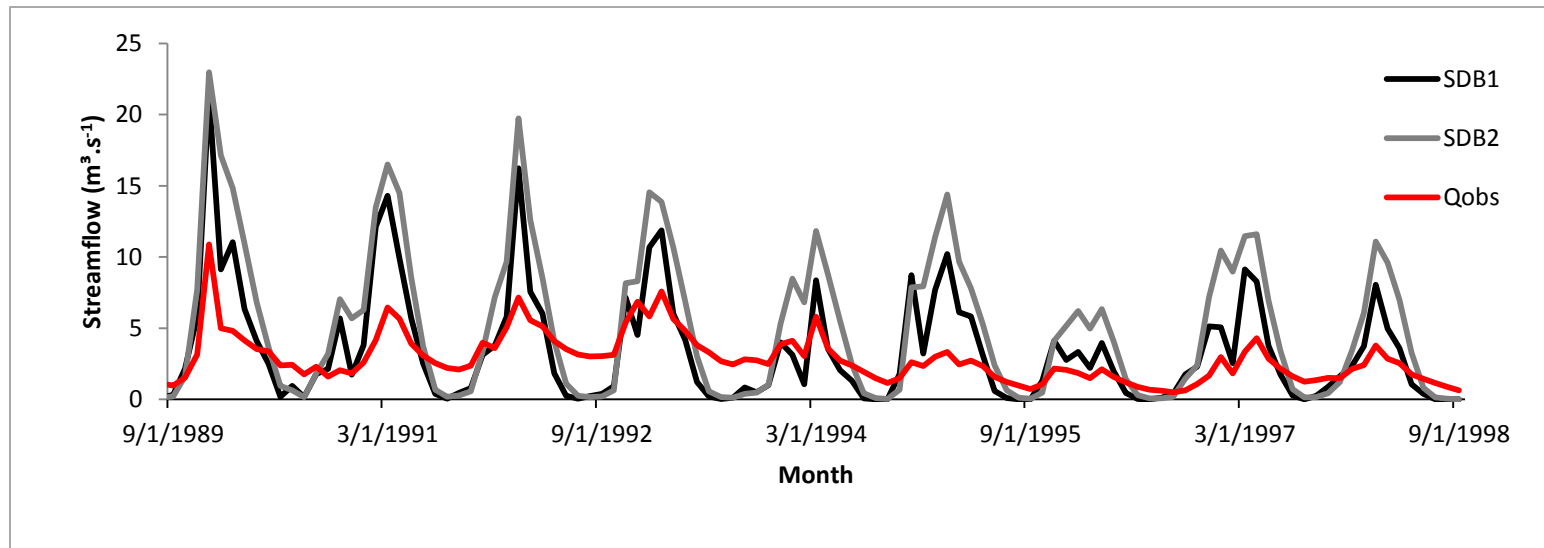
Performance rating	NSE	ANSE	PBIAS (%)
Very good	$0,75 < \text{NSE} \leq 1,00$	$0,75 < \text{ANSE} \leq 1,00$	$\text{PBIAS} < \pm 10$
Good	$0,65 < \text{NSE} \leq 0,75$	$0,65 < \text{ANSE} \leq 0,75$	$\pm 1 \leq \text{PBIAS} \leq \pm 15$
Satisfactory	$0,50 < \text{NSE} \leq 0,60$	$0,50 < \text{ANSE} \leq 0,60$	$\pm 15 \leq \text{PBIAS} \leq \pm 25$
Unsatisfactory	$\text{NSE} \leq 0,50$	$\text{ANSE} \leq 0,50$	$\text{PBIAS} \geq \pm 25$



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RESULTS AND DISCUSSION

- Visual comparison between observed streamflow data and monthly streamflow simulation, using SDB1 and SDB2

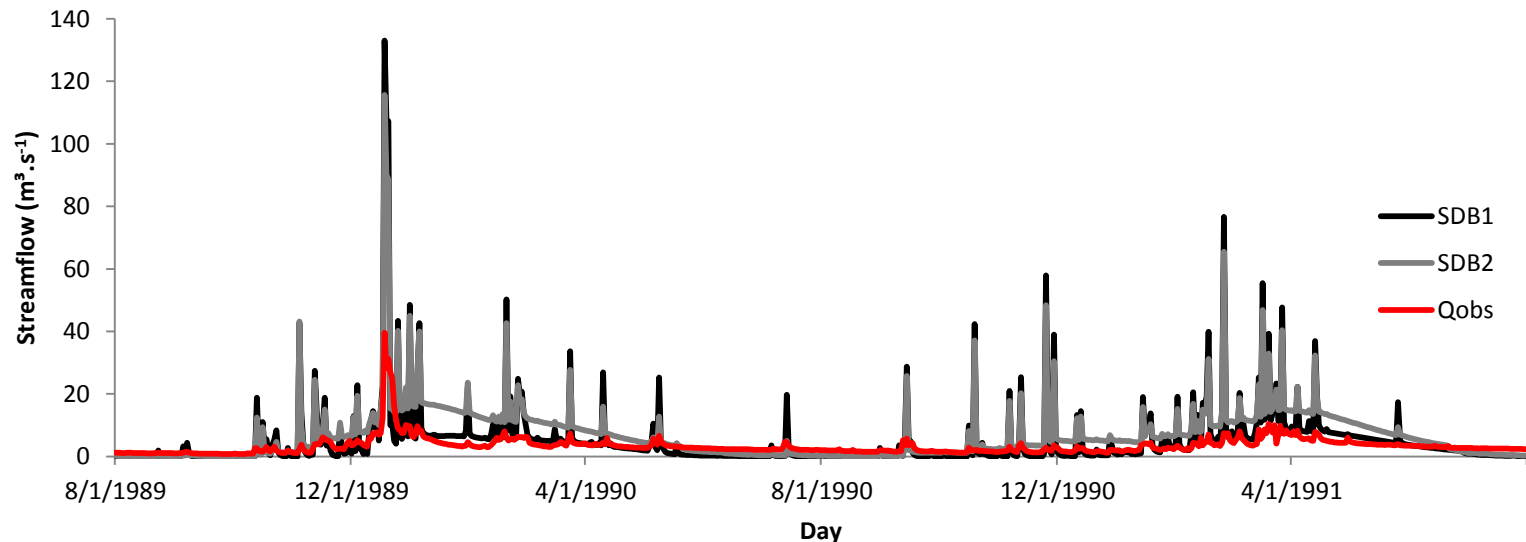




RESULTS AND DISCUSSION

- Visual comparison between observed streamflow data and daily streamflow simulation, using SDB1 and SDB2

➔ Sample of the results

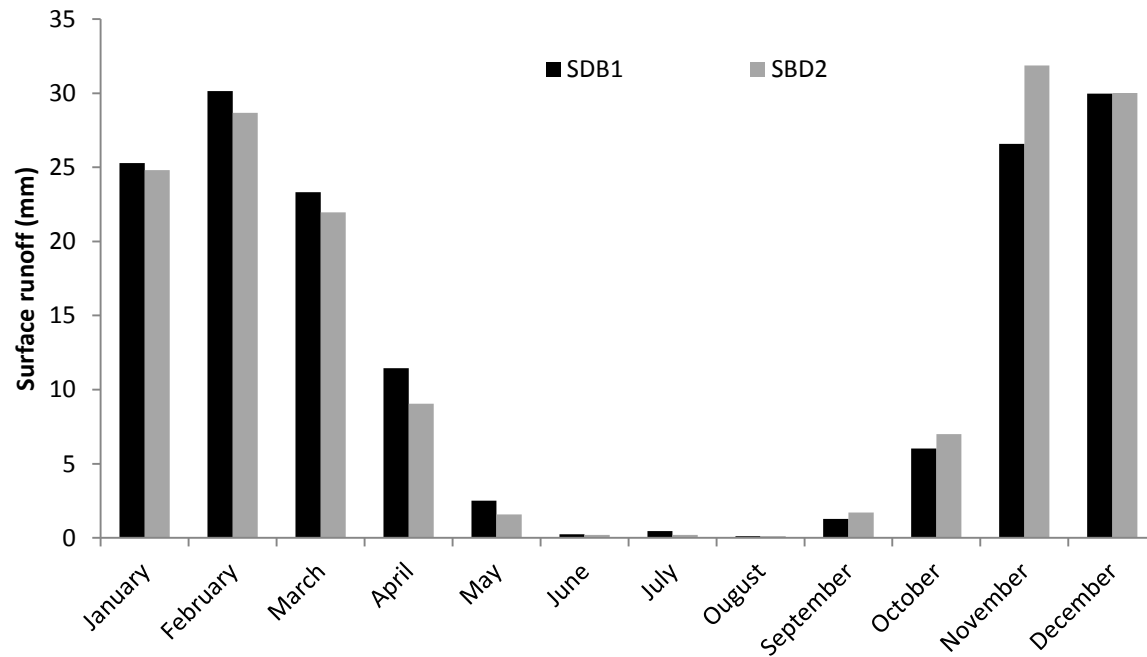




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RESULTS AND DISCUSSION

Average monthly basin values

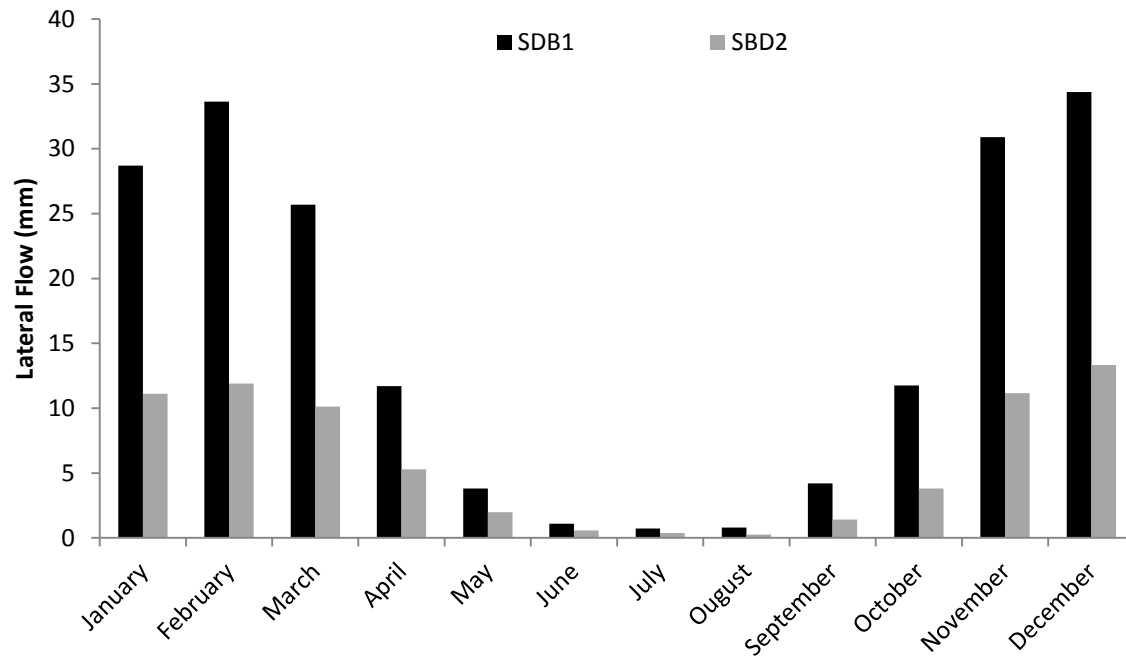




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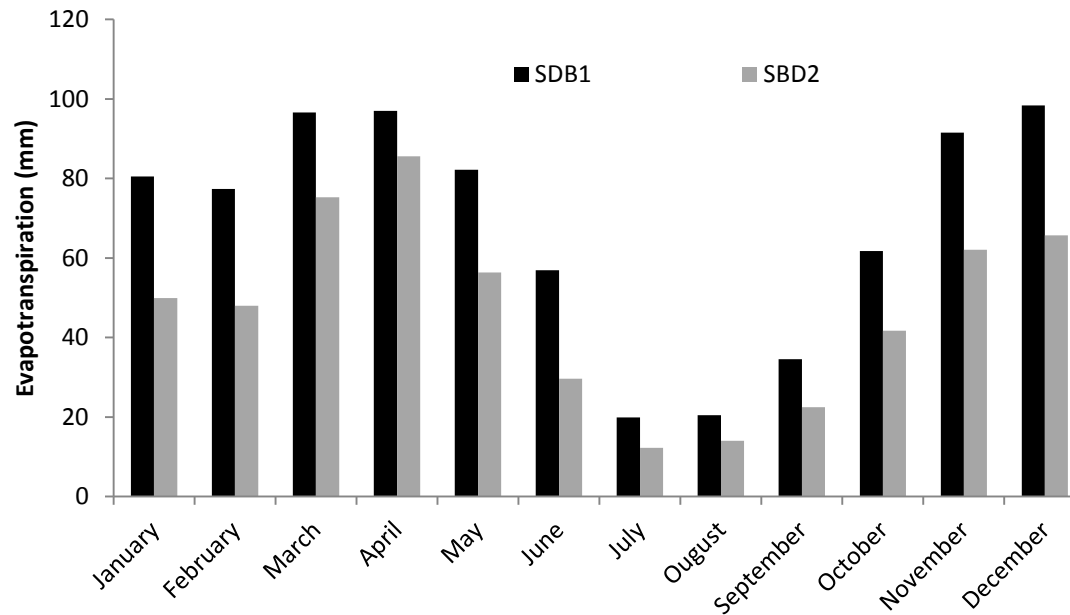




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RESULTS AND DISCUSSION

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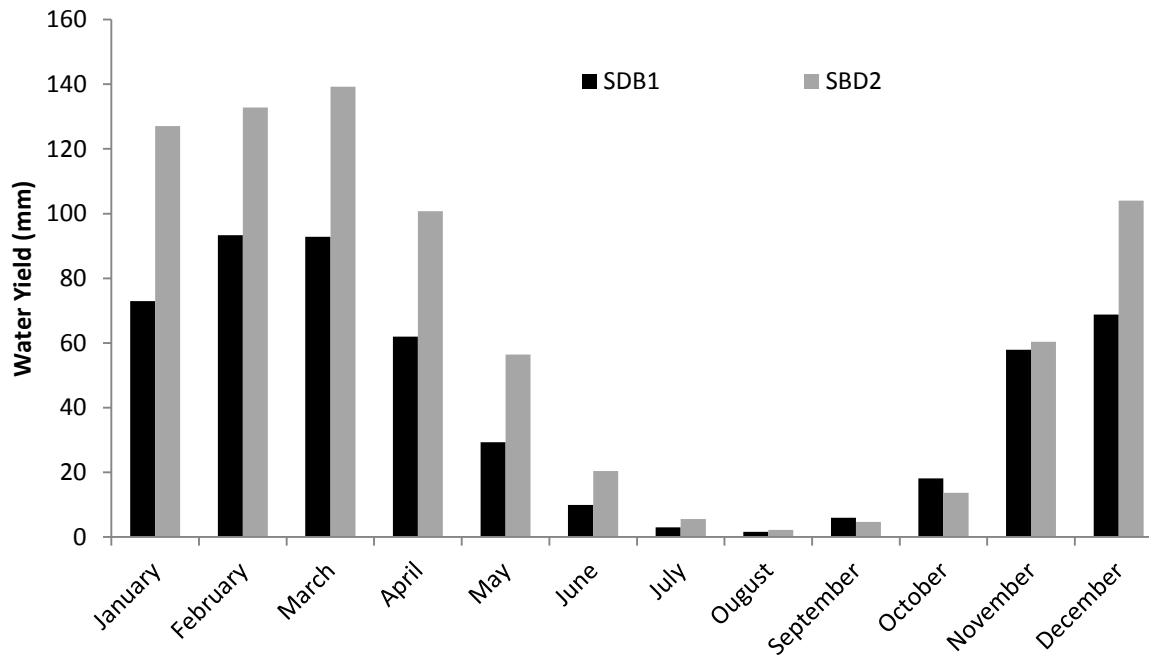




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RESULTS AND DISCUSSION

Average monthly basin values





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RESULTS AND DISCUSSION

Annual water budget results for SB1 and SB2 and for the Capetinga (DF) and for the Alto Jardim (DF) river basin

Lima (2000);

Reference	Silva & Oliveira (1999)		Lima et al. (2001)		Lima (2010)		This Study: SDB1		This Study: SDB2	
Period	1996/1997		1998/1999		2007/2008		1989/1999		1989/1999	
River basin	Capetinga (DF)		Capetinga (DF)		Alto Jardim (DF)		Pipiripau (DF/GO)		Pipiripau (DF/GO)	
Area (km ²)	10.00		10.00		104.86		235.00		235.00	
Variable	mm*year ⁻¹	%	mm*year ⁻¹	%	mm*year ⁻¹	%	mm*year ⁻¹	%	mm*year ⁻¹	%
Precipitation	1744	100.0	1058.73	100.0	1100	100.0	1373.1	100.0	1373.1	100.0
Surface Runoff	52.5	3.01	15.08	1.42	32.33	2.94	157.59	11.48	157.4	11.46
Base Flow	444	25.46	284.39	26.86	289.89	26.35	348.64	25.39	581.93	42.38
Total Flow	496.5	28.47	299.47	28.29	322.22	29.29	506.23	36.87	739.33	53.84
Evapotranspiration	1247.5	71.53	831.03	78.49	777.78	70.71	817.6	59.54	563.3	41.02



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RESULTS AND DISCUSSION

Evaluation criteria results for daily and monthly simulation with SDB1 and SDB2.

Evaluation criteria	Daily results		Monthly results	
	SDB1	SDB2	SDB1	SDB2
PBIAS	-23.15	-84.72	-24.53	-86.49
NSE	-11.88	-9.94	-1.78	-6.51
ANSE	-11.80	-9.88	-2.98	-9.74



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CONCLUSION

The study indicates the importance of developing soil databases for specific regions throughout Brazil and furthermore research on other parameters in order to improve physical basis on SWATs simulation.



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CONCLUSION

Continue improving SWAT model Physical basis
for the Cerrado region:

- ➔ Parameters and conceptual model
- ➔ Cenarios Land use/Climate Change



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ACKNOWLEDGMENTS

Brasilia's Environmental Agency (IBRAM/DF)

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CNPq – SWAT Cerrado Project (EMBRAPA)



Thank you!!