Changes in the timing of snowmelt onset in the Colorado Rocky Mountains

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Abstract

The annual hydrograph of most rivers in the mountains of the western United States is driven by the melting of deep seasonal snowpacks. A recent study documented significant trends in the timing of spring runoff in the west between 1950 and 2000, with runoff advancing by an average of two weeks (Stewart and others, 2004). The study indicated changes were most pronounced in the Sierra Nevada, Cascades, and northern Rocky Mountains, and were hypothesized to be caused by changing climate. Only minor changes were identified in Colorado, suggesting that the state was relatively immune to climate change due to the state's cold snowpacks and high elevations. The study raised important issues about the effects of climate change on water supplies in the west, but the results for Colorado were somewhat puzzling given local perceptions that recently, melt has been occurring earlier in Colorado as well.

We are conducting a study of changes in snowmelt timing in Colorado during 1978–2004 using snowpack data from 72 SNOTEL sites in Colorado. Results are being compared to trends in the timing of runoff at 40 headwater streams with minimal diversions. The data indicate that snowmelt is occurring earlier at all of the SNOTEL and streamflow sites that were analyzed, with an average change of 0.5 days per year. There appear to be important regional variations in the snowmelt- and runoff-timing trends; the strongest trends are in the western and southern parts of the State. Changes in snowmelt timing are strongly correlated with increasing springtime air temperatures, which show strong positive (warmer) trends during the study period. These results indicate that even Colorado is not immune from the effects of recent springtime warming, which may have important implications for water resources across the west.