How Will a Warmer Climate Affect Water Quality in the Mountainous Western United States?

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Mountain runoff provides essential water resources to millions of people and serves as a habitat for aquatic ecosystems. While shifts in streamflow quantity and timing with climate change have been the subject of a number of studies for key global mountain ranges, few studies have investigated changes in water quality on the regional scale. In this study, the Soil and Water Assessment Tool (SWAT) was used to assess the impact of climate changes as projected by general circulation models (GCMs) through 2100 on streamflow, stream temperature, dissolved oxygen, and sediment yield in the Sierra Nevada, Colorado River watershed and Columbia River watershed in the United States. SWAT model calibration, validation, and uncertainty analyses were performed based on estimated natural flows and unimpaired gauging stations using an automated sequential uncertainty fitting algorithm in conjunction with manual calibration. For areas that lacked water quality data, we assumed that water quality model parameters were similar as those found for regions calibrated with water quality data. Output from 16 GCMs and two emission scenarios were downscaled to a 1/8-degree (approximately 12km) grid. These 32 future scenarios were used to force the SWAT model to assess the sensitivity of climate change on a sub-basin scale. The ensemble of projections was used to assess the range of plausible hydrologic responses to climate change. Results indicate that not only streamflow timing, but also stream temperature, chemistry, and ultimately aquatic ecosystems are affected by the climatic changes projected through 2100.