Capturing the Scale Dependency of Erosion-Induced Variation in CO2 Emissions on Terraced Slopes

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

ID 4640551
Author(s) Hu , Yaxian; Schneider , Vincent; Kuhn, Brigitte; Guo , Shengli; Kuhn, Nikolaus J.
Author(s) at UniBasel Kuhn, Nikolaus J. ;
Year 2021
Title Capturing the Scale Dependency of Erosion-Induced Variation in CO2 Emissions on Terraced Slopes
Journal Frontiers of Environmental Science
Volume 9
Pages / Article-Number 688286
Net soil CO2 emissions are not independent of topography but tend to decline with increasing slope gradients. Such decline has been attributed to increased runoff and greater soil loss on steep slopes, leaving the soil less habitable for microorganisms. However, the specific variations of slope gradients and thus the associated soil properties relevant for CO2 emissions, especially from terraced slopes, are often disguised by the coarse resolution of digital terrain models (DTMs) based on commonly available open-source data. Such misrepresentation of the relationship between topography and soil CO2 emissions carries the risk of a wrong assessment of soil-atmosphere interaction. By applying a slope dependent soil CO2 emission model developed from erosion plots to nearby sloping and partially terraced cropland using two DTMs of different spatial resolutions, this study tested the significance of these resolution-induced errors on CO2 emission estimates. The results show that the coarser-resolution Shuttle Radar Topography Mission (SRTM) underestimated CO2-C emission by 27% compared to the higher-resolution DTM derived from Unmanned Aerial Vehicles (UAV) imagery. Such difference can be mostly attributed to a better representation of the proportion of flat slopes in the high- resolution DTM. Although the observations from erosion plots cannot be directly extrapolated to a larger scale, the 27% underestimation using the coarser- resolution SRTM DTM emphasizes that it is essential to represent microreliefs and their impact on runoff and erosion-induced soil heterogeneity at an appropriate scale. The widespread impact of topography on erosion and deposition on cropland, and the associated slope-dependent heterogeneity of soil properties, may lead to even greater differences than those observed in this study. The greatly improved estimation on CO2 emissions by the UAV-derived DTM also demonstrates that UAVs have a great potential to fill the gap between conventional field investigations and commonly applied coarse-resolution remote sensing when assessing the impact of soil erosion on global soil- atmosphere.
ISSN/ISBN 2296-665X
edoc-URL https://edoc.unibas.ch/87663/
Full Text on edoc No;
Digital Object Identifier DOI 10.3389/fenvs.2021.688286
ISI-Number 000668723900001
Document type (ISI) Article