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Analysis of the influence of synoptic weather pattern on the solar resources intraday variability in the Southern Iberian Peninsula

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A better understanding of solar resources variability and its causes at different spatial and temporal scales is mandatory to develop efficient mitigation solutions for the solar energy intermittency. Particularly, temporal scales from tens of minutes to hours (intra-day variability) are often associated with characteristic synoptic weather patterns. As the area of influence of these patterns usually reaches thousands of square kilometers, these time scales are relevant to the solar energy grid integration. In this work we aim to identify the main intra-day modes of variability of the solar resources in the central and southwestern parts of the Iberian Peninsula, to analyze the causes behind these modes and their impact on the solar power generation. To this end, firstly, a clustering analysis is conducted to identify the main modes. This analysis was based on two years of GHI and DNI one-minute data collected at four stations; namely, Seville, Madrid, Lisbon and Jaen. Secondly, the associated weather patterns were obtained using NWP reanalysis (SLP) and satellite (cloud maps) data. Finally, the aggregated solar PV power yield in the study area associated with each mode was assessed. Yearly and seasonal analyses were conducted independently. Results revealed, firstly, the existence of a relative low number (3 to 4 depending of the seasons) of modes of variability. Secondly, that these modes shown to have distinctive weather pattern and specific impacts on solar power generation in the study area. Implications of these results for the solar energy grid integration in the study area are discussed.