Geophysical Research Abstracts
Vol. 18, EGU2016-10053, 2016
EGU General Assembly 2016

Exploring the impact of co-varying water availability and energy price on productivity and profitability of Alpine hydropower

Daniela Anghileri (1), Martina Botter (2), Andrea Castelletti (1,2), and Paolo Burlando (1)

(1) Institute of Environmental Engineering, ETH Zurich, Zurich, Switzerland, (2) Department of Electronics, Information, and Bioengineering, Politecnico di Milano, Milano, Italy,

Alpine hydropower systems are experiencing dramatic changes both from the point of view of hydrological conditions, e.g., water availability and frequency of extremes events, and of energy market conditions, e.g., partial or total liberalization of the market and increasing share of renewable power sources. Scientific literature has, so far, mostly focused on the analysis of climate change impacts and associated uncertainty on hydropower operation, underlooking the consequences that socio-economic changes, e.g., energy demand and/or price changes, can have on hydropower productivity and profitability. In this work, we analyse how hydropower reservoir operation is affected by changes in both water availability and energy price. We consider stochastically downscaled climate change scenarios of precipitation and temperature to simulate reservoir inflows using a physically explicit hydrological model. We consider different scenarios of energy demand and generation mix to simulate energy prices using an electricity market model, which includes different generation sources, demand sinks, and features of the transmission lines. We then use Multi-Objective optimization techniques to design the operation of hydropower reservoirs for different purposes, e.g. maximization of revenue and/or energy production. The objective of the work is to assess how the tradeoffs between the multiple operating objectives evolve under different co-varying climate change and socio-economic scenarios and to assess the adaptive capacity of the system. The modeling framework is tested on the real-world case study of the Mattmark reservoir in Switzerland.