



## **Nonstationary Approaches to Hydrologic Design**

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We introduce a generalized framework for evaluating the risk, reliability and return period of hydrologic events in a nonstationary world. A heteroscedastic regression model is introduced as an elegant and general framework for modeling trends in the mean and/or variance of hydrologic records using ordinary least squares regression methods. A regression approach to modeling trends has numerous advantages over other methods including: (1) ease of application, (2) considers linear or nonlinear trends, (3) graphical display of trends, (4) analytical estimate of the power of the trend test and prediction intervals associated with trend extrapolation. Traditional statements of risk, reliability and return periods which assume that the annual probability of a flood event remains constant throughout the project horizon are revised to include the impacts of trends in the mean and/or variance of hydrologic records. Our analyses reveal that in a nonstationary world, meaningful expressions of the likelihood of future hydrologic events are unlikely to result from knowledge of return periods whereas knowledge of system reliability over future planning horizons can effectively communicate the likelihood of future hydrologic events of interest.