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Analyzing and modeling CRE in a changing climate and energy system - a case study from Mid-Norway

Lena S. Tøfte, Julian F. Sauterleute, Sjur A. Kolberg, and Geir Warland
SINTEF Energy Research, Trondheim, Norway (lenat@sintef.no)

Climate related energy (CRE) is influenced by both weather, the system for energy transport and market mechanisms. In the COMPLEX-project, Mid-Norway is a case study where we analyze co-fluctuations between wind and hydropower resources; how co-fluctuations may change in the long-term; which effects this has on the power generation; and how the hydropower system can be operated optimally in this context.

In the region Mid-Norway, nearly all power demand is generated by hydro-electric facilities, and the region experiences a deficit of electricity. This is both due to energy deficiency and limitations in the power grid system. In periods of low inflow and situations with high electricity demand (i.e. winter), power must be imported from neighboring regions. In future, this situation might change with the development of renewable energy sources. The region is likely to experience considerable investments in wind power and small-scale hydropower. In relation to the deployment of wind power and small-scale hydropower and security of supply, the transmission grid within and out of the region is extended.

With increasing production of intermittent energy sources as wind and small-scale hydro, dependencies and co-fluctuations between rain and wind are to be analyzed due to spatial and temporal scale, in the present and a future climate. Climate change scenarios agree on higher temperatures, more precipitation in total and a larger portion of the precipitation coming as rain in this region, and the average wind speed as well as the frequency of storms along the coast is expected to increase slightly during the winter. Changing temperatures will also change the electricity needs, as electricity is the main source for heating in Norway. It's important to study if and to which extent today's hydropower system and reservoirs are able to balance new intermittent energy sources in the region, in both today's and tomorrow's climate.

The case study includes down-scaling of climate scenarios, analyses of hydro-meteorological variables, and modeling inflow and electricity production in both today's and tomorrow's system.