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Assessing The Value of Hydrological Ensemble Predictions for Rio Tinto Alcan's Hydropower System in Eastern Canada

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Rio Tinto Alcan (RTA) is a multinational aluminium producer with smelters in Quebec, Canada. RTA also owns and operates power houses on Péribonka and Saguenay Rivers. The system, which is run by RTA's Quebec Power Operations Division, consists of 6 generating stations and 3 major reservoirs, for an installed capacity of 2900 MW. One of the significant issues that had to be resolved for effective operation of this system was to determine the volume of water release per week for all generating stations. Several challenges had to be dealt with before a suitable solution could be found. Last year, RTA started a five year R&D project for improving the management of the hydropower system. This project includes data monitoring, hydrological ensemble prediction (HEP) and stochastic optimization methods.

A concomitant presentation (submitted to HS5.7 by Cote et al.) describes the stochastic optimization project that aims to assess the value of using a stochastic solver instead of a deterministic one. Cote et al. evaluated two different stochastic optimization approaches: lag-1 Stochastic Dynamic Programming (SDP) and Sampling Stochastic Dynamic Programming (SSDP) algorithms. Both stochastic optimization methods use Hydrological Ensemble Prediction (HEP) to capture the spatio-temporal variability of the inflows. This presentation investigates the value of using different HEP procedures in the operation of RTA's hydropower system with stochastic optimization methods. More precisely, the value of using biased or unbiased HEP, the value of using HEP with a good representation or a misrepresentation of the predictive uncertainties were assessed using a test bench study that mimics real-world RTA's operations. The results indicate that in real world operations, biased HEP or under-dispersed HEP can void the gain obtained by stochastic optimization methods.