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Operational use of distributed hydrological models. Experiences and challenges at a Norwegian hydropower company (Agder Energi).

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The Scandinavian hydropower industry has traditionally adopted the lumped conceptual hydrological model - HBV, as the tool for producing forecasts of inflows and mountain snow packs. Such forecasting systems - based on lumped conceptual models – have several drawbacks. Firstly, a lumped model does not produce spatial data, and comparisons with remote sensed snow cover data (which are now available) are complicated. Secondly, several climate parameters such as wind speed are now becoming more available and can potentially improve forecasts due to improved estimates of precipitation gauge efficiency, and more physically correct calculation of turbulent heat fluxes. At last, when the number of catchments increases, it is cumbersome and slow to run multiple hydrology models compared to running one model for all catchments.

With the drawbacks of the lumped hydrology models in mind, and with inspiration from other forecasting systems using distributed models, Agder Energy decided to develop a forecasting system applying a physically based distributed model.

In this paper we describe an operational inflow and snowpack forecast system developed for the Scandinavian mountain range. The system applies a modern macroscale land surface hydrology model (VIC) which in combination with historical climate data and weather predictions can be used to produce both short-term, and seasonal forecasts of inflow and mountain snowpack.

Experiences with the forecast system are illustrated using results from individual subcatchments as well as aggregated regional forecasts of inflow and snowpack. Conversion of water volumes into effective energy inflow are also presented and compared to data from the Nordic hydropower system. Further on, we document several important "lessons-learned" that may be of interest to the hydrological research community. Specifically a semi-automatic data cleansing system combining spatial and temporal visualization techniques with statistical procedures are combined into a robust and fast data cleansing and interpolation system. One experience from this work is that advanced interpolation techniques (kriging), do not outperform calibrated inverse distance methods when also computational speed is used as a criteria for model selection. The paper also discusses several challenges related to uncertainty in simulated snow reservoir, regionalization of parameters, choice of spatial resolution, techniques for reducing computational needs without compromising information needs, amongst others.