EGU21-3601
https://doi.org/10.5194/egusphere-egu21-3601
EGU General Assembly 2021
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Predicting Soil erosion based on the machine learning in Loess Plateau of China

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Soil erosion is one of the global ecological and environmental problems, which is an important factor leading to land degradation. To scientifically and effectively control soil erosion, it's necessary to improve soil erosion evaluation methods that can obtain the actual rates of soil erosion, rather than potential erosion. For this, about 300 sampling units deployed in the Loess Plateau used as the basic data in our study, combining the seven soil erosion factors (rainfall-runoff erosivity factor, soil erodibility factor, slope length and steepness factor, biological-control factor, engineering-control factor, tillage practices factor) involved in the CSLE model and 50 soil erosion covariates related to climate, soil, topography, vegetation, human activities, etc. Using machine learning methods to establish an optimal model, and spatially predict the soil erosion rate and make a soil erosion mapof the entire study area. The prediction results show that the explanation degree of the random forest spatial prediction model is 73%. Among the selected optimal characteristic parameters, terrain and vegetation-related variables are the most important factors affecting soil erosion, from high to low, the order is LS > B > NDVI (May to September). Compared to previous studies with USLE/RUSLE/CSLE and GIS integrated mapping methods, or sampling survey based interpolation method, improvements in this paper can be concluded to : (1) the use of machine learning instead of simple multiply by soil erosion factors (linear regression), (2) higher resolution interpretation results supported by the project of "Pan-Third Pole Project", which provide soil erosion that closed to the actual rates of soil erosion. (3) considerate additional related covariates such as population density, precipitation, soil conservation measures and so on. Further development of soil erosion prediction could provide a more accurate soil erosion evaluation method. This method can not only monitor and evaluate soil erosion in real time, and provide the possibility for the dynamic change analysis? of soil erosion in the future, but also help decision makers take effective measures in the process of mitigating soil erosion risk.