Extreme impacts in the European renewable electricity system as a result of climate variability

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Aim | impact analysis with large ensembles

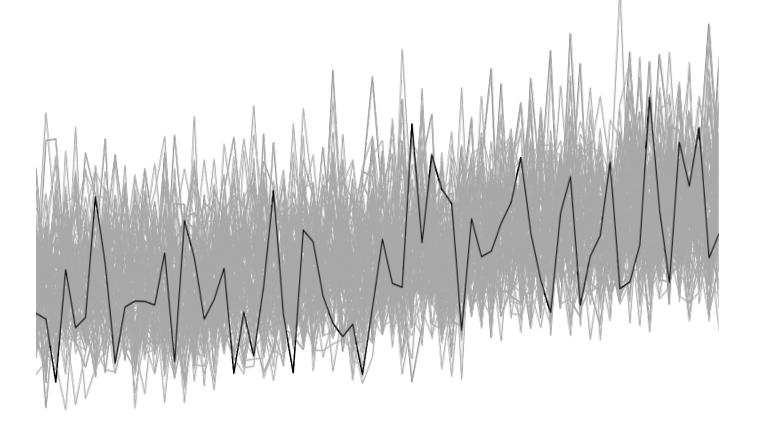
Possibilities of application of :

- large ensembles
- a simplified energy model

Impact of **meteorological conditions** and **climate variability** on **extreme events** in the European electricity system.



Meteorological data | Large climate ensembles





surface temperature from dataset MPI grand ensemble by Karin van der Wiel, KNMI

Meteorological data | Large climate ensemble

KNMI LENTIS¹ 800 years of meteorological data for:

- present-day climate (2000-2009)
- +2°C climate

Temporal resolution: daily Spatial resolution: ~75km

Electricity system data | Installed capacities

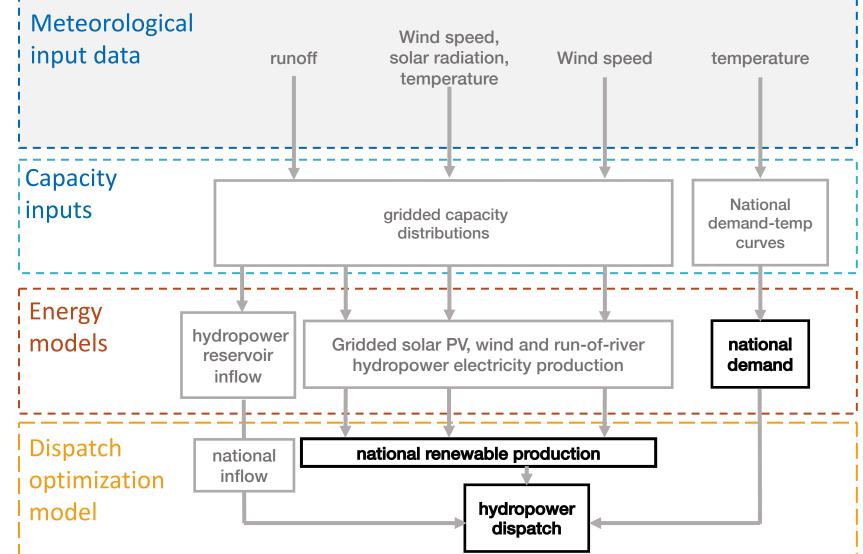
Present-day gridded installed capacities



Δ

Model |

- Europe
- Copper plate theory within countries
- no cross-border connections





Type of events

Residual load = demand – renewable production

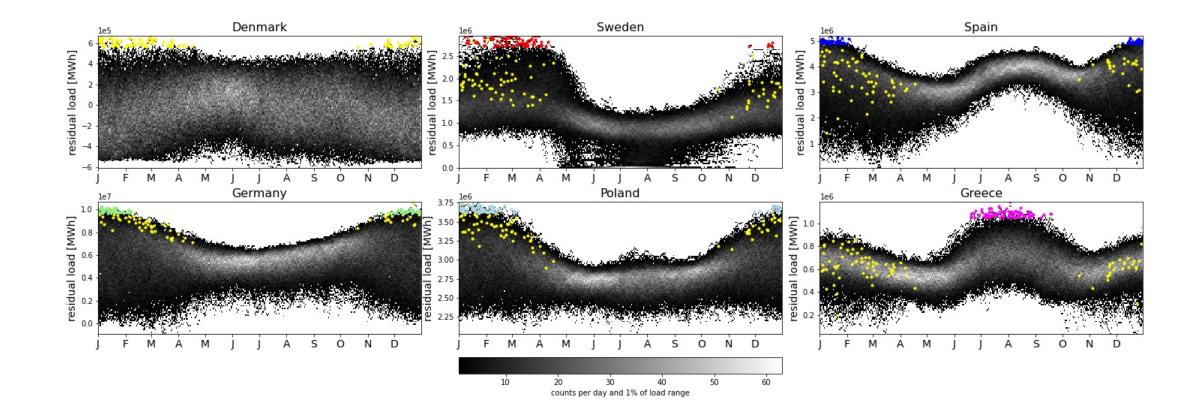
- 1 in 10 year events (80 events)
- 7-day events



1. Co-occurrence of events between countries



Co-occurrence | of extreme events





2. Meteorological conditions during events



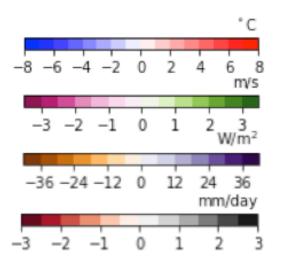
Weather | During events

• Events in winter

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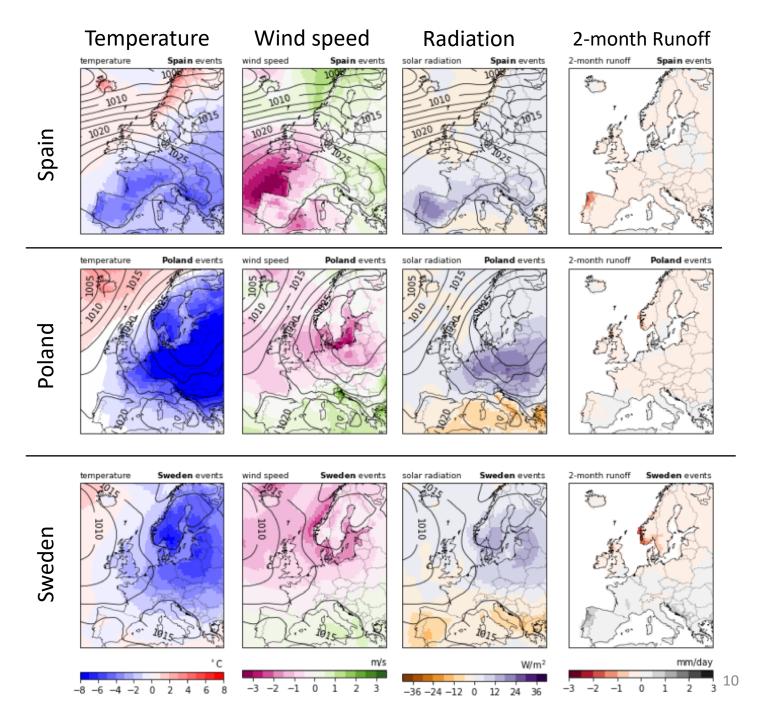
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- Composites of winter events
- Anomalies relative to 800 year daily means



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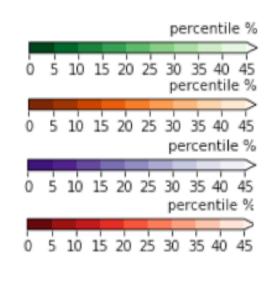
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Weather | how extreme?

Wind speed Temperature Radiation 2-month Runoff temperature Sweden events wind speed Sweden events 2-month runoff Sweden events solar radiation Sweden events 30 2mg 2m Spain temperature Poland events wind speed Poland events solar radiation Poland events 2-month runoff Poland events Strang 30 Poland temperature Sweden events wind speed Sweden events solar radiation Sweden events 2-month runoff Sweden events 30 Sweden percentile % percentile % percentile % percentile % 5 10 15 20 25 30 35 40 45 0 5 10 15 20 25 30 35 40 45 0 15 20 25 30 35 40 45 5 10 15 20 25

 Percentile of meteorological variable relative to 800 year



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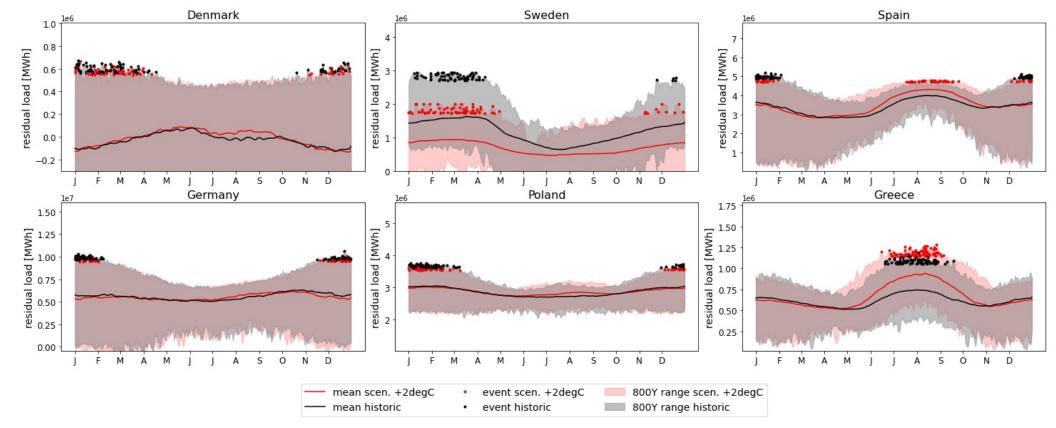
3. Impact of climate change on events



Climate change | Events under +2degC and present-day climate

Sensitivity of **present-day electricity system** to climate change

Present day installed capacity and demand curves



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Concluding

large ensembles + simplified models =

- a full distribution of climate and energy variability
- a tool for analyzing very extreme cases

