

A Streamflow Generation Technique Under Climate Change Using Paleo and Observational Data for Colorado River

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Abstract. Robust water management strategies to withstand climate variability and change are crucial for sustainability. Nowhere this more stark than in the Western United States, especially in the Colorado River Basin, which is undergoing a severe drought and facing unprecedented stress from growth in the basin states. This planning requires plausible streamflow scenarios conditional on future climate projections. Projections of future climate from global climate models (GCMs) are associated with large uncertainty. This is further enhanced when these projections are downscaled to generate hydrologic scenarios. In addition, the ‘hydrologic sequence’ from the GCM projections is even more uncertain. Paleo reconstructions of streamflow extending back to 900AD on the Colorado River are available which provide a rich variety of flow sequences. For a water resources system such as the Colorado River with large storage capacity the hydrologic sequence is highly critical to the system reliability. Thus, the simulated streamflows scenarios should be plausible both in terms of the magnitude and their sequence. Here we develop such a technique that combines flows from paleo reconstructions, observations and future climate projections. The method is demonstrated by applying it to generate streamflows at Lees Ferry, an important location on the Colorado Basin. In this, first the paleo data is used to provide a rich variety of flow state (i.e., wet, dry, normal) sequences. Then, the flow magnitudes are generated from the probability distribution of flows from observations and future climate projections. Furthermore, the method is simple and flexible in that flows from multiple downscaling techniques can be easily included, thus enabling a realistic multi-model streamflow ensemble.

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