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Evaluating seasonal drought prediction in snow-fed systems past, present, and future: towards identifying resilient prediction techniques

Ben Livneh[1,2], Parthkumar Modi[1], Joseph Kasprzyk[1], Brooke Ely[1], and Benet Duncan[2]
[1]University of Colorado Boulder, Civil Environmental and Architectural Engineering, Boulder, United States of America (ben.livneh@colorado.edu)
[2]University of Colorado Boulder, Cooperative Institute for Research in Environmental Sciences, United States of America (ben.livneh@colorado.edu)

Seasonal water supply predictions offer critical information to aid in planning and mitigation of drought impacts. In many northern and montane systems, spring snow information has been shown to be the most important predictor of seasonal drought, since in these systems snow water storage can exceed that of man-made reservoirs. However, a warmer future portends for less precipitation falling in the form of snow, which challenges current prediction methods. This presentation focuses on evaluating physical and statistical techniques for seasonal water supply prediction in snow-fed systems under both historical and future climate conditions with the goal of identifying regions and methods where predictions are likely to remain skillful under future warming. Initial results using downscaled hydrologic projections over the western U.S. indicate that snow information contributes less predictive skill to drought forecasts over roughly two thirds of snow dominated regions by the middle of this century. Significantly greater resilience to warming is seen higher elevation zones ($p<0.01$) and for prediction methods that include non-snow predictors such as soil moisture. To understand the impact of non-stationary snow conditions on future drought predictions, we conduct a series of idealized experiments to evaluate the relative importance of secular trends versus changing variability of both snow and seasonal climate conditions. This presentation is part of a larger research effort seeking to identify alternatives to snow-based streamflow predictions to advance future drought predictability.