A case study approach to understanding variability and risk in the energy sector: Winter 2010

Climate Change

Emma Suckling
University of Reading

e.suckling@reading.ac.uk

Copernicus
Europe's eyes on Earth

European Commission

Climate Change

MOTIVATION

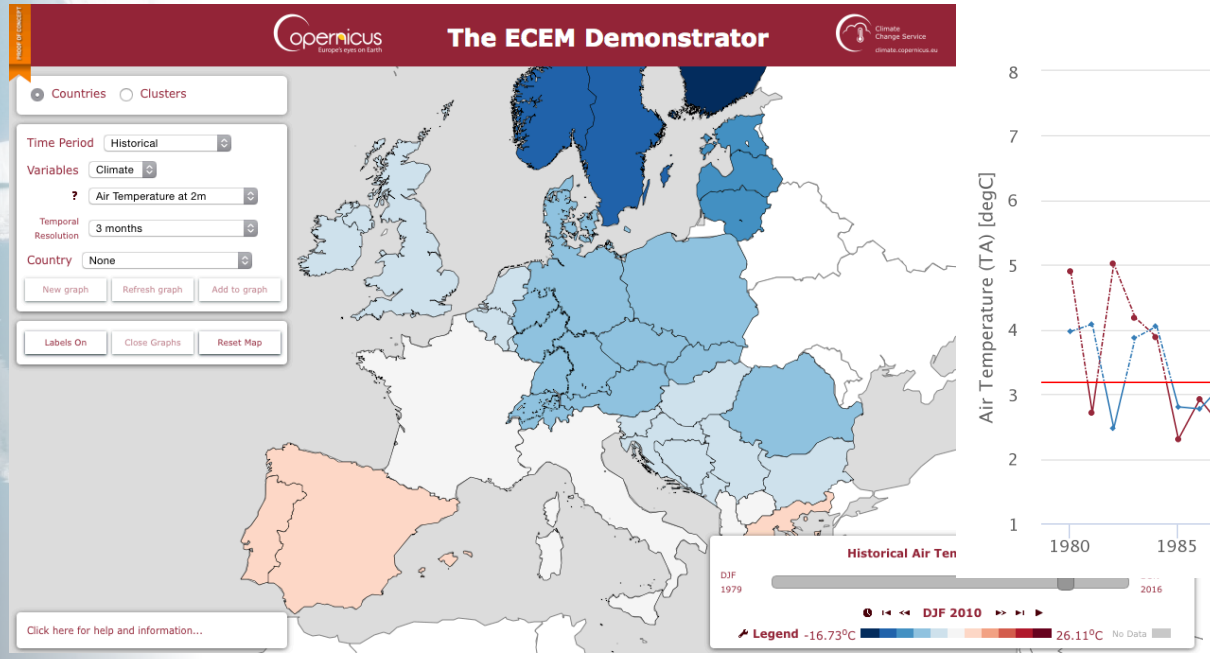
- Using a case study approach to:
  - Demonstrate the value of climate information for understanding variability and informing risk

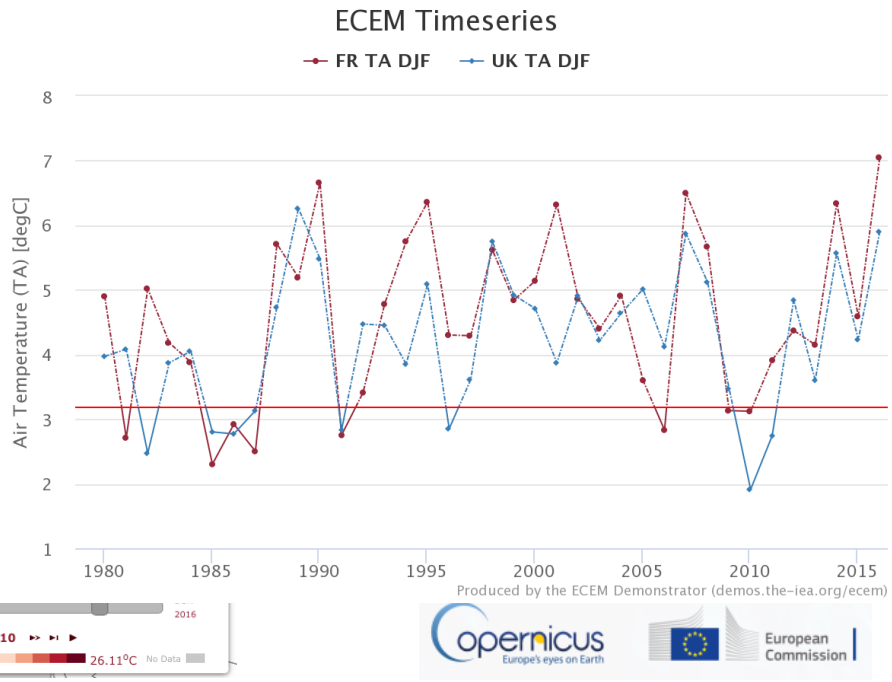
Understanding Variability	Seasonal Forecasting	Future Change
Return times of particular classes of events and their impacts	How can seasonal forecasts be used for the energy sector?	Changes in return times of events under future climate
Pattern based analysis of large-scale drivers using historical reanalysis		Identifying vulnerabilities under future power systems

Climate Change

MOTIVATION

- Using a case study approach to:
  - Get the best out of the ECEM demonstrator tool and datasets
  - How might demonstrator tool be used to understand risks of particular events?

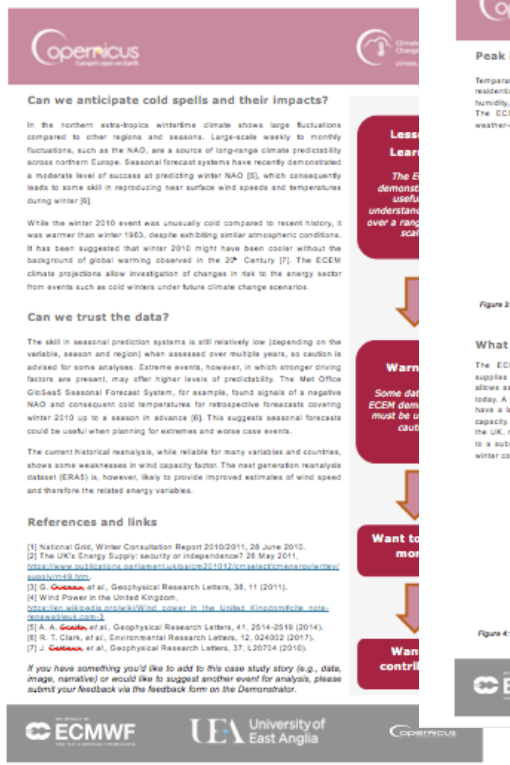


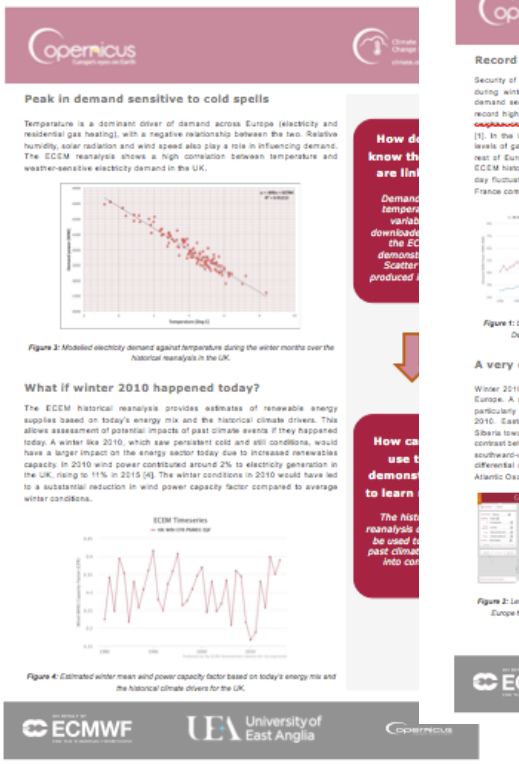


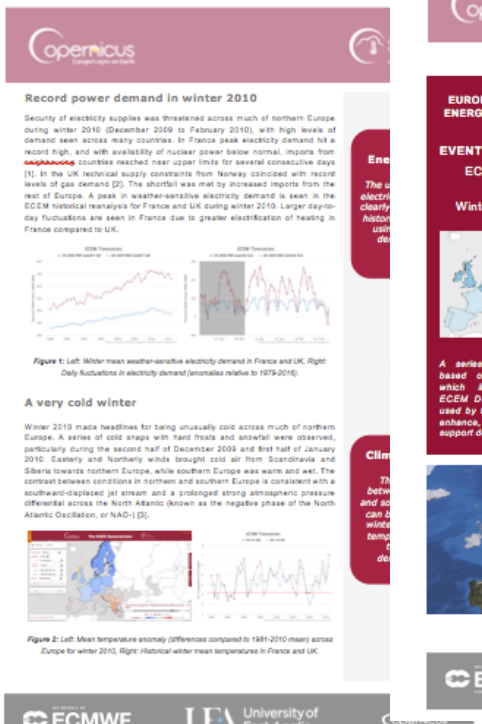
Climate Change

ECEM CASE STUDIES

- A series of case study documents available from the ECEM demonstrator







Climate Change

CASE STUDIES – WINTER 2009/2010

- Use ECEM demonstrator and data to boost decision-making
  - Unusually cold winter of 2009/2010 can be seen in the ECEM data
  - Impact of a winter like 2009/2010 would have bigger impact on energy sector today
- The ECEM datasets:
  - Bring together credible climate and energy data
  - Processed in a consistent way over Europe
  - Covering a range of time scales and resolutions
- Reanalysis, seasonal forecasts and climate projection data can:
  - Reveal dependencies and risks across Europe
  - Put an event into context of recent history
  - Ask 'what if' questions
  - Help to anticipate future risks

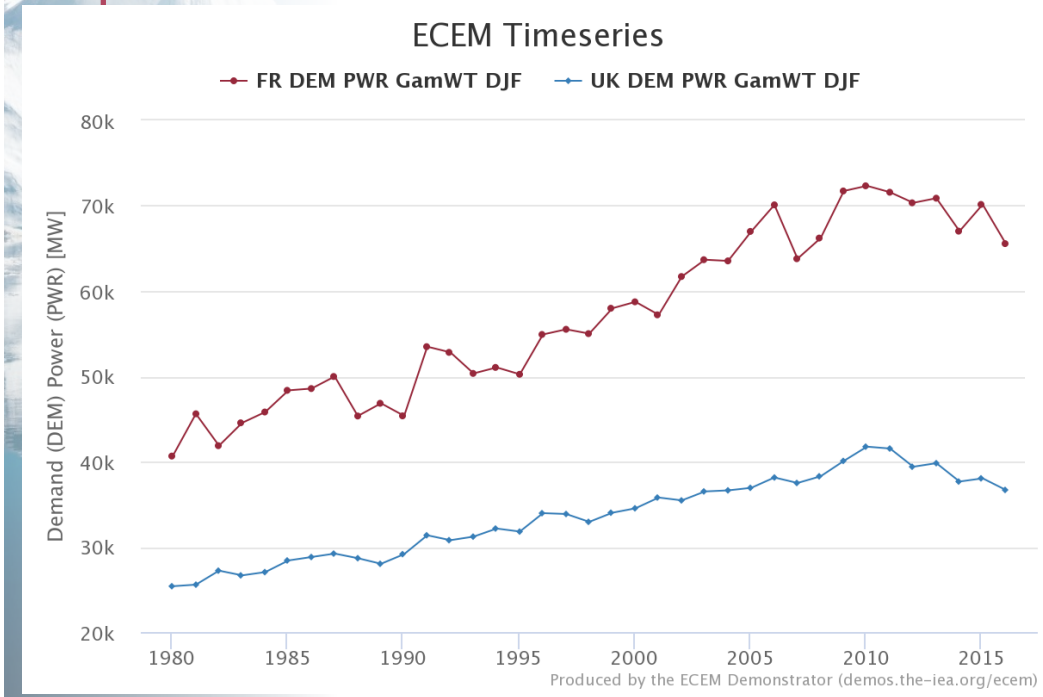
Copernicus Europe's eyes on Earth

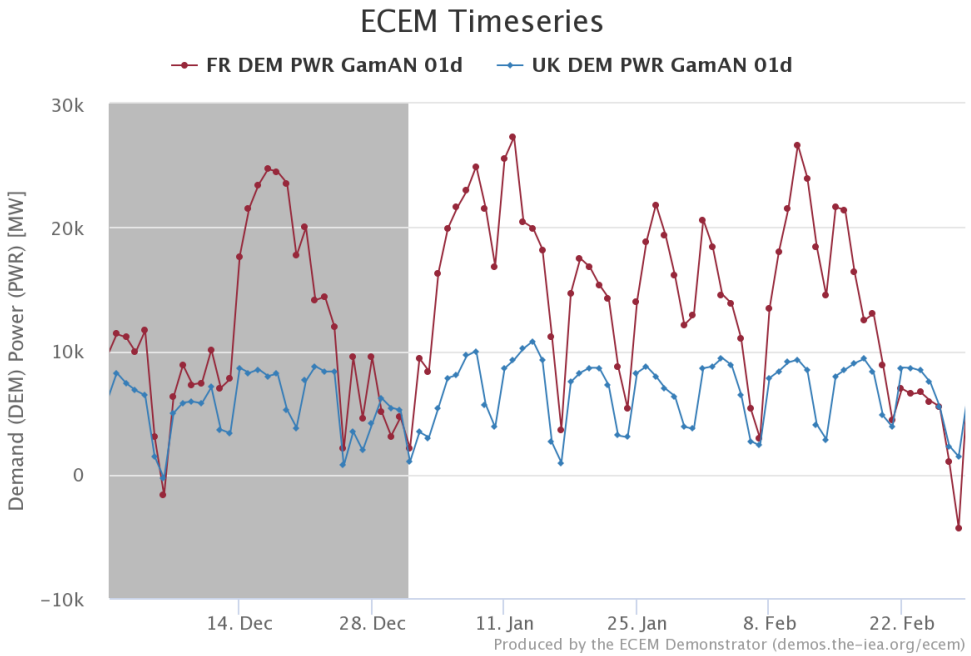
European Commission

Climate Change

CASE STUDIES – WINTER 2009/2010

- Record power demand in 2010





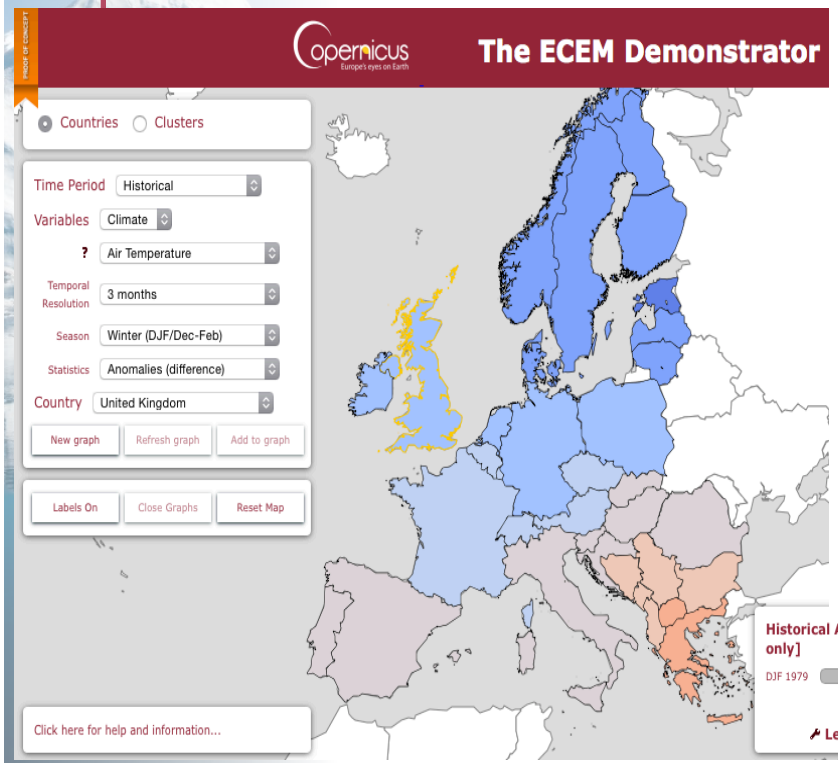
opernicus Europe's eyes on Earth

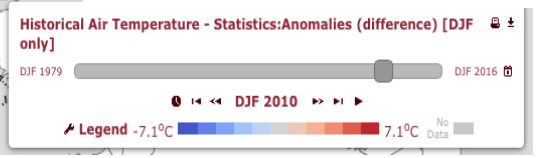
European Commission

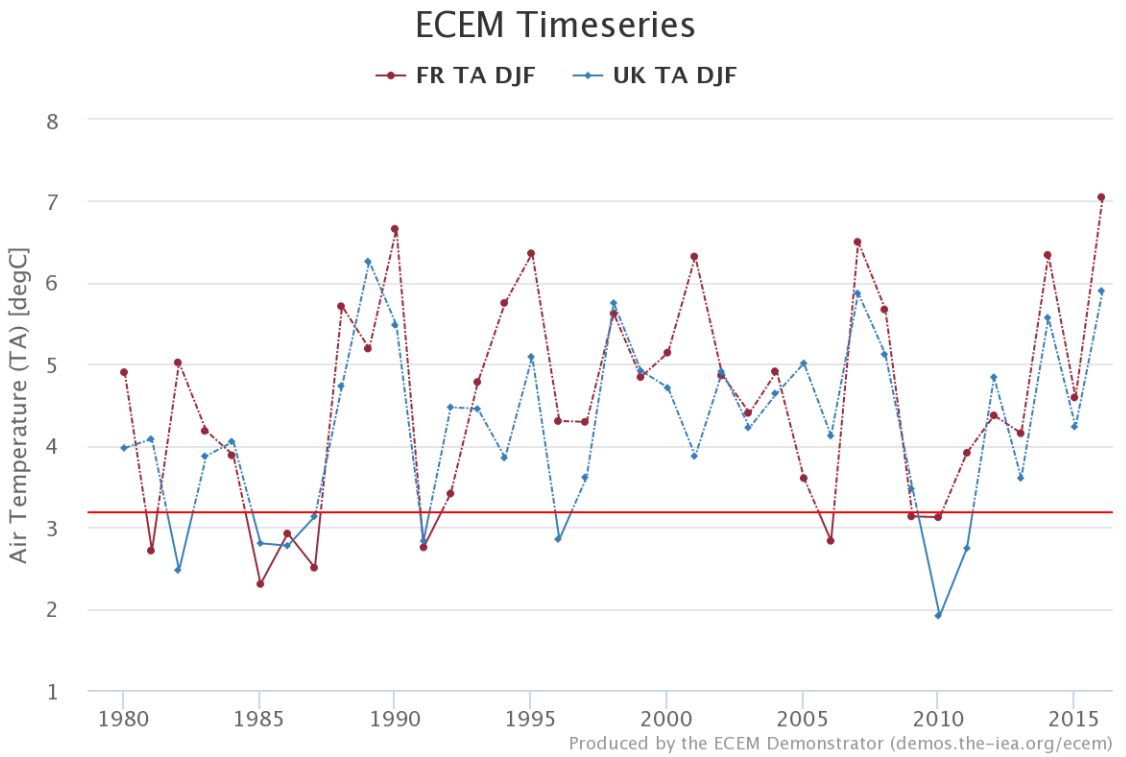
CASE STUDIES – WINTER 2009/2010

Climate Change

- A very cold winter



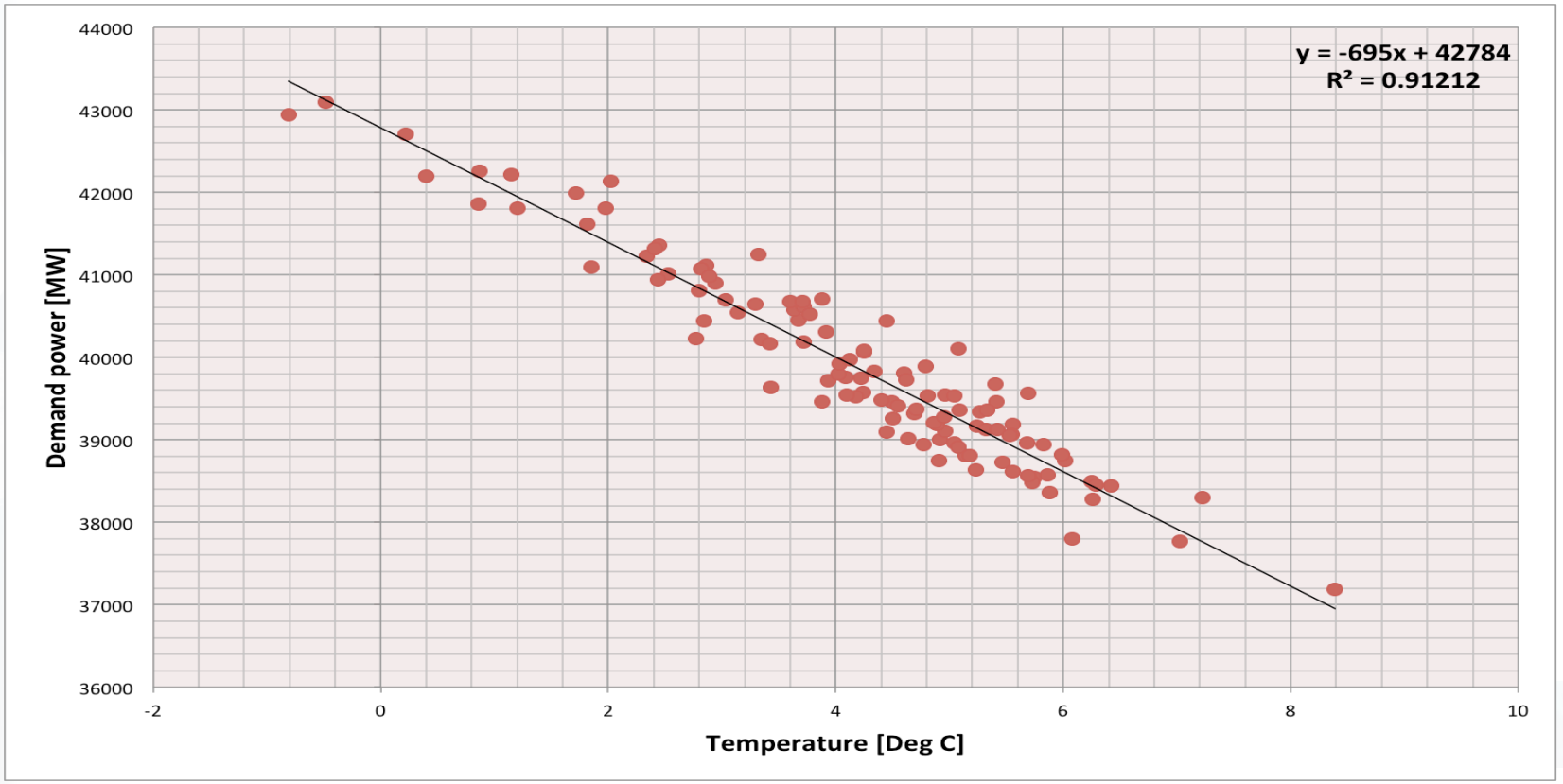




Climate Change

CASE STUDIES – WINTER 2009/2010

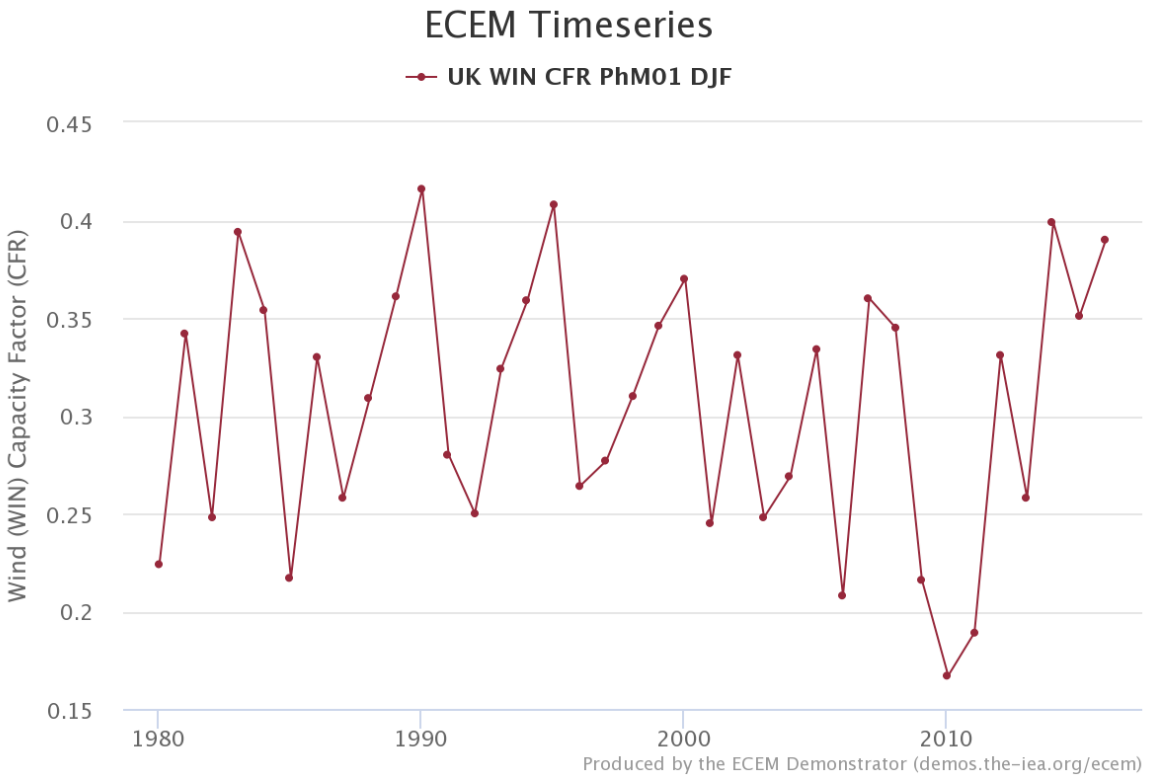
- Linking temperature and demand
  - Temperature and modelled electricity demand over UK



Climate Change

CASE STUDIES – WINTER 2009/2010

- What if winter 2009/2010 happened today?



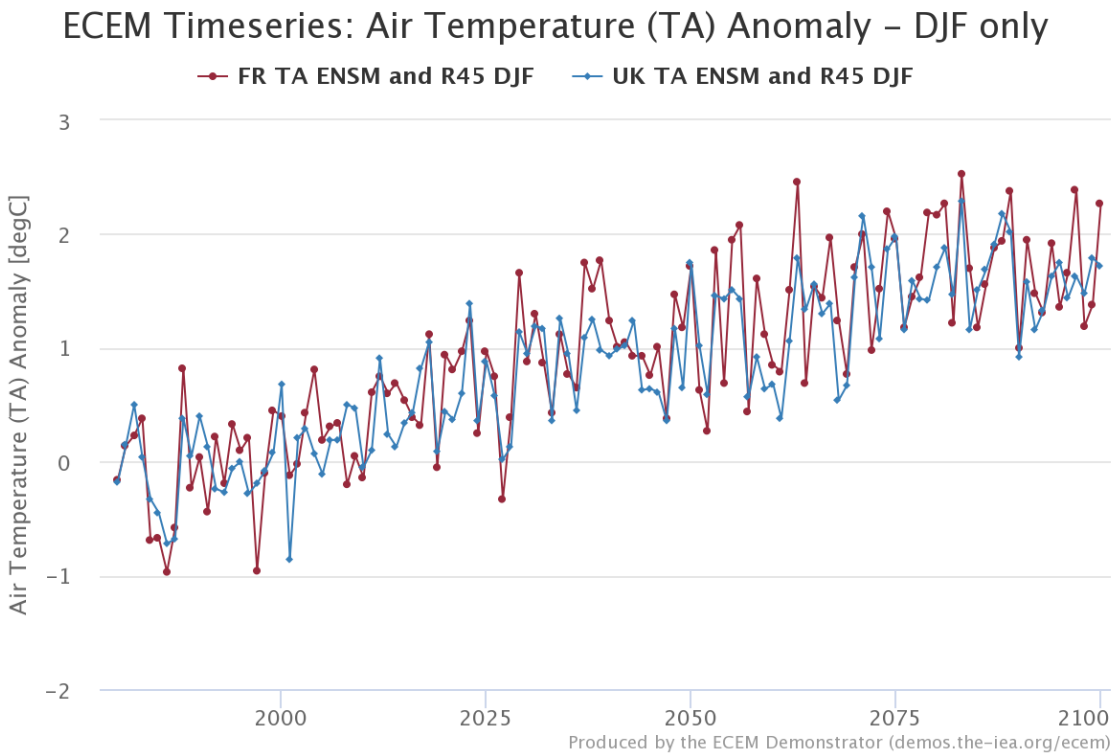
opernicus Europe's eyes on Earth

European Commission

Climate Change

CASE STUDIES – WINTER 2009/2010

- Can we anticipate cold spells and their impacts?
  - Climate projections useful to anticipate changes in risk
    - Fewer cold winters likely in future



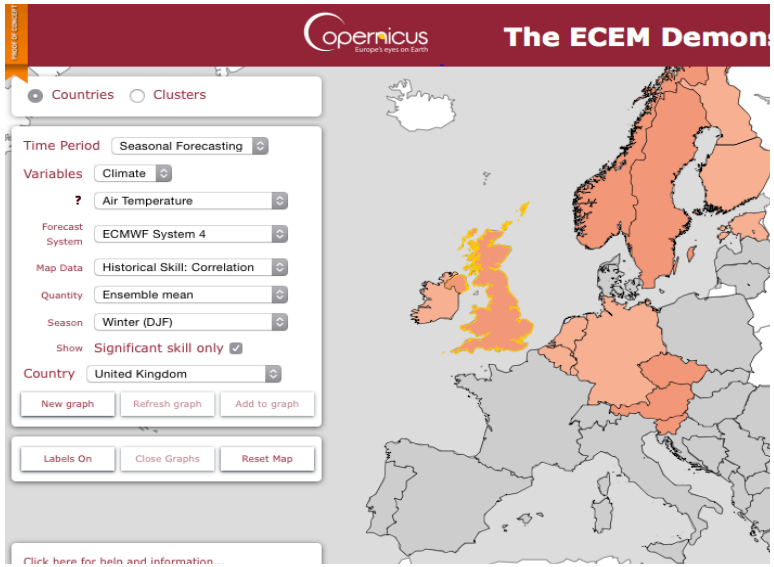
Copernicus Europe's eyes on Earth

European Commission

Climate Change

CASE STUDIES – WINTER 2009/2010

- Can we anticipate cold spells and their impacts?
  - Seasonal forecasting shows some skill
- Words of caution!
  - Seasonal forecasts not skillful everywhere
  - Some variables from reanalysis still have some weaknesses
- The demonstrator does provide valuable insight for a wide range of energy-relevant applications/ questions



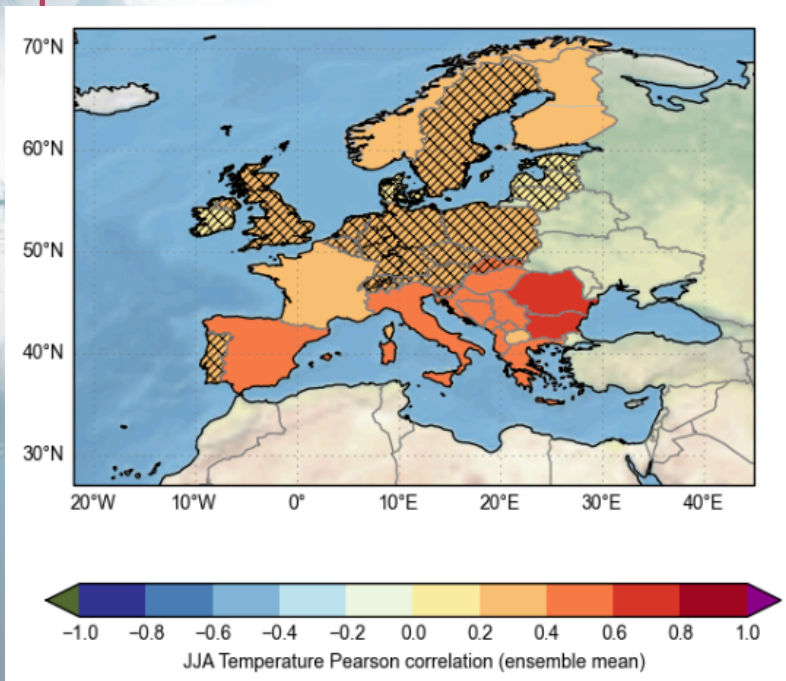
opernicus Europe's eyes on Earth

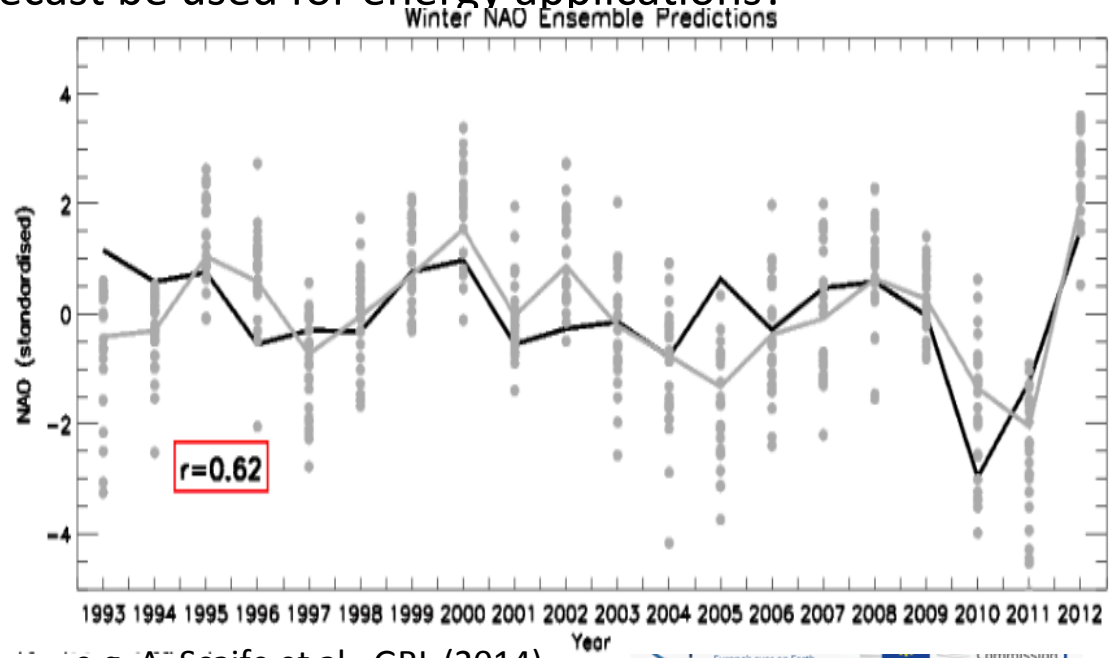
European Commission

Climate Change

CASE STUDIES – SEASONAL FORECASTS

- Highlight current state of seasonal forecasting
  - Skill in some variables, seasons and models (e.g. Balkans in JJA SAT)
  - Skill in seasonal forecasts of winter North Atlantic Oscillation
  - How could NAO forecast be used for energy applications?





e.g. A. Scaife et al., GRL (2014)

Climate Change

CASE STUDIES – UNDERSTANDING VARIABILITY

- Use 30yr reanalysis based on current power system to study:
  - Co-variability between climate and energy indicators
  - Dependencies between European countries

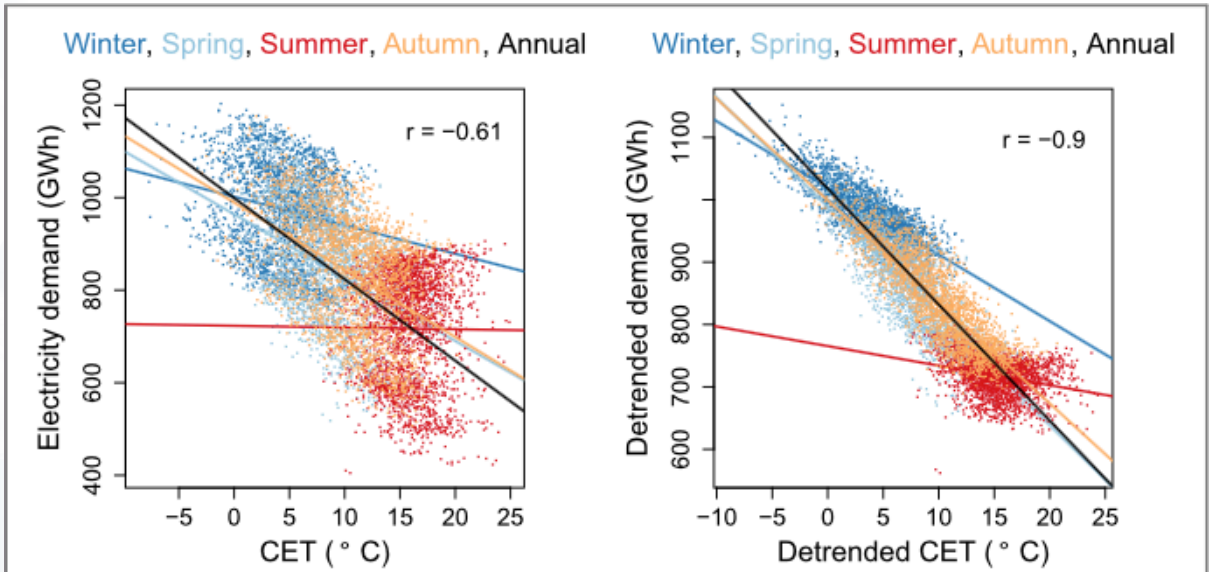


Figure 4. Left: scatter plot of daily temperature (°C) and GB electricity demand (GWh) between January 1975 and March 2013, during week days and non-holidays, coloured by season. The Pearson correlation coefficient (r) is given for the annual relationship, with linear fits for each season and annually. Right: as left but detrended GB electricity demand and detrended CET.

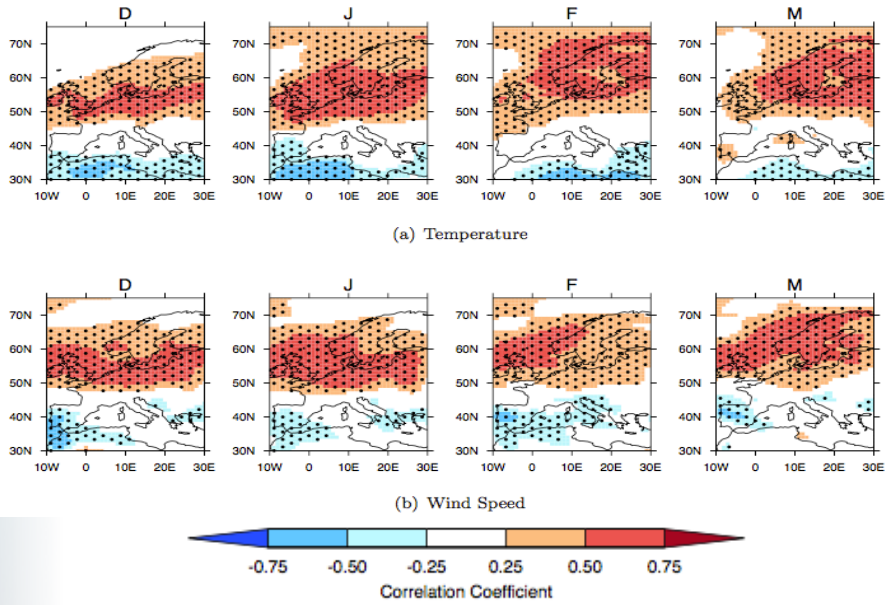
e.g. H. Thornton, B. Hoskins and A. Scaife, ERL, 11 (2016)

Copernicus Europe's eyes on Earth | European Commission

Climate Change

CASE STUDIES – UNDERSTANDING VARIABILITY

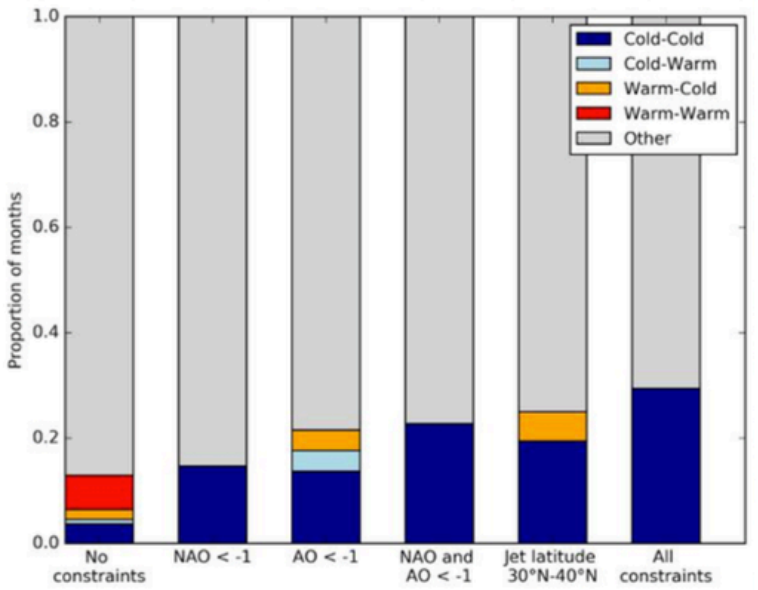
- Use 30yr reanalysis based on current power system to study:
  - Large-scale modes of variability – e.g. North-South dipole, NAO
    - Pattern-based (EOF) analysis
    - Impacts of large-scale modes



(a) Temperature

(b) Wind Speed

C. Ely et al., (2013)



(a) Proportion of months

Sandra Hansen, David Brayshaw and John Methven

Copernicus Europe's eyes on Earth

European Commission

Climate Change

CASE STUDIES – SUMMARY

- Current cases:
  - Winter 2010
  - Seasonal Forecasting (focus on the Balkans region)
  - Climate projections
  - Technical report on historical variability

- Other cases:
  - This is open for suggestion!

Copernicus Europe's eyes on Earth

European Commission

Climate Change

CASE STUDIES – SUMMARY

- Use ECEM demonstrator and data to boost decision-making
  - Unusually cold winter of 2009/2010 can be seen in the ECEM data
  - Impact of a winter like 2009/2010 would have bigger impact on energy sector today
- The ECEM datasets:
  - Bring together credible climate and energy data
  - Processed in a consistent way over Europe
  - Covering a range of time scales and resolutions
- Reanalysis, seasonal forecasts and climate projection data can:
  - Reveal dependencies and risks across Europe
  - Put an event into context of recent history
  - Ask 'what if' questions
  - Help to anticipate future risks

Copernicus Europe's eyes on Earth

European Commission