Mapping rainstorm erosion associated with an individual storm from InSAR coherence loss validated by field evidence for the Atacama Desert

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Abstract

Extreme high-magnitude and low-frequency storm events in arid zones provide the necessary runoff to entrain sediments from source areas and therefore dictate the linkages between hillslopes and channels. Nevertheless, the erosive impact of large storms remains difficult to predict. Most of the uncertainty lies in the lack of topographic change maps associated with single hydro-meteorological events. Consequently, event-based erosion models are poorly constrained and their extrapolation over long time periods remains uncertain. In this study, a 15-month Sentinel-1A coherence time series, optical and field data are used to map the spatial patterns of erosion after the 5-day storm occurred on March 2015, in the Atacama Desert. The coherence change detection (CCD) analysis suggests that temporal loss of coherence is related to variations in soil moisture, while permanent loss of coherence is related to modification of soil texture by erosion and sedimentation. Importantly, permanent loss of coherence is more apparent on gentle rather than steeper slopes, likely reflecting differences in regolith cover and thickness. These findings can contradict the landscape models predicting higher erosion on steeper hillslopes. The CCD technique represents a promising tool for analysing and modelling sediment connectivity in arid areas, giving a clear picture of the relation between sediment sources and sink pathways. (c) 2020 John Wiley & Sons, Ltd.

Keywords

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