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Hidrossedimentologic study in piquiri river

Estudo hidrossedimentologico no rio piquiri

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Abstract - The objective of this paper was to evaluate the hidrossedimentologic parameters of the Piquiri river and relating them to basin land use systems. They were monitored the parameters of flood and suspension sediment concentrations during the period from August/2007 to April/2008 in Piquiri bridge station, Ubiratã, PR town, BR-369. They determined the rating curve of flood (R^2=0,99), rating curve of suspension sediment concentrations (R^2=0,95), rating curve of daily total discharge of sediments (R^2=0,98) and rating curve of turbidity in function of suspension sediments (R^2=0,94), being that all presented good settlements. The results indicated that can be classified in a very decrease it moderated the output of sediments of the basin.

Key words: suspended sediment, flood, rating curve

Resumo - O objetivo deste trabalho foi avaliar os parâmetros hidrossedimentologic do rio Piquiri e relacioná-los com sistemas de uso da terra da bacia. Eles foram monitorados os parâmetros de inundação e concentrações de sedimentos em suspensão durante o período de agosto/2007 a abril/2008 na estação ponte Piquiri, Ubiratã, cidade PR, BR-369. Eles determinaram a curva de classificação de inundação (R2 = 0,99), a curva de avaliação das concentrações de sedimentos em suspensão (R2 = 0,95), a curva de classificação de descarga total diária de sedimentos (R2 = 0,98) ea curva de avaliação de turbidez em função de sedimentos em suspensão (R2 = 0,94), sendo que todos apresentaram bons sedimentos. Os resultados indicaram que podem ser classificados em um decréscimo muito que moderou a saída de sedimentos da bacia.

Palavras-chave: sedimentos em suspensão, inundação, curva classificação.

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INTRODUCTION

The production of sediment and pollutants within a river basin systems almost always reaches its downstream basins, and the river basin Piquiri is part of the Paraná river basin, draining about 30 km above the beginning of the Itaipu Reservoir. The sediments produced in the basin that are deposited along the river course are carried by the Paraná River and subsequently deposited in the reservoir causing serious siltation and eventually can cause the decrease of the potential power generation of the Itaipu hydroelectric dam. The pollutants also cause several problems within the basin such as eutrophication of environments, especially in the reservoir where nutrients will focus. Pollutants resulting from agricultural runoff surface are composed of sediments, nutrients, pesticides and animal wastes. For Brazilian conditions, has not quantified how much these pollutants contribute to the degradation of water resources (MERTEN e MINELLI, 2002).

The presence of nutrients in water and sediment that is carried by the river which can demonstrate the degree of pollution that is being generated by the basin and systems to prevent runoff from agricultural areas are effective.

According Machado & Vetotorazzi (2003) the hydrological processes associated with land use and management of exercise clearly play a dominant role in the production and sediment transport. With the excessive increase in solid concentration and solid discharge of water sources, can occur over time, siltation, which in addition to modify or degrade water quality, fauna and flora (CARVALHO et al, 2000), causes a decrease water velocity, resulting also in reduced water availability. The sediments are probably the most significant of all pollutants in terms of its concentration in water, its impact on water use and its effects on transport of other pollutants (MACHADO e VETORAZZI, 2003).

The objective of this paper was to evaluate the hidrossedimentologic parameters of the Piquiri river and relating them to basin land use systems. They were monitored the parameters of flood and suspension sediment concentrations during the period from August/2007 to April/2008 in Piquiri bridge station, Ubiratã, PR town, BR-369.

MATERIALS AND METHODS

The collection of water samples were taken at the station located on Bridge Piquiri BR - 369 Ubiratã municipality, latitude and longitude 24:31:0 53:10:0. (HIDROWEB, 2008). The section of the basin above the station has drainage area of 11,303 km2. The site where it has installed the station altitude of 310 m. The place where the collections were made presents approximate width of 187 m, rocky bottom with not allowing the collection of material bed.

We conducted a total of seven campaigns of flow during the period August 2007 to April 2008. For liquid flow measurement method was used to speed-area, where the flow velocity was obtained with hydrometric vane model MLN-07 (Figure 2). We carried out the bathymetry of the river every ten meters for a total of 18 vertical along the river with the help of the winch attached to a hydrometric ballast is also taken these points of data flow velocity at two points in the vertical, where the the river was deeper than 60 cm and at a point where the depth was less than 60cm. The area was determined from the width of the river outlet with the aid of steel cable and graduated vessel and depth (Figure 2).

The speeds of each point were calculated using the number of turns of the helix reel (equation 1), through the equation reel MLN-07 for the propeller JC 017/06 (equations 2 and 3).

$$N = \text{Nº of pulses}/50 \text{ of seconds} \quad (1)$$

$$V = 0.01641847 + 0.25366065 * N \quad \text{for } N < 0.5051 \quad (2)$$

$$V = 0.00233053 + 0.28154932 * N \quad \text{for } N > 0.5051 \quad (3)$$

The area of each section was calculated by multiplying the depth by the width. With the data area and average speed in the vertical flow was calculated for each section, these flows being combined to determine the total river flow. The method used was the method of the half section (SANTOS et al., 2001).

The method used for measuring solid discharge was indirect. In this method were carried out in the field of material collected and analyzed the concentrations in the laboratory. The collection of material in suspension was evaluated by means of vertical integration with Equal Width Increment (IIL). The equipment used was the DH-49 sampler attached to the winch on the fluviometric aluminum boat. For the quantification of suspended sediment was used the method of filtering and evaporation. The analysis of sediment concentration were performed in the laboratory Hidrossedi-mentologia Unions, Campus of Cascavel-PR.

RESULTS AND DISCUSSION

Rating curves of flood and suspended sediments

For the rating curve quota-flow (Figure 1) and rating curve flow-sediment (Figure 2) we used data from seven campaigns.

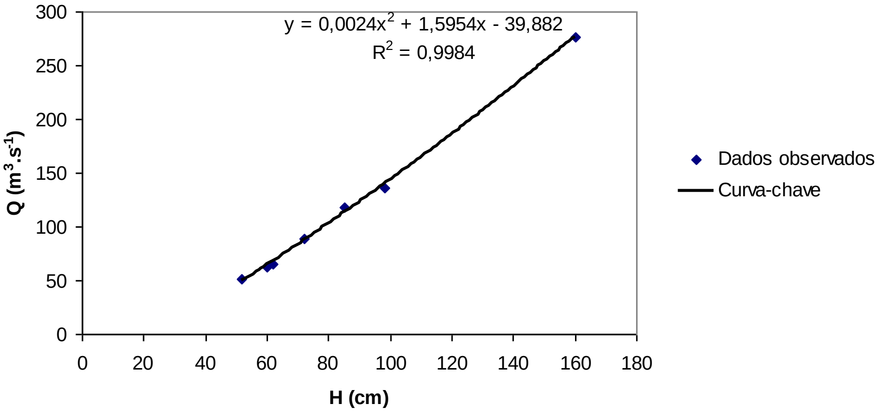

Figure 1 - Rating curve quota-flow.

The relationship that best expressed the curve above was the key polynomial with coefficient of determination R2 = 0.998.

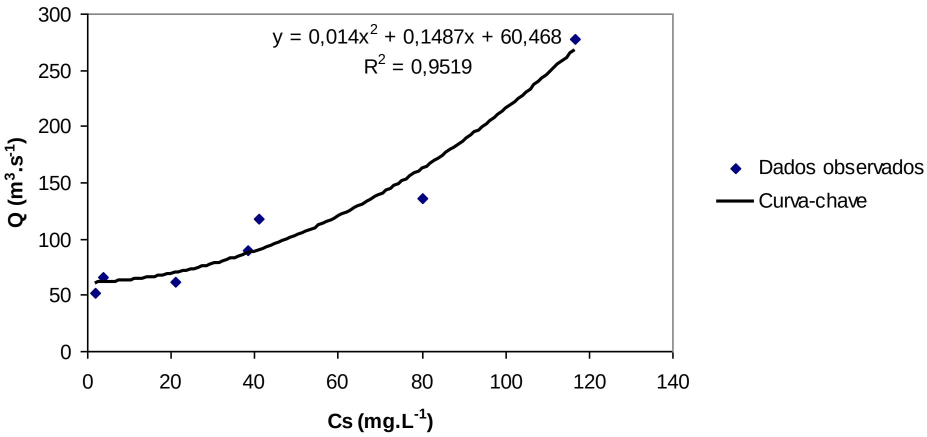

Figure 2 - Rating curve flow-sediment.

The Piquiri river can be considered very low to moderate concentrations of suspended sediments. with a concentration ranging from 46 to 140 mg.L-1, and an average concentration for the study area of 74 mg.L-1 . These results may suggest that soil conservation techniques, widely used in the basin under study, reduce the amount of sediment reaching the water body (LIMA et al., 2004)

The mathematical equation that best expressed the rating curve between the river flow and suspended sediment concentration was the polynomial with R^2 = 0.95 (Figure 2). For the total daily discharge of sediment was also the polynomial equation that best expressed the data, with R^2 = 0.98 (Figure 3).

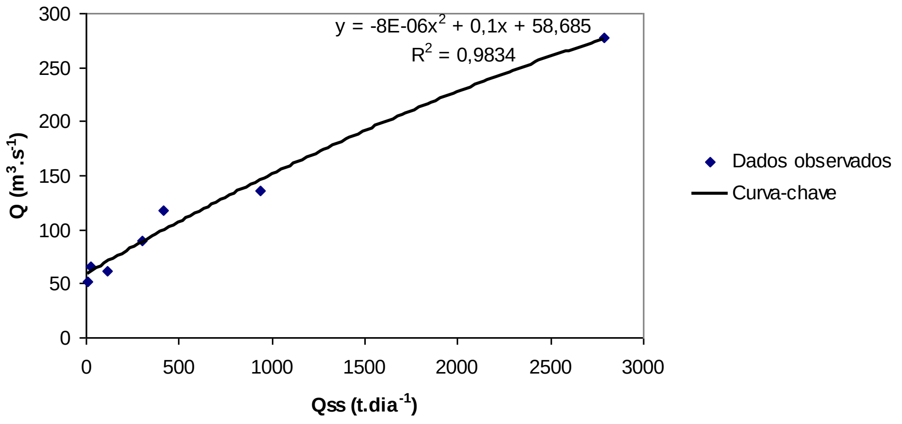

Figure 3 – Rating curve between the river flow and total daily discharge of sediment

Bicalho (2006) found a R^2 = 0.99 for the rating curve solid discharge for the same number of campaigns. According Lima et al. (2004) and Carvalho et al (2000), the rating curve solid discharge generally has the form of power. LIMA et al. (2004), studying the solid discharge in Piquiri river a point near the sampling point, found the best relationship between flow and solid discharge in the form of power with an R^2 = 0.82. In the same work in other seasons the best fit of data was rating curve of polynomial form.

The daily sediment discharge measured at the sample ranged from one-eighth t.dia for the month of April to a discharge of 2789 t.dia-1 in November. Lima et al. (2004) determined an average daily solid discharge to the region of sampling of 2447 $t.dia^{-1}$. The study analyzed the parameters of turbidity of the river and this data was an established relationship with the data of concentration of suspended sediments. The relationship was to determine if there is the possibility of assessing the concentration of suspended sediment by turbidity data.

The best fit rating curve to the data was the polynomial with R^2 = 0.948 (Figure 4) demonstrated good fit to the data of turbidity against of suspended sediments concentrations, suggesting that the turbidity data can be useful for determining of suspended sediment concentrations in a river. Carvalho et al. (2000) also determined the rating curve turbidity in relation to the concentration of suspended sediments with R^2 = 0.8.

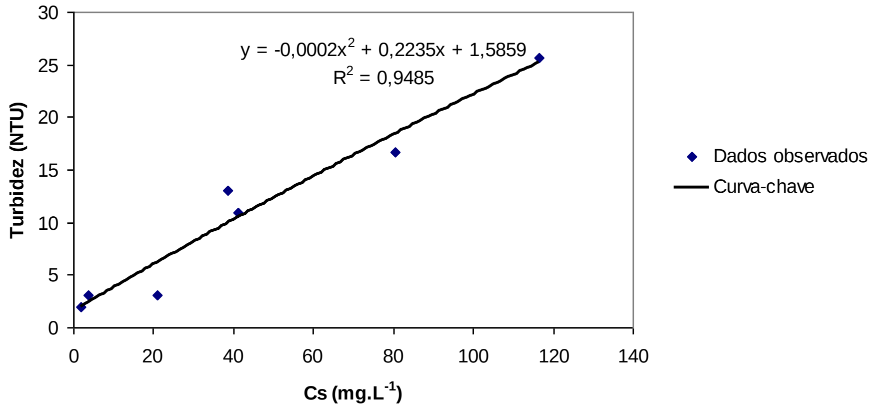

Figure 4- Rating curve of turbidity and suspended sediments concentrations.

CONCLUSIONS

The flow rating curve developed in this study had a good relationship between elevation and flow with a good fit to the data, allowing its use for determining the flow of the river from the values of the shares.

The analysis of suspended sediments showed a good relationship to rating curve. The results show that the river can be classified as very low to moderate concentrations of suspended sediments, with good conservation practices in the management and land use of the basin, which cause fewer emissions of sediment to the river's course.

The relationship between suspended sediments concentrations and water turbidity showed good relationship and can be used to water turbidity to estimate suspended sediments concentrations.

REFERÊNCES

BICALHO, C. C. **Estudo do transporte de sedimento em suspensão na bacia do rio Descoberto**. Dissertação (Mestrado em Tecnologia Ambiental e Recursos Hídricos) UNB. Brasília, DF. 2006.

CARVALHO, N. de O.; FILIZOLA JUNIOR, N. P.; SANTOS, P. M. C. dos; LIMA, J. E. F. W. **Guia de avaliação de assoreamento de reservatórios**. Brasília: ANEEL, 2000, 132p.

CARVALHO, N. de O.; FILIZOLA JUNIOR, N. P.; SANTOS, P. M. C. dos; LIMA, J. E. F. W. **Guia de práticas sedimentométricas.** Brasília: ANEEL, 2000. 154p.

HIDROWEB, AGÊNCIA NACIONAL DE ÁGUAS (ANA). **Banco de dados HIDROWEB**. Disponível em http://hidroweb.ana.gov.br/. Acesso em 01/03/2008.

LIMA, J. E. F. W. et al**. Diagnóstico do fluxo de sedimentos em suspensão na Bacia Araguaia-Tocantins**. Planaltina, DF : Embrapa Cerrados, Brasília, DF. ANEEL. ANA, 2004.

MACHADO, R. E.; VETTORAZZI, C. A. **Simulação da produção de sedimentos para a microbacia hidrográfica do Ribeirão dos Marins.** Revista Brasileira de Ciência do Solo, 27: 735-741, 2003

MERTEN, G. H.; MINELLA, J. P. **Qualidade da água em bacias hidrográficas rurais: um desafio atual para a sobrevivência futura**. Revista Agroecologia e Desenvolvimento Rural Sustentável: EMATER, Porto Alegre/RS, v.3, n.4. 2002.