Exploitation of high resolution reanalyses

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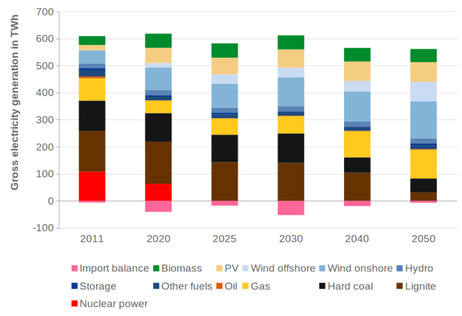
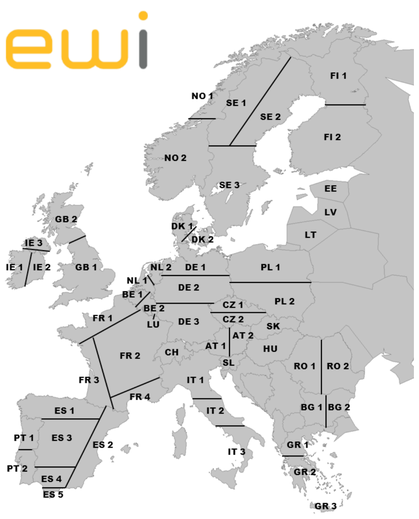
1. Renewable Energy

- **Transition towards renewable energy sources**
  - **Accelerated transition** from carbon-based energy generation **to renewables** is expected
  - **Weather conditions** exert strong **influences on** dispatch of **power plants** as well as on **electricity infrastructure**, e.g., the power grid



ETCC ENERGY TRANSITION& CLIMATE CHANGE

How can regional reanalyses contribute to renewable energy applications?

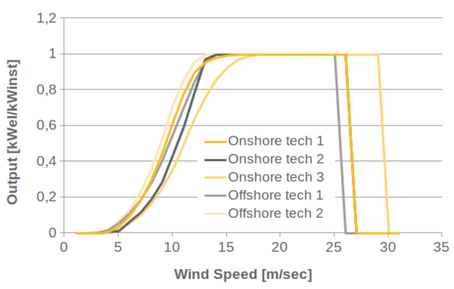


- **Optimized data set**
  - Regional reanalyses **provide relevant quantities** (wind speed, solar irradiation) at high temporal and spatial resolution
  - Conversion of **meteorological parameters** to **power production will be published** as a sub dataset by applying additional diagnostics

European regions with homogeneous wind speed and solar irradiation

➔ Quantify the theoretical potential for renewable energy
- Temporal and spatial dependencies
- Natural limits of renewable energy

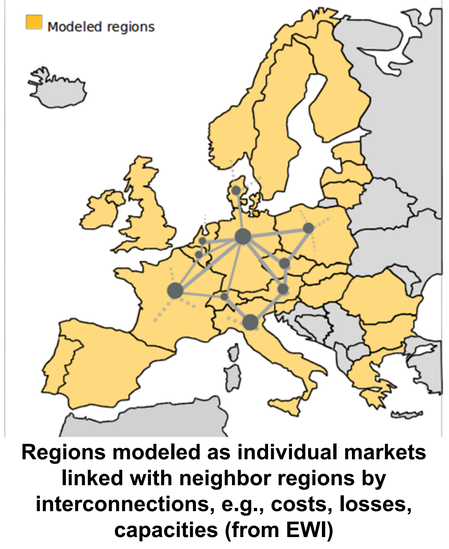
- **System adequacy**
  - **Availability** of renewables limited wrt **weather related risks**, e.g., non-resolving stratus clouds, snowfall, wind extremes
  - **Compound events** especially **threatening**, e.g., simultaneous reduction of solar, wind and water energy production



Power output as function of wind speed for different onshore and offshore technologies

➔ Evaluate risks of high-impact weather
- Identify critical weather constellations and assess their likelihood

- **European dimension**
  - European electricity market **highly connected**
  - Institute of Energy Economics (**EWI**) at the Universitiy of Cologne (HErZ partner in ET-CC) **developed models for Europe** such as a total system cost minimizing model.
  - **Jointly explore** extreme weather events and their **impact on power systems / markets**



Regions modeled as individual markets linked with neighbor regions by interconnections, e.g., costs, losses, capacities (from EWI)

➔ Define constraints for European market
- Robustness of market wrt impact of severe weather events

2. Future Observation Networks

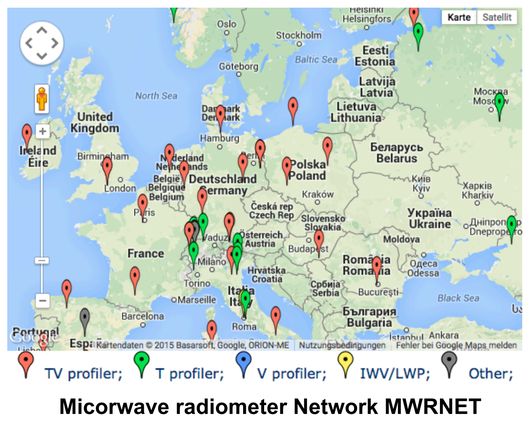
- **Importance of the observations network for climate monitoring purposes**
  - **New observing systems** provide **extended possibilities** for climate monitoring
  - **Quality** of high resolution **regional reanalyses** as a climate monitoring tool **depend strongly on observation** input

What is the optimised design of a future observation network for climate monitoring?

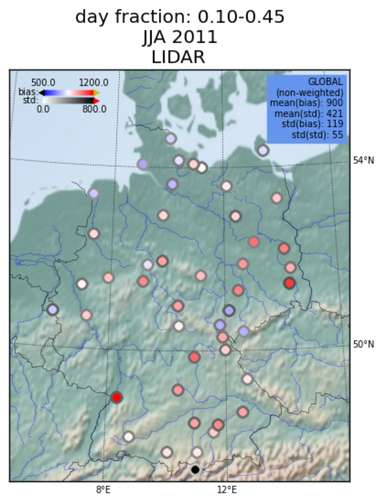
- **Observation Systems Simulation Experiments (OSSE)**
  - Existing reanalysis used as nature run
  - Observing systems can be tested wrt their added value to the reanalysis

➔ Quantify the potential of future observing systems for climate monitoring purposes
- Design OSSEs to assess added value
- Include ground-based as well as satellite instruments

- **Ground-based networks**
  - **Emerging technologies** enable ground-based remote sensing by micro-wave radiometer, lidars etc. to become **cost attractive** and **operational**



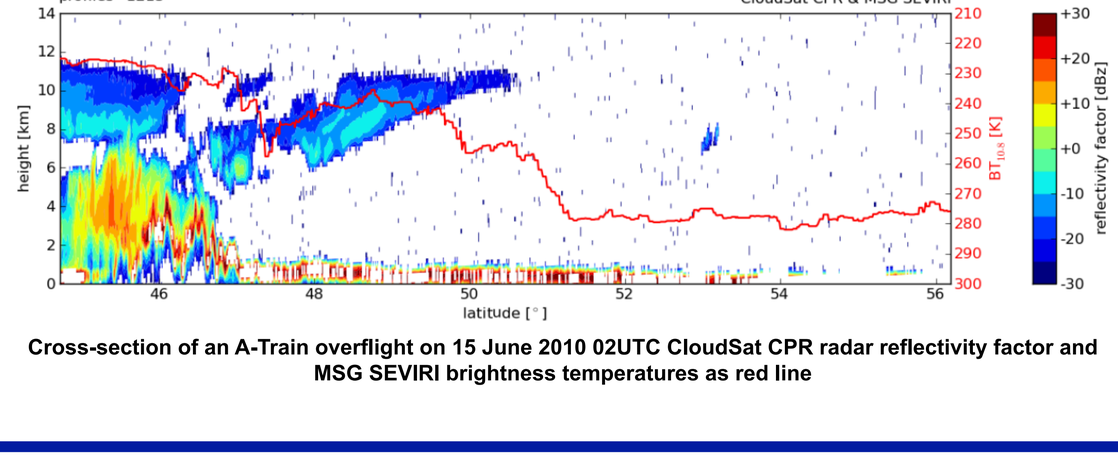
Micorwave radiometer Network MWRNET



Mean daytime mixing layer height for Summer 2011 from DWD Ceilometer network

- Scientists from DWD FE12 and University of Cologne as **working group chairs** in COST action **TOPROF** (*Towards operational ground based profiling*)
- **Synthetic observations** will be created to investigate **optimised setup** of such networks with respect to density, locations, etc

- **Satellite-based networks**
  - **PAMTRA** forward operator **already developed** in first HErZ phase
  - Synthetic observations for **active and passive microwave measurements**
  - **Ready to be assimilated** using DWD‘s **LETKF** framework



Cross-section of an A-Train overflight on 15 June 2010 02UTC CloudSat CPR radar reflectivity factor and MSG SEVIRI brightness temperatures as red line