



Geomorphological analysis of recent flash-flood events in the Atacama Desert using high-resolution UAV images

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The Atacama Desert is one of the most arid areas of the world (average annual precipitation <20 mm). According to the available historical record, it has been recurrently affected by extreme flood events in the last 400 years. These events are generally related to intense rainfall that normally occurs during the winter months or to snowmelt in the summer season. The last significant event, known as 25M, occurred on 24th – 26th March, 2015, when more than 80 mm fell in the area causing flash floods in 17 catchments of the Atacama Region. In Copiapó (420 m a.s.l.), located at the confluence between the Copiapó River and the ephemeral Paipote stream (Quebrada Paipote), over 70% of the urban area was flooded and more than 2.2 million m³ of sediment accumulated. Most of the sediment in the city came from Quebrada Paipote, whose morphology was dramatically altered by this flood. We studied two sites in Quebrada Paipote, La Puerta (1,875 m a.s.l.) and El Salto (2,000 m a.s.l.), 83 km and 84 km upstream of Copiapó, respectively. Both sites are located in narrow sectors of the valley that were particularly affected by erosion during the flood. In particular, we produced geomorphological maps for each site before and after the 25M event. For the pre-event cartography satellite images (Digital Globe, resolution 50 cm, available on Google Earth) were used, whereas for the post-event map, high-resolution drone imagery (resolution 2 cm) of the area were specifically acquired. A DEM was produced for the after-event through photogrammetry. The comparison between pre- and post-event maps evidenced that both sites were affected by strong lateral erosion and entrenching of the river channel (up to 10 meters deep). Moreover, different gravity processes were triggered on the valley slopes, such as backward toppling and slumps. This caused the complete destruction of several sectors of the road that run at the valley floor. The high erosion rate recorded in these sectors of the valley favoured the transport of large volumes of sediment that were finally deposited in the Quebrada Paipote fluvial fan where the city is located.