



The wet bonding forces in soils and their effect on threshold friction velocity of wind erosion.

S. Ravi (1), T.M. Zobeck (2), T.M. Over (3), G.S.Okin (1) and P. D'Odorico (1)

(1) Department of Environmental Sciences, University of Virginia, 291 McCormick Road, Box 4000123, Charlottesville, VA 22904-4123, USA, (2) Wind Erosion and Water Conservation Research Unit, USDA, Agricultural Research Service, 3810 4th Street, Lubbock, TX 79415, USA, (3) Department of Geology / Geography, Eastern Illinois University, 600 Lincoln Ave, Charleston, IL 61920, USA (sujith@virginia.edu / Phone: 1-703-581-8186)

Wind erosion is a widespread process in the arid and semi arid regions of the world with implications on regional climate and desertification. The erosion process occurs when the wind speed exceeds a certain threshold value, which depends on a number of factors including surface soil moisture. Arid regions are characterized by very low annual precipitation and soils with poor vegetation cover and hence the variation in surface soil moisture is significantly affected by changes in atmospheric humidity. Thus under these circumstances the atmospheric humidity has a significant influence on the threshold for wind erosion. This dependence of threshold velocity on near surface humidity is studied for three soils of different texture (sand, sandy loam and clay) through a series of wind tunnel tests, laboratory experiments and theoretical analysis. The results show that the threshold shear velocity decreases with increasing values of relative humidity for values of relative humidity between about 40% and 65%, while above and below this range the threshold shear velocity increases with air humidity. A theoretical framework is developed to explain these dependences assuming an equilibrium between the surface soil moisture and the overlying atmosphere. The results obtained in the wind tunnel are also replicated at the field scale. Another series of experiments were performed to determine the time needed to reach equilibrium, starting from both wet and dry initial conditions. Sands reached equilibrium within about 1-2 hours starting from both wet and dry regimes while, clays were found to take several days to reach equilibrium starting from wet surface conditions. Additional laboratory analyses are discussed to support the results of this study.