Weather and Power Information Tailored to the Needs of Renewable Energy Industry in a web-based GUI

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EMS 16th EMS Annual Meeting & 11th European Conference on Applied Climatology (ECAC)
12–16 September 2016  Trieste, Italy
Objective of the Project EWeLiNE

Delivering *fast* and *intuitively* resolved information based on weather & power forecast systems → TSO (e.g. probabilistic forecasts, MOS, warnings etc.)

Web-Based GUI is designed & compiled by DWD & IWES.

**Tasks**

- Variability of Wind & PV Energy challenges the power grid
- Research on intra-day and day-ahead forecasts
- Users’ requirements are directly integrated into the R&D activities
- Achieve a balance of consumption and generation of energy
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Preparing and Modifying Data for GeoServer

Obtaining products

- COSMO-DE-EPS Model is used (Ensemble Forecasts of 20 members with different initial conditions & model physics increase the accuracy)
- Products are obtained through calculations of retrieved data
  - e.g. ensemble mean, spread or exceedance probability of significant values/thresholds (e.g. $\bar{v} > 25 \frac{m}{s}$ ≈ as a measurement of cut-off)

User-oriented products

- Generate products through existing products
  - e.g. global radiation, low stratus risk, cyclone detection
GeoServer - Process & Edit Geospatial Data

Visualization of meteorological data: WMS/WFS

- Open source GeoServer: publish georeferential weather-data using open standards (e.g. OGC, W3C)
- Rendering Transformation: interpret values ▶ raster/vector
- StyledLayerDescriptor (XML): defines the illustration of all values (e.g. points, polygons, color, isobars, windarrows)
Motivation

Process Chain

Results

Graphical User Interface

User-oriented Products

GUI of IWES

GUI of DWD

**wind: speed and direction**

**exceedance probability of \(5 \frac{m}{s}\)**
GUI of DWD

**high level cloud cover mean**

**mid level cloud cover mean**
GUI of DWD

- total cloud cover mean
- global radiation mean
User-oriented Products - Low Stratus Risk

- Deep impact on PV-yield
- Forecast of weather model difficulties → User specific products!
- → Saturation deficit & inversion strength $T$ (based on SK-scheme [Seidl & Kann 2007]
- Risk to appear of low stratus (● high risk, ○ low risk)

Reference:
User-oriented Products - Warnings

Official Warnings of DWD
- e.g. frost, gust of wind, storms

- Clicking on the polygons
- Pop up window with info of the kind of warnings
- Warnings for economic loss
- Different severity levels of warning are coded in color
User-oriented Products - Cyclone Detection

Critical Weather:
- Definition of critical areas
- Detection of cyclones and troughs in time and space → alarm TSOs
- Circles are center of cyclones and troughs (color coded)

Reference:
User Interface of GUI of DWD

- Activating Layers via GeoServer
- Timeslider selecting the timestep (via scrollbar)
- Function buttons → hiding/showing illustrated elements, etc.
- Warning window: showing the warnings (time) and the information by click (pop up)
- Legend: showing the definition of values (kind of styling)
- Information window: warnstate, selected forecast time horizon.
IWES Power Forecast for Wind

**Motivation**

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**User-oriented Products**

**GUI of IWES**

**Representative wind farms**

**Numerical weather model**

**Upscaling of un-observed wind farms**

- Online value of the actual produced power of the wind farm
- Weather prediction for the site of the repr. wind farm
- Wind power prediction for representative wind farms
- Extrapolation for each location of the energy feed-in
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GUI of IWES

GUI of DWD & IWES

weather forecasts

c power forecasts
Summary

Conclusion

- Unified weather & power information in a compact GUI for TSOs
- Fast & intuitive display of information
- Interaction of weather with power forecast
- Inclusion of observed information (e.g. satellite, radar)

Thank you for your Attention

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