

THE ASSESSMENT OF BRAZIL'S POWER GENERATION THROUGH WIND AND WATER RESOURCES BASED ON LONG-TERM CLIMATE DATA ANALYSIS

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RESEARCH PROJECT: PREAMBLE

Given the increasing participation of wind power within its electricity mix in the past years, Brazil faces the challenge of integrating this renewable energy source efficiently in its electric system, which is currently supplied by hydroelectric and thermoelectric power plants in its majority. Wind resources, as well as water resources, exhibit stochastic behavior – determining variability in their availability – and they present signs of complementarity between each other in some Brazilian areas. In these terms, understanding the long-term history of the wind resources in synergy with water resources seems essential towards the mitigation of uncertainties and risks amidst the planning and operation of the electricity sector.

RESEARCH PROJECT: OBJECTIVES

This research intends to explore how exactly water and wind resources interact with one another in face of larger-scale atmospheric phenomena that have well known relations to Brazil's climate system, such as El Niño South Oscillation. Moreover, long-term data analysis will be carried out in order to identify trends and to track significant patterns of interactions.

RESEARCH PROJECT: METHODOLOGY

Databases from different sources, including reanalysis climate data (each of which having its own specific characteristics, as seen on Table 1) and Brazil's rivers and reservoirs data, will be explored and studied with statistical tools comprised in software of interest. The construction of scenarios considering different availability of both wind and water resources combined can shed some light over possible extreme conditions that may arise from climate change. It is expected that this analysis' findings may provide relevant information to be utilized in decision making regarding planning and operation of the Brazilian electrical system.

Table 1 – Available reanalysis data sets (adapted from Dee et al. (2016))

Reanalysis	Spatial resolution	Temporal resolution	Timespan
NCEP/NCAR R1	2.5°x2.5°	6 hours	1948 - present
NCEP-DOE R2	2.5°x2.5°	6 hours	1979 - present
CFSR (NCEP)	0.5°x0.5° 2.5°x2.5°	6 hours	1979 - 2011
C20r V2 (NOAA)	2.0°x2.0°	6 hours	1850 - 2014
ERA-20C	2.5°x2.5°	3 and 6 hours	1900 - 2010
ERA-Interim	0.75°x0.75°	6 hours	1989 - present
MERRA (NASA)	0.5°x0.667°	1 hour	1979 - present