A Forecast-skill-based dynamic pre-storm level approach for reservoir flood control operation

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The advanced flood forecasts challenged the current reservoir flood control operation strategies that no excess storage beyond the flood limited water level is allowed when incoming inflow is relative large. Along with the maturing short-term flood forecasts, this study focuses on establishing linkage between flood limited water level and forecast skill, and thus developing a dynamic pre-storm level approach for each flood event. The approach utilizes forecasted flood magnitude, skill of forecast and exceedance probability of forecast error to determine the pre-storm reservoir storage. Instead of using the probability of a static return interval flood as reservoir flood control standard, this study redefined the standard in terms of the exceedance probability of the forecast error for each incoming flood. This approach is applied to the Three Gorges Reservoir in China as a case study. The results show that: 1. When a design flood is expected, the proposed dynamic pre-storm level coincides well with the Three Gorges Reservoir designed flood limited water level under zero forecast skill. 2. The dynamic pre-storm level increases considerably with the increase of forecast skill, thus improve the utilization of floodwater. This demonstrates that current use of flood limited water level can be, at least, modified without adding flood risk, subjective to the advances in flood forecasts. This study demonstrates a need to introduce dynamic water level control during flood season, dependent upon the improvement of flood forecast accuracy