H51Q-1711 - Detailed simulation of storage hydropower systems in a large Alpine watershed

Friday, 13 December 2019

08:00 - 12:20

Moscone South - Poster Hall

ePoster

Copy and pasted text document 1.txt Download

Abstract

Hydrological simulations in river networks with streamflow altered by storage hydropower systems represent an open challenge due to the difficulties in acquiring data on reservoir operation. Given these difficulties, most of the existing studies focus on run-of-the-river systems, adopt indirect proxies of regional hydropower production (e.g. gross potential estimates, selected quantiles of the streamflow flow duration curves), or limit their analyses to small areas with a very limited number of hydropower systems. To overcome the limitations of existing approaches we embedded hydraulic elements and connections of the hydropower systems (e.g. reservoirs, intakes, diversion channels and powerhouses) into a hydrological model such as to represent both natural and induced water fluxes within a common framework. To illustrate this approach, we present an application to the Adige river, an important river with a contributing area of 10,500 km^2, located in the Southeastern Alps, which streamflow is strongly affected by 40 large hydropower systems (i.e. with installed capacity larger than 3 MW) operated with 30 reservoirs. Simulations are performed with HYPERstreamHS, a distributed hydrological model specifically designed to simulate the interactions between human and natural hydrologic systems. To make the framework widely applicable we inferred the operational rules by using only publicly available data. We performed a multi-site calibration of the hydrological model by using streamflow time series during the period 1989-2013, achieving an overall NSE index of 0.78. The hydropower production module was validated against monthly time series, achieving a difference of 4.7% between observed and simulated production, a significant improvement with respect to the application of existing approaches. Our modelling framework may be applied in other catchments and to conduct additional analyses like e.g., to evaluate potential impacts of climate change on the regional hydropower production and to compare streamflow alterations due to alternative management strategies of the hydropower systems.

Authors

Andrea Galletti
University of Trento

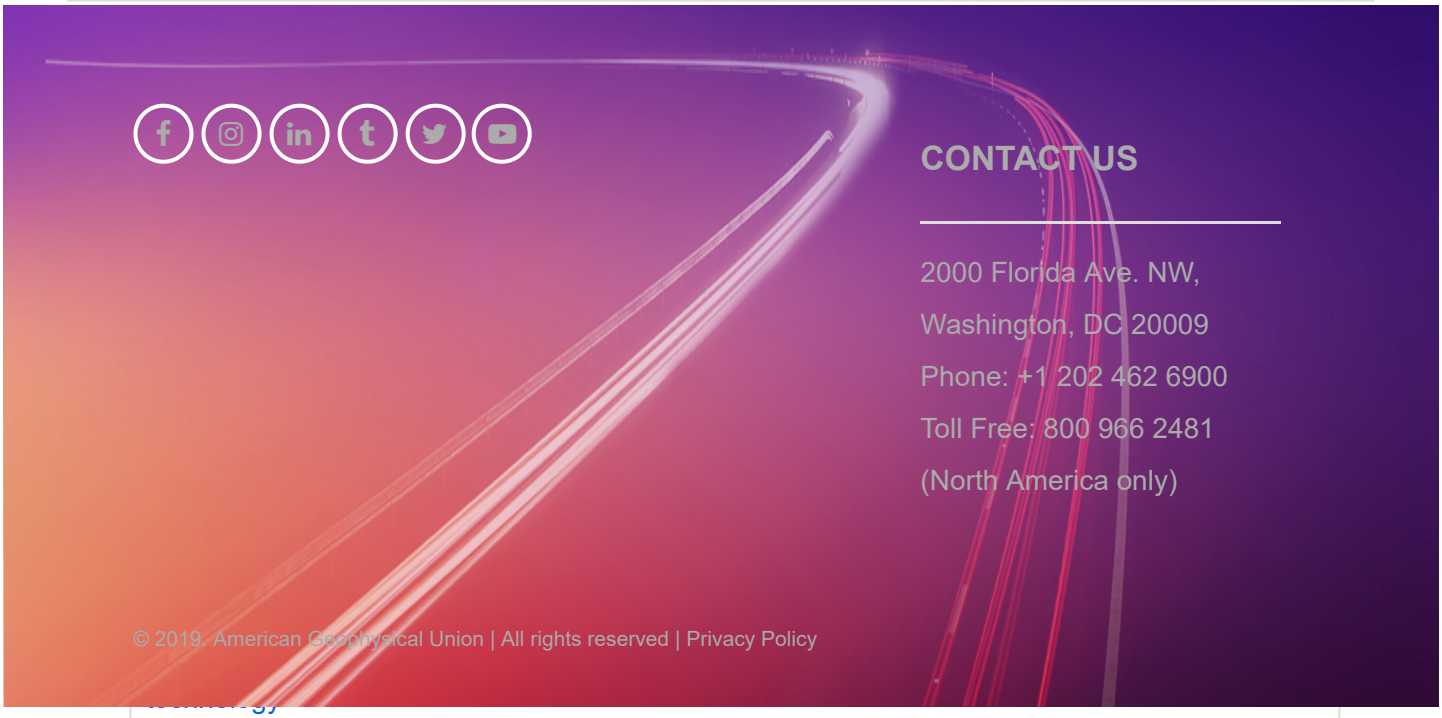
Diego Avesani
Free University of Bozen-Bolzano

Alberto Bellin
University of Trento

Bruno Majone
University of Trento

View Related

H51Q - Managing Water and Energy Systems for Increasing Penetration of Renewable Generating Technologies II Posters ›



Suyog Narendra Chaudhari[1], *Yadu Pokhrel*[1], *Erik Brown*[2], *Raul Quispe-Abad*[2] *and Norbert Mueller*[2], *(1)Michigan State University, Department of Civil and Environmental Engineering, East Lansing, MI, United States, (2)Michigan State University, Mechanical Engineering, East Lansing, MI, United States*

Six challenges to successfully inform hydropower operation by improved hydro-meteorological forecasts

Andrea Castelletti[1], *Matteo Giuliani*[2], *Maria-Helena Ramos*[3], *Manuel Pulido-Velazquez*[4], *Gustafson David*[5], *Hector Macian-Sorribes*[6], *Louise Crochemore*[5], *Ilias Pechlivanidis*[5], *Guillaume Thirel*[7] *and Manon Cassagnole*[3], *(1)Politecnico di Milano, Milano, 20133, Italy, (2)Politecnico di Milano, Milano, Italy, (3)IRSTEA, Antony Cedex, France, (4)Universidad Politecnica de Valencia, Valencia,, Spain, (5)Swedish Meteorological and Hydrological Institute, Norrköping, Sweden, (6)Universidad Politecnica de Valencia, Valencia, Spain, (7)IRSTEA, Antony, France*

Surface depression water storage improves continental scale modeling for watershed management

Adnan Rajib[1], *Heather E Golden*[2], ***Charles Lane***[2] *and Qiusheng Wu*[3], *(1)Texas A&M University Kingsville, Department of Environmental Engineering, Kingsville, TX, United States, (2)US Environmental Protection Agency, Office of Research & Development, Cincinnati, OH, United States, (3)University of Tennessee, Geography, Knoxville, United States*