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AFRICAP - The impact of climate change on soil erosion in Tanzania and Malawi in a convection-permitting model

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East Africa has high rates of soil erosion which negatively impact agricultural yields. Climate projections suggest that rainfall intensity will increase in East Africa, which may increase soil erosion. Soil erosion estimates require information on rainfall erosivity, which is calculated using sub-daily storm characteristics that are known to be biased in traditional parameterized convection climate models. Convection-permitting climate models, which are run at higher resolution to negate the need for convection parameterisation, generally better represent rainfall intensity and frequency. We use a novel convection-permitting pan-Africa regional climate model (CP4A) to estimate rainfall erosivity in Tanzania and Malawi, and compare it to its parameterized counterpart (P25), to determine if there is a benefit to using convection permitting climate models to look at rainfall erosivity. We use 8-year historical and end-of-century RCP8.5 simulations to examine the impact of climate change on rainfall erosivity. We then apply the Revised Universal Soil Loss Equation (RUSLE), using the rainfall erosivity estimates from CP4A and P25, to calculate soil erosion in Tanzania and Malawi. The distribution of rainfall intensity and duration was closer to the TRMM rainfall observations in the convection permitting model than in the parameterized model before and after bias-correction. We found that rainfall erosivity was lower in the parameterized convection model than in CP4A due to differences in storm characteristics, even after bias-correction. These results suggest that parameterized convection regional and global climate models might under-estimate rainfall erosivity, and the associated soil erosion. We found high values of present day erosion associated with mountainous regions in Tanzania and Malawi in CP4A. Under climate change, areas at high risk of soil erosion expanded due to increases in rainfall intensity in CP4A. The levels of soil erosion were high enough to negatively impact on agricultural yields. Soil management was less effective in the future at reducing soil erosion risk than in the present day, and more extensive soil management may be required in the future to manage soil erosion and reduce the negative impacts of soil erosion on agriculture.