

Neglecting hydrological errors can severely impact predictions of water resource system performance

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Abstract: Risk-based decision making for water resource systems often relies on streamflow predictions from hydrological models. These predictions are integral for estimating the frequency of high consequence extreme events, such as floods and droughts. However, streamflow predictions are known to have errors due to various factors such as incomplete hydrological understanding, parameter misspecification, and uncertain data. Despite these errors being well known, they are frequently neglected when undertaking risk-based decision-making. This paper demonstrates that neglecting hydrological errors can impact on drought risk estimation for high stakes decisions with potentially severe consequences for water resource system performance. A generic framework is introduced to evaluate the impact of hydrological errors for a wide range of water resource system properties. This framework is applied in two Australian case study catchments, where we use a stochastic rainfall model, the GR4J hydrological model, a residual error model, and a simplified reservoir storage model to estimate water resource performance metrics (risk and yield). The results underscore the impact of neglecting hydrological errors on decision-making. In one case study catchment, the yield was over-estimated by ~15%-55%, resulting in the (actual) risk of running out of water being ~2-30 times larger than reservoir design. The magnitude of these errors in water resource performance metrics is striking, especially considering that the streamflow predictions appear reasonable based on typical performance metrics (e.g., NSE of ~0.7). The errors in performance metrics stem from the complex propagation of hydrological errors through the water resource system modelling chain. By accounting for critically important hydrological errors we can mitigate highly erroneous risk estimates and improve decision-making related to water resource management

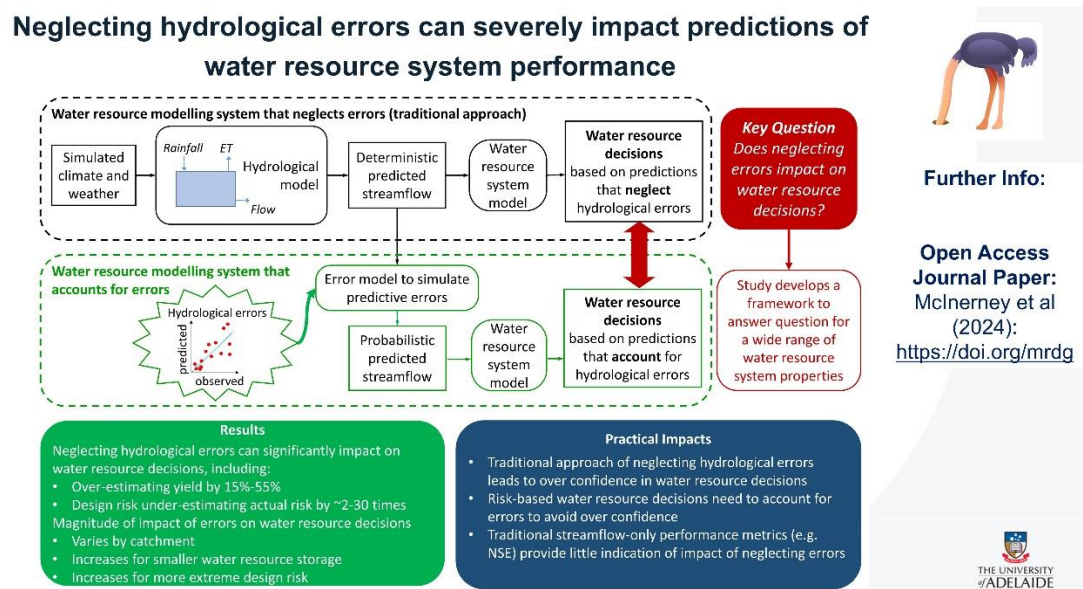


Figure 1: Summary of How Neglecting Hydrological Errors can severely impact system performance

REFERENCES

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