EGU23-16025, updated on 28 Mar 2023
https://doi.org/10.5194/egusphere-egu23-16025
EGU General Assembly 2023
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Medium range ensemble streamflow forecasts for hydropower dams of the Brazilian National Interconnected System

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Short-to-medium range streamflow forecasting is essential for planning and operating hydropower plants (HPPs). The Brazilian National Interconnected System (SIN) is composed of more than 150 HPPs that are located over a wide range of climate and hydrological conditions. Forecasts of natural inflow into the SIN reservoirs are important to establish optimal operating rules to reduce costs with other energy sources, therefore influencing the prices in the energy market. The objective of this work is twofold: (i) evaluate the skill of ensemble streamflow forecasts for the SIN hydropower plants based on continental-scale hydrological modeling (MGB-SA) and medium-range ECWMF rainfall forecasts (MGB-ECMWF), and (ii) compare the MGB-ECMWF forecasts to those produced operationally by the Electric System National Operator (ONS). The MGB-ECMWF predictions were additionally bias-corrected and updated using quantile mapping and auto-regressive model approaches, and were assessed in the period from 2015 to 2020 in terms of weekly averages. The forecast skill was estimated relative to both streamflow climatology and persistency using the CRPS metric, while the comparison between MGB-ECMWF and operational forecasts was performed using deterministic metrics typically adopted by ONS. The skill of MGB-ECMWF forecasts was substantially improved (especially in the first week) by the use of output correction methods, which were demonstrated to be essential for quantitative streamflow forecasting using a continental-scale hydrological model. The relative performance between ONS and MGB-ECMWF forecasts was quite variable (exhibiting positive and negative values) over the geographical extent of the SIN, although in several locations the MGB-ECMWF forecasts have performed equal to or even better than those issued by ONS. Finally, the results presented here provide insights for investigations and applications of streamflow forecasts using continental-scale modeling and simple output correction techniques, which can bring benefits, for example, in the optimization of the reservoir operation and electricity generation.

Acknowledgments: This work presents part of the results obtained during the project granted by the Brazilian Agency of Electrical Energy (ANEEL) under its Research and Development program Project PD 6491-0503/2018 – “Previsão Hidroclimática com Abrangência no Sistema Interligado Nacional de Energia Elétrica” developed by the Paraná State electric company (COPEL GeT), the Meteorological System of Paraná (SIMEPAR) and the RHAMA Consulting company. The Hydraulic

Research Institute (IPH) from the Federal University of Rio Grande do Sul (UFRGS) contribute to part of the project through an agreement with the RHAMA company (IAP-001313).