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Clarify the dependency of controlling factors in DOC transport in small mountainous rivers by redundancy analysis

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Dissolved organic carbon (DOC) serves as one of the major energy sources in aquatic ecosystems, which is an important pathway connecting terrestrial and marine carbon reservoirs. DOC transport at catchment scale is recognized as being regulated by runoff, slope, soil organic carbon (SOC), biome, and wetland proportion; however, the controls in subtropical small mountainous rivers (SMRs) is rarely discovered before. This study investigated DOC export in 19 catchments in northern Taiwan supplemented with landscape and land use dataset to characterize the controlling factors of DOC transport. Meanwhile, the principle component analysis (PCA) and redundancy analysis (RDA) are applied to untangle the dependence of the controlling factors. Results showed that DOC concentration in Taiwan is very low at approx. 0.8 mg L^{-1}, yet the annual DOC yields of the 19 catchments is around 25.23 kg ha^{-1} yr^{-1}, which is much higher than the global mean (14.4–19.3 kg-C ha^{-1} yr^{-1}). PCA and RDA shows that the human activities and landscape can explain 87% and 77% of the explained variance, yet runoff play an independent role in DOC transport. Excluding the overlap, human activities and landscape only accounts for 15 % and 5% of the explained variance, respectively. The overlap between the two components are as high as 72%, indicating the two components could not be separated subjectively. Conclusively, DOC export is mostly dominated by human activities and landscape together, which suggests that they should be considered simultaneously. Besides, DOC yield is positively correlated with streamflow and SOC, but negatively correlated with slope gradient. Our study suggests that interpretation of spatial variation in DOC export should address the overlap between human activities and landscape, which can help predicting the ungauged catchments in catchment management.