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Semi-automated morphological characterization using South Rivers Toolbox

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Abstract. Automatic morphological characterization of river systems is important because it provides valuable information on river behavior, helps quantify fluvial changes, improves model accuracy, and supports the management and restoration of river systems. In recent years, scientific interest in the development and use of automated tools for the geomorphological characterization of rivers has increased. The objective of this study was to characterize in a semi-automated way the River Styles of the Duqueco River in south-central Chile. To achieve this objective, an experimental complement within QGIS called South Rivers Toolbox (SRT) was developed. This toolbox allows users to characterize and classify River Styles based on hydromorphological metrics extracted at segment scale, implementing a semi-automatic approach that no longer relies on subjective expert judgment. As a result of the analysis, 43 Rivers Styles have been classified and characterized using the SRT. The upper zone is characterized by being mostly confined, single-channel, with a bed dominated by boulders and blocks, this section of the river is highly affected by hydropower generation plants; the middle zone is confined and single-channel, with a change in the granulometry more dominated by boulders. The lower zone is more diverse in styles, unconfined, with a high presence of geomorphic units that give way to multichannel styles and transition zones. Using the SRT program it is possible to retrospectively analyze the evolution of the river, identifying sections sensitive to geomorphological modification, which is very useful to synoptically evaluate the flood risk, given that, traditionally, for this type of studies only hydraulic modeling is implemented at a river section scale, often with total lack of knowledge of how the river functions and evolves.

1 Introduction

Studies have shown that there has been an increase in the frequency and intensity of heavy precipitation events in many parts of the world in recent decades, and that this trend is likely to continue as temperatures rise further. This can lead to more frequent and severe flooding, as well as other impacts on the environment and human infrastructure (Duarte et al., 2006; Eissa and Zaqui, 2011; IPCC, 2014). In Chile, the factors that contribute to flooding can vary depending on the region and the specific climatic conditions. For example, in the northern regions of Chile, floods can occur when heavy rainfalls overcome the riverbeds capacity, leading to flash floods. In central Chile, floods can be caused by heavy rainfall, but can also be linked to the El Niño South-