

“Preliminary Evaluation of Climate Change impact in the Codegua’s River Irrigation Improvement Project”

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The aim of this study is to quantify the impact of Climate Change in one of the projected dams for farming activities in Codegua’s catchment, near to Santiago, Chile. This reservoir is one of the twenty that will be built by the Hydraulics Infrastructure Management Department of Chile in the next years. The design is based on the concept of “Irrigation Security”, defined as the quotient between the number of years where is possible to deliver the crop demand and the total of years. It must be greater than 85% to approve the project.

The evaluation of Climate Change is based in two scenarios: RCP 4.5 and RCP 8.5. The forecast hydroclimatology is based in General Circulation Model MPI-ESM, from Max Planck Institute, Germany. The evaluation considers two future periods: a near future (2020-2055) and a further future (2065-2100). First, statistical downscaling of precipitation and temperature time series are made and then the yearly inflow to the dam is estimated by a simple rainfall-runoff relation, the future evapotranspiration is estimated by Penman-Monteith method and with an empirical mathematical relation, based in Blaney and Criddle method. For this reason, the analysis included additional scenarios to incorporate the uncertainty in the evapotranspiration estimation as well as on tributary volumes from the basin to the dam, for each Climate Change scenarios.

Climate Change in the zone of study indicates that precipitations will be lower than the present and the temperature will increase. For example, the results predict that precipitation in the best scenario, for near future, will go down 15% and temperature will increase in 0.6 (°C). For the further future in the worst scenarios, model predicts that precipitation will go down around 30% and temperature will increase 2.5 (°C). This coupled effects modify in a great way the water supply and demand in the zone of study.

With the new hydrology forecast for the future, the “Irrigation Security” is recalculated in a simulation model, with the dam capacity and farming area constant, being those specified in the original project. The results suggest that “Irrigation Security” will go down 5 percentage points in the best scenarios for near future and around 15 percentage points in the critical scenarios for further future. This result reduces the feasible area to be improved and changes the economic analysis. It is demonstrated that is necessary to incorporate the Climate Change in the conception of the projects to make the correct economical decision and modify some irrigation channel to adequate the distribution of water in the future scenarios, where water will be limited in the central valley of Chile.