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A Multidirectional Wind Erosion Model for Western Saxony

Simon Schmidt (1), Katrin Meusburger (1), Tomás de Figueiredo (2), and Christine Alewell (1)

(1) Environmental Geosciences, University Basel, Basel, Switzerland (si.schmidt@unibas.ch), (2) Mountain Research Centre CIMO, Escola Superior Agrária, Instituto Politécnico de Bragança, Bragança, Portugal

Wind erosion can trigger a non-visible loss of fine soil up to 40 t ha-1 per single event and is as such a major soil threat and environmental concern in areas susceptible to wind erosion. Western Saxony was assessed to be among the most susceptible landscapes not only within Germany but even within Europe (Borelli et al., 2015; Borelli et al., 2014). Moreover, wind erosion events in eastern Germany cause very severe off-site effects with impacts on road traffic. So far the wind erosion model that is normally applied in Germany is based on the norm DIN standard 19706. The DIN standard 19706 was revised by new controlling factors and fuzzy logic to consider the multi-directionality of wind and make it more realistic to wind erosion processes. The new factors are based on different datasets like (i) wind and temperature data (1hr resolution) for 9 gauging stations and interpolated long-term wind speed (1981-2000, 200m resolution) provided by the German Weather Service, (ii) soil erodibility extracted from the digital soil map 1:50,000, (iii) landscape components from different data sources (ATKIS, OpenStreetMap and others), and (iv) a DEM (20m resolution) for local orographic modeling. For a risky sub-region, local wind speeds and directions were modelled based on the Wind Atlas Analysis and Application Programs (WAsP) orography-model to assess road bodies for priority actions. Major improvements of the proposed model are the consideration of changing wind directions and the implementation of factors on soil cover and field length. An estimation of the long-term spatiotemporal variability under changing climate is possible with the model conception. The revised model assesses 3.6% of western Saxonies agricultural fields under very high risk to wind erosion. Larger fields (greater than 116 ha) are connected to a higher frequency (51.7%) of very high risk. Only a small proportion (5.2%) of the high risk class was found in small fields (smaller than 21 ha). Fields under very high risk to wind erosion are predominantly in the loess hill country and meadows. A special concern is that sections along the highway Autobahn 72 are especially under risk in the southern part of the study area. The revised model and its application improves the accuracy of spatial wind erosion modelling in western Saxony and can be used for early hot spot identification and selective erosion control measures.