

Dust emission and soil loss due to anthropogenic activities by wind erosion simulations

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Wind erosion is major process of soil loss and air pollution by dust emission of clays, nutrients, and microorganisms. Many soils throughout the world are currently or potentially associated with dust emissions, especially in dryland zones. The research focuses on wind erosion in semi-arid soils (Northern Negev, Israel) that are subjected to increased human activities of urban development and agriculture. A boundary-layer wind tunnel has been used to study dust emission and soil loss by simulation and quantification of high-resolution wind processes. Field experiments were conducted in various surface types of dry loess soils. The experimental plots represent soils with long-term and short term influences of land uses such as agriculture (conventional and organic practices), grazing, and natural preserves. The wind tunnel was operated under various wind velocities that are above the threshold velocity of aeolian erosion. Total soil sediment and particulate matter (PM) fluxes were calculated. Topsoil samples from the experimental plots were analysed in the laboratory for physical and chemical characteristics including aggregation, organic matter, and high-resolution particle size distribution. The results showed variations in dust emission in response to surface types and winds to provide quantitative estimates of soil loss over time. Substantial loss of particulate matter that is < 10 micrometer in diameter, including clays and nutrients, was recorded in most experimental conditions. Integrative analyses of the topsoil properties and dust experiment highlight the significant implications for soil nutrient resources and management strategies as well as for PM loading to the atmosphere and air pollution.