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Improved Water Supply Predictions

New prediction modeling technique could result in substantial savings through better water resource management

What Is The Problem?

Water managers depend upon accurate predictions of spring runoff to make reservoir operation decisions that will optimize power generation, delivery of water, and maintenance of flood control. Inaccurate predictions of runoff can result in poor water management decisions that unnecessarily sacrifice one or more of the objectives.

Typically, current measurements of snow pack, precipitation, and runoff, are combined with historical data for the same parameters, and input to computer models to predict runoff for the coming months. Making the best use of these data is not simple. In most river basins, snow pack, precipitation, and runoff are highly correlated with each other. Because of this, it can be hard to discern which of the variables, or combinations of variables, is best able to predict seasonal runoff. If the model does not optimally use the data, the accuracy of runoff forecasts will be degraded. In addition, many existing runoff prediction models do not provide decision makers with measures of confidence or risk associated with a prediction.

What Is The Solution?

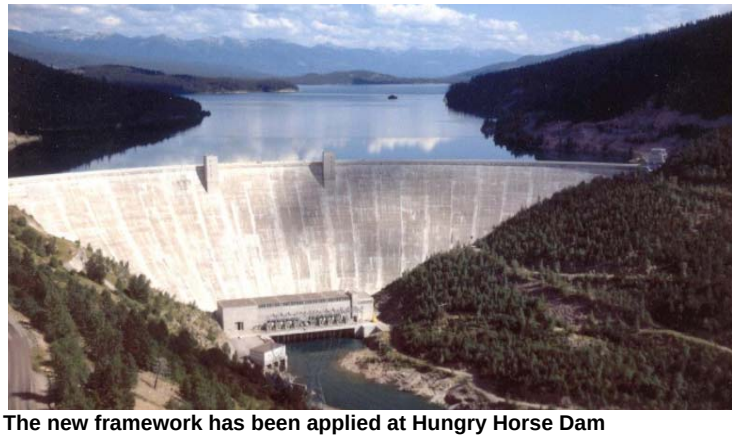
Reclamation has developed a new water supply prediction model framework (the term framework is used because each prediction model is unique) that incorporates innovative mathematical techniques to produce more useful and accurate information so that water managers can make better operations decisions. The new model framework uses all of the available data discussed above, plus teleconnection information (see Teleconnections Bulletin). In addition, the data are processed in such a way as to extract the most independent predictive value from each of the correlated variables. This process, Principle Component Analysis, allows the runoff model to identify and use the best data sets more effectively and produce more accurate predictions. Multivariate statistical techniques are used to develop and validate model equations, and calculate measures of confidence or risk associated with predictions. Based on preliminary results, the new model framework produces more accurate predictions, with associated measures of uncertainty. The improved prediction models will allow water managers to make better water management decisions resulting in greater benefits, including increased power generation, water deliveries, recreation, flood control, and more.

Who Can Benefit?

All water managers and their customers can benefit from the new water prediction model framework. The tool can be used by water managers to develop 'in-house' prediction models or as a validation tool to compare water supply predictions.

Where Have We Applied This Solution?

Models with the new framework have been developed and validated for approximately 30 forecast locations within Reclamation's Pacific Northwest Region. The new framework models will be used in conjunction with previous forecast models available to the River and Reservoir Operations Group of the Pacific Northwest Region over the next three to five years in order to test long-term reliability and develop user confidence in the new technology.



The new framework has been applied at Hungry Horse Dam

Future Development Plans

We will modify the model framework as needed based on further validation doing real-time testing against historical models during subsequent water supply seasons. As water managers gain experience with the new framework models, they will be able to make improved water supply decisions based on risk considerations. Additional development will include predicting the timing and magnitude of spring runoff at short-term prediction intervals of ten-days to two-weeks, or more.

More Information

A detailed report on this topic is available at the following link:
Combinatorial Principal Component Regression for Pacific Northwest Volumetric Forecasting

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Collaborators

Reclamation's Science and Technology Program and Pacific Northwest Region