Assessing the spatio-temporal variability of erosion with a novel wind erosion model and GIS: A case-study of the South Australian agricultural zone

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Abstract

Agricultural productivity in dryland areas can strongly decrease with wind erosion. However, wind erosion events currently cannot be predicted. Here, we show that a comprehensive model of daily horizontal sediment flux with high spatio-temporal resolution can quantify the impact of surface wind erosion in different regions in South Australia with different land management practices. For example, the model showed that during the Millennium drought period (2001-2010), surface wind erosion led to the loss of fertile land, contributing to a decrease in agricultural productivity. Since 2013, surface wind erosion has decreased, likely owing to a change in farming practices that maintain higher ground coverage for longer periods. The model also showed that surface wind erosion was generally higher in farmed areas than in natural environments such as shrubs and forests. Within the farmed areas, the model indicated that management practices influenced the magnitude of surface wind erosion. We were able to validate our model using the frequency of dust storms as a proxy. Our model is a proof of concept that, through an improved understanding of how different land uses and management affect regional wind erosion severity, wind erosion models can inform future land management. They can provide critical information for land managers and policymakers to apply corrective measures for better and more cost-effective wind erosion management, thereby increasing or maintaining agricultural productivity in areas affected by wind erosion.

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