Detection and Attribution of Climate Change in Streamflow Seasonality of the Western United States

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This article focuses on observed shifts in the seasonality of streamflow, and is the first in a series of papers centered on the detection and attribution of hydroclimatological parameters in the western US. The detection of climate change is the process of identifying whether an observed change is significantly different from what would be expected given natural internal climate variability. The attribution of anthropogenic climate change is the process of identifying whether an observed change is: a) *consistent* with the type of changes obtained from climate simulations that include both external anthropogenic forcings and internal variability; and b) *inconsistent* with other explanations of climate change. The optimal detection method applied here reduces the dimensionality of a problem to a univariate or low-dimensional space. In this low-dimensional space, a detection vector is used to assess the significance of the observations for a given variable with an expected climate change pattern. The results of this work indicate that observed changes in the January--March streamflow fraction in the western US are detectable and can be attributed to climate change. Detection and attribution are positive even after the El Nino-Southern Oscillation and the North Pacific Oscillation signals are factored out of the analysis. In general, we find that anthropogenic greenhouse gases and sulphate aerosols have had a detectable influence on the seasonality of streamflow over the second half of the 20th century.