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Evaluation of CMIP6 models for water and energy fluxes and analysis of source of errors over the Tibetan Plateau

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Climate change affects the hydrological cycle and induces extreme weather events, such as storms, floods and droughts. Adaptation to climate change needs to be based on assessments of future impacts. The new generation of Coupled Model Inter-comparison Project Phase 6 (CMIP6) is widely used in future flood prediction and drought risk assessment. However, many studies have found that CMIP6 global climate models for simulating land surface water and energy fluxes have significant biases, which poses a problem for using CMIP6 as input data for hydrological impact studies. Therefore, the output of CMIP6 cannot be directly used in hydrological models to project the impacts of future climate change. To overcome this problem, the correction of model output towards observations for its subsequent application in climate change impact studies has now become a standard procedure. And hydrological simulations generally use bias corrected output. But bias correction methods cannot really correct bias. The commonly used bias correction approaches only force the model outputs to match observations, and does not consider the mechanisms within the model and the interaction between variables. This study systematically evaluates water and energy fluxes of CMIP6 model over the Tibetan Plateau. Results show that the inter-model variability is substantial in temperature simulations. Snow that the largest component of the cryosphere responds significantly to changes in temperature. In the study, we study snow depth simulations corresponding to temperature simulations of different models over the Tibetan Plateau. Based on the water balance formula, analysis of how water balance fluxes respond to temperature changes in CMIP6, and determine the sources of error and ultimately lead to improved predictions.