Clim2Power

Next Generation Challenges in Energy-Climate Modelling
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Objectives:
- making energy and power models respond to climate variability
- statistical meaningful approach to enhance the predictive skill of the current models over Europe, instead of “just” numerical downscaling
Clim2Power Pipeline

**UNCERTAINTY**

**Climate Data**
- **Reanalysis**
  - COSMO REA6, 1995-2015, 1 hr (daily), 6km
- **Seasonal Forecasts**
  - MPI-ESM-HR/GCFS2.0
  - 10+ runs, 6 months ahead, daily, 6km, monthly updates
- **Climate Projections**
  - EUROCORDEX, 11 climate models, RCP4.5 & 8.5, 1976-2065, daily, 12.5km

**Hydrological models, Machine Learning**

**PV & Wind Power Simulation Tools**

**Energy System & Power System Models**

**TIMES, Dispatch models, Machine Learning**

**Web Service Application**

**Interactive, User-friendly Layout**

**Input Indicators**
- Hydro capacity factors (national)
- Wind & Solar capacity factors (NUT2)
- % variation in demand for space heating and cooling in buildings (national)

**Output Indicators (national, hourly)**
- % of electricity generated from RES
- g CO2/kWh
- % variation in electricity costs for final consumers
- % usage of existing electric grid interconnection capacity
- electricity stored in batteries and hydro pumped storage (GWh)
- (…)

**Seasonal**

**Long-term 2030, 2050**

**Policy**
- RCP4.5
- Policy 1
- Policy 2
- Policy 3
- RCP8.5
- Policy 1
- Policy 2
- Policy 3
Lessons learnt

CLIMATE DATA

reanalysis

assimilation data

anomaly

hindcast

optimisation

remapping

EU-ETS

cost-effective

load

dispatch

Climate scientist

Energy modeller

Wow, great! Please put it all in here!

Here is the data you asked for
Challenges / difficulties

- combining expertise of persons with a multi-disciplinary background
- different data demands on the spatial/temporal resolution
- tight/challenging timings for processing the seasonal forecasts and downscaling
- how to assess uncertainty in the modelling cascade
- communicating to users the limited skill of seasonal forecasts over Europe
- process and store the large amount of climate data - get familiar with different data types and storage protocols
- computation limits of energy system model for Europe

How useful is C2P to users (which users)?
How insights of national case-studies feed the EU analysis?
Can we recommend the Seasonal Forecasts for some months/regions?
Some insights

• many other factors affecting the energy system evolution (technology evolution, market dynamics, policy decision as shutting down nuclear or not, etc.) than climate

• changing with the more clear effects of climate change and increasing shares of RES power plants – yet climate change trends are still not a very major factor - how to deal with extreme events in energy models with some degree of reliability?

• In energy system modelling we do not quantify risk - although climate scientists deal competently with assessing risks and uncertainty, energy systems modellers do not assess uncertainty (or risk). We simply deal with it by creating many scenarios but we cannot attribute a probability to each one of our scenarios

• Increasing substantially our time-slices and geographical disaggregation led to huge computational problems (in fact the models stopped running) - still trying to find solutions for this.

• in the power domain we are lacking a coordinated time series of daily/hourly power outputs for each country in Europe – ENTSO-E only has at the moment a 3 year time-series. Thus, integrating bias adjustment from GCM into “bias adjustment” of power plants output becomes a big challenge
Some Publications

Published

SUBMITTED

UPCOMING
1. Adaptation needs for EU power sector
2. Review existing web-based climate services highlight the importance of user-centred approach + integration of transdisciplinary perspectives and cross-disciplinary expertise
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More on CLIM2POWER:

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