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Understanding Climate and Weather Drivers of Tailings Risk in Chile: A Complex Multi-Hazard Challenge

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Tailings are typically voluminous, reactive, and potentially toxic by-products of ore processing that must be safely and securely isolated from living organisms and the environment. Multiple tailings hazards involve water, which is why understanding the behaviour and transport of tailings and their derivatives when exposed to extreme weather conditions and shifts in climate is fundamental to reducing tailings risk. The aim of the research is to draw attention to these issues and better understand the interactions between tailings, weather, and climate by using Chile as a case study.

Chile's 757 active, inactive, and abandoned tailings deposits mostly derive from copper and associated metal production and reside almost entirely within the central and northern parts of the country, which are experiencing significant changes in weather and climate. From 1915 to 2010, seismic activity triggered 80% of tailings incidents in Chile, with the rest linked to hydrometeorological events. Since then, erosive flash floods from extreme precipitation have resulted in two of Chile's larger tailings incidents by volume. Moreover, windblown tailings dust is becoming recognised as a significant hazard.

Reanalysis of past hydrometeorological events that resulted in tailings erosion by wind and water has enabled better characterisation of preconditioning factors and interactions before and during these tailings hazard events. This has been used to identify certain tailings highly susceptibility to erosion. The tailings beach at Chañaral (Atacama Region) is one example of a hazard hotspot, as public health concerns have been raised over tailings dust in the town and several 100,000 m^3 of tailings were eroded during the March 2015 flash flood. Similarly, the May 2017 flash flood in the Marquesa valley (Elqui river catchment, Coquimbo Region) eroded about 100,000 m^3 of tailings upstream of urban centres and agricultural land.