Joint Research Centre

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Using DSM data for modeling wind erosion events

Bridging the gap between DSM and DSA

Introduction

The Soil thematic strategy has been adopted in September 2006 by the European Commission to improve the protection of European Soils. Wind erosion is one of the threats outlined in there. DSM with its uncertainty has distinctive power for Digital Soil Assessment (DSA), as well as for Digital Soil Risk assessment (DSRA). In here, it is applied in the context of the prediction of wind erosion events using long term time series of meteorological data.

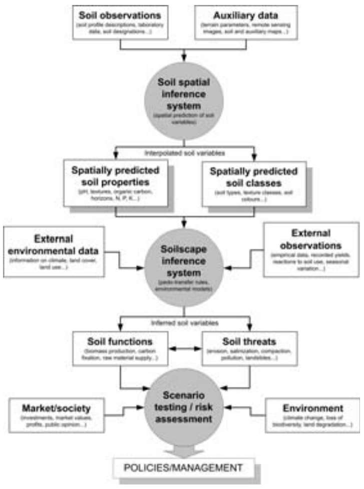

Fig. 1: Workflow for DSM/DSFM activities

Methods

A regresssion kriging approach used 1200 profile observations (Fig.2) together with parent material, DEM and RS parameters to estimate clay, silt and sand content in % and its uncertainty. Based on the texture, two data sets have been derived to show the applicability of DSM. For the first case the wind erosion aggregate stability (ASEAGS) has been derived: ASEAGS = 0.83 + 15.7 x clay - 23.8 x clay^2 for 4 different clay contents. The second data set contained 4 settings: Soil texture as pro-vided by the Dom. Soil Surface Texture in the European Soil Database; the estimated texture based on the RK, as well a RK-Best Case- and Worst Case (minimum clay, maximum sand content) Scenario. The number of erosive days on bare agricultural soil (see Fig. 3) was computed based on the Wind Force Integral, for 2 scenarios: daily wind speed, precipitation and evaporation data for 1961-1990 and for a scenario 2071-2100.

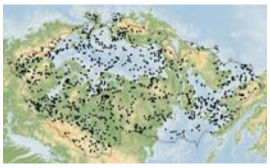

Fig. 2: Soil Profiles for RK- estimation

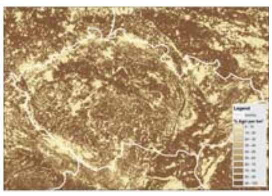

Fig. 3: Perc. Agriculture for 1km INSPIRE grid cell

$$\mathrm{WFI}\,\Sigma\sum_{1}^{n}(u\,\Sigma u_{thr})\,\Sigma u^{2}$$

see Carre et al. 2007 / Geoderma for further reading on DSA and DSRA

Results and Discussion

ASEAGS shows clear differences between ESDB (M2.83/Std 0.8) and RK (M3.1,Std 0.35)(Fig.4). Lower and upper limits of clay content (Fig 4 c/d) show severe differences for each single location, which are not possible to estimate with the ESDB

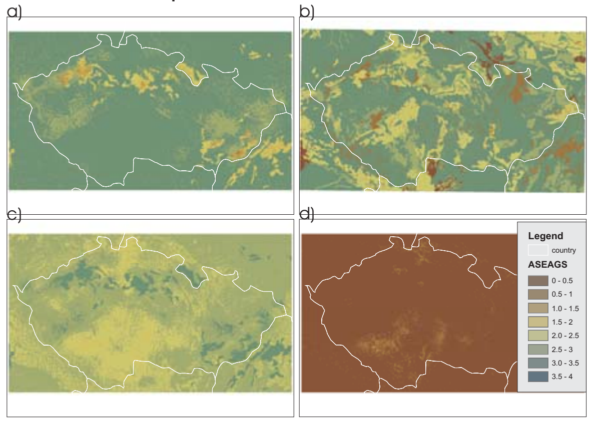

Fig. 4 :Aggregate Stability derived from RK (a), the ESDB database (b), for the 95% lower limit (c) and the 95% upper limit of the RK clay content (d).

approach. The consequences of different ASEAGS are multiplied in the number of ED for soil threat/scenario testing (Fig 5). ESDB (Fig. 5a) and WC-Scenario (Fig. 5d) deliver similar numbers of ED, whereas the RK shows 1/4 of the number of EDs. Climate Scenarios allow for the forecast that areas in eastern CZ will be more prone to wind erosion events in the future, whereas an overall decrease can be observed.

Conclusion

DSM provides information for DSA and DSRA to outline uncertainties for wind erosion estimations.

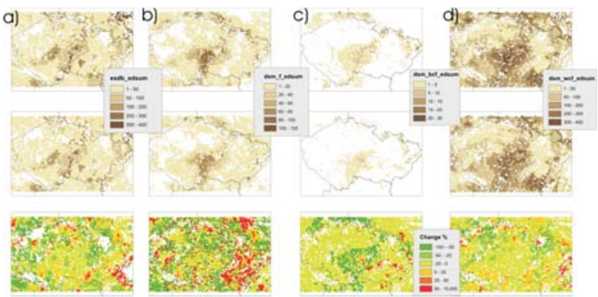

Fig. 5: Number of Erosive Days for 30 years, based on texture of the ESDB database (a), from RK (b), for the Best Case Scenario (c) and Worst Case Scenario (d) for a current climate (top row), a climate scenario (middle row) and the change in percentage (bottom).

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