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Complementarity of potential Iberian offshore wind farms in allowed locations based on COSMO-REA6 high-resolution reanalysis

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Europe's goal of becoming the first climate-neutral continent by 2050 implies increased investment in renewable energy sources at both continental and national level. The offshore wind is a rapidly maturing renewable energy technology that is poised to play an important role in future energy systems, as it is at the core of the European Green Deal. In this context, Spain and Portugal governments are working on legislation to facilitate the market in floating offshore wind energy. Most studies over the Iberian Peninsula (IP) are focused on the analysis of temporal and spatial changes of the wind resource, showing that some areas such as the western IP show high potential. However, there are important spatial planning conflicts for the deployment of floating offshore wind towers, related to wind infrastructure technologies and legislative limits. Moreover, the variable nature of wind power poses challenges for its use in the national electricity generation system. Increasing interconnections between regions of the IP can smooth the variability of local wind generation by exploiting their spatial complementarity. In this work, we present an analysis of the geographical combination of potential floating offshore wind farms sites over the IP. Hourly wind speed at 105 and 150 meters hub heights (typical of present and future offshore wind installations, respectively) were extracted from the very high resolution (0.055º) COSMO-REA6 reanalysis for 1995-2018. Then, wind speed was translated into capacity factor using an adequate power curve for each hub height. In order to assess the spatial complementarity of potential Iberian wind offshore farms, around 15 gross locations were chosen based on the publicly available planning information given by the Spanish Maritime Spatial Plan and the Direção-Geral de Recursos Naturais, Segurança e Serviços Marítimos of the Portuguese government. Then, the coefficient of variation (CV) was calculated for each site, and the geographic aggregation of sites that minimizes the CV of the aggregated wind capacity factor was analysed considering annual and seasonal time scales. First results show that, at both hub heights, as more distant sites are added, the coefficient of variation decreases (~ 40%) more than the capacity factor (~ 15%). This behaviour varies slightly by season, with the hourly variation decreasing the most in winter (~45%) and the capacity factor mean decreasing the most in summer (~ 24%). This ongoing analysis indicates that it is clearly more advantageous for the Iberian electricity system to build farms far apart than to concentrate wind farms in one or two highly productive areas. It also shows that a

larger and more stable offshore wind resource can be obtained at higher heights. Thus, the capacity factor is around 11% larger and with less hourly and interannual variation (~12%) at 150 meters than at 105 meters.