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Increasing the spatial resolution of MERRA-2 reanalysis data for energy system modeling

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Reanalysis data such as MERRA and MERRA-2 are commonly used to derive solar and wind power generation time series, and to estimate their resource potentials. However, the spatial resolution of the reanalysis data (0.5° latitude x 0.625° longitude for MERRA-2) is not sufficient for small-scale energy system models (e.g. states and cities), nor for siting potential projects. This paper uses the MERRA-2 reanalysis data in combination with additional data sources for land-use, topography, and protected areas, in order to obtain accurate global resource potential maps with a spatial resolution of 15 arcseconds. We also generate time series for individual cells of the rasters and identify the best locations for future wind and solar projects. The results are validated against measured hourly generation data of wind and photovoltaic power plants in Europe.