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Correlation analysis of renewable resources in Ecuador based on meteorological data with high spatial and temporal resolution

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The current Ecuadorian power mix highly relies on hydropower and fossil-based thermal power to meet the country's electricity demand. Given the dependency of hydropower on climate conditions and the negative effects of fossil fuels, risks associated with climate change could however jeopardize security of electricity supply of the country in the long term.
As a first step to investigate transformation pathways for building a more sustainable and resilient power system, the mutual correlations between hydro, wind and solar resources in the Ecuadorian territory are assessed. For this purpose, a long-term data set with high spatio-temporal resolution of wind and solar resources combined with an open-source Geographic Information Systems is used.
A consistent wind and solar resources dataset was generated, based on the new ERA5 reanalysis dataset from the European Centre for Medium-Range Weather Forecast (ECMWF). For the period 2000-2018, hourly estimates of solar radiation and wind speed data of the Ecuadorian region were retrieved from the ERA5 dataset on a 30 km-grid resolution. The Ecuadorian territory is characterized by complex terrain and high altitude conditions that could not be entirely represented by the native spatial resolution of the reanalysis dataset. For this reason, the Weather Research and Forecasting Models WRF and its solar-specific derivative WRF-Solar were used to increase the spatial resolution from 30 km to 3 km for the investigated area. The downscaled data is validated in locations where observed data were available as well as with satellite-derived data for the solar resource.
Next steps of the methodological approach will be to determine spatio-temporal correlations for hydro/wind and hydro/solar resources at selected hydropower plants. This assessment will take into account seasonal changes in the hydrological regime and temporal variabilities of wind and solar resources during the investigated period. The results from the correlations will provide hints for the construction of future scenarios that consider diversification of technologies to complement seasonal variability of hydro resources in order to build resilience against climate-related stressors for the Ecuadorian power system.