Analysis of Fluctuation and Correlation Tendency among Precipitation, Wind, and Solar from Various Spatio-temporal Perspectives: a Case Study in China

Xianxun Wang
Yangtze University, 111th University Road, Wuhan, China (xianxunwang@gmail.com)

Analysis of correlation among precipitation, wind, and solar resources could explore their complementary features, enhance the utilization efficiency of renewable energy and further alleviate the carbon emission issues caused by fossil energy. In this study, we discuss the correlation between precipitation and wind, wind and solar, precipitation and solar from various Spatio-temporal perspectives (from east to west in China, in terms of plain, plateau, hill, and mountain, from daily to ten days and monthly) with observed data. With investigation of daily time series of precipitation, wind speed and solar radiation ranging from 1961-1-1 to 2016-12-31 of 726 meteorological stations located in various landform and distributed dispersedly in China, the results show that 1) the fluctuation value, quantified by Mei-Wang Fluctuation index, denotes the descending tendency when the time resolution increases, and this tendency is stronger in the southern and eastern China; 2) the correlation coefficient, characterized by Kendall's rank correlation coefficient, changes from east to west in China, and the strength of this correlation displays certain connection to the local topography (e.g., in Qinghai province which is located in the plateau region the complementarity between precipitation and wind speed is stronger than that between precipitation and solar, the mid-stream basin of Yangtze River where the topography is scattered and complex has the weaker complementarity compared to other areas in China). According to the results of this research, it is helpful from the temporal perspective to understand the requirement of complementarity in the utilization of wind, and solar resources which are intermittent, and from the spatial perspective to know the solution of mitigating fluctuation via integration of multi-renewable energy situated in different locations.