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Quo vadis soil erosion? Global impacts of 21st century land use change

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Human activity and related land use change are the primary cause of accelerated soil erosion. This has substantial implications for nutrient and carbon cycling, land productivity and thus the worldwide socio-economic conditions. In this study we provide quantitative, thorough estimates of soil erosion at the global scale by means of an unprecedentedly high-resolution (250 x 250 m grid), spatially distributed, RUSLE-based modelling approach. Unlike previous studies which dealt with soil erosion as a static process, here we shed light on the impacts of 21^{st} century global land use change on soil erosion (2001-2012). The proposed geo-statistical approach, allows for the first time, the thoroughly incorporation of land use types and their changes, the extent, types, spatial distribution of global croplands, the effects of the different regional cropping systems, as well as the mitigation effects of conservation agriculture into a global soil erosion model. Our baseline model predicts an annual average potential soil erosion amount of 35 (+5.5/-2.3) Pg yr^{-1} for 2001, with an area-specific soil erosion average of 2.8 (+0.44/-0.19) Mg ha^{-1} yr^{-1}. In 2012, we estimated an overall increase of 2.5% in soil erosion (35.9 (+5.6/-2.4) Pg yr^{-1}), driven by spatial changes of land use. The reduction of soil erosion considering croplands under soil conservation practices in 2012 is estimated at ca. 1 Pg yr^{-1}. Combining the global soil erosion with a recent SOC map, we estimated a gross SOC displacement by soil water erosion on the order of 2.5 (+0.5/-0.3) Pg C yr^{-1}.

The preservation of the soil quality and the attainment of a land degradation neutral world belong to the recently approved UN Sustainable Development Goals (SDG). Notwithstanding the significant scientific contribution of the expert based global maps created in the early 1990s such as GLASOD, a soil erosion modelling framework, based on the latest technologies, opens up new scientific perspectives to dynamically simulate alternative conservation scenarios and design more effectively future land management programmes.

References

Borrelli, P., Robinson, D.A., Fleischer, L.R., Lugato, E., Ballabio, C., Alewell, C., Meusburger, K., Modugno, S., Schütt, B., Ferro, V., Bagarello, V., Van Oost, K., Montanarella, L. and Panagos, P. 2017. An assessment of the global impact of 21st century land use change on soil erosion. *Nature Communications* **8**, 2013. DOI:10.1038/s41467-017-02142-7