

Selecting suitable climate models for examining future changes in soil erosion and muddy flooding

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Abstract

Climate models consistently project large increases in the frequency and magnitude of extreme precipitation events in the 21st century, revealing the potential for widespread impacts on various aspects of society. While the impacts on flooding receive particular attention, there is also considerable damage and associated cost for other precipitation-driven phenomena, including soil erosion and muddy flooding. Multiple studies have shown that climate change will worsen the impacts of soil erosion and muddy flooding in various regions. These studies typically drive erosion models with output from a single climate model or a few models with little justification. A blind approach to climate model selection increases the risk of simulating a narrower range of possible scenarios, limiting vital information for mitigation planning and adaptation. This study provides a comprehensive methodology to efficiently select suitable climate models for simulating soil erosion and muddy flooding. For a study region in Belgium using the WEPP soil erosion model, we compare the performance of our novel methodology against other model selection methods for a future period (2081–2100). The main findings reveal that our methodology is successful in generating the widest range of future scenarios from a small number of models, compared with other selection methods. This represents a novel targeted approach to climate model selection with respect to soil erosion by water but could be modified for other precipitation-driven impact sectors. This will ensure a broad range of climate impacts are simulated so the best- and worst-case scenarios can be adequately prepared for.

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