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Investigating the impact of sparse vegetation on the near-surface dust flux using Large Eddy Simulations.

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Understanding the impact of sparse vegetation on the dust exchange between the surface and the atmosphere in semiarid regions is essential owing to mineral dust's impact on agriculture, micro-climate, human health and economic activities. To this effect, we applied a complete physically-based aeolian soil erosion model on a sparse vegetated surface. The originality of the model is to simulate explicitly (i) the main turbulent eddies of the flow using a Large Eddy Simulation (LES), (ii) the saltator motions through a Lagrangian approach, and (iii) dust emission through the impaction of saltators at the surface. The presence of vegetation is accounted for (i) on the flow by adding a drag force, and (ii) on saltation and dust suspension by allowing deposition onto the vegetation. The model is evaluated against the WIND-O-V field experiments performed in Tunisia in 2017 and 2018, without and with sparse vegetation, respectively. An interesting result from these campaigns was the significant reduction in the near-surface dust mass concentrations in the presence of sparse vegetation, even at considerably higher friction velocities. This was accompanied by an impoverishment of the near-surface dust flux in particles larger than 1 μm. The accelerated deposition of the larger particles in the presence of vegetation may explain this impoverishment. The LES model is used here to explore the sources of impoverishment in the presence of vegetation.