



A pan-European quantitative assessment of soil loss by wind

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Soil erosion by wind is a serious environmental problem often low perceived but resulting in severe soil degradation forms. On the long-term a considerable part of topsoil — rich in nutrient and organic matters — could be removed compromising the agricultural productivity and inducing an increased use of fertilizers. Field scale studies and observations proven that wind erosion is a serious problem in many European sites. The state-of-the-art suggests a scenario where wind erosion locally affects the temperate climate areas of the northern European countries, as well as the semi-arid areas of the Mediterranean region. However, observations, field measurements and modelling assessments are extremely limited and unequally distributed across Europe. It implies a lack of knowledge about where and when wind erosion occurs, limiting policy actions aimed at mitigating land degradation. To gain a better understanding about soil degradation process, the Soil Resource Assessment working group of the Joint Research Centre carried out the first pan-European assessments of wind-erodible fraction of soil (EF) (Geoderma, 232, 471-478, 2014) and land susceptibility to wind erosion (Land Degradation & Development, DOI: 10.1002/ldr.2318). Today's challenge is to integrate the insights archived by these pan-European assessments, local experiments and field-scale models into a new generation of regional-scale wind erosion models. A GIS version of the Revised Wind Erosion Equation (RWEQ) was developed with the aim to i) move a step forward into the aforementioned challenges, and ii) evaluate the soil loss potential due to wind erosion in the agricultural land of the EU. The model scheme was designed to describe daily soil loss potential, combining spatiotemporal conditions of soil erodibility, crust factor, soil moisture content, vegetation coverage and wind erosivity at 1 km² resolution. The average soil loss predicted by GIS-RWEQ in the EU arable land ranges from 0 to 39.9 Mg ha⁻¹ yr⁻¹, with a mean value of 0.53 Mg ha⁻¹ yr⁻¹. A cross-country analysis shows highest mean annual soil loss values in Denmark (3 Mg ha⁻¹ yr⁻¹), the Netherland (2.6 Mg ha⁻¹ yr⁻¹), Bulgaria (1.8 Mg ha⁻¹ yr⁻¹) and to a lesser extent in the United Kingdom (1 Mg ha⁻¹ yr⁻¹) and Romania (0.95 Mg ha⁻¹ yr⁻¹). The cross-validation results provides encouraging outcomes in line with the local measurements reported by academic literature. Novel insights into the spatiotemporal dynamics of wind erosion processes have been achieved, providing knowledge and a tool to gain a more comprehensive understanding of wind erosion processes in Europe.