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

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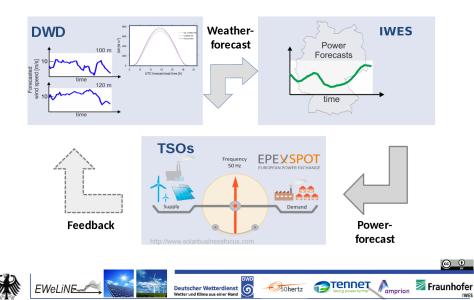
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Project EWeLiNE

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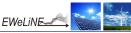
Objective of the Project EWeLiNE

- 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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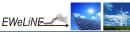
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Datatransfer in DWD Illustration of Data



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Preparing and Modifying Data for GeoServer

Obtaining products

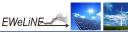
- COSMO-DE-EPS Model is used (Ensemble Forecasts of 20 members with different initial conditions & model physics increase the accuracy)
- Products are obtained through calculations of retrieved data

 e.g. ensemble mean, spread or exceedance probability of significant values/thresholds (e.g. v̄ > 25 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











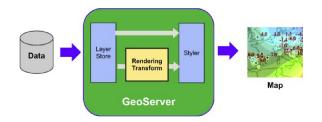
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Datatransfer in DWD Illustration of Data

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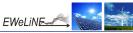
GeoServer - Process & Edit Geospatial Data



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)













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GUI of DWD

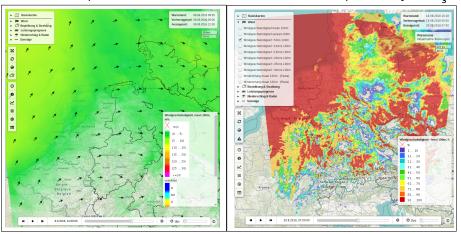
Graphical User Interface User-oriented Products GUI of IWES

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exceedance probability of $5\frac{m}{c}$



wind: speed and direction















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GUI of DWD

Graphical User Interface

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high level cloud cover mean

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mid level cloud cover mean



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GUI of DWD

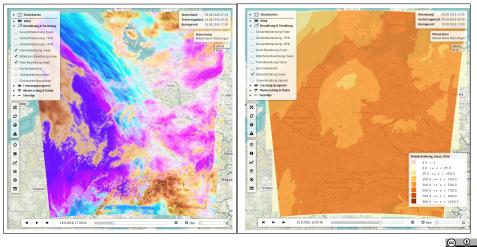
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global radiation mean



total cloud cover mean











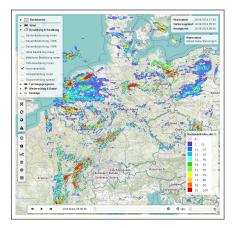




Graphical User Interface User-oriented Products GUI of IWES



User-oriented Products - Low Stratus Risk



- Deep impact on PV-yield
- forecast of weathermodel difficulties \rightarrow User specifc products!
- -> Saturation deficit & inversion strength T (based on SK-scheme [Seidl & Kann 2007]
- Risk to appear of low stratus
 (• high risk, low risk)

Reference:

C. Köhler, A. Steiner, Y.M. Saint Drenan, D. Ernst, A. Bergmann-Dick, M. Zirkelbache, Z. Ben Bouallégue, I. Metzinger, B. Ritter, 2016:

Critical Weather Situations for Renewable Energies -Part B: Low Stratus Risk for Solar Power, Renewable Energy,

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doi: 10.1016/j.renene.2016.09.002





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Graphical User Interface User-oriented Products GUI of IWES

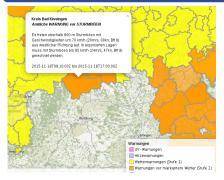




User-oriented Products - Warnings

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

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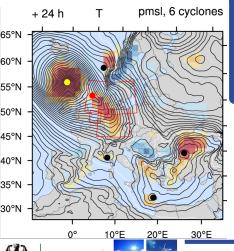


Graphical User Interface User-oriented Products GUI of IWES



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User-oriented Products - Cyclone Detection



Critical Weather

- Definition of critical areas
- Detection of cyclones and troughs in time and space \rightarrow alarm TSOs
- Circles are center of cyclones and troughs (color coded)

Reference:

A. Steiner, C. Köhler, I. Metzinger, A. Braun, M. Zirkelbach, D. Ernst, P. Tran, B. Ritter, 2016: Critical Weather Situations for Renewable Energies - Part A: Cyclone Detection for Wind Power Renewable Energy, **101**, **41-50**, **doi: 10.1016/j.renene.2016.08.013**.



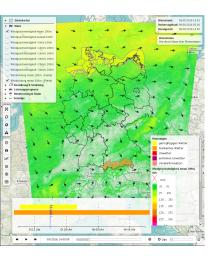
Graphical User Interface User-oriented Products GUI of IWES





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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.

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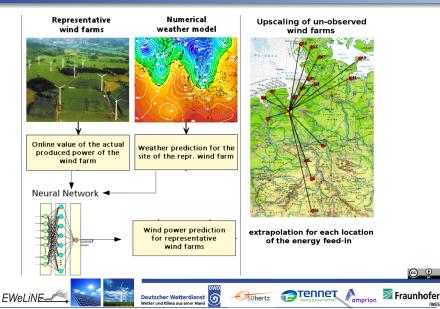
Graphical User Interface GUI of IWES

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IW/ES

IWES Power Forecast for Wind



Graphical User Interface GUI of IWES

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power forecasts

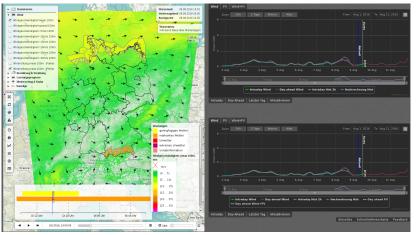


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IWES

GUI of DWD & IWES

weather forecasts













Summary

Graphical User Interface User-oriented Products GUI of IWES

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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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