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Impact of climate change on groundwater/surface water interactions projected by a multimodel ensemble

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General circulation models (GCMs) are one of the primary instruments for obtaining projections of future global climate change. Outputs from GCMs, aided by dynamical and/or statistical downscaling techniques, have long been used to simulate changes in regional climate systems over wide spatiotemporal scales. Numerous studies have acknowledged the disagreements between the various GCMs and between the different downscaling methods designed to compensate for the mismatch between climate model output and the spatial scale at which hydrological models are applied. Despite these studies, however, very little is known about the significance of such differences once they have been input or assimilated by a nonlinear hydrological model. In this work, we used a process-based model to investigate in detail the uncertainty in the physical mechanisms controlling the catchment response originating from a multimodel climate ensemble. The investigation is based on daily values of precipitation and min/max temperature from twelve members obtained by combining four regional climate models (RCMs) and five GCMs for the des Anglais catchment in southwestern Quebec (Canada). The results show that hydrological components (river discharge, aquifer recharge, and soil moisture content) respond differently to any precipitation or temperature anomalies in the multimodel climate outputs. We also find that processes such as runoff generation, which is highly sensitive to extreme events, and aquifer recharge, which is closely linked to the distribution of precipitation, are characterized by a high level of uncertainty