

Geomorphic effects and sedimentological record of flash floods in the Copiapó River salt marsh (Atacama coast, Northern Chile)

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The Copiapó River is located South of the Atacama Desert (northern Chile) that is considered one of the most arid areas of the planet. On March 25 2015 this fluvial valley experienced one of the largest hydrometeorological events recorded in historical times. The rain, unusually high, favored the run off in fluvial channels and alluvial fans that were dry for decades and triggered the rise and overflow of the Copiapó River at different points along the valley causing severe damages. In this work, we realize a characterization of the geomorphic configuration of the Copiapó River before and after this event with the aim of analyzing the main changes produced in the river mouth, where and extent coastal wetland of high ecological value is developed. The geomorphological mapping show a drastic change in the river mouth with the development of forms related with the river overflow and the flooding of the coastal plain such as levees, activation of abandoned channels, flooding lagoons, widening and deepening of the main channel, foredune rupture and, more importantly, a large mud sheet that covers almost the 80% of the study area, including the wetland and the main coastal dune systems. Just a small area of the wetland, far from the main channel, was not affected by this process as it was protected by the levees formed during the first stages of the overflow. The mud flow facies are homogeneous and consist of a layer of massive silty sands with a maximum thickness of 10-75 cm overlaid by 5-20 cm of clay with wavy top and carbonaceous rest. It also presents a wide development of mud cracks and salt crusts. At the same time, 4 stages have been differentiated along the event: 1) arrival to the wetland of the first surge that flows in the channel and flooding of the southern sector of the wetland; 2) flooding of the complete mouth area because of the peak discharge arrival and generalize overflow with and associate muddy facies deposition; 3) erosional stage of the channel due to the formation of confined and turbulent flows in the channel; and 4) water logging of the wetland and adjacent areas that lasted several weeks. Using geostatistic technics, we have estimated a minimum volume of mud of 48,892 m³ (37,600 m³/km²) that accumulated during this event in the river mouth.