

Rooftop solar photovoltaics (PV) potential in Germany

Sander L, Schindler D, Jung C

Introduction

- Sustainable energy concept for cities required
- Solar rooftop photovoltaics (PV) as a promising solution
- Challenge of accurately assessing the potential

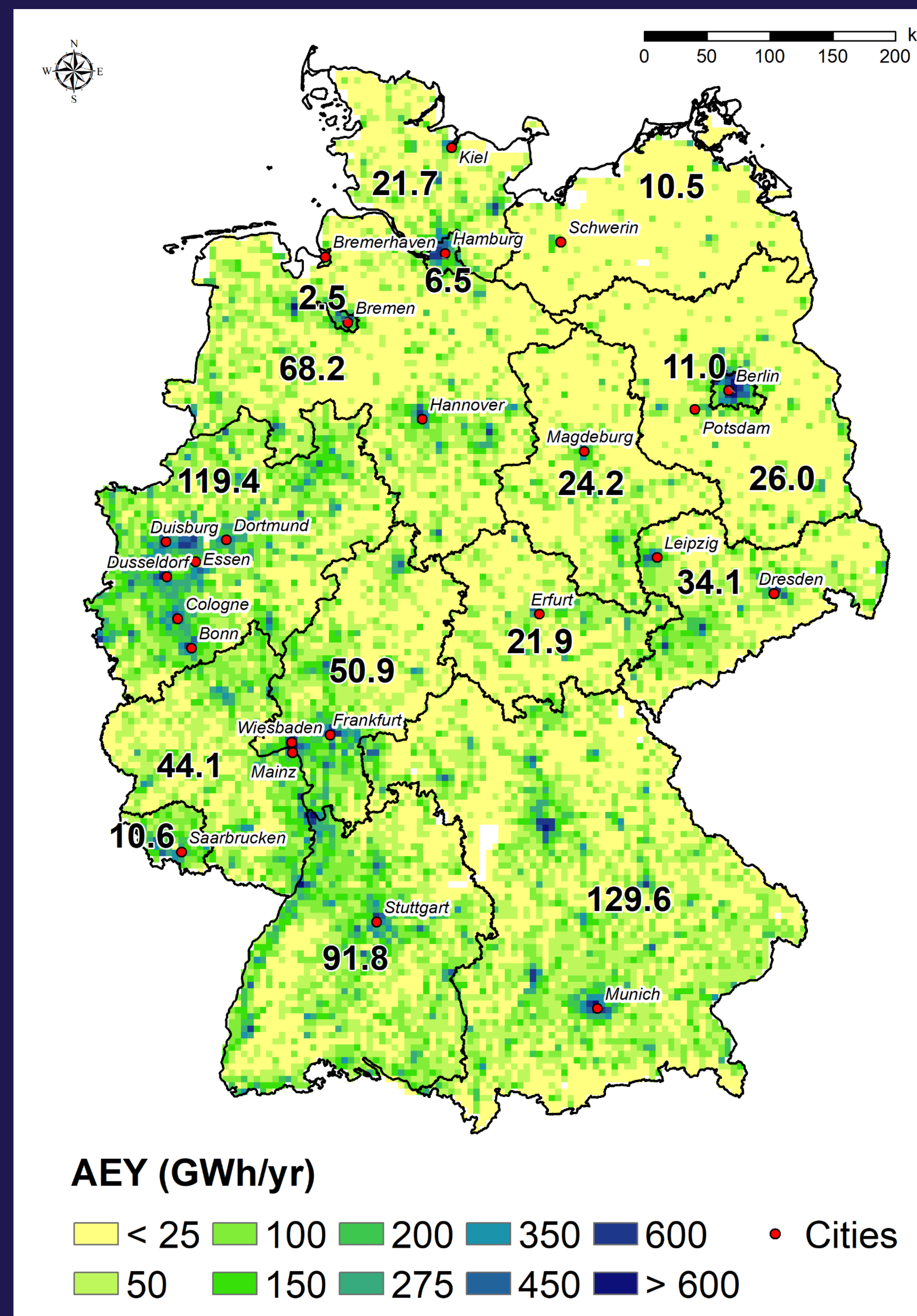
Methods

1. Meteorology: satellite solar radiation and reanalysis air temperature data
2. Rooftop area: European Settlement Map and solar cadastre
3. Technical solar module parameters
4. Calculation of hourly rooftop PV power output
5. Determination of the spatiotemporal variability of the rooftop potential

Results

- 2,113 to 4,491 km² usable rooftop area
- 475 to 1,009 TWh yr⁻¹ rooftop potential
- Pronounced spatiotemporal variability

Rooftop PV can represent a cornerstone in the German energy transition provided suitable sites are selected.



Download the poster



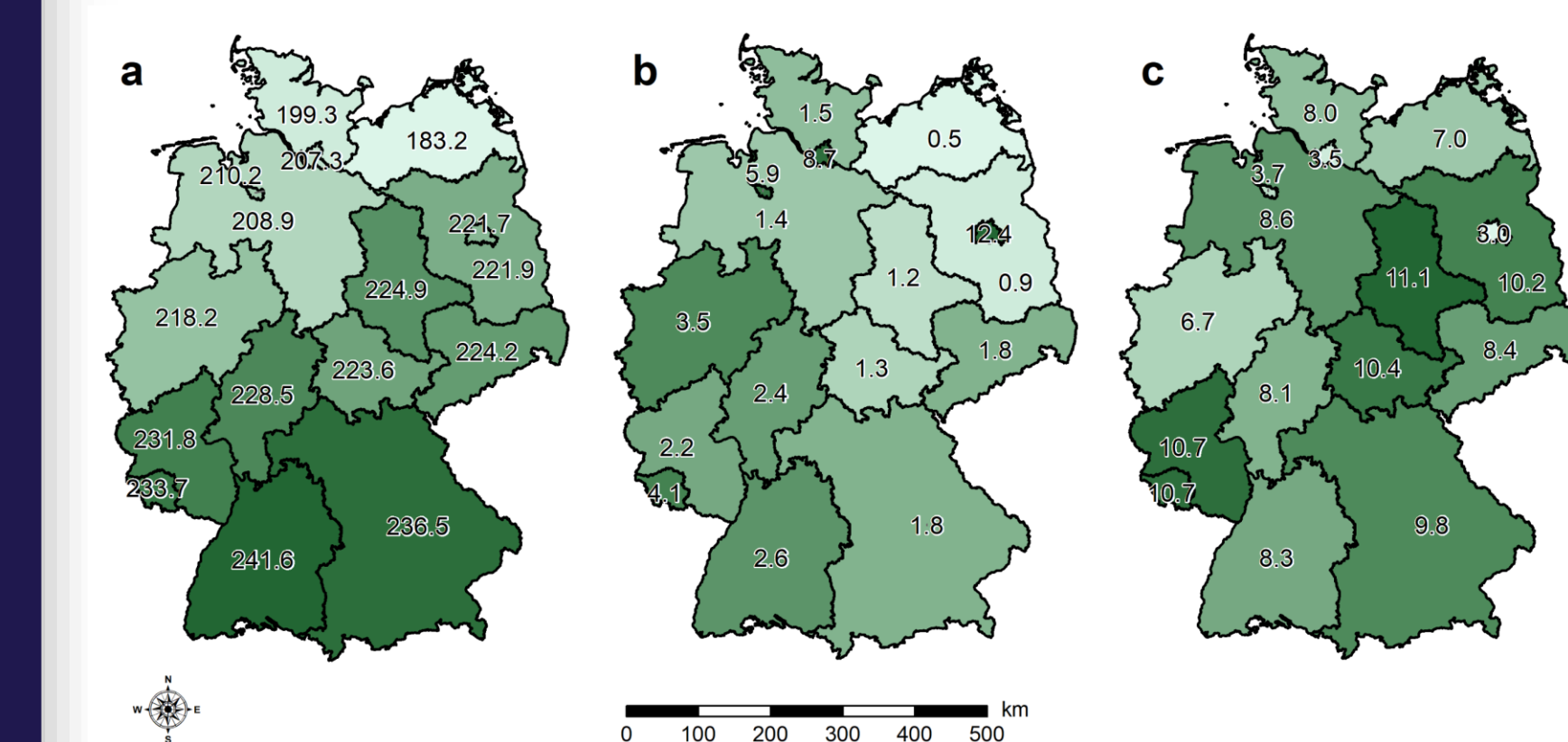
Sander et al., 2024



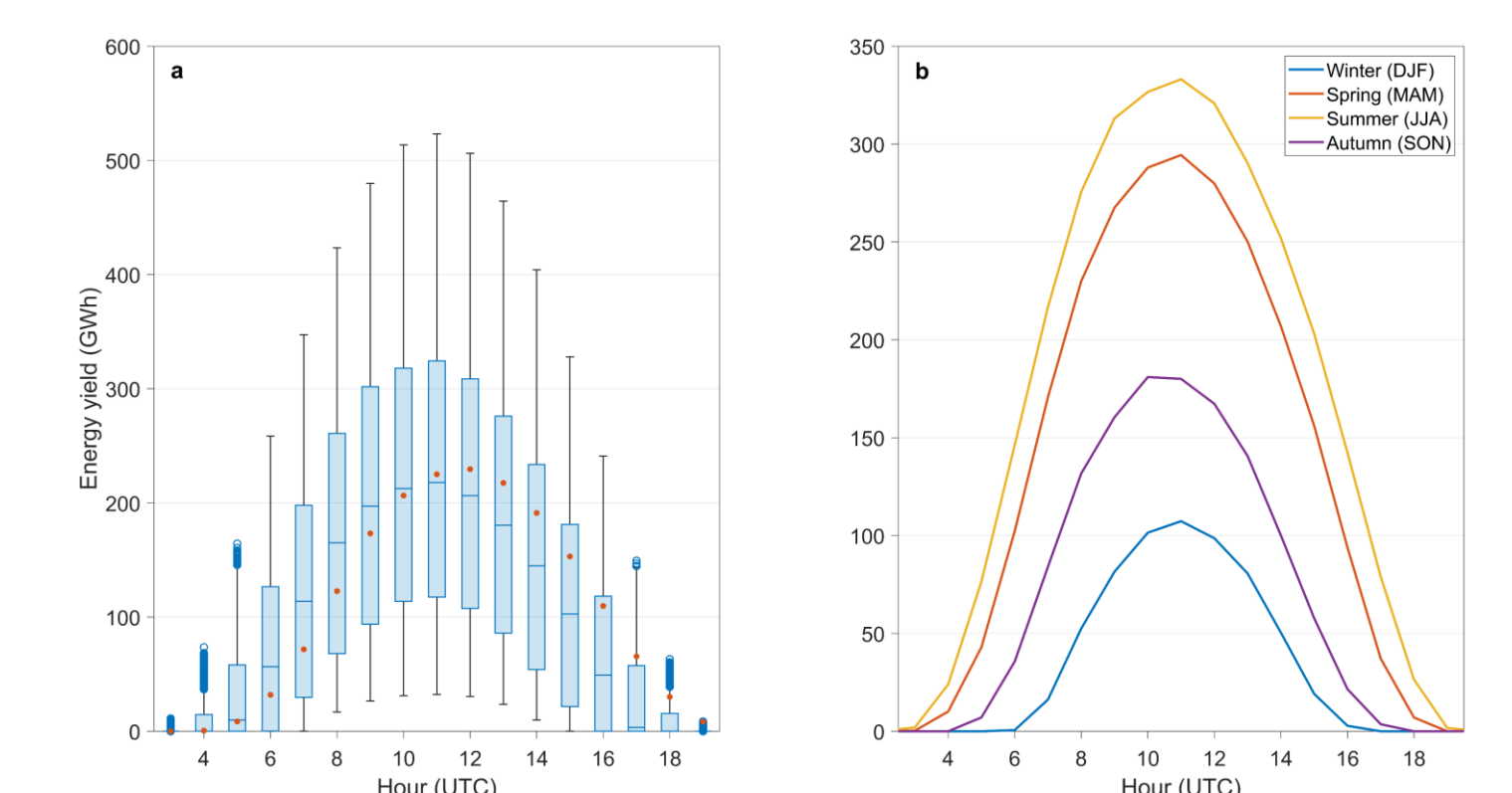
Discussion

- High uncertainty related to different methods and assumptions
- Limited self-sufficiency potential at the federal state level
- Temporal dynamics require smart-grid technologies, including battery storage

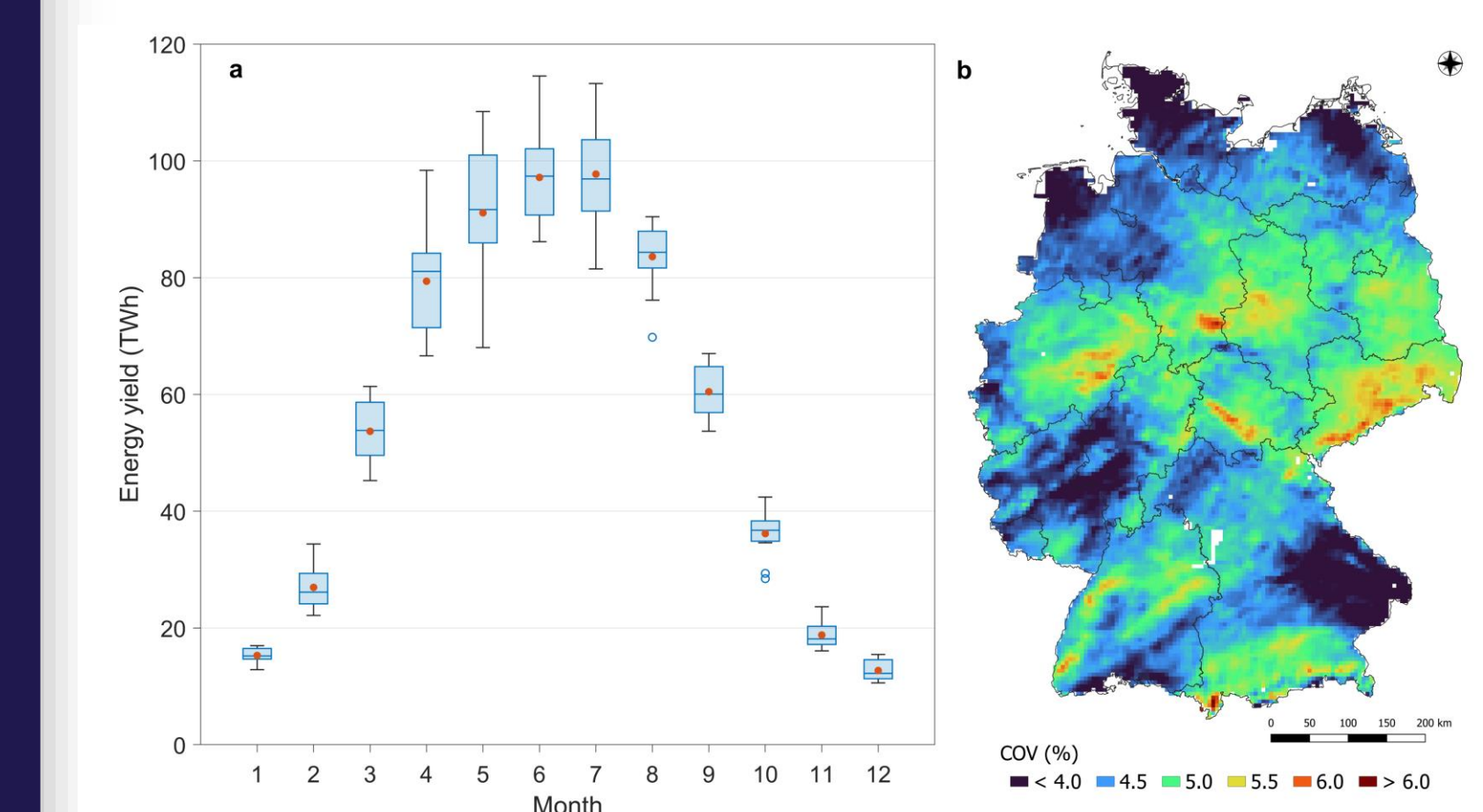
Additional info



Mean annual rooftop potentials: (a) per rooftop area (GWh km⁻²); (b) per federal-state area (GWh km⁻²), and (c) per capita (MWh cap⁻¹).



Diurnal cycle of the overall German rooftop PV potential: (a) Boxplots of all hourly energy yield values per hour of the day. (b) Mean diurnal cycles in the seasons winter, spring, summer, and autumn.



(a) Boxplots of the overall monthly sums of German rooftop PV energy yield values. (b) Inter-annual variability (coefficients of variation) based on the annual means in the study area.