Long term wind speed and wind power changes analysis over South Greenland using the MAR regional climate model

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Why doing this study?

- Wind is an abundant **renewable energy source**
- **South Greenland** is one of the windiest places on Earth (Moore et al., 2015)
- Anti-correlated wind regime with **western Europe** (Radu et al., 2019) → addresses the intermittency issue
- The Arctic is undergoing the strongest climate change

Fig. 1: Greenland and surroundings. The blue lines represent the ice sheet topography in meters. The red box is the study area. (Lambin et al., under review)
Methods

Modèle Atmosphérique Régional

Present climate 2016-2021
- forced with ERA5
- Evaluation against *in situ* observations: KATABATA, DMI, PROMICE

Projections 1981-2100
- forced with ensemble of CMIP6 ESMs with SSP5-8.5
Decreasing trends in winter

Betz equation:

\[ P_{\text{max}} = (16/27) \times 0.5 \times \rho \times S \times v^3 \]

Fig. 2: Yearly, winter and summer wind speed trends above tundra, ocean and ice sheet between 1981 and 2100 over South Greenland in m/s

(Lambin et al., under review)

Fig. 3: Yearly, winter and summer wind power trends above tundra and ocean between 1981 and 2100 over South Greenland in W
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Decreasing trends

Fig. 2: Yearly, winter and summer wind speed trends above tundra, ocean and ice sheet between 1981 and 2100 over South Greenland
Spatial trends

Fig. 4: Mean summer wind speed change over South Greenland from 1981 to 2100 (Lambin et al., under review)
Conclusions

- Significant wind speed decrease in winter by 2100
  - Arctic Amplification? (Jung and Schindler, 2019)

- Significant wind speed increase in summer along the ice sheet margins and the nearby tundra.
  - enhanced temperature contrast between boundary layer and upper air layers → katabatic wind speed acceleration

