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Impact of a volcanic eruption on the wood fluctuation along a Chilean river basin: the Calbuco study case

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Large wood (LW), both as individual pieces and in accumulations (WJ), plays an important role in the morphology, hydrology, and ecology of rivers. However, LW dynamics in rivers affected by volcanic eruptions has been little studied. This study aims to investigate the changes of LW volumes along a segment of the Blanco-Este River (southern Chile) affected by the 2015 Calbuco volcanic eruption. The following research questions were addressed: a) what are the drivers that explain the spatial and temporal variability of the amount of LW along the river active channel? b) what is the level of connection between the potential source areas of wood and the channel? c) is it possible to infer a relationship between recruitment sources and floods, with fluctuations in the amount of wood along the channel? The study was conducted in two reaches, the upstream one more proximal to the volcano (hereinafter R1) and the downstream more distal from the volcano (R2). LW and WJ volume were calculated using the structure from motion (SfM) technique for several sampling campaigns performed between 2017 and 2020 using a drone. Data from a fluviometric station near the Blanco-Este River and time lapse camera records were used to interpret the dynamics of wood during floods. Finally, the stability of WJs was used to indirectly evaluate the mobility of LW in the study reaches. Results show that the amount of LW (n°/ha), WJ (n°/ha) and total wood volume (m^3/ha) are considerably higher in R2 than in R1. In both reaches, the main recruitment source of LW to the channel is associated with erosions of the forested margins, but for R2 a tributary and erosions of old laharic deposits are also recruitment sources. LW volume in R1 did not vary much between campaigns (1.9-5.1 m^3/ha) which would indicate that this reach is in an equilibrium condition of LW loading. Since the wood volume in R2 showed important variations between sampling campaigns (9.1-73.9 m^3/ha), this reach does not seem to have reached this equilibrium condition yet. Results showed that there is no clear relationship between the wood fluctuations and the flood intensities (volume increases and decreases indistinctly associated to low or high peak flows), a fact confirmed from the time lapse cameras. However, wood supply appears, as might be expected, somehow controlled by floods, as well as wood transport. But, apparently, the floods competent to move logs are of lower magnitude than those generating bank erosions and subsequent wood recruitment. From the analyses of the

drone images, it was observed that the stability of the WJs was very low in the Blanco-Este, which indicates a high LW mobility. A connection between the areas that supply LW to the river channel appears to occur during major flood events with sufficient competence to erode forested streambanks. The latter calls for the need to incorporate the analysis of longitudinal wood connectivity in channel studies. This study is part of the FONDECYT 1200079 project.