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Parametric Methods for Probabilistic Forecasting of Solar Irradiance

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Abstract

This paper proposes two parametric probabilistic forecast methods using beta and two-sided power distributions to predict solar irradiance. It also evaluates their performance. To improve their performance metrics a hybrid procedure based on the beta transformed linear opinion pool is utilized. Our simulations show that these methods – despite their simple structure – can effectively forecast solar irradiance and accurately describe its stochastic characteristics. The proposed approach is flexible and could be extended to many different point forecast methods which otherwise minimize RMSE or MSE.

Keywords: Probabilistic forecast, solar radiation, power system

1. Introduction

Using renewable energy sources like wind and solar power is a key solution for environmental concerns such as air and water pollution and climate change associated with using fossil fuel resources, as well as long-term economic and political concerns regarding depletion of fossil fuel resources. Solar energy is the most abundant renewable energy source on the earth surpassing hydro power, geothermal, wave and tides, biomass, and wind. In recent years photovoltaic (PV) generation has rapidly increased as it provides a competitive solution for sustainable electricity generation. For example the total PV generation capacity reached 40 GW in the United States after installation

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