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Geomorphic change along a gravel bed river affected by volcanic eruption: Rio Blanco - Volcan Chaiten (South Chile)

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Gravel bed rivers are environments shaped by the balance of flow, sediment regimes, large wood (LW) and vegetation. Geomorphic changes are response to fluctuations and changes of runoff and sediment supply involving mutual interactions among these factors. Typically, many natural disasters (i.e. debris flows, floods and forest fires) can affect the river basin dynamics. Explosive volcanic eruptions present, instead, the potential of exerting severe impacts as, for example, filling river valleys or changing river network patterns thanks to massive deposition of tephra and volcanic sediment all over the main channel and over the basin. These consistent impacts can strongly affect both hydrology and sediment transport dynamics, all over the river system, producing huge geomorphic changes. During the last years there has been a consistent increase in the survey technologies that permit to monitor geomorphic changes and to estimate sediment budgets through repeat topographic surveys. The calculation of differences between subsequent DEMs (difference of DEMs, DoD) is a commonly applied method to analyze and quantify these dynamics. Typically the higher uncertainty values are registered in areas with higher topographic variability and lower point density. This research was conducted along a $\sim$ 2.2 km-long sub-reach of the Blanco River (Southern Chile), a fourth-order stream that presents a mainly rainfall regime with winter peak flows. The May 2008 Chaitén volcanic eruption strongly affected the entire Rio Blanco basin. The entire valley was highly exposed to the pyroclastic and fluvial flows, which affected directly a consistent area of evergreen forests. Extreme runoff from the upper Blanco catchment aggraded the channel and deposited up to several meters of tephra, alluvium, and LW along the entire river system. Aims of this contribution are to define and quantify the short term evolution of the Blanco River after the big eruption event and a subsequent consistent flood that happened in 2013. A post eruption airborne LiDAR data set (2009) and two different Terrestrial Laser Scanner (TLS) surveys carried out in 2013 and 2014 have been used to investigate this. We applied an approach to assessing spatially variable uncertainty in DoDs computation that is based on the creation of an ad hoc fuzzy inference system (FIS) that permits us to combine individually errors of different sources. Particularly attention was applied to define a new approach that permit to filter the huge amount of LW present into the active channel, depending on the superficial roughness values. After the LW filtering, the very high point clouds density allowed us to derive three high resolution DEMs. Topographic data were more accurate for exposed surfaces than those collected in wet areas. Two DoDs were computed, showing consistent erosion processes and deposition within the study area, and changes in geomorphic characteristics of channel and bars could also be detected, demonstrating a strong dynamicity of the study reach. This research is been developed within the framework of Project FONDECYT 1110609.

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