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Simulation of Hydropower Impact on Ice

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Abstract
Changing energy demand, climate change impacts and focus on renewable energy systems are important topics in the energy discussion today. Among the renewable energy sources, hydropower is the only source so far with a feasible storage potential. Hydropower also has an operational flexibility that can provide a load balancing in a system with increasing use of non-storable renewable energy production. Norwegian storage capacity amounts to around 50% of the total European storage, and could be important both nationally and as for export when increased amount of other renewable meet the market. In cold regions, the highest electrical demand is during the winter months when river has low flow and thus water is released from reservoirs to meet the demand. Release of warm water from deep reservoir outlets will influence downstream ice regimes, and hydropower operation can therefore be seasonally constrained due to ice problems. Fluctuating flow during winter due to production releases tends to aggravate ice problems until the surface of the river becomes ice covered, which in many cases may not happen at all in many northern regulated rivers. In a future with a stronger emphasis on load balancing and covering peak demands, we can expect a more variable release pattern and a potential for increased problems with river ice. The objective of the study is to establish a model to identify impacts of hydropower production on the ice and temperature regime in a river. The established model will then be used to study impacts of peaking scenarios on ice conditions during winter. The onedimensional hydrodynamic model MIKE 11 from DHI, Denmark is used together with an ice module developed by Le Groupe- Conseil LaSalle, Canada for simulation of ice formation and break-up in the river. The study site is the regulated Orkla river south of Trondheim. In the poster present, we present the results from the model setup and calibration, and experiences in simulating impacts of the current hydropower operation on the ice regime.

Keywords: River ice, hydrodynamic, regulated, MIKE 11, ice formation, break-up