Geophysical Research Abstracts
Vol. 20, EGU2018-9940, 2018
EGU General Assembly 2018

Climate change impact on long-term capacity of hydropower reservoirs in Andean regions. Case of study: Cañete river, Peru.

Miluska Rosas (1), Veerle Vanacker (2), and Christian Huggel (3)

(1) Earth and Life Institute, Georges Lemaître Centre for Earth and Climate Research, Université Catholique de Louvain, Bélgica (miluska.rosas@uclouvain.be), (2) Earth and Life Institute, Georges Lemaître Centre for Earth and Climate Research, Université Catholique de Louvain, Bélgica (veerle.vanacker@uclouvain.be), (3) Department of Geography, University of Zurich, Suiza (christian.huggel@geo.uzh.ch)

The hydropower capacity in South America has largely increased in the last decade. In Peru, hydropower is the largest energy resource accounting for about 60% of the total energy production in 2017. The hydropower plants in Peru commonly have a large impoundment facility, allowing to carry over the storage of river water from the wet season to supplement lower flows in the dry season. Erosion rates of catchments draining the steep escarpments of the Andean Cordillera, where hydropower plants are preferentially located, are known to range between 0.2 and 1.0 mm/yr, or roughly 520 to 2600 t/km2/yr. High rates of erosion and sediment transfer in the Andes lead to rapid accumulation of sediment in the hydropower reservoirs and a potentially severe decrease of the carryover storage. However, little is known to date concerning quantified assessments of erosion and deposition and how climatic changes influence these processes.

This paper focuses on the potential impact of climate change on sediment dynamics in the Peruvian Andes, and evaluates the potential changes in sediment transfer and mobilization, and reservoir sedimentation. Within the Peruvian coastal mountain range, the catchment of the Cañete River is studied as it plays an important role in the social and economic development of the region due to its provision of water and energy to rural and urban areas. The 220MW El Platanal hydroelectric plant located on Canete's river, involves the Capillucas reservoir dam that was constructed on the middle reach of the Cañete River. The lower part of the Cañete catchment is an arid desert, the middle subhumid part sustains subsistence agriculture, and the upper part is a treeless high-elevation puna landscape. Snow cover and glaciers are present at its headwaters located above 5000 masl.

The retreat of glaciers due to climate change is expected to have an impact on water availability in Cañete's headwaters, and on the production and mobilization of sediment within the river channels. Global and regional climate models do not provide clear indications on future precipitation changes in the catchment. Projections over the 21st century range from -24% to +15% change of precipitation (with reference to the 1981-2005 period) for the rainy season and -33% to +24% for the dry season, depending on the model, emission scenario and exact time period. Likewise, climate variability and land cover changes might trigger an important change in erosion and sediment transport rates. In this work, we use a hydrological model coupled to a sediment transport model to simulate future changes in discharge and river load. Four scenarios were developed, and evaluated. Two of them show an increase of 10% and 25%, respectively, of the annual precipitation rate, distributed in the rainfall season (December to March). While, the others, evaluate the impact of these increments in the extreme events or peaks only.

The paper presents new data on the sensitivity of water infrastructure and hydro-power facilities to climate-induced changes in sediment mobilisation in the river network.