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Ephemeral and intermittent rivers in a subtropical headwater catchment

Alondra Beatriz Perez (1), Pedro Luiz Borges Chaffe (2), João Henrique Macedo Sá (3), Camyla Innocente (4), and Pedro Ferreira Arienti (5)

(1) Graduate Program in Environmental Engineering, Federal University of Santa Catarina, Florianópolis, Brazil (alondra_920@hotmail.com), (2) Department of Sanitary and Environmental Engineering, Federal University of Santa Catarina, Florianópolis, Brazil (pedro.chaffe@ufsc.br), (3) Graduate Program in Environmental Engineering, Federal University of Santa Catarina, Florianópolis, Brazil (joao.h.sa@posgrad.ufsc.br), (4) Graduate Program in Environmental Engineering, Federal University of Santa Catarina, Florianópolis, Brazil (camylainnocente@gmail.com), (5) Undergraduate Course in Sanitary and Environmental Engineering, Federal University of Santa Catarina, Florianópolis, Brazil (pedropp1995@gmail.com)

The definition of springs and drainage networks is essential for activities varying from the planning of an experimental campaign to the definition of Permanent Protection Areas, such as in the case of Brazil's Forest Code. However, the mechanisms that control the contraction, expansion and discontinuity of those channel networks are still elusive. In this work, we monitored runoff generation in a small headwater with ephemeral and intermittent rivers. Our objective was to determine how the catchment physiographic characteristics control the occurrence of intermittency. The study catchment is a small coastal headwater of 2.65ha located in Southern Brazil and it is covered mainly by Atlantic forest. The average annual rainfall is 1800mm and the average temperature varies from 15°C in the winter to over 25°C in the summer. The hydrography is ephemeral in the upper and lower slopes, and intermittent in the middle region. The soil is characterized as moderately drained cambisol with rocky areas and strong undulation. We installed 21 overland flow detectors for the determination of the ephemeral stream network. The groundwater level was measured by 10 wells installed along the channels. The density of the active drainage network varied between 3961m/km^2 and 17788m/km^2, representing an increase of more than 77% in the drainage network, including the intermittent and ephemeral network. The frequency of activation of each ephemeral channel increases with the contribution area following a logarithmic function. In the middle region of the hillside, where the river is intermittent, the soil is shallow (average of 1.3m) and the slope of the main channel is low (average of 22%). In the other channels, where the slope is high (until 67%), or the soil is deeper (upper 4m), the river is ephemeral. Preliminary results show that the dominant runoff generation mechanism in this area is saturation excess. The subsurface flow is formed due to the high infiltration rates and the soil permeability decreasing with depth. This relationship may be indicating a moisture threshold in the basin that must be exceeded for the beginning of the flow. Soil structure seems to be influencing the duration of runoff occurrence. On the other hand, the contribution area size may be affecting the activation frequency in ephemeral channels.