The long-term development of wind direction-dependent wind resource

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Introduction

- Trends in wind resource decisive for site selection
- They influence the wind farm design
- Hypothesis: wind direction sector-dependent wind resource trends exist around the world

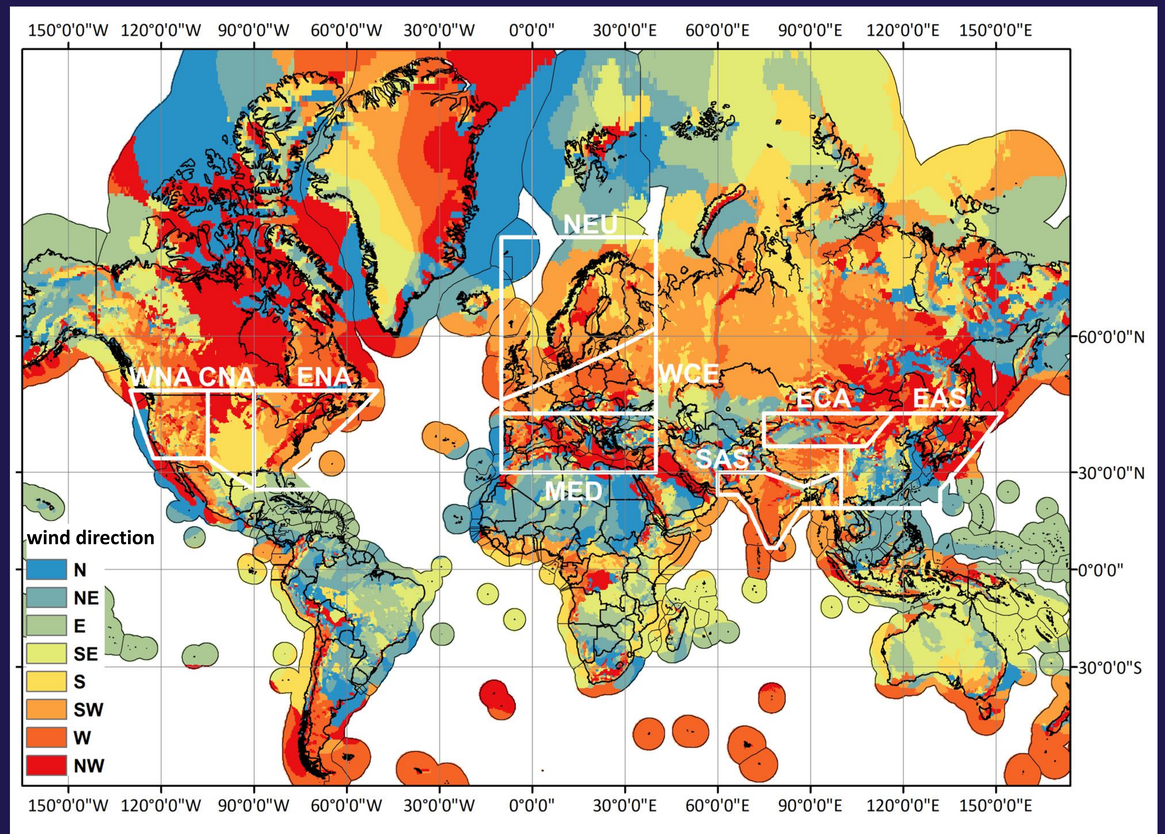
Methods

1. Zonal and meridional wind vector components from 1973-2022
2. Directional wind speed
3. Generic wind turbine power curve
4. Evaluation of (1) annual energy yield, (2) capacity factor, and (3) wind direction share trends

Results and Discussion

- Considerable spatial variability of sector-dependent energy yield trends
- Changes of wind direction share mainly drive annual energy yield

More attention **for** wind direction-dependent **wind resource** changes required.



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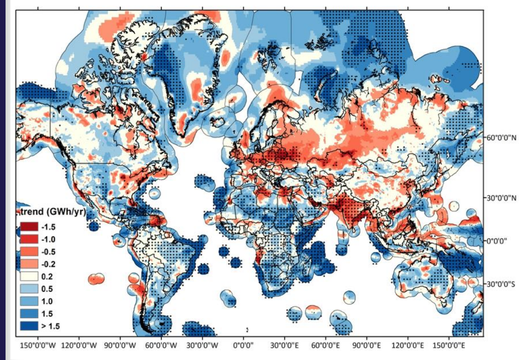
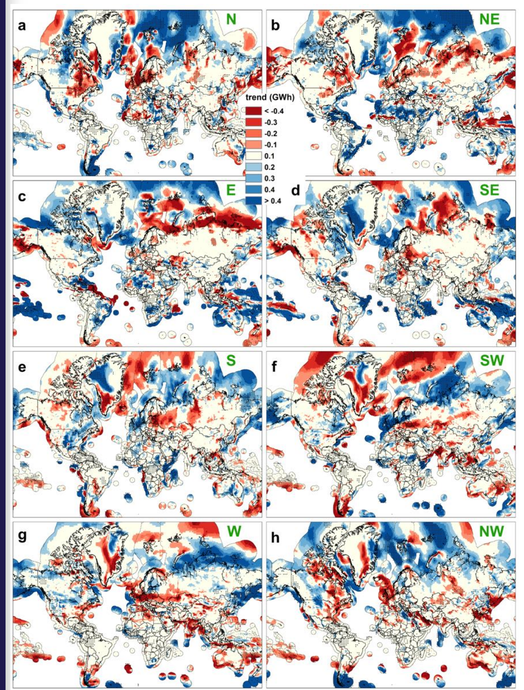
Additional info



Long-term trend of annual energy yield (*ΔAEY*) between 1973–2022. The stipples indicate significant trends (significance level α = 0.05).



Long-term trend of annual energy yield (*ΔAEY*) between 1973–2022 in the eight wind direction sectors: a) north (N), b) northeast (NE), c) east (E), d) southeast (SE), e) south (S), f) southwest (SW), g) west (W), and h) northwest (NW).