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- Recent Final Revised Papers
- Volumes and Issues**
- Special Issues
- Library Search
- Title and Author Search

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Alerts & RSS Feeds

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Submission

Review

Production

Subscription

Comment on a Paper



[Volumes and Issues](#) [Contents of Issue 1](#)

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## Has spring snowpack declined in the Washington Cascades?

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**Abstract.** Our best estimates of 1 April snow water equivalent (SWE) in the Cascade Mountains of Washington State indicate a substantial (roughly 15–35%) decline from mid-century to 2006, with larger declines at low elevations and smaller declines or increases at high elevations. This range of values includes estimates from observations and hydrologic modeling, reflects a range of starting points between about 1930 and 1970 and also reflects uncertainties about sampling. The most important sampling issue springs from the fact that half the 1 April SWE in the Cascades is found below about 1240 m, altitudes at which sampling was poor before 1945. Separating the influences of temperature and precipitation on 1 April SWE in several ways, it is clear that long-term trends are dominated by trends in temperature, whereas variability in precipitation adds "noise" to the time series. Consideration of spatial and temporal patterns of change rules out natural variations like the Pacific Decadal Oscillation as the sole cause of the decline. Regional warming has clearly played a role, but it is not yet possible to quantify how much of that regional warming is related to greenhouse gas emissions.

[Final Revised Paper](#) (PDF, 4298 KB) [Discussion Paper](#) (HESSD)

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