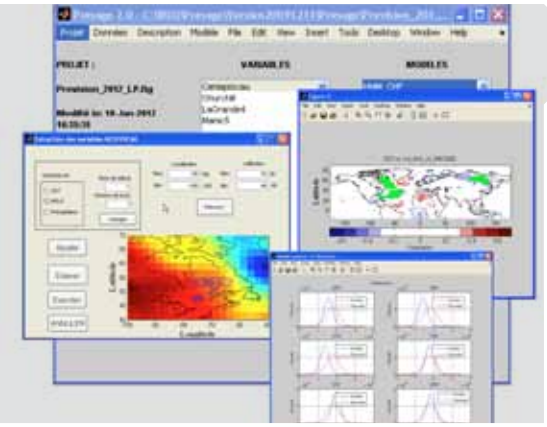

Long-term forecasts of flood volume using PRÉSAGE software.

Présage - Seasonal energy inflow forecasts

The quality of runoff forecasts and hydrometeorological measurement data is crucial to the operation of Hydro-Québec generating stations. Optimal management of hydro development systems depends on a thorough knowledge of a number of factors. In particular, the entire water cycle must be considered, i.e., its atmospheric stage, its terrestrial stage and how the two interact. Researchers at IREQ, Hydro-Québec's research institute, have thus developed a valuable software tool supporting long-range hydrological forecasting: Présage.

Vast research project

Long-range runoff forecasts and energy planning are based on scientific assumptions of a statistical nature. Recent studies in hydrology and climatology, however, have cast doubt on those assumptions. One of the questions raised is the validity of averaging historical data to forecast water availability. Is averaging still the best means of predicting inflows for each watershed in the years to come? Do exogenous variables exist that are available to be leveraged when making long-range hydrological forecasts? From such research questions stemmed one part of an innovation project on runoff forecasting in major water systems for energy management purposes. The solutions worked out have been incorporated into Présage.

Adding variables

Until very recently, 3-to 12-month hydrological forecasting was based solely on mean inflows in past years. An effort is made with Présage to go beyond that. The software's forecasting models factor in such uncertainties as possible periods of low or high runoff, in addition to climatic variables that help estimate flood volumes more accurately. A number of climatic variables recorded in the fall in certain locations on earth, notably air pressure and temperature data at the surface of oceans, can provide a sign of the depth of snow cover in the areas that those variables affect. Such information is crucial for forecasting flood volumes.

Main Hydro-Québec watersheds

Présage was designed for statistical analyses primarily for the following purposes:

- To study the relationships between runoff and various hydrometeorological variables.
- To build different types of probabilistic models for the long-range (three months or more) forecasting of runoff.

Three types of probabilistic models

With Présage, the following three types of models can be built:

- Regression models that can leverage diverse variables, including atmospheric and oceanic data from reanalyses (atmospheric pressure and mean temperature at the surface of the sea)
- Auto-regressive models that leverage the persistence observed in runoff time series
- Non-stationary models that formalize the existence of regime changes in the runoff time series, help predict them and associate a likelihood of occurrence with them

Optimal water management

The prime objective of the project on runoff forecasting in major water systems for energy management purposes is to develop statistical tools for improving long-range forecasts of natural inflows on a daily basis for major water systems, i.e., ones with more than 90 watersheds. Better estimates of runoff allow optimal use of water resources.

For information:

Luc Perreault, Project Manager
Institut de recherche d'Hydro-Québec
Expertise – Mécanique, métallurgie et hydro-éolien
1800, boul. Lionel-Boulet
Varennes (Québec) J3X 1S1
Canada
Telephone: 450 652-8254
E-mail: perreault.luc@ireq.ca

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