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Analysis of Status and Trends in Short Term Flow Regulation in Nordic Rivers

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Hydropower has a significant role in Europe's energy market since its offers low-carbon and flexible energy source. In this study, measure of hydropeaking on an hourly scale from hydropower regulation over northern Europe has been calculated. Hydropeaking has been quantified and compared with the effects of hydropower type and catchment properties across multiple Nordic rivers. Discharge data from 150 gauging stations or hydropower dams on major pristine and regulated rivers spread across all of Norway, Sweden and Finland was used. For the analysis indices developed by Carolli et al., (2015) and hydropeaking (HP1) and ramping rates (HP2) were used to quantify hydropeaking across all the studied stations. It was shown that the catchment size was directly proportional to the measure of HP1 and HP2. Lake area percentage, elevation difference and precipitation were inversely proportional to HP1 and directly proportional to HP2. Rivers with run-of-the-river (ROR) type hydropower showed higher hydropeaking values during summer and autumn, whereas, rivers with combination of dams and tunnel based power plants had higher hydropeaking values during spring and autumn. According to this analysis, there is an increase in hydropeaking in Nordic rivers over the period of last two decades, which might have resulted from the use of hydropower as an adjustment source of energy. Results of this study show there is a clear need for optimization of hydropower operations in the Nordic countries in terms of ecological sustainability. Topic of 'impacts of using hydropower as an adjustment source of energy' clearly needs to be looked up more thoroughly to help policy makers decide if it is an environmentally sustainable choice.