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Long term morphological adjustments at the Blanco-Este River (southern Chile) after volcanic eruptions

Andrés Iroumé (1), Ramon Batalla (2), Valeria Zingaretti (3), and Lorenzo Picco (4)

(1) Universidad Austral de Chile, Instituto de Conservacion, Biodiversidad y Territorio, Valdivia, Chile (airoume@uach.cl), (2) Fluvial Dynamics Research Group (RIUS), University of Lleida, Lleida, Catalonia, Spain. rbatalla@macs.udl.cat, (3) Valeria Zingaretti, Universidad Austral de Chile, Graduate School, Facultad de Ciencias Forestales y Recursos Naturales, Valdivia, Chile. valezingaretti@gmail.com, (4) Lorenzo Picco, University of Padova, Department of Land, Environment, Agriculture and Forestry, Padova, Italy. lorenzo.picco@unipd.it

Strengthening the resilience of communities affected by volcanic eruptions and monitoring the associated hydrologic and geomorphic processes have prime societal relevance in a country such as Chile. The country is patched by ca. 90 active volcanoes (i.e. with geological evidence of eruptive activity in the last 10 ky) and ranks 5th worldwide. Clearly, studying short-, medium- to long-term impacts of eruptions is of utmost priority to underpin an accurate volcanic hazard assessment and management. Quantifying the resilience response to the impacts of explosive eruptions and the subsequent hydromorphological processes depends on the modes and rates at which communities adjust to the altered surrounding landscapes and on their recovery following disturbance. When compared to background fluxes, sediment and biomass budgets are indispensable to achieve sustainable management of the short-term impacts and to understand the long-term legacies of landscape-scale disturbances on forest and water resources, land use, and biogeochemical cycles. We study the long-term morphological adjustments of the fluvial corridor of Blanco-Este River in southern Chile, following the last two eruptions (1961 and 2015) of the Calbuco volcano which incorporated a massive input of sediments into the system. The river drains the north-eastern flanks of the Calbuco and was heavily affected by ash fall, pyroclastic flows, post-eruption channel reworking and subsequent cascading processes. The study reports the channel adjustments from 1961 (immediately after the eruption, same year) until 2017 (i.e. two years after the 2015 eruption) along a 6.5 km-long segment using a sequence of eight remote images. After the 1961 eruption the mean active channel width in the study segment was 210 m, and by 2014 the channel had adjusted its morphology showing a mean width of 76 m, possibly reaching a quasi-equilibrium condition. The 2015 eruption severely modified this condition conveying the channel in the 6.5 km-long study segment to a mean width of 202 m and to a morphology almost identical to the one observed after the 1961 eruption. Based on these evidences, we hypothesize that the river system will require at least 40-50 years to reach a more stable morphological setting. This research is being developed within the framework of Project FONDECYT 1170413.