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Dust emission from crusted surfaces

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Crusted surfaces, such as crusted playas or ephemeral lakes, can be major sources of mineral dust emission. Understanding of dust emission from crusted surfaces is limited, because (1) few comprehensive sets of measurements exist that focus on the emission mechanisms and as a result theories on dust emission are not well tested for such surfaces; and (2) modelling is hampered by a lack of input data sufficient to describe the surface conditions. Based on detailed measurements that were collected in the southwestern United States in 2016, we present insights in dust emission from crusted surfaces. Our measurement results suggest that dust emission mechanisms vary with crust and loose erodible material characteristics and that crust erodibility and dust emission intensity can increase or decrease after previous erosion events. To support interpretation of the measurements and to test the applicability of a state-of-the-art parameterization to simulate dust emission from crusted surfaces, we apply the dust emission scheme of Shao (2004) together with the saltation scheme of White (1979) for selected events. As expected due to the limited particle supply, saltation flux is overestimated compared to the measurements. As a first-order correction, we use a simple scaling to match the order of magnitude between modelled and observed saltation flux and test the dust emission scheme using the scaled saltation flux as an input. Our results show that the dust emission scheme is able to reproduce the observed dust emission flux if accurate input data is provided, i.e. particle-size distributions of the surface crust and loose erodible material, and parameters, such as soil plastic pressure, are adapted to represent the crust condition. A larger and more diverse set of measurements is needed to generalize our findings, but hopefully our results provide new momentum for future studies aiming at increasing our understanding of dust emission from crusted surfaces for use in dust modelling.