



Experimental study on dust emission from soil crusts on croplands in the Free State, South Africa

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Satellite images have shown that the Free State is the most dust emissive area in South Africa, whereby most dust source points are located on croplands. These croplands consist of heavily cultivated sandy soils that have no protective vegetation cover after harvest, approximately from August till November, leaving the surface vulnerable to wind erosion. Beside the land degradation on the emissive surface due to a loss of fines, nutrients and organic matter, dust can also have an off-site effect, for example, on human health and regional and global climate.

Physical soil crusts have been observed in large amounts on these croplands. Recent rainfall experiments on the formation of crusts in the Free State show that significantly strong soil crusts can form within 15 mm of rainfall. Soil crusts are known to be able to influence the emissivity of a surface, but this might not be the case for crusts on sandy soils (Rajot et al., 2003). This could be due to the abrasion of saltating particles, which can ultimately lead to the degradation and destruction of a crust.

The results from both rainfall and wind erosion experiments will be presented. Rainfall experiments give insight in the crusts that can form on the soils in the Free State and the associated crust strength. These characteristics can be correlated to the measured threshold friction velocity, the dust emission flux, and the resistance to abrasion of the crust. The experiments on dust emission are accomplished using the Portable In-Situ Wind EROsion Lab (PI-SWERL, Desert Research Institute). The addition of abrading particles will show the resistance to abrasion and the degradation of crusts over time. These results can be used to quantify the influence of crust formation and crust deterioration on dust emission rates, to improve model performances on dust emission, and to ultimately contribute to improved land management practices in the Free State with a focus on dust prevention.