



Controls on rapid post eruption fluvial system response, Calbuco, Chile

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Calbuco, a 2015m high, glacier capped, stratovolcano in the heavily populated Los Lagos district of southern Chile, has a history of numerous volcanic eruptions. Calbuco experienced a powerful eruption on 22 April, 2015 followed by additional major eruptions on 23 & 30 April. The eruption deposited ~ 0.5 km³ of tephra and generated Pyroclastic Density Currents (PDCs) which interacted with snow and glacier ice to form lahars which descended into river catchments radiating from the volcano for distances of up to 14 km. PDCs overprinted proximal lahar deposits in the Rio Blanco Este and Rio Blanco Sur on the northern and southern flanks of Calbuco respectively. Satellite imagery acquired following the first two eruptions on 24 April, 2015 shows largely undisturbed PDC deposits in the upper reaches of the Rio Blanco Este with no fluvial system adjustment in the medial and distal reaches downstream of the furthest lahar extent. Field (TLS and dGPS) and airborne (LiDAR) surveys of the Rio Blanco Este in July 2015, January 2016 and April 2016 show major (~ 20 m) proximal erosion of PDC and lahar deposits generating simultaneous medial and distal aggradation of up to 5 m burying a two story hydropower plant. Erosion of proximal PDC deposits in the Rio Blanco Este generated a 'stair case' of erosional terraces, each capped by < 2 m thick flood deposits. Aggrading medial and distal reaches of the Rio Blanco Este are characterised by channel avulsion and widening. Despite the presence of large volumes of tephra our study highlights the importance of reworked PDC deposits as a driver of major rapid fluvial system response within 1 year of the eruption. Continued erosion of PDC deposits and tephra at high elevations on Calbuco has the potential to generate further fluvial system response over decadal timescales.