

Study of unregulated flow conditions in Norwegian rivers

A model approach according to the EU water framework directive.

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Background



The EU Water Framework Directive commits European Union member states to achieve good ecological status or good ecological potential in all water bodies. Many of Norway's rivers have been heavily regulated by hydropower operation since decades, and their hydrology deviates in varying degrees from natural conditions.

Norway's water authorities require a comprehensive tool to generate hydrological reference conditions for all water-bodies to implement the EU water framework directive, including lakes. Hydraulic alteration from natural status may be classified using water level time series from both natural and regulated conditions. There are several thousand water-bodies in Norway, and for many of them, natural lake water level variations are unknown.

Previous studies and model set-ups showed that the HYPE model (<http://hypecode.smhi.se/>) produces relevant hydrological output for natural flow conditions on a multi-catchment scale. Model results were used to classify the hydrological alteration of several rivers in Norway. Insufficient model performance for regions downstream of natural lakes have been identified.

This Master thesis is part of the HydroCen research center (ntnu.edu/hydrocen). The main objective of HydroCen is to enable the Norwegian hydropower sector to meet complex challenges and exploit new opportunities through innovative technological solutions.

For additional project details, candidates are encouraged to contact us.

Methods and Materials

To improve model output for natural flow conditions, an existing HYPE model setup for the mainland of Norway will be used. The existing model suggests that hydrological impact of lakes is high and potential for optimization by calibrating lake model parameters is large.

The study will focus on improving model performance with regards to lake outflow and lake water levels. Different optimization criteria will be tested with strategic calibrations towards an optimization for lake model properties.

Simulations optimized towards lake regulations will enable hydrological classification of waterbodies in Norway and help to understand how hydropower affects river hydrology on a national scale.

Main tasks:

- Become familiar with HYPE software for precipitation-runoff modelling
- Identify potential calibration strategy to improve model performance downstream of lakes
- Calibrate and validate of HYPE model with focus on lake parameters
- Analyses of simulation results

Additional information

Type: Master thesis
Level: Master (1st or 2nd year)
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