SINTEF Energy Research
Norway

Type: Internship or master thesis,
Duration: 6 months (can be discussed)
Level: Master (1st or 2nd), Engineering School
Location: Trondheim, Norway

Study of unregulated flow conditions in Norwegian rivers

A model approach to improve model performance for low-flows

Water Resources Section, SINTEF Energy Research

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. Hydrological alteration from natural status may be classified using discharge time series from both natural and regulated conditions. There are several thousand water-bodies in Norway, and for many of them, natural flow conditions 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 low-flow conditions and for regions downstream of natural lakes have been identified.
This Master thesis is part of the HydroCen project (ntnu.edu/hydrocen). HydroCen is a large hydropower centre. 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
The study will also focus on improving model performance for low-flow conditions. Different optimization criteria will be tested with strategic calibrations towards an optimization for low-flow conditions.
Simulations optimized towards lake regulations and low-flow conditions 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
- Identifying potential calibration strategy to improve low-flow performance
- Calibration and validation of HYPE model with focus on low-flow conditions
- Analyses of simulation results

Additional information

Type: Master thesis
Level: Master (1st or 2nd year), Engineering School
Duration: 6 months (can be discussed)
Start: March-June 2021
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