Wind erosion within and above vegetation canopies: A wind tunnel study with live plants

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World wide, wind erosion and desertification cause tremendous losses of fertile soil and increase the content of mineral fine dust in the atmosphere, thereby affecting climate and human health. Re-establishing an intact vegetation cover is a common measure to counteract soil degradation by wind erosion. To develop efficient revegetation strategies for degraded soils and to improve the predictive capabilities of wind erosion models, the effectiveness of different vegetation covers in reducing wind erosion must be known.
In the present study, wind tunnel experiments were performed with Perennial Ryegrass (*Lolium perenne*). The novelty of these experiments is the use of live plants instead of artificial plant imitations or clipped plant parts. Total sediment mass flux, fine dust concentration and the vertical profile of sediment mass flux were studied in four levels of canopy density with frontal area indices λ = 0.58, 0.16, 0.03 and 0. For visualizing sand erosion and deposition patterns, coloured quartz sand was used.
Both total sediment mass flux and fine dust concentration decreased exponentially with increasing canopy density. However, in the very sparse grass canopy (λ = 0.03), the values tended to be slightly higher than in the unplanted configuration. This is attributed to elevated shear stress on the sand bed caused by flow acceleration around the tussocks and by vortical structures in the lee of the tussocks. Furthermore, the grasses were observed to trigger erosion by oscillating movements at the ground surface. It was also found that vegetation profoundly changed the characteristics of vertical sediment flux profiles, with decreasing flux fractions near the ground in denser plant canopies. The application of coloured quartz sand revealed characteristic deposition patterns around plants and ripple formation. Detailed image analysis is planned for gaining spatial and temporal information on the observed erosion and deposition processes.