Generation of a future-proof hydro inflow dataset for power system studies

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Resource Adequacy and Power System studies have considered so far a consistent set of data - to model temperature-dependent demand, wind and solar infeed time series and hydro inflow - derived from climate reanalysis. Recent European regulation prescribes that power system adequacy studies should account for climate change when estimating the availability of variable renewable resources and their correlation. With regards to this challenge, HelioSwitch developed algorithms for regression and analysis of hydroelectric power plant production and river discharge data. The resulting transfer function, trained with historical river discharge data [1], has then been applied to river discharge derived from bias-adjusted climate projection models [2] to study hydro inflow changes between a reference and a future climate projection.

The approach developed, which will be will be presented and discussed, involves the 2 following main steps:

1. creation of a location-specific data mask for each hydroelectric power and decomposition via Principal Component Analysis (PCA) of gridded river discharge data;
2. generation of nonlinear transfer functions for each hydroelectric power plant between river discharge data, and the water inflow at the power plants, inferred from their production.

The approach has been tested and applied to data from more than 25 European Countries members of ENTSO-E (European Network of Transmission System Operators for Electricity) as part of the Service Agreement contract related to the development of Hydro Dataset for power system modeling.

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2. P Berg, C Photiadou, A Bartosova, J Biermann, R Capell, S Chinyoka, T Fahlesson, W Franssen, Y Hundecha, K Isberg, F Ludwig, R Mook, J Muzuusa, L Nauta, J Rosberg, L Simonsson, E Sjökvist, J Thuresson, and E. van der Linden. Hydrology related climate impact indicators from 1970 to 2100 derived from bias adjusted european climate projections. 2021.