Sediment Dynamics from the Summit to the Sea
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Simulation of hydrosedimentological impacts caused by climate change in the Apucaraninha River watershed, southern Brazil

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Abstract Climate change can cause significant modifications in hydrosedimentological processes. Climate projections indicate the occurrence of extreme events, in terms of precipitation, droughts, floods and temperature. By increasing temperatures and altering precipitation regimes, climate change is expected to affect sediment dynamics. Predictions of the effects of climate change on streamflow and sediment yield vary widely, depending on the geographical location and climate scenarios used. Mathematical modelling can be used to simulate the hydrosedimentological processes in watersheds and enable the simulation of climate change effects on sediment yield. This paper aims to simulate the impacts of climate change hydrosedimentological dynamics in the Apucaraninha River watershed (504 km²), southern Brazil, considering the climate change scenarios A2 (pessimistic about the emissions of greenhouse gases) and B2 (optimistic about the emissions of greenhouse gases), developed by the IPCC. The Soil and Water Assessment Tool (SWAT) was used to evaluate the impacts of climate projections on the sediment yield in the Apucaraninha River watershed. The model was calibrated and validated using daily streamflow and sediment data from 1987 to 2012. The model presented satisfactory fit to the observed data allowing the reproduction of the current hydrological conditions of the watershed. Based on the satisfactory results in calibration and validation, the climate scenarios A2 and B2 were inserted to simulate streamflow and sediment conditions for the period 2071–2100. The results for both scenarios indicate that simulations of both climate scenarios resulted in changes in hydrosedimentological dynamics in the Apucaraninha River watershed, mainly in terms of decrease in average sediment yield due to the reduction in precipitation amount and increase in evapotranspiration. Our results also indicate that every 1% change in precipitation has resulted in 2.8% change in soil erosion and 1.6% change in runoff under scenario A2, and 2.3% change in erosion and 1.1% in runoff under scenarios B2, thus suggesting that climate change tends to affect sediment yield more than streamflow, although seasonally both could be impacted in similar ways.

Key words sediment; SWAT; hydrological modelling; climate change; IPCC