Joint Research Centre

Forecasting wind erosion events in Europe - first results of a reanalysis

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Introduction

The Soil thematic strategy has been adopted in September 2006 by the European Commission to improve the protection of the protection of European Soils. Wind erosion is one of the threats outlined in

Figure 1: Dust storm event in Nordrhein Westfalia in Germany arbitrary selected years.

there. Wind erosion in Europe will hopefully never reach dust storm levels for example as in the desert areas or in the 1930 in the US. Areas of wind erosion have been already outlined in several publications and are based on long term observations at local spots and soil science knowledge (see Figure 3).

Figure 2: Haboob storm

However, a near real time forecasting of wind erosion events is missing. and would be useful for minimize effects for example on human health, agriculture production

Methods

Wind Force Integrals can be used to approximate the energy, which is available to erode soil surfaces. Data used in this
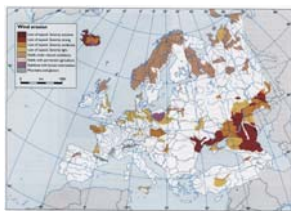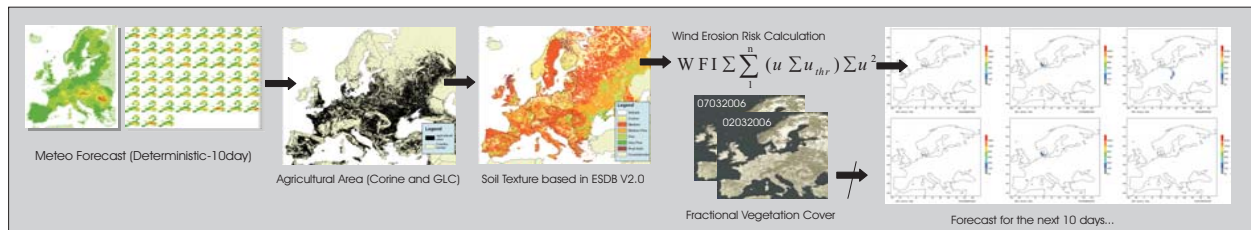

Figure 3: Long term wind erosion risk (ISRIC in EEA

approach are (i) texture data from the European soil database, (ii) daily forecast data from 2005/2006 created by the European Center for Medium Range Weather Forecast, and (iii) agricultural area mask based on CORINE landuse classification and global land cover classification. Each forecast ranges from

3h up to 10 days with initial 3h timestep and after day 10 a 6h time step. Spatial resolution of the older forecasts (2004/2005) is 0.5 degrees, whereas newer forecast are available in 0.25 degree resolution. The prototype is running as a research tool for the area -10 degrees W to 40 E, 35 S 70 N as the areas of EU25. In this phase of research phase we calculate 10 day forecasts based on the deterministic weather forecasts for time periods in Spring 2004, 2005 and 2006 to improve our methodology.

Results

Daily 10 day forecasting based on data from ECMWF and soil data allows for an increased preparedness in decision support. Areas observing wind speeds in the next 10 days exceeding soil

textural thresholds are shown in Figure 4 middle. Background rural PM10 measurement stations as provided by the AIRBASE database, show also elevated levels of PM10 for the same time period (Figure 4 Top). A background station (HASENHOLZ/Brandenburg) is shown for

comparison of timing of wind erosion events using the 0.5 degree forecasts from ECMWF and the actually measured PM10 concentrations. Timing is far from perfect, however, as data from completely different scales are compared (point observation against a 0.5 by 0.5 degree cell) reasonable. A direct comparison between the two dataset can not be made due to the fact that the forecast are based on the wind force integral. This is done to allow an assessment in a reasonable amount of computer time and is also constrained by data availability. Further research has to show how a full wind erosion prediction system can be executed only on these selected locations. Daily vegetation fractions prepared based on satellite data coming from SPOT or MSG might serve as an additional parameter to exclude areas

without risk for wind erosion. However, more research is needed to how incorporated these large scale information into the processing chain as well as how to deal with data failures in time series.

Future

Forecasts from the Eropean Center for Medium Range Weather Prediction are also available with 52 ensembles, representing different uncertainties in the prediction of weather forecasts. Model runs including these datasets should help to understand further the wind erosion risk.
Secondly, the ESDB version 2.0 contains soil textural data in five classes with only a limited information on its uncertainty. Digital Soil mapping techniques can provide estimates for uncertainty as well as real texture values instead of groupings. Both approaches will likely improve the prediction results. Further skill assessment has to be performed to validate the prediction on a larger timescale.

Meteo Forecast (Deterministic-10day)

Agricultural Area (Corine and GLC)

Soil Texture based in ESDB V2.0

Wind Erosion Risk Calculation

$$W\,F\,I\,\sum\sum_{1}^{n}\,(u\,\sum u_{thr})\sum u^{2}$$

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Fractional Vegetation Cover

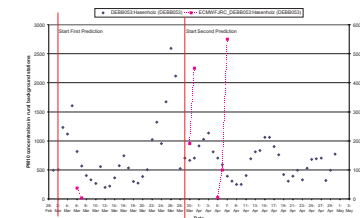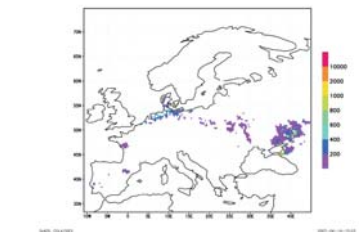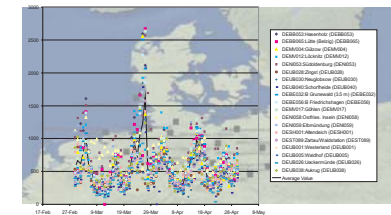Forecast for the next 10 days...

Figure 4: Examples for evaluation of wind erosion prediction using WFI for march/April 2005.