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MSc in Hydrogeology and Geothermics
MSc Thesis Summary, 2017-2018
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The Impact of Climate Change on Hydropower Potential and Droughts in New Zealand

Hydropower plays a central role for socioeconomic development around the globe. A few qualitative studies have been done in New Zealand so far to assess the impact of climate change on hydropower generation. For the first time, this study aims to quantify those impacts, as well as, analysing the changes on hydropower droughts. Six hydropower schemes that represent more than 80% of the total electricity supply by hydropower of the country are considered in the computations. Hydrological simulations of all New Zealand from 1972-2099, and under 6 GCMs (Global Climatic Models) and 4 RCPs (Representative Concentration Pathways) are used to convert future flow to generating potential. This Master Thesis examines the effect across a spatial scale: the analysis of the simulations is done for each region separately and also for the two main islands and for the country itself because there is a single electricity network. The location of the study is particular because it involves a snow influenced environment that is highly dominated by ocean's effects. Another point that makes this research unique is that importation of electricity is impractical for New-Zealand. Therefore, predictions about power potential in the future is really important. Different statistical tests are applied to the data: the one and two-sample Kolmogorov-Smirnov tests to check the population's distribution, the Mann-Kendall test and the Sen's slope estimator to determine trends.

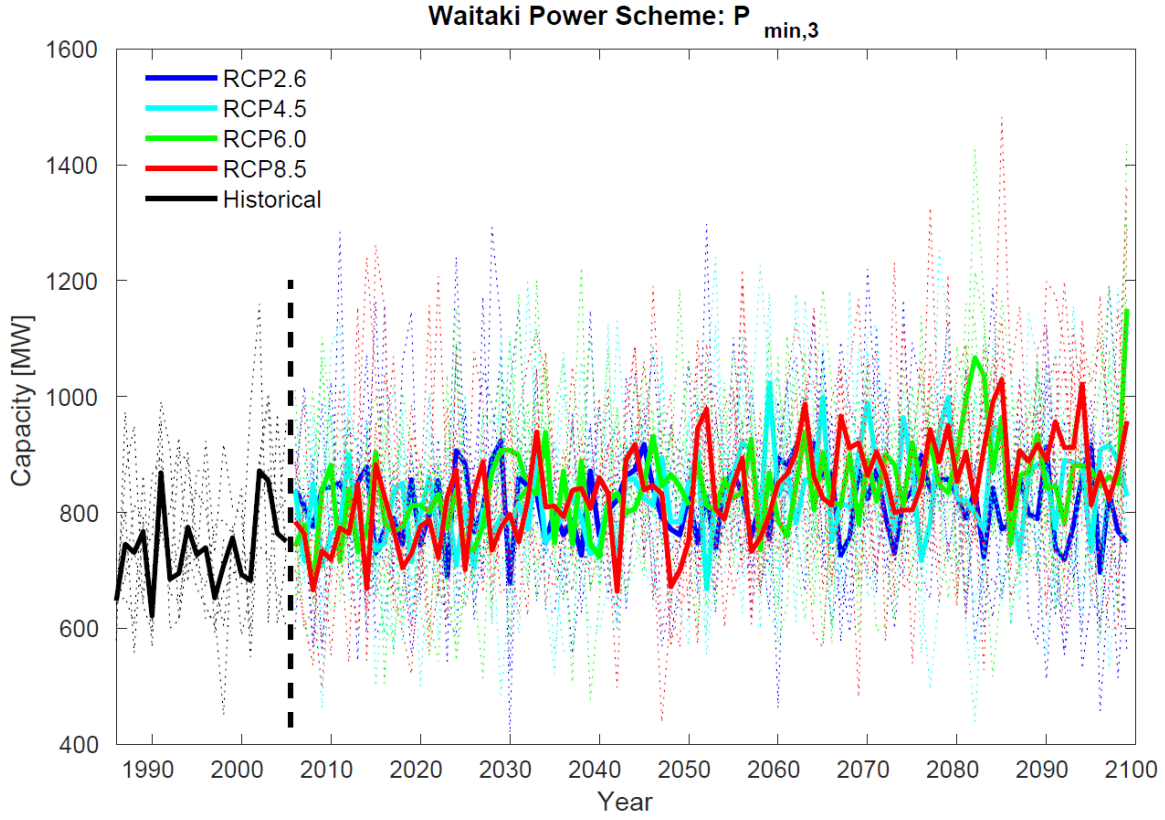

Figure 1: Future generating potential projections for the Waitaki Power Scheme. The generating capacity for every GCMs over every RCPs is drawn with a dashed line. For each RCP, the median of the different GCMs is represented as a full-line.

The impact on hydropower droughts is evaluated by analysing the changes in the mean annual 3-month low generating potential. All datasets have a non-normal distribution. The tests show more difference between the late-century period and the reference period than between the mid-century and the reference (+30%). Significant increasing trends for the South Island and slightly decreasing ones for the North Island are revealed. This diminution in the North Island is however compensated by the extra-production generated in the South. Globally, the mean annual low potential is higher in the future as well. The conclusion of this study is that climate change will most likely have a positive impact in New Zealand on hydropower potential in the next century. This leads to reflections about possible further developing of hydropower capacity. Studies about future generating power in general are an important topic for the country.

Keywords: Hydropower generating potential | Climate change | Droughts | New Zealand | Kolmogorov-Smirnov test | Mann-Kendall trend test