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Climate change impacts on the streamflow of a semi-arid watershed, Northeast Brazil

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Background and Objectives

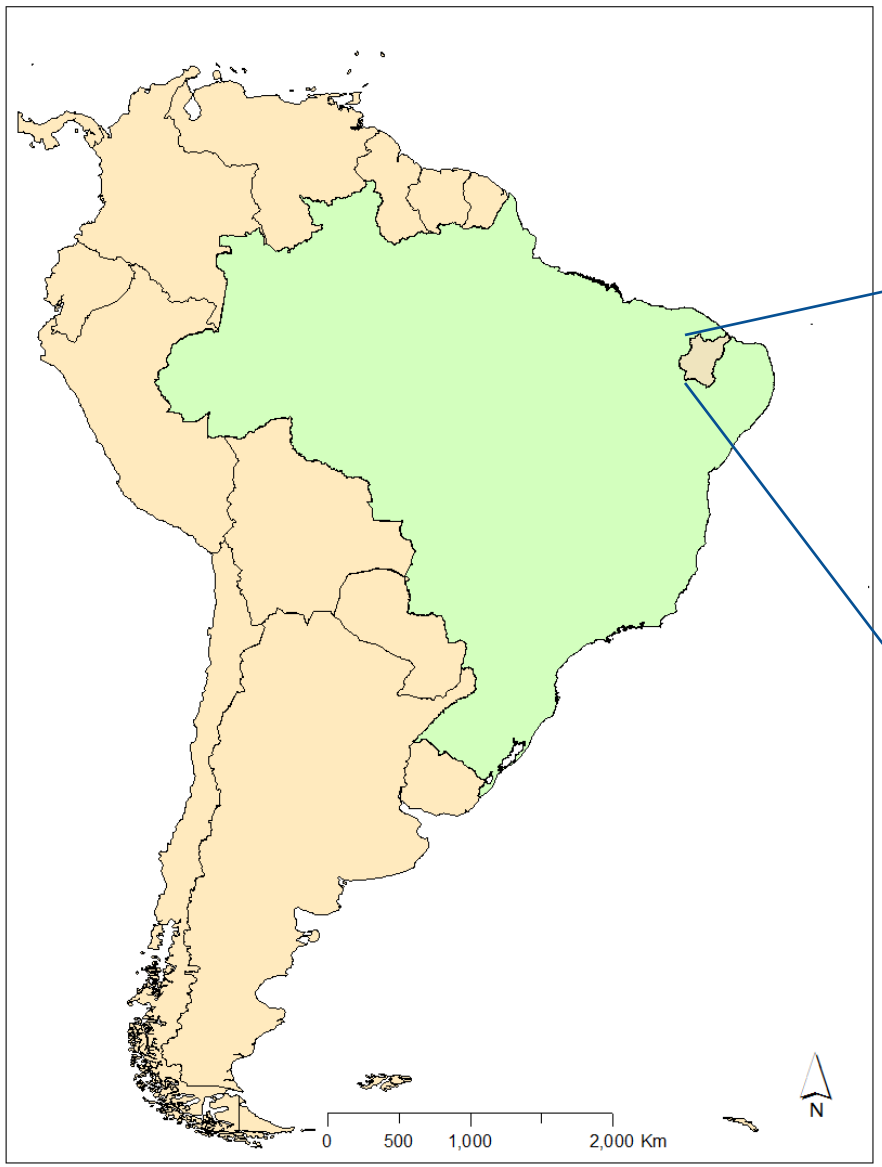
- *The northeast region of Brazil is the **most vulnerable region in Brazil to climate variability**, having suffered from recurrent and severe droughts.*

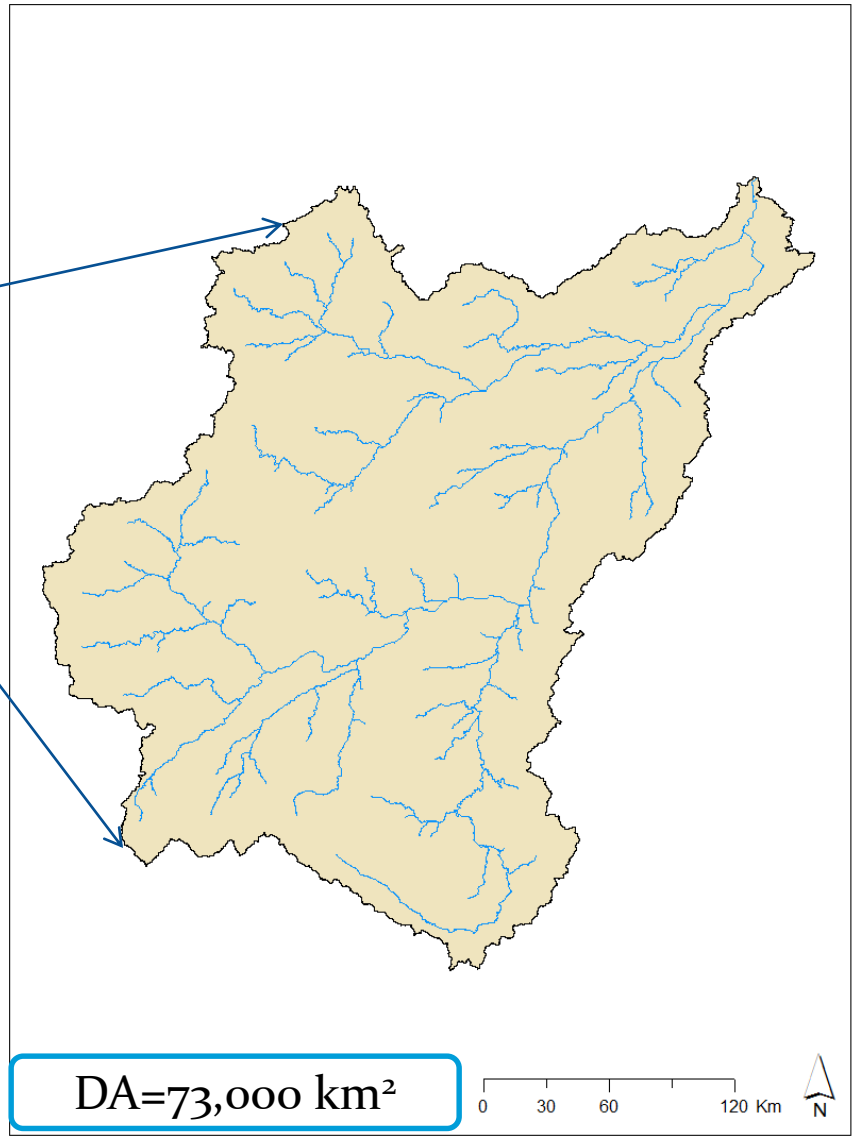
- *To decrease the vulnerability of the water scarce region good **water management** and appropriate infrastructure are vital, especially for irrigated agriculture and municipal water supply.*

- *In this context, the **assessment of climate change impacts** in the water resources is very important in for **planning**;*

- *An assessment of climate change impacts in the water resources of the semi-arid Jaguaribe watershed (73,000 Km²), Ceará, Brazil is presented*

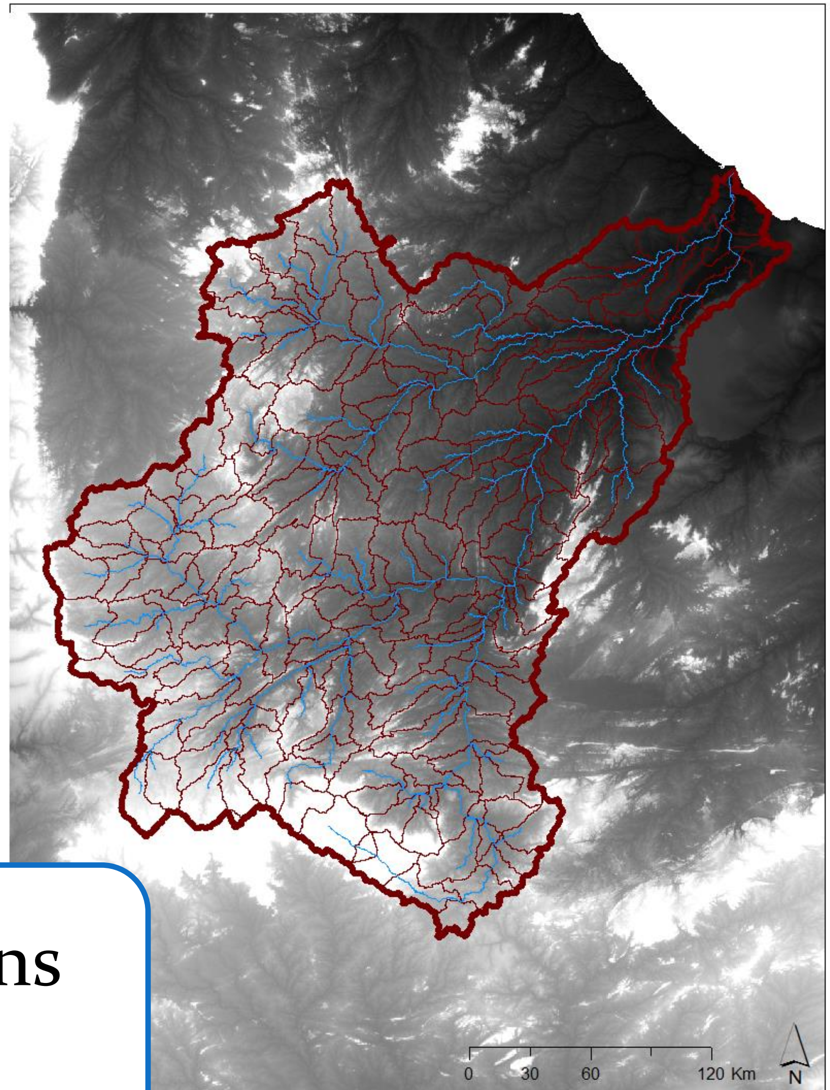
Study Area





SWAT Model Set-up and Data Sets

- The Jaguar[...] up using the ArcSWAT[...]
- “Adapting Wa[...] Operation to Climate Varia[...] Selected River Basins in Nor[...]
- the data from [...]y Mission (SRTM) was [...]oximately 90 meters;
- Which establ[...]ocal government agencies.



232 sub-basins
A=315 km²

SWAT Model Set-up and Data Sets

- Soils Data

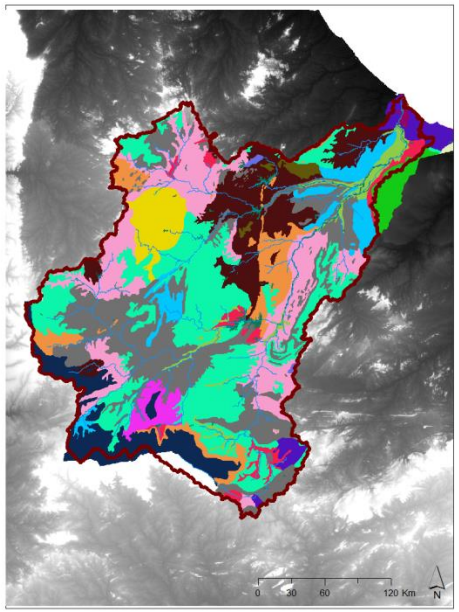
Soils Map is the 1:600.000 from MA/SUDENE (1973) and was vectorized by FUNCEME

ISRIC World Soil Information

Texture, Organic Matter, and soil depths

Pedotransfer Functions (Saxton & Rawls, 2006)

Soil & Water Assessment Tool SWAT

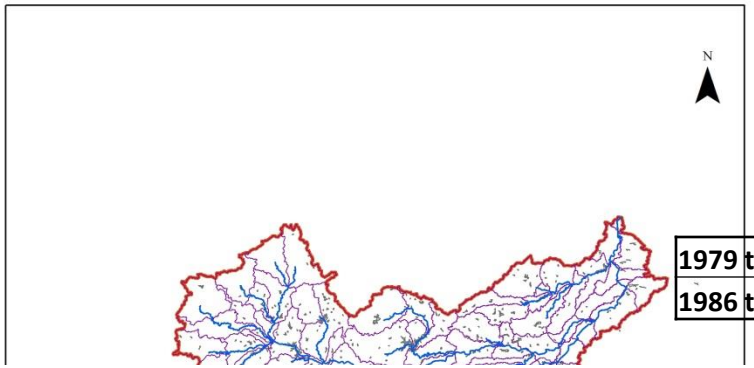


SWAT Model Set-up and Data Sets

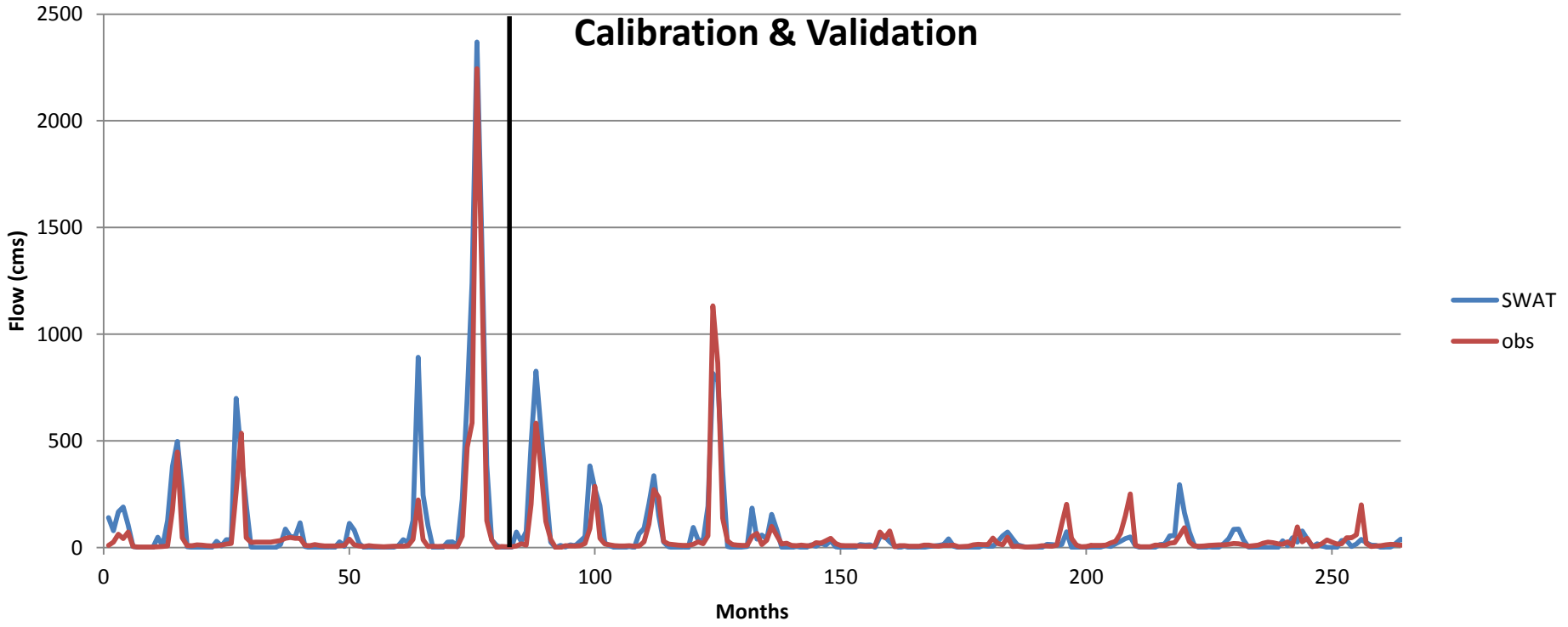
- Land Use:
- Map from FUNCEME (FUNCEME, 2009)
- Municipal Agriculture Production data for Ceará State, from the Brazilian Institute of Geography and Statistics (IBGE, 2009).

Land Use Map	Adopted Crop	From SWAT Data Base
Agriculture	Corn and Cowpea	Corn and Cowpea
Agriculture and Forest	Cassava	Potato
Agriculture with Irrigation	Sugar Cane and Cashews	Sugar Cane and Banana
Plantations	Cashews	Banana

Calibration & Validation



		NSE	RMSE	RMSE%	MSE	NMSE	R2	PBIAS
1979 to 1985	Calibration	0.78	136.94	6%	18753.27	0.07	0.88	-58.14
1986 to 2000	Validation	0.72	65.60	6%	4302.82	0.13	0.78	-12.20



Climate Change Scenarios

- Silva, R. F. V., 2013.
- Martins et al., 2010

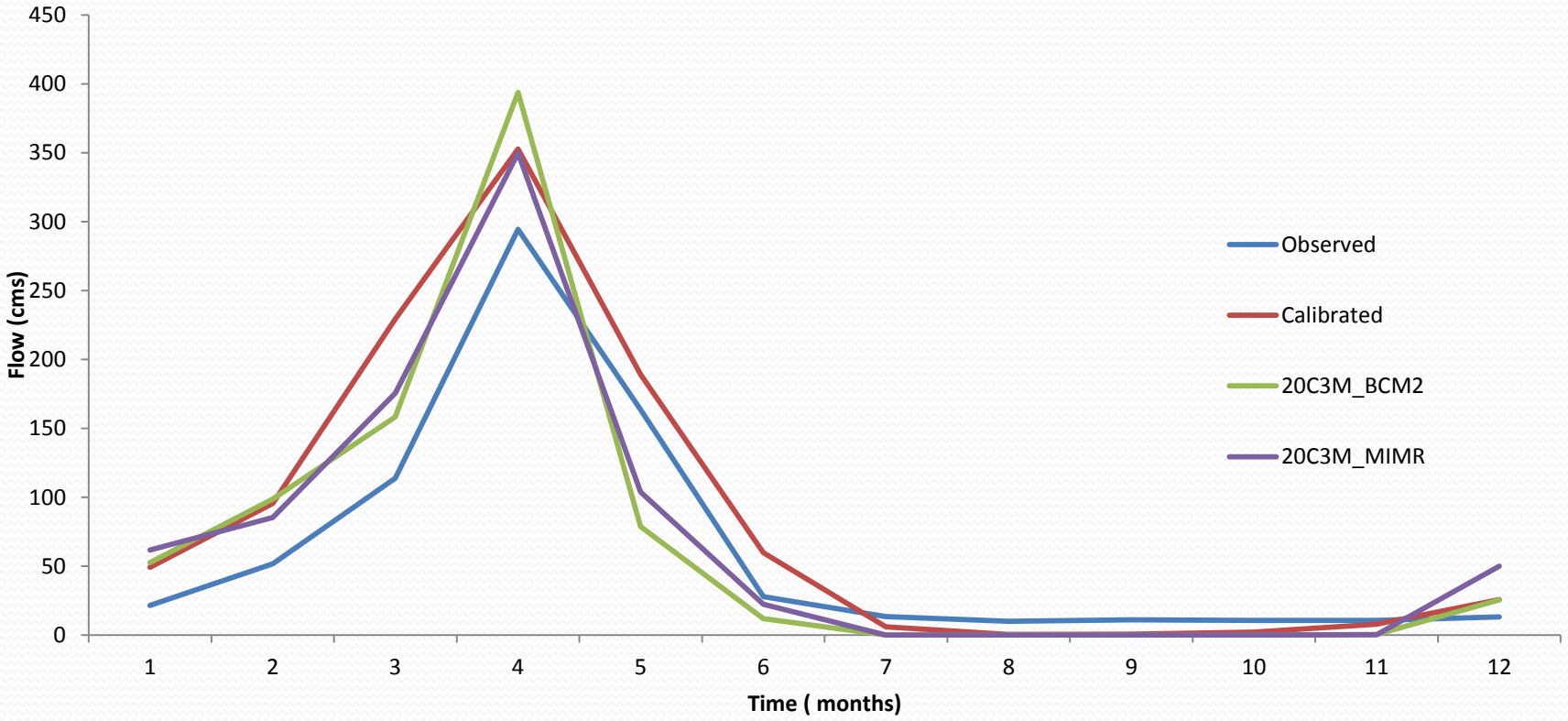
- Indicators of the models of AR5, based on (a) seasonality, (b) multiannual and (c) general evaluation.

- *Intergovernmental Panel on Climate Change (IPCC) (A2 and B1) for 2041 to 2070 generated by a global circulation model from the Assessment Report 4 (AR4).*

- 3 models were identified based on the evaluation from Martins and Silva, two of them were tested on the SWAT model.

- MIMR and BCM2

Historical Series (1975-1999)

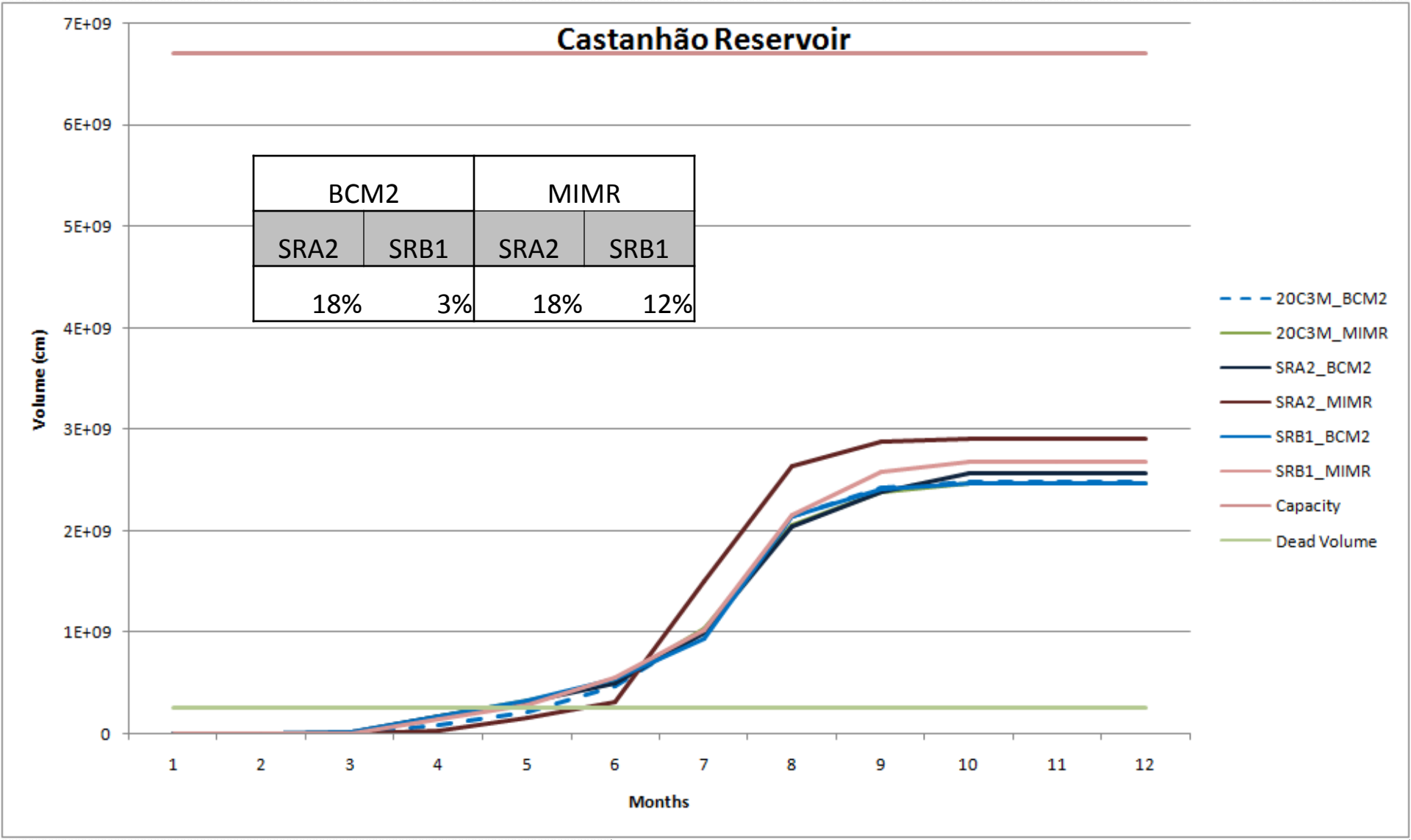


Climate Change Scenarios Results

	BCM2		MIMR	
	SRA2	SRB1	SRA2	SRB1
PRECIP	3%	3%	-3%	-2%
ET	3%	3%	-2%	1%
Total Water Yield	10%	4%	5%	-3%
Surface Runoff	7%	1%	20%	6%

	SRA2		SRB1	
	BCM2	MIMR	BCM2	MIMR
Banabuiu	34%	-3%	3%	-22%
Castanhão	3%	18%	-1%	9%
Orós	2%	20%	-2%	11%
Outlet	10%	6%	3%	-3%

Volumes on Reservoirs



BCM2		MIMR	
SRA2	SRB1	SRA2	SRB1
18%	3%	18%	12%

Months

Final Remarks

- Small increase/decrease in precipitation;
- Increase on water yield for most of the scenarios;
- Big increase in runoff
- Increase in sediment and water volumes for the reservoirs;
- Sediment (peak flows, runoff), decrease volume on the reservoirs;
- Water management, Transposition inside the watershed

Thanks and Acknowledge!

- Reference and Thank Robson Silva and Eduardo Martins for their colaboration!!!

- Silva, R. F. V. Impactos das mudanças de clima na Hidrologia de Duas Bacias Hidrográficas do Semiárido Brasileiro. 2013. Dissertação (Mestrado em Ciências Físicas Aplicadas) - Universidade Estadual do Ceará. Orientador: Eduardo Sávio Passos Rodrigues Martins.

- MARTINS, E.S.P.R. et al. A questão da água no nordeste: As águas do nordeste e o balanço hídrico. In: . [S.l.]: Centro de Gestão e Estudos Estratégicos/Agência Nacional de Águas, 2010. cap. 3.

Thank you very much!

- For more information:

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