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Projection of future rainfall erosivity over China under global warming

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Five CMIP6 models were selected to project changes in rainfall erosivity of China for two future periods (the near-term in 2041-2065, the long-term in 2076-2100) under SSP1-RCP2.6 and SSP5-RCP8.5 scenarios. Models' capacity in estimating two erosivity indices, annual average rainfall erosivity (R-factor) and the storm erosivity at 10-year return level (10-year storm EI) were evaluated by comparing the model derived indices for the historical period with the state-of-the-art reference erosivity maps of China interpolated with hourly observations. Results show that GFDL-ESM4, IPSL-CM6A-LR, and UKESM1-0-LL outperform the other two models with higher NSEs and better spatial correlation, especially in the water erosion regions. R-factor and 10-year storm EI estimated using MMEs (the arithmetic means of the aforementioned three models) for the historical period are generally underestimated, and the median biases are 0.80 and 0.66, respectively. Biases for each grid were determined as the bias-correction factors for future erosivity projection. Generally, most areas in eastern and central China are expected to experience larger rainfall erosivity. Under SSP1-RCP2.6 and SSP5-RCP8.5 scenarios, R-factor over mainland China is projected to increase by 18.9% and 19.8% for the near-term and 26.0% and 46.5% for the long-term, respectively; and 10-year storm EI is projected to increase by 14.2% and 17.4% for the near-term, and 14.9% and 45.0% for the long-term, respectively. The projected increases in rainfall erosivity are mainly due to the increasing probability of extreme precipitation. This implies that soil and water conservation measures in China need to be further strengthened to meet the challenges brought by the increasing number and magnitude of extreme events in the context of global warming.