

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

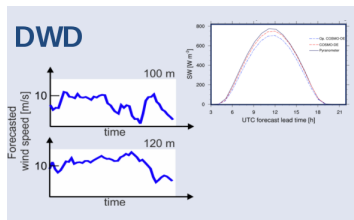
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<sup>1</sup>Deutscher Wetterdienst (DWD)

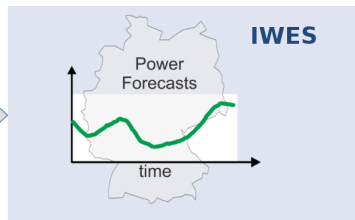
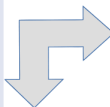
<sup>2</sup>Frauenhofer Institut IWES (IWES)

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

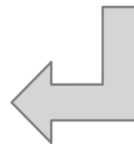
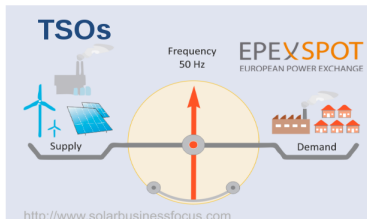
# Project EWeLiNE



Weather-  
forecast



Feedback



Power-  
forecast

# 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

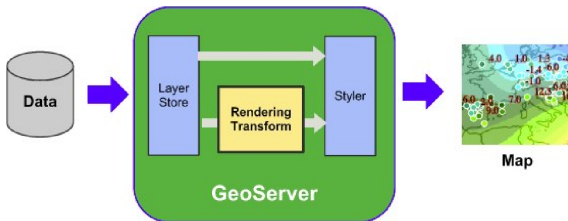
## Obtaining products

- 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.  $\bar{v} > 25 \frac{m}{s} \approx$  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

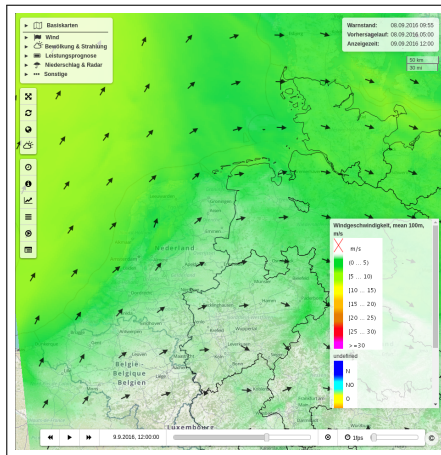


## Visualization of meteorological data: WMS/WFS

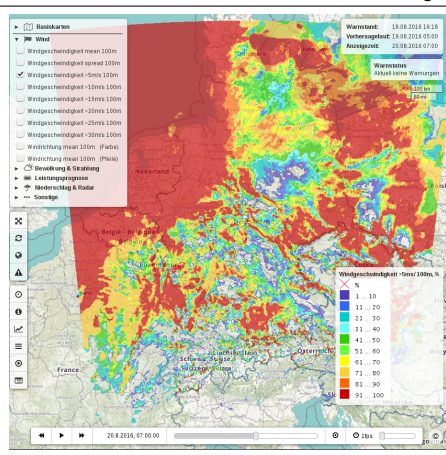
- Open source GeoServer: publish georeferential weather-data using open standards (e.g. OGC, W3C)
- Rendering Transformation: interpret values ► raster/vector
- StyledLayerDescriptor (XML): defines the illustration of all values (e.g. points, polygons, color, isobars, windarrows)

# GUI of DWD

wind: speed and direction

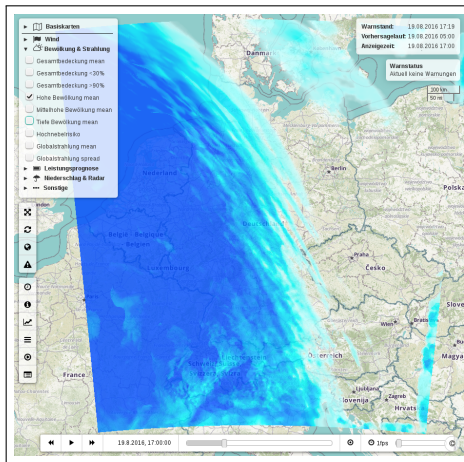


exceedance probability of 5  $\frac{m}{s}$

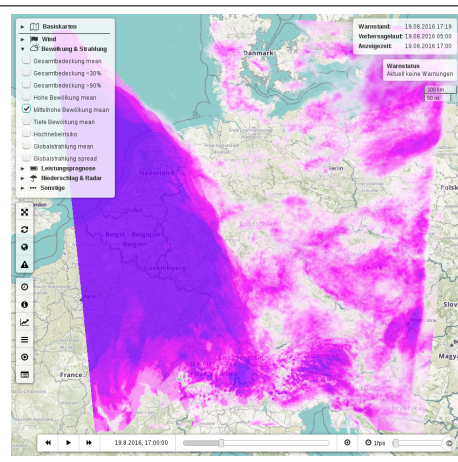


# GUI of DWD

## high level cloud cover mean

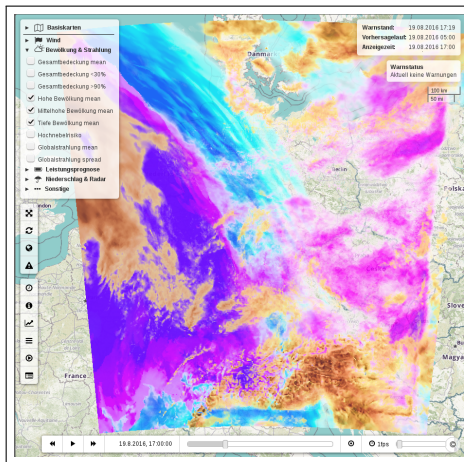


## mid level cloud cover mean

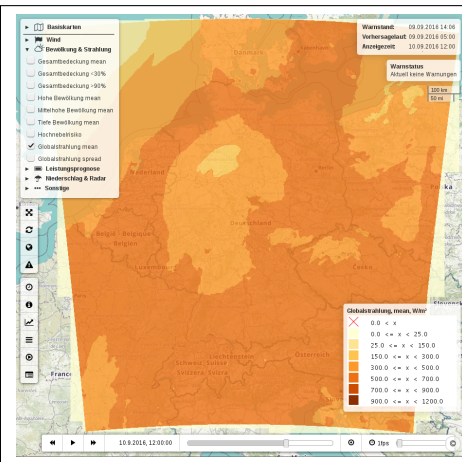


# GUI of DWD

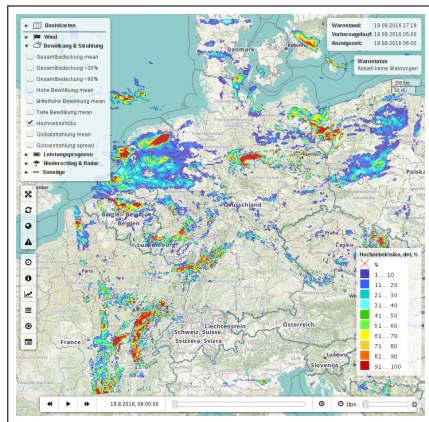
total cloud cover mean



global radiation mean



# User-oriented Products - Low Stratus Risk



- Deep impact on PV-yield
- forecast of weathermodel 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:

C. Köhler, A. Steiner, Y.M. Saint Drenan, D. Ernst, A. Bergmann-Dick, M. Zirkelbach, Z. Ben Bouallégue, I. Metzinger, B. Ritter, 2016:  
Critical Weather Situations for Renewable Energies - Part B: Low Stratus Risk for Solar Power, Renewable Energy,

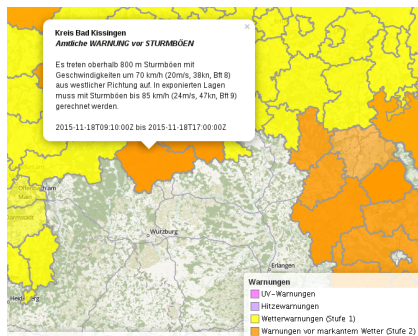
doi: 10.1016/j.renene.2016.09.002



# User-oriented Products - Warnings

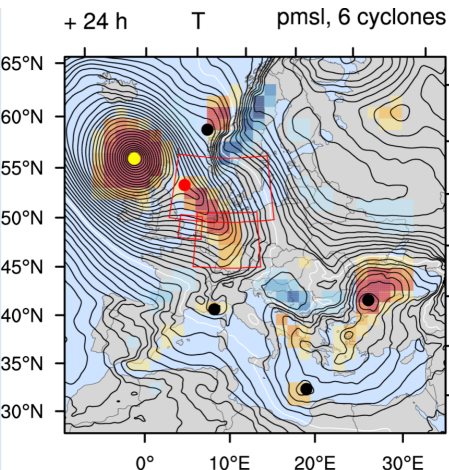
## Official Warnings of DWD

- 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

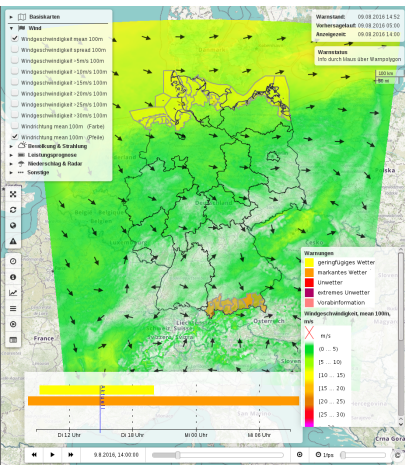
- Definition of critical areas
- Detection of cyclones and troughs in time and space → alarm TSOs
- Circles are center of cyclones and troughs (color coded)

## Reference:

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](https://doi.org/10.1016/j.renene.2016.08.013).

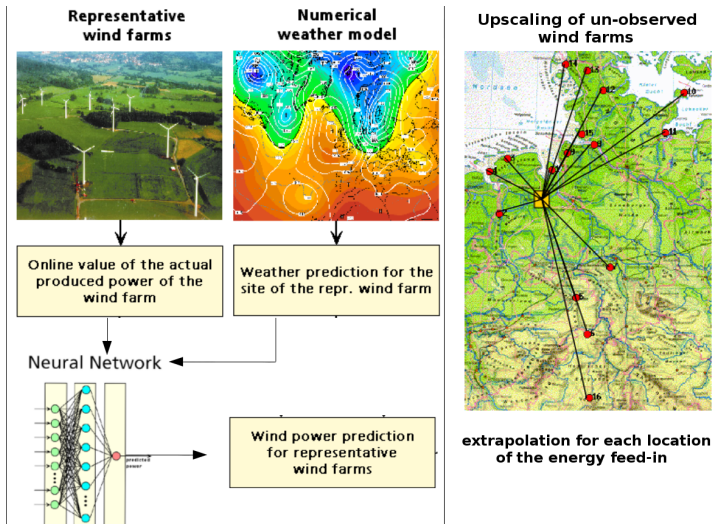


# User Interface of GUI of DWD



- 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





# 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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