Estimation of wind soil erosion in a semiarid region of Mexico

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Abstract

Land degradation is a global problem. One of the main factors of this degradation is intense winds in the world's arid and semi-arid regions. The wind acts on soils without vegetation cover in increasingly large regions. The impact of dust storms is considerable, from massive soil deterioration to health problems. In the arid regions of northern and central Mexico, the problem of changing land use from grasslands and forests to rainfed agriculture has increased notably in recent decades. Recurring dust storms due to winds associated with the passage of cold fronts have become a severe environmental problem. The Weather Research and Forecasting Model (WRF-Chem) was applied to analyze dust storms that occur mainly during the winter. An analysis was performed for wind speed data in the period from October 2005 to April 2018. It revealed that about 20 events per year exceeded a threshold erosion speed of 9 m/s. Fifteen events with the potential to generate dust storms were selected. The total amount of dust emitted was added together, and an average dust storm was calculated. Since the massive land-use change began approximately 50 years ago, a total erosion effect was estimated for this period. The characterization of eight soil samples revealed the texture of fine silty sands with low clay content and low organic content due to the mechanical processes of removing the finest fraction. Comparison between observed and modeled dust storm events showed good agreement.

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3

NOAA/ESRL Physical Sciences Division

20 m s⁻¹

101400   101800   102200   102600

(b)

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270   275   280   285   290   295   300

(b)

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4

40   45   50   55   60   65   70   75   80   85   90