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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 rely on accurate predictions of spring snowmelt water supply (runoff) to make operation decisions to maximize power generation, meet water user demands, and provide flood control for their reservoirs. Inaccurate predictions of runoff can result in poor water supply decisions that may cause undesirable consequences.

Runoff prediction models use all available information including current year measurements of snow pack, precipitation and runoff from the preceding months, and historical data for the same parameters to predict runoff for the coming months. The problem is the historical data for a given year are correlated and this can cause instabilities in the runoff prediction model that will affect its accuracy. For instance, the precipitation data from multiple weather stations within a river basin will typically follow a similar pattern making it difficult for the model to identify the best data to use. If the model does not use the best data it may not be able to accurately predict runoff for the coming months. Also, 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 water managers can make better operation decisions. The new model framework uses all available historical data, but applies only uncorrelated information to eliminate model instability and produce more accurate predictions. Rigorous mathematical techniques are used to synthesize uncorrelated information from the correlated data, develop and validate model equations, and calculate measures of confidence or risk associated with a prediction. Based on preliminary results, the new model framework produces more accurate predictions and each prediction includes a measure of its probability or likelihood of it being correct. 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 water supply prediction framework has been applied at Hungry Horse Dam in Montana.

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

Combinatorial Principal Component Regression for Pacific Northwest Volumetric Forecasting

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Collaborators

Reclamation's Science and Technology Program and Pacific Northwest Region