

## 2011 International SWAT Conference & Workshops

# The use and results of the Soil Water Assessment Tool in Brazil: A Review from 1999 until 2010



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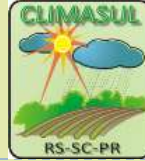
# Summary

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- ▶ Climasul project
- ▶ Published studies
- ▶ Survey procedures
- ▶ Results
- ▶ Conclusion



# Climasul project



- ▶ Study of the climatic changes in southern Brazil



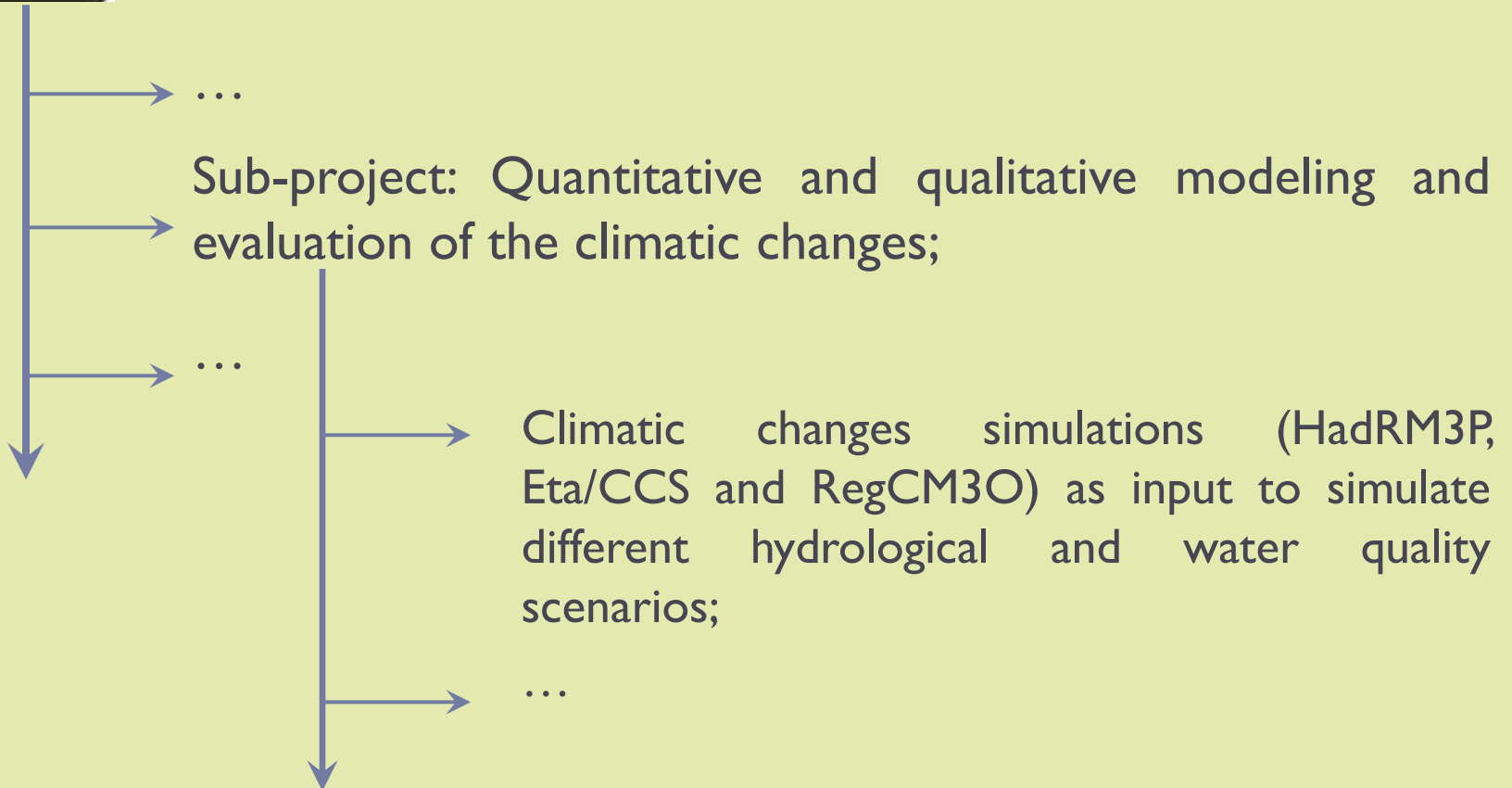
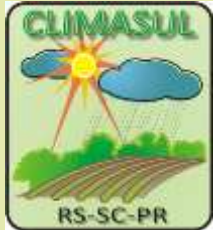
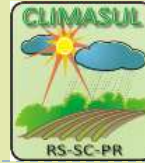
# Climasul project



## ▶ Institutions and partners



# Climasul project



# The use of SWAT

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## ▶ Questions:

- ▶ Which model should be used ?
- ▶ Is this model robust to be used in Brazilian conditions ?
- ▶ What are the main trends to use the model ?
- ▶ Which practical applications are available ?



# Published studies

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- ▶ **Publications found**

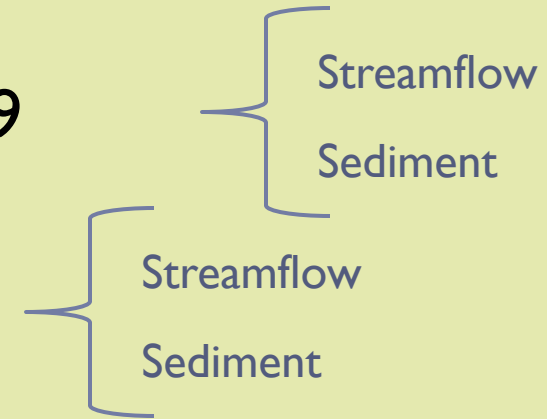
- ▶ 74 publications were found;
- ▶ 60 publications are presented;

- ▶ **Oldest: Oliveira and Medeiros, 1999**

- ▶ **Most recent: Santos et al., 2010**

- ▶ **Basins sizes**

1.2 km<sup>2</sup> (RS)  
29,000.0 km<sup>2</sup> (MT)



# Survey procedures

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## ▶ Questions

- ▶ Number of studies
- ▶ Studies published in Portuguese
- ▶ Focus on verify the viability of SWAT in Brazi
- ▶ The focus of the studies (indicator)
  - ▶ Streamflow
  - ▶ Sediment
  - ▶ Nutrients

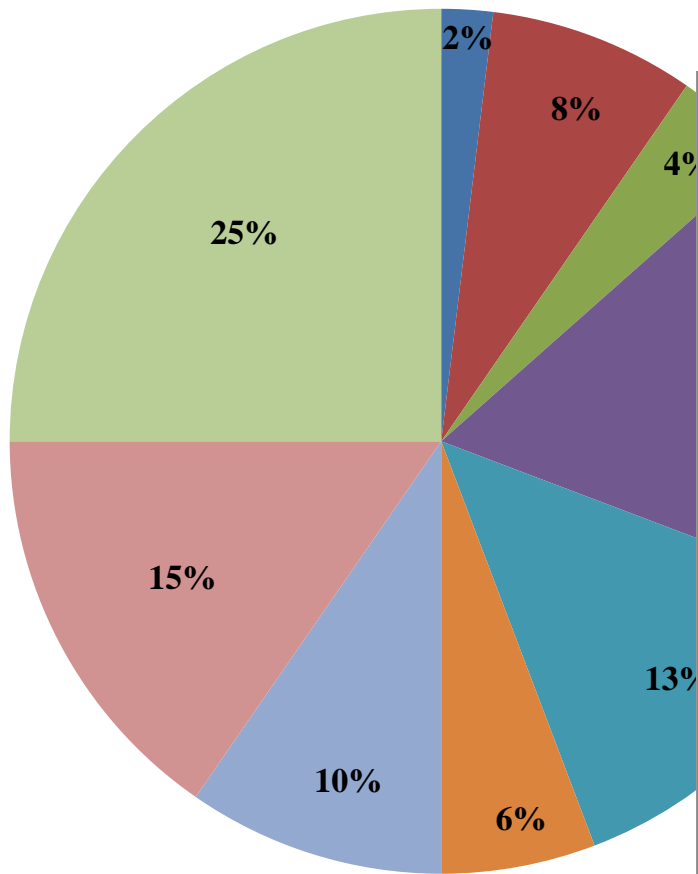
## ▶ Summary of the found papers:

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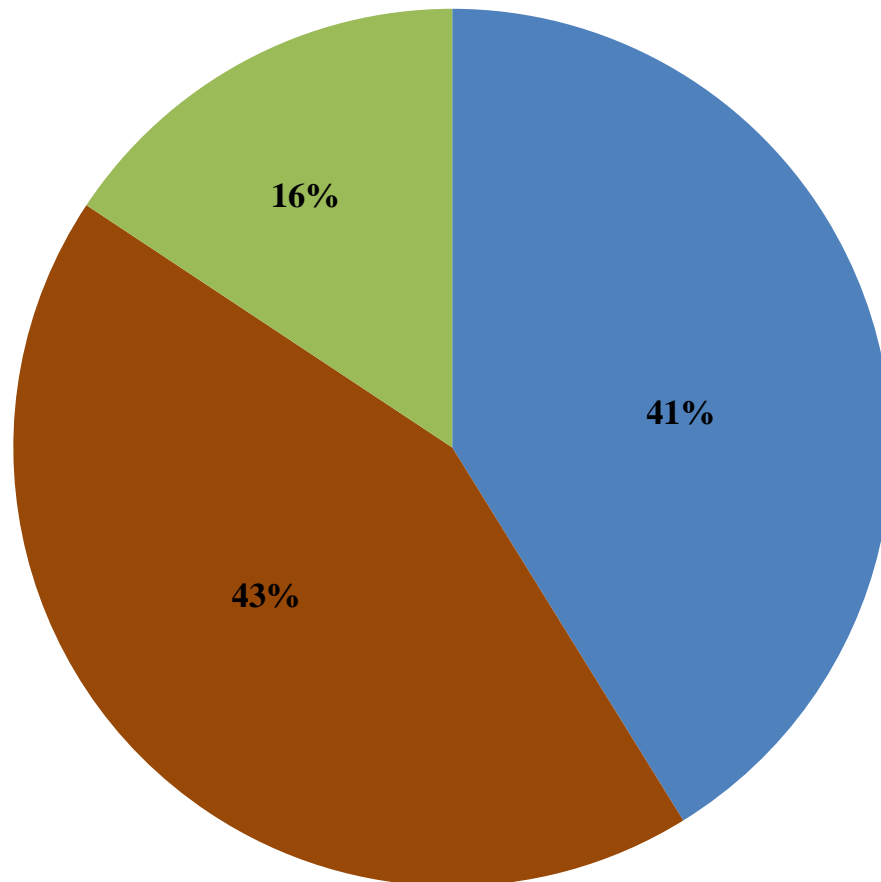




# Survey procedures



## Years



## Indicator

- Streamflow
- Sediment
- Nutrients

# Map of the published studies

## Regions:

South – 42%

Southeast – 32%

## States:

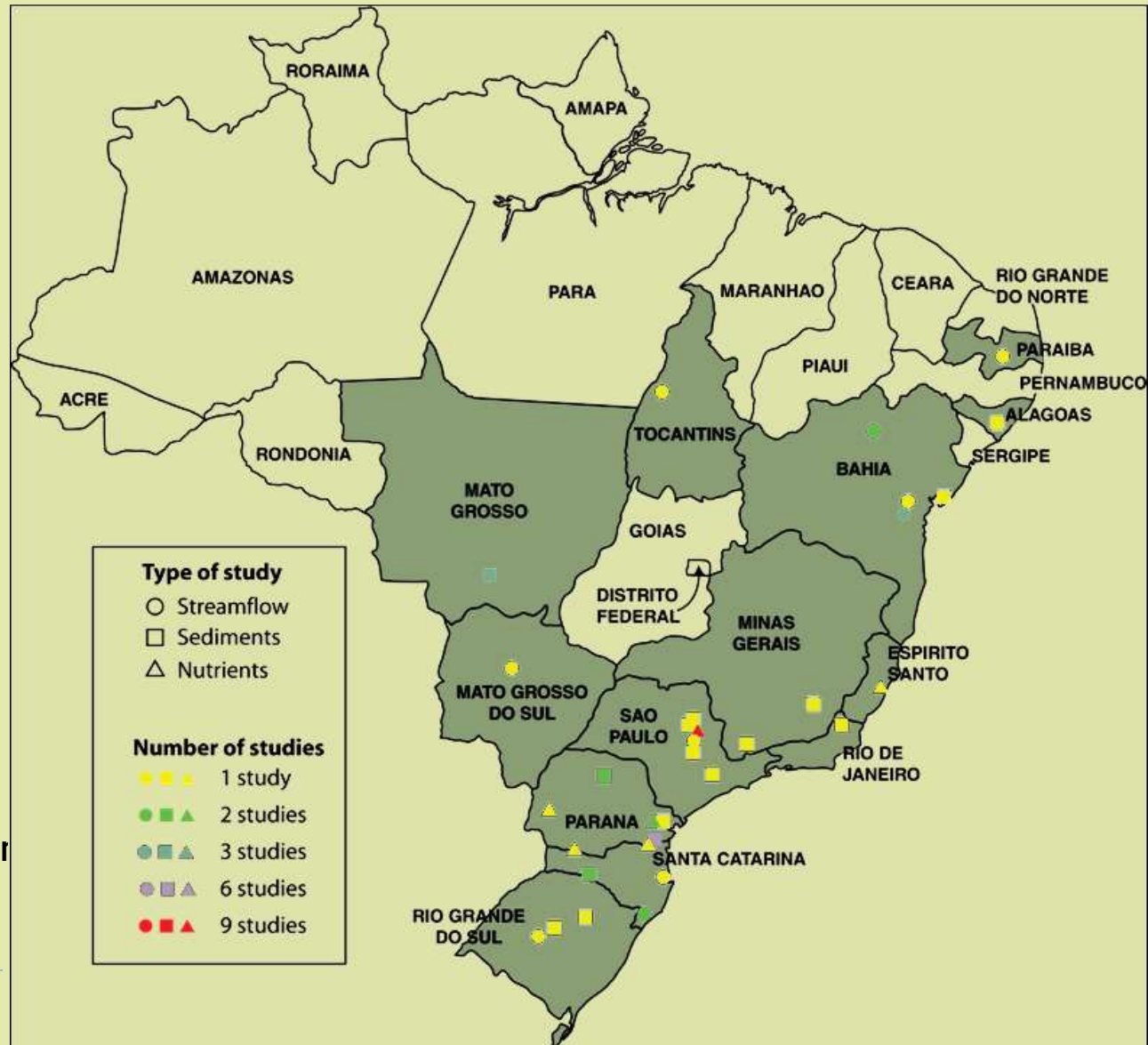
SP – 26 %

PR – 18 %

SC – 18%

## Paraná:

Nutrients and  
Practical application



# Brazilian climate characteristics

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- ▶ Brazil latitude varies from 7 °S  $\leftrightarrow$  31 °S
- ▶ Northeast Climate
  - ▶ Köppen climatic classification system: Af, Am, Cwb and BSh.
    - ▶ Hot summer;
    - ▶ Average temperature near 23 °C;
    - ▶ Annual precipitation from less than 800 mm  $\leftrightarrow$  1,200 mm.
- ▶ South Climate
  - ▶ Köppen climatic classification system: Cfa and Cfb
    - ▶ Average temperatures varying from 15.5 to 17 °C;
    - ▶ Annual precipitation from 1,200 mm  $\leftrightarrow$  2,100 mm.
  - ▶ Authors  $\rightarrow$  good results / Coefficients  $\rightarrow$  in the south



# Brazilian data sources

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- ▶ The main sources:
  - ▶ ANA – National Water Agency (hydrology)
  - ▶ ANEEL – National Agency for Electrical Energy (hydrology)
  - ▶ EMBRAPA - Brazilian Agricultural Research Corporation (soils)
  - ▶ IGBE - Brazilian Institute of Geography and Statistics (maps)
  - ▶ INMET - National Institute of Meteorology (weather)
  - ▶ INPE – National Institute for Space Research (weather)
- ▶ Another sources: Power plants, environmental studies, ...



# Some paper results (monthly)

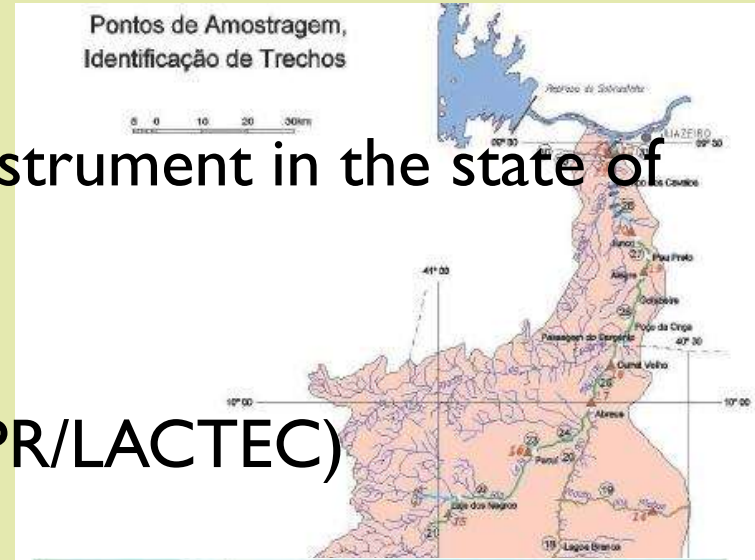
Year	Watershed (location)	Drainage Area (km <sup>2</sup> )	Indicator	Time Period C = calib. V = valid.	Best NSR and R <sup>2</sup>		
					Daily	Monthly	Annual
1999	Joazeiro River (Bahia)	755.40	Streamflow sediment	-	-	-	-
2003	Yaguazinópolis river	1,500.00	Streamflow	-	-	C: 0.61 and 0.79	-
	Aquidauana river	15,200.00	Streamflow	-	-	C: 0.58 and 0.82	-
2003	Jaguariçá river (Bahia)	6,900.00	Streamflow	1993-1995 1997-2002	C: -1.03 and 0.23 V: -65.9 and 0.37	-	-
2003	Macon river (São Paulo)	59.73	Sediment	C: 1999-2000	-	C: 0.83 and 0.92	-
2003	Macon river (São Paulo)	59.73	Streamflow	C: 1999-2000	-	C: 0.92 and 0.94	-
2004	Guabiruba river (São Paulo)	54.12	Sediment	1999-2003	-	-	-
2004	Carchim river (São Paulo)	15.00	Sediment	1999-2003	-	-	-
2005	Coíba river (Matô Grosso)	29,000.00	Streamflow	C: 1994-1998	-	C: 0.77 and 0.81	-
2005	Paraguari river (Paraná)	100.00	Stream flow Water Quality	C: 1984-1998	-	C: - and 0.83	-
2005	Brasão river (São Paulo)	223.00	---	1992-2004	-	-	-
2005a	Salitre river (Bahia)	13,470.00	Streamflow	C: 1969-1972	-	C: - and 0.80	-
2005b	Salitre river (Bahia)	13,470.00	Streamflow	C: 1977-1979 V: 1969-1973	-	C: - and 0.88 C: - and 0.70	-
2005a	Jaguariçá river (Bahia)	6,900.00	Streamflow	C: 1993-1995	-	-	-
2005b	Jaguariçá river (Bahia)	6,900.00	Streamflow	C: 1993-1995 V: 1997-2002	C: -2 and 0.37 V: -49 and 0.51	-	-
2005	Jundiaí-Mirim river (São Paulo)	120.15	Sediment	-	-	-	-
2005	Brasão river (São Paulo)	47.17	Sediment	1992-2004	-	-	-
2006	Curumbataí river (São Paulo)	1,710.00	Streamflow	C: 1973-1984 V: 1985-2003	-	C: 0.94 and 0.94 V: 0.84 and 0.92	C: 0.89 and 0.93 V: 0.27 and 0.67
2006	Paraguari river (Paraná)	58.00	Streamflow Phosphorus	1998-2002	-	-	C: - and 0.82
2006	Macon river (São Paulo)	59.73	Sediment	1999-2000	-	-	-
2006	Brasão river (São Paulo)	223.00	Nitrogen Phosphorus	12 years period	-	-	C: 0.76 and - C: 0.74 and -
2006	Mesoin Deim I (Rio Grande do Sul)	18.00	Streamflow	1996-1998	C: - and 0.54	C: 0.88 and 0.88	-
2006a	Carchim river (São Paulo)	15.00	Nitrogen Phosphorus	1993-2004 1993-2004	-	-	C: 0.79 and - C: 0.80 and -
2006b	Beça-Fluzadai river (São Paulo)	110.00	Sediment	-	-	-	-
2007	Macon river (São Paulo)	59.73	Sediment	1999-2000	-	C: 0.78 and -	-
2007	Curupipe river (Alagoas)	1,562.00	Sediment	2004-2006	-	-	-
2007	Tule do river	65.00	Streamflow, sediment and quality	1998-2004	-	-	-
	Ajuicaba river (Paraná)	16.50	Streamflow, sediment and quality	1998-2004	-	-	-
2008	Apucaranioba river (Paraná)	504.00	Sediment	C: 2000-2005 V: 1988-1999	C: 0.20 and - V: -2.36 and -	C: 0.42 and - V: 0.62 and -	-

s for:

\* Annual

# Brazilian watershed practical application

- ▶ Water resources management instrument in the state of Bahia (not implemented)
- ▶ Hydroelectric power plants (UFPR/LACTEC)
  - ▶ Parigot de Souza Power Plant
  - ▶ Mauá Power Plant



Built in 2010

# Conclusions

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- ▶ Great potential to be used in Brazilian watersheds
- ▶ Most academic purposes – testing model
- ▶ No need of model adaptation
- ▶ Need of effective data quality and availability
- ▶ Evaluate relation of the datababases vs. results





Obrigado!

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