WATER BALANCE MODEL TO PREDICT CLIMATE CHANGE IMPACTS IN THE WATERSHED EPITÁCIO PESSOA DAM– PARAÍBA RIVER - BRAZIL

Dra. Josiclêda D. Galvíncio

Dra. Magna S. B.de Moura

Department of Geographic Sciences, Center of Philosophy and Human Sciences, Federal University of Pernambuco, P. O. Box 7308, Recife, PE, 50670-900, Brazil, Phone/Fax Numbers +55 81 2126 8277, E-mail address: josicleda.galvincio@ufpe.br






Introdução

- Global climatic change /carbon dioxide
- Climate change/runoff
- Implications for existing water resources systems as well as for future water resources planning and management.
- Climate change/ imbalance between water supply and water demands
- Urgent action
- Water balance

Introdução

- In 2006, Galvíncio and Sousa, superficial water balance developed at Epitácio Pessoa river basin, in the state of the Paraíba-Brasil. In this study the authors demonstrated the impact of climate, vegetation, and topography of land use in the runoff. The model developed responded very well to these variables






Introdução

- In 2007, Galvíncio and Sousa, evaluated the performance of the water balance model developed for years of El Nino and La Nina in the sub-basin of Caraúbas. The authors also concluded that the water balance model developed was able to make estimates of daily discharges, for years of La Niña, El Niño moderate and normal years.






Introdução

- In 2007, Galvíncio and Sousa, evaluated the performance of the water balance model developed for years of El Nino and La Nina in the sub-basin of Caraúbas. The authors also concluded that the water balance model developed was able to make estimates of daily discharges, for years of La Niña, El Niño moderate and normal years.

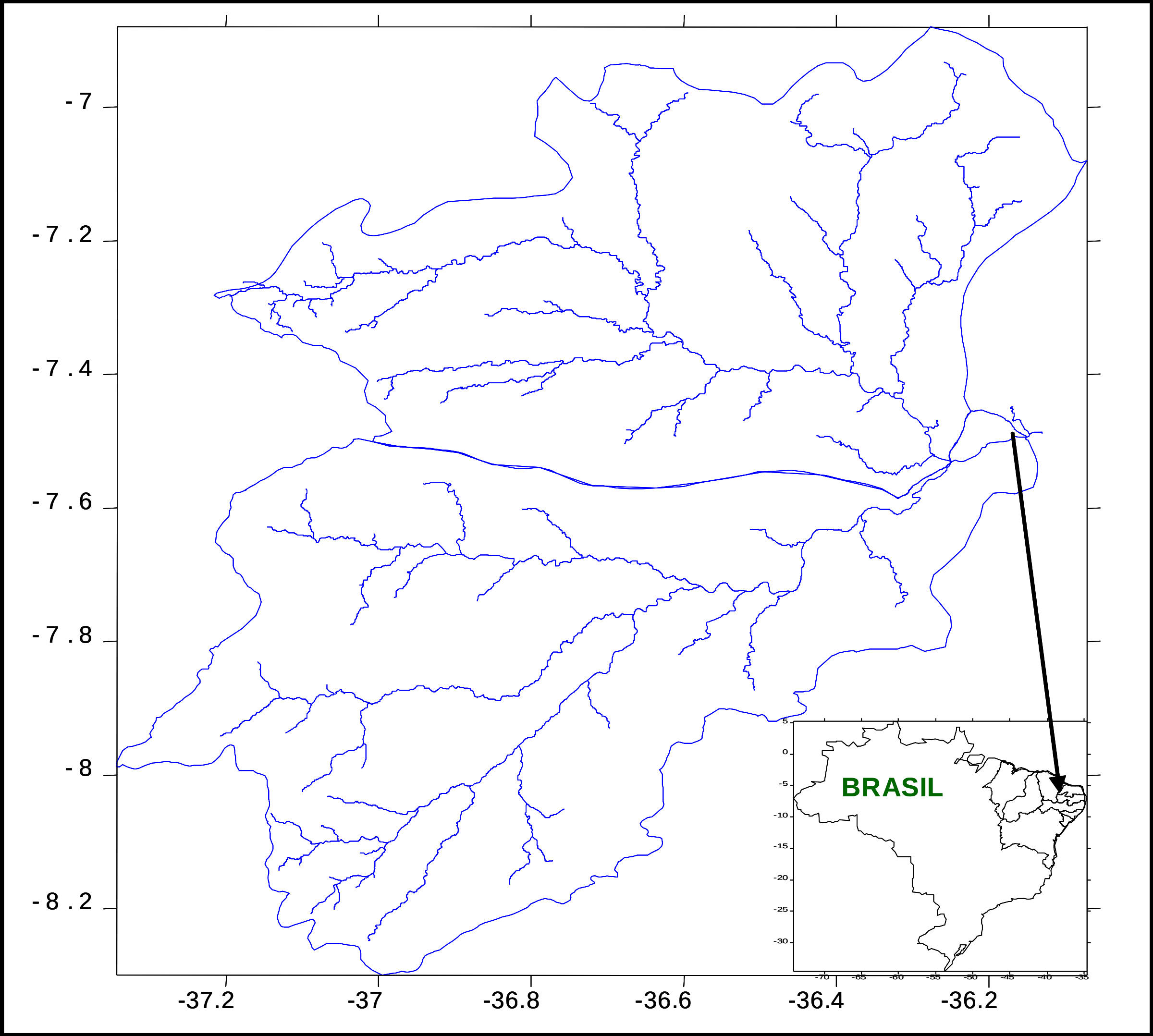
Purpose

- For the purpose of water resources assessment and study of climate change impacts, a water balance model was proposed and developed in this paper to simulate and predict the hydrological process and water resources in the Epitácio Pessoa – Paraíba river - Brazil watershed. GIS techniques were used as a tool to analyze topography, river networks, land-use, human activities, vegetation and soil characteristics.

Region Studied










Methodology

- **Vegetal cover**

- For to characterize the vegetation, Geographical Information Systems tools were used. This characterization is estimated by the NDVI and by the vegetal cover fraction of the river basin in study, based on images of the satellite Landsat - TM 5.

•Water balance equations

$$ds(t)/dt = p(t) - q_{ss}(t) - q_{se}(t) - e_b(t) - e_v(t)$$

where $p(t)$ is the intensity of the rain (mm), $q_x\,(t)$ is the superficial runoff rate or water excess after soil saturation, $\frac{ds(t)}{dt}$ is the water volume variation stored in the soil, q_{ss} is the subsuperficial drainage, $e_b(t)$ is the evaporation rate in the soil without vegetation, and $e_v(t)$ is the rate of vegetal transpiration. The subsuperficial runoff in the Eq. (1) is described as function of the soil storage water:

$$q_{ss} = (s - s_f)/t_c \quad se \quad s > s_f$$

Results

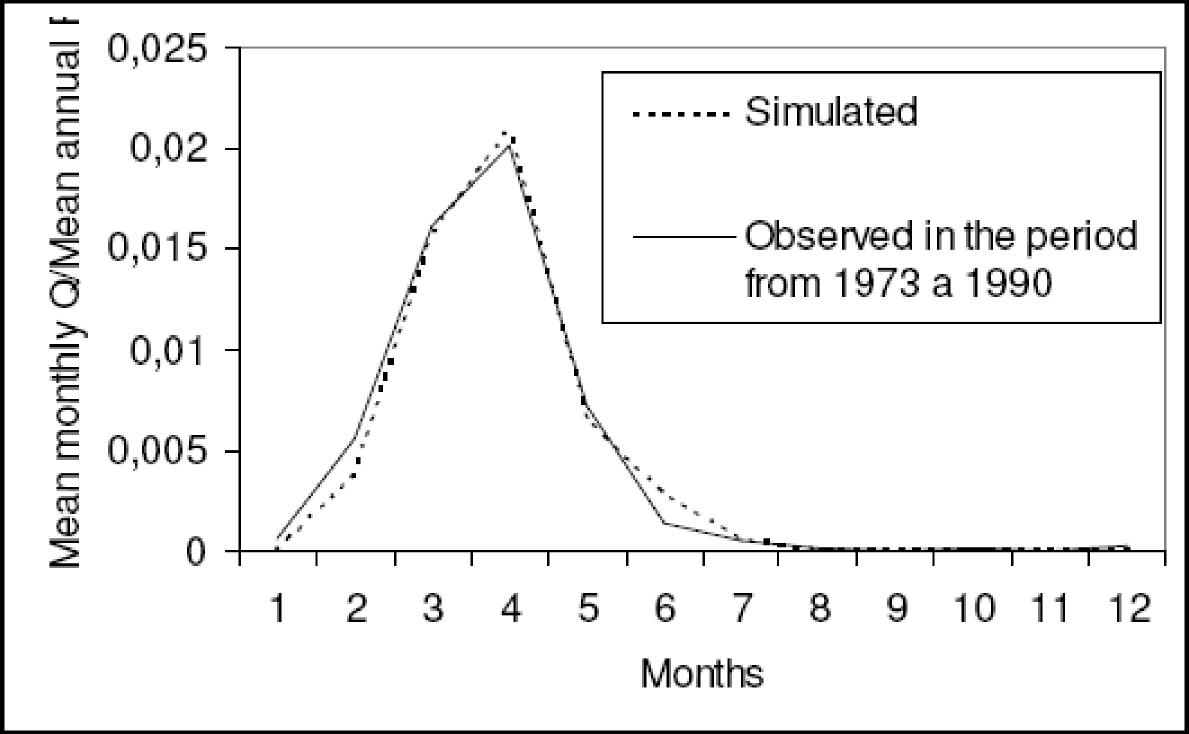


Figure 1 - Simulated (dash line) and observed (solid line) runoff in the watershed Epitácio Pessoa dam

Results

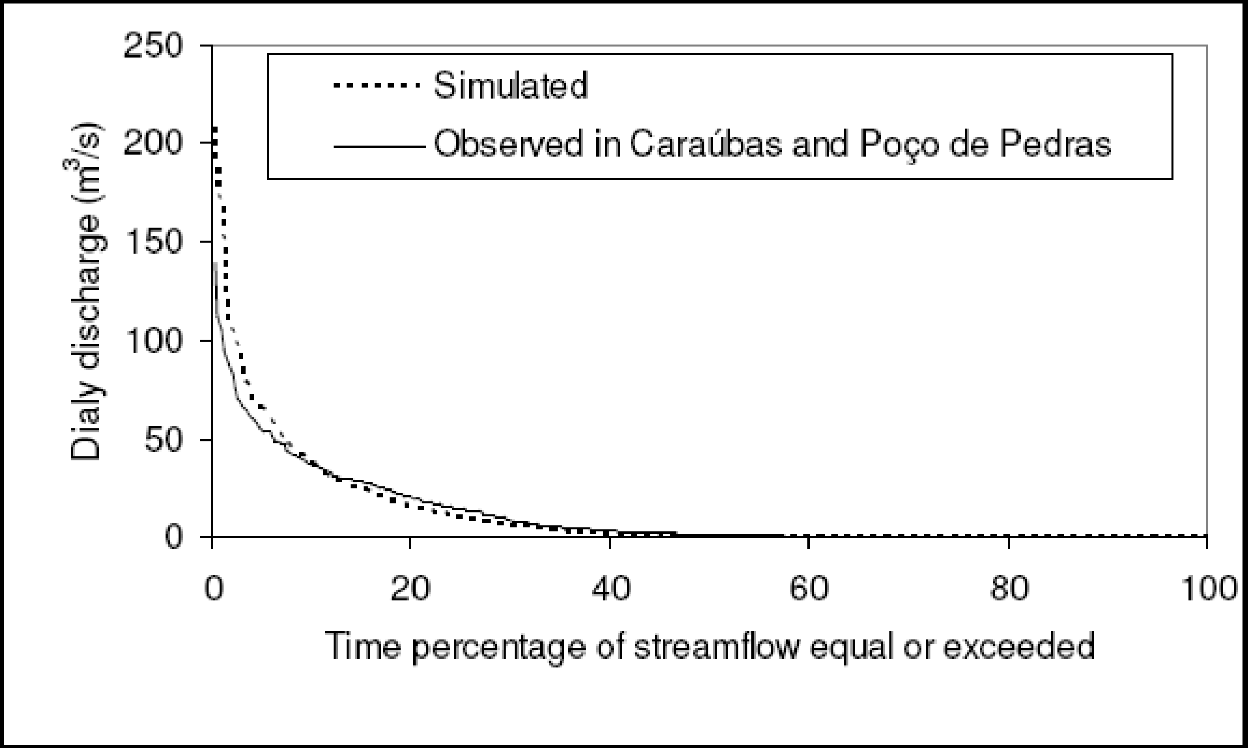


Figure 2 – Simulated (dash line) and observed (solid line) runoff in the watershed Epitácio Pessoa dam






Results

Table 1 – The sensitivity of runoff to temperature change (∂T) and precipitation change (∂P)

	(∂P)				
(∂T)	**-50**	**-25**	**0**	**25**	**50**
-3	-0,06	0,74	0,973	-0,59	-5,4
-2	-0,08	0,71	0,974	-0,51	-5,23
-1	-0,1	0,69	0,976	-0,42	-5,02
0	**-0,127**	**0,66**	**0,979**	**-0,3**	**-4,75**
1	-0,15	0,62	0,95	-0,18	-4,4
2	-0,17	0,58	0,94	-0,05	-4,11
3	-0,19	0,54	0,92	0,09	-3,7





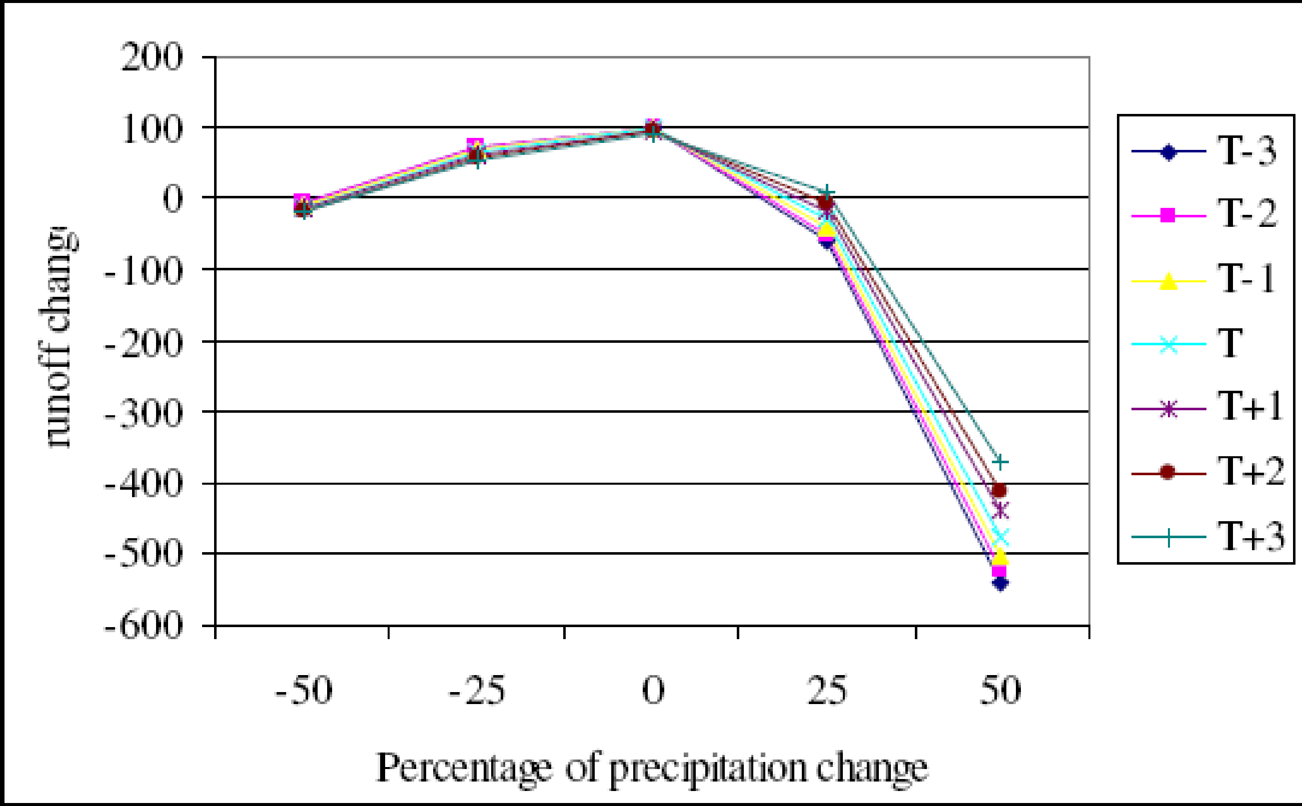



Figure 3 – Relation percentage of precipitation change and runoff change

Conclusion

The runoff is more sensitive to variation in precipitation than to increase in temperature. Climate change challenges existing water resources management practices by additional uncertainty. Integrated water resources management will enhance the potential for adaptation to change.






Thanks!!!