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Impact of uncertainty about the length of dry epochs on quantifying and managing the chance of urban water supply shortages

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The duration of dry or wet hydrological epochs (run lengths) associated with positive or negative Inter-decadal Pacific Oscillation (IPO) or Pacific Decadal Oscillation (PDO) phases, termed Pacific Decadal Variability (PDV), is an essential statistical property for understanding, assessing and managing hydroclimatic risk. Numerous IPO and PDO paleoclimate reconstructions provide a valuable opportunity to study the statistical signatures of PDV, including run lengths. Due to inherent errors, discrepancies exist between multiple reconstructions of the same climate variable over the same period. Here the influence of such errors on the interpretation of Pacific Decadal Variability (PDV), specifically the duration of certain climate epochs (i.e. runs), are explored through pseudo-proxy experiments. It is found that errors in the paleoclimate reconstructions artificially increase the interpreted variability of runs. To address this statistical artefact/bias an Error Compensated Run Model (ECRM) that directly accounts for bias is proposed. Using the ECRM, 90% of PDV phases are estimated to be between 15 and 27 years, compared to 5 and 56 years when bias is not properly accounted for. The implication of this PDV run length estimation is explored using a simplified single-reservoir water supply system. More cyclicity is found to present when drought risk is assessed using runs that estimated from PDV reconstructions. Large uncertainty associated with utilizing PDV information in drought risk assessment also exists.