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Quantifying above-ground biomass, SOC and erosion using a new detailed crop pattern map including double and triple cropping in the Yangtze River basin using the PESERA model

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Soil erosion represents a primary threat to soil systems with adverse implications for ecosystem services, crop production, potable water, and carbon storage. While numerous studies have quantified the spatial distribution of Above-Ground Biomass (AGB), soil erosion, and Soil Organic Carbon (SOC) in the Yangtze River Basin (YRB) in China, limited attention has been given to assessing the contributions of different land use types and especially crop types to AGB, soil erosion, and SOC. In most studies, cropland is taken as a land use class, while detailed crop types and rotation patterns, and their effect on soil erosion and SOC, vary significantly. In this study, we used the Metronamica model to generate a detailed crop rotation and distribution map across the YRB and subsequently employed the PESERA model to simulate the spatial distribution of AGB, soil erosion, and SOC on a monthly basis. PESERA model simulations indicate an average soil erosion rate across the entire YRB of 7.7 t/ha/yr, with erosion hotspots concentrated in the Sichuan Basin and the central-southern regions. The southwestern region and western Sichuan show elevated levels of AGB and SOC, while the eastern plains display lower levels. Erosion rates are lowest in areas designated as artificial land, pasture and grassland, whereas cropland and fruit trees experience the highest erosion rates. In terms of crop types, the highest erosion rates and lowest AGB are observed in fallow and potato cultivation, while the lowest erosion rates and highest AGB are found in rice-wheat rotation fields. To the best of our knowledge, this is the first study including detailed crop types and patterns into account while evaluating their effect on relatively large scale (i.e. YRB). These findings can help to develop sustainable soil management and (cropping) conservation strategies.