TECHNISCHE UNIVERSITÄT DRESDEN

IHM METEOROLOGIE

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

DWD

A concept for modelling quantitative wind climatology for wind energy applications at heights above 100 m

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Project QuWind100 | WindEurope Summit 27.09.2016

Content

- Motivation
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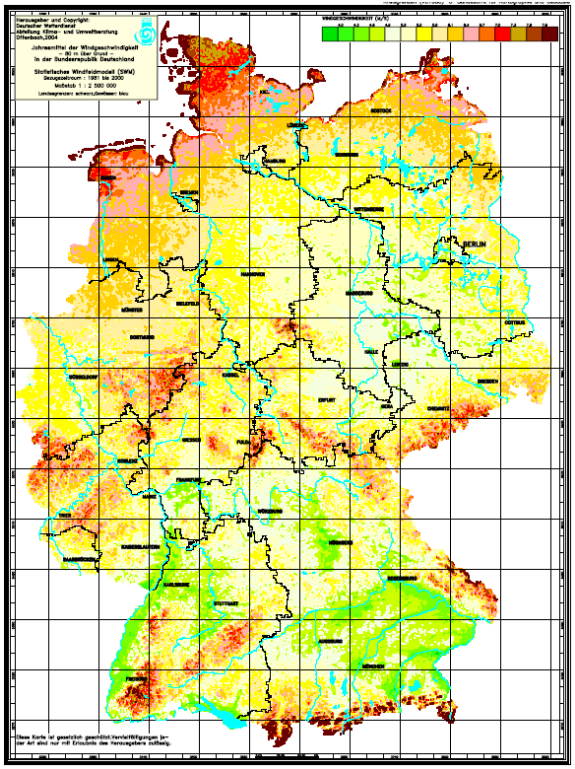
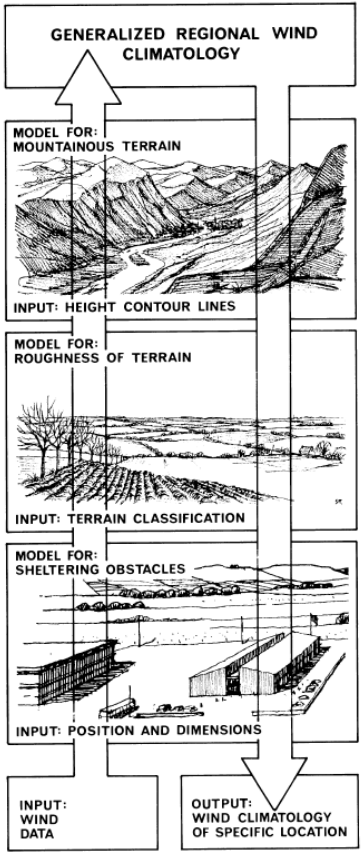
Status: Wind climatologies for wind energy applications



No consistently mapping of wind field data in heights above 100 m available

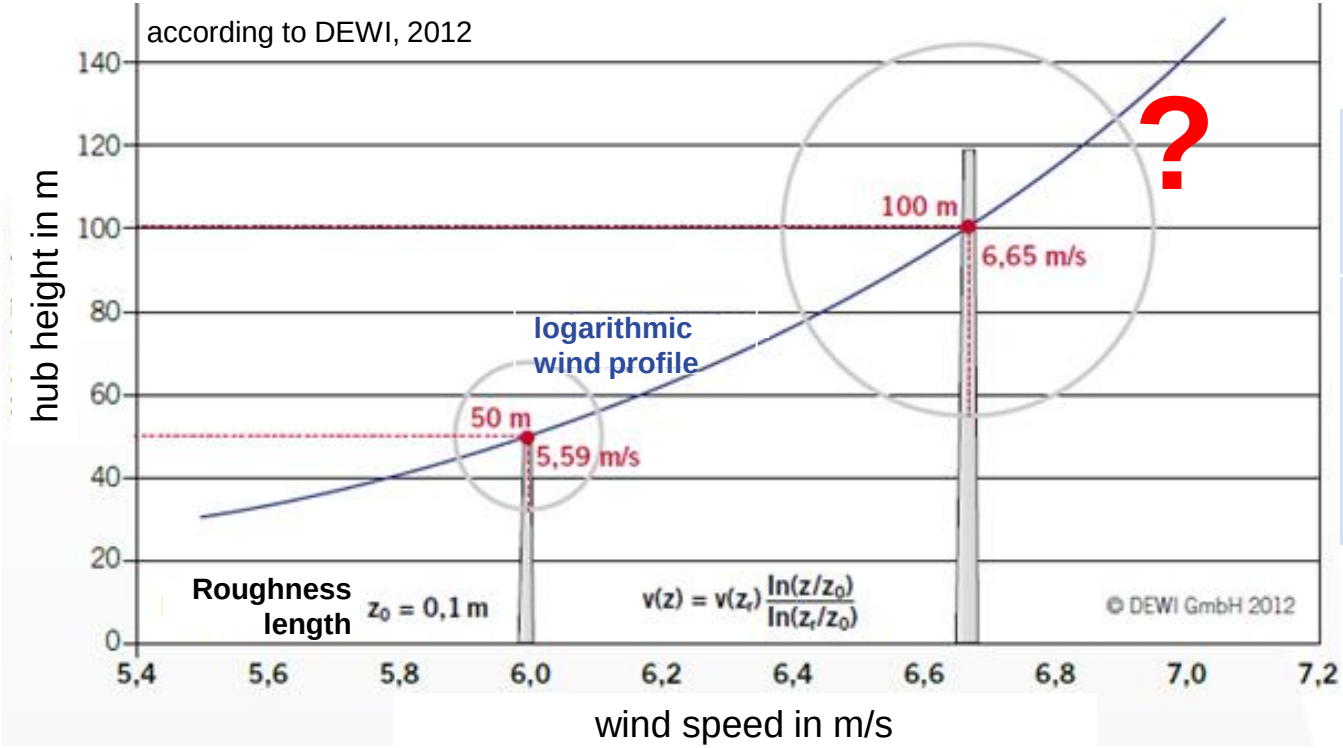
Statistical Wind field Model (SWM, developed by DWD)

European Wind Atlas
DTU Wind Energy
Risø (WAsP)



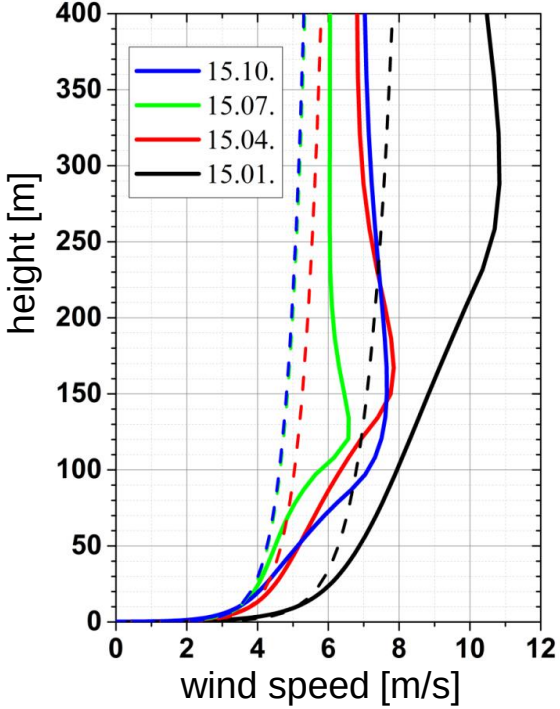
Troen und Petersen 1989

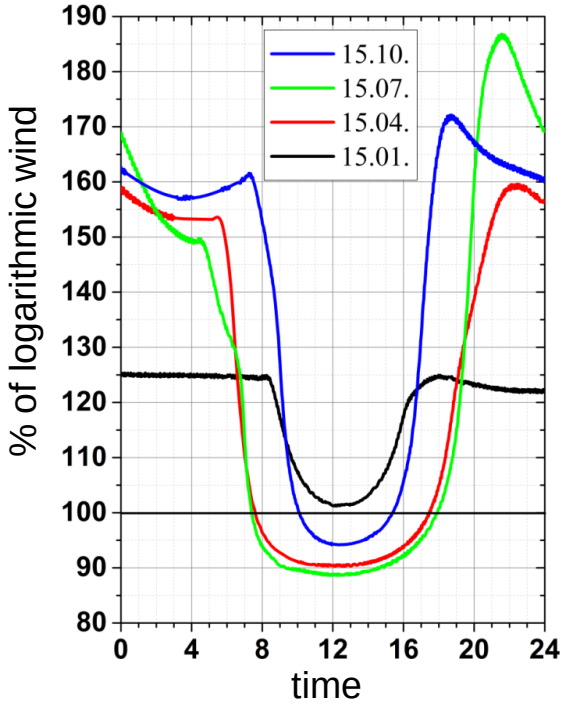
Challenge: increasing rotor diameter and mean hub height



- optimise the yield on a wind farm site
- open up areas with increased roughness (e.g. forests)

Characteristics of wind profile in diurnal/seasonal variation





Simulated wind profiles for different days of a year (colored lines) in comparison with the logarithmic wind profile (wind in 10 m height as reference value)

according to Ziemann and Goldberg, 2015, Barth et al. 2016

Project QuWind100

Quantitative wind climatology for wind energy applications in heights above 100 m

Project partners: TU Dresden, Chair of Meteorology (Coordination)
Deutscher Wetterdienst, Offenbach

Application partner: EVO AG Offenbach

Duration: 01/2016 – 12/2018

Supported by:
Federal Ministry for Economic Affairs and Energy
Projektträger Jülich
Forschungszentrum Jülich
on the basis of a decision by the German Bundestag

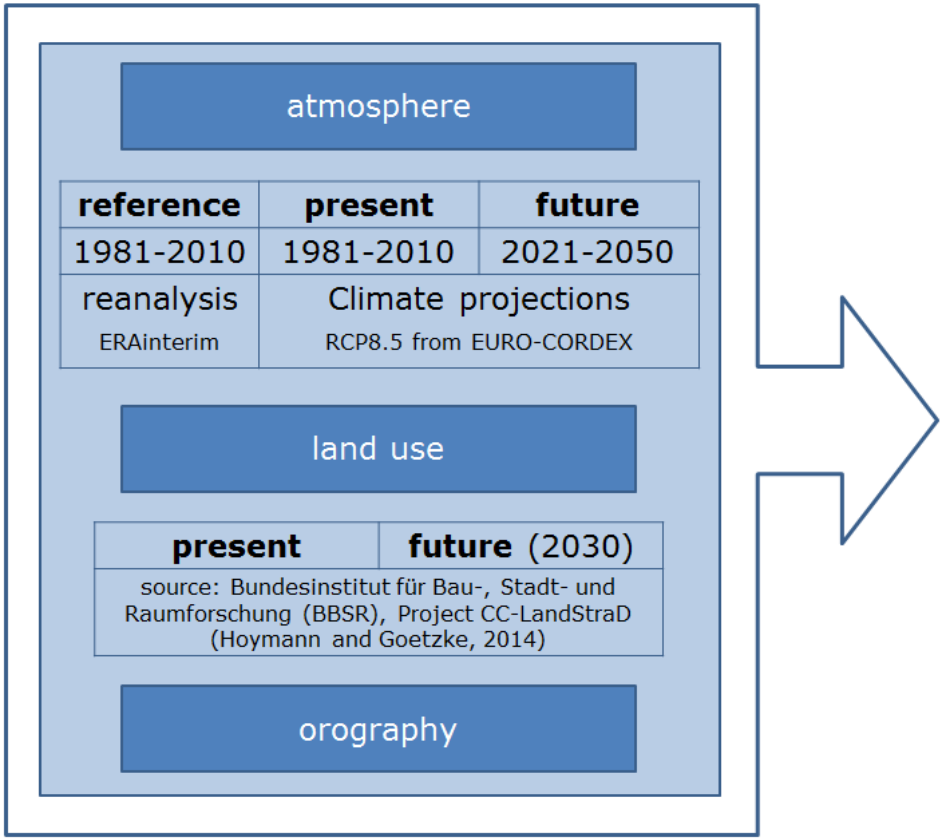
Objectives of QuWind100

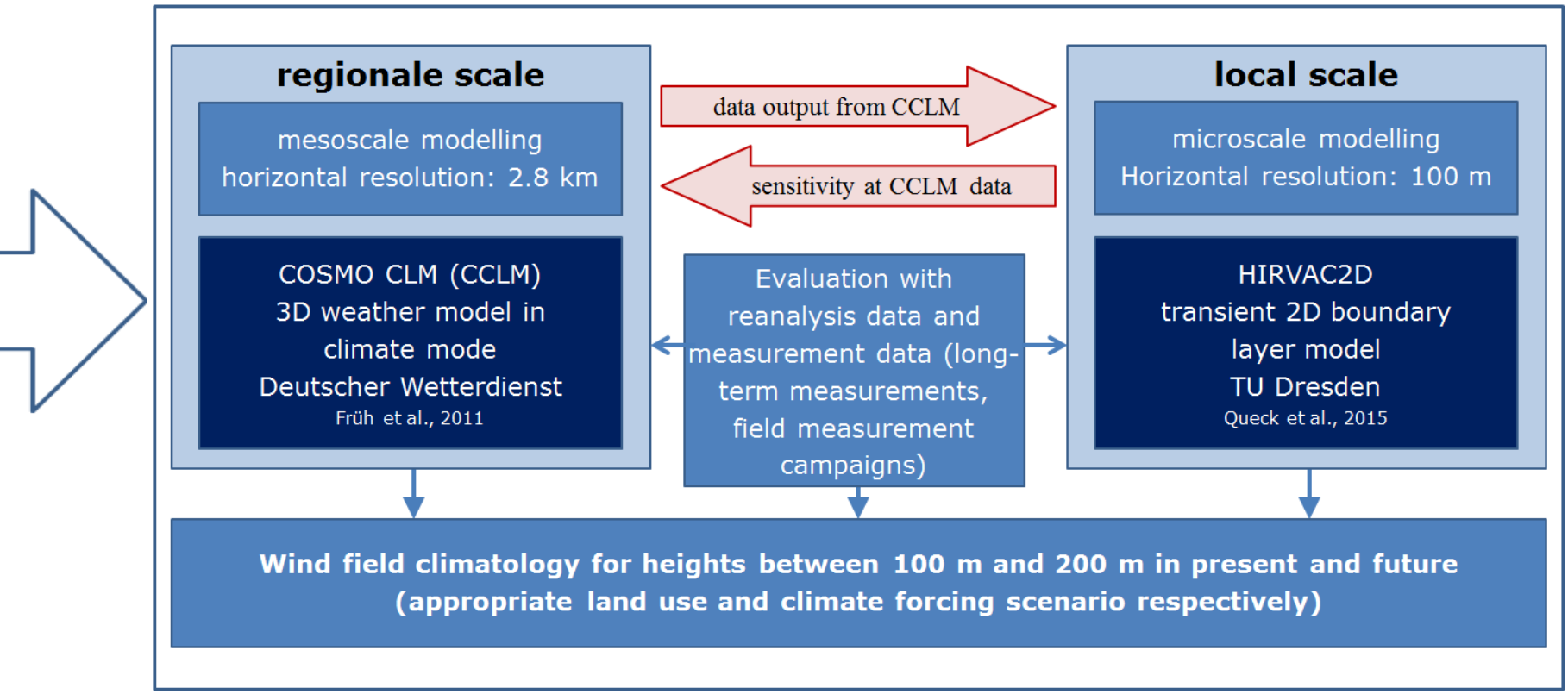
Mapping and database of wind climatology will be derived for heights between 100 m to 200 m

1. Linking 3D weather model of DWD in climate mode (COSMO CLM) and transient 2D boundary layer model of TU Dresden (HIRVAC2D)
2. Model simulation using appropriate land use scenario and climate forcing scenario with boundary conditions for 3 climate periods
3. Evaluate the results of model chain with appropriate measurement data and reanalysis data

Model concept

data base

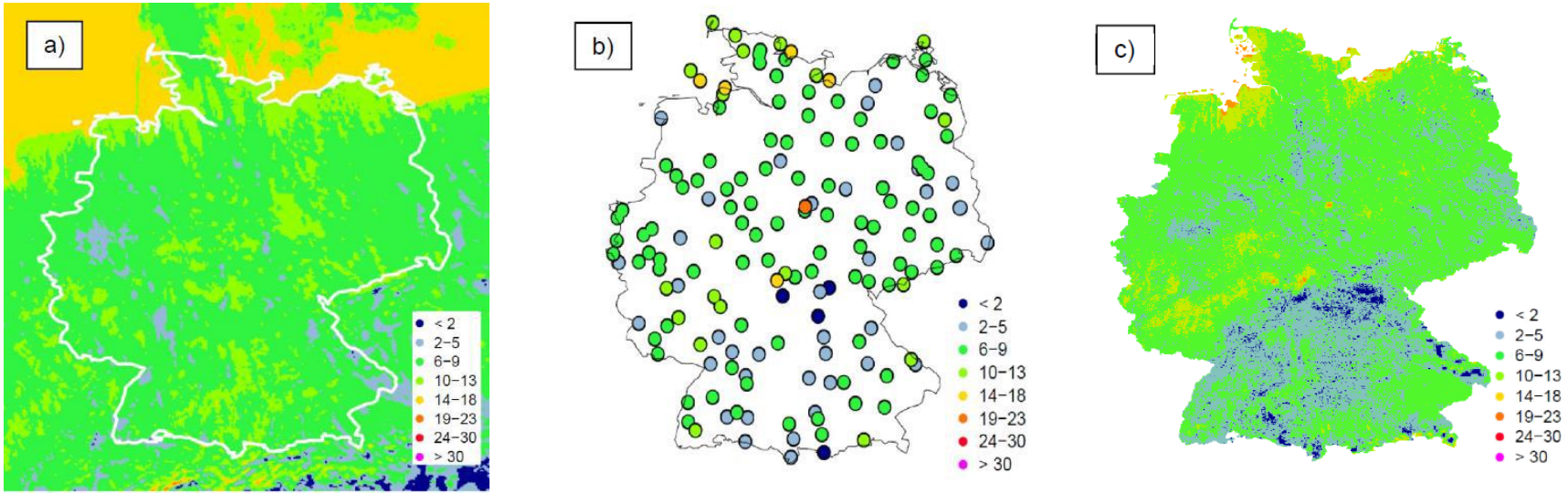



regionale scale
mesoscale modelling
horizontal resolution: 2.8 km
COSMO CLM (CCLM)
3D weather model in
climate mode
Deutscher Wetterdienst
Früh et al., 2011
data output from CCLM
sensitivity at CCLM data
Evaluation with
reanalysis data and
measurement data (long-
term measurements,
field measurement
campaigns)
local scale
microscale modelling
Horizontal resolution: 100 m
HIRVAC2D
transient 2D boundary
layer model
TU Dresden
Queck et al., 2015
Wind field climatology for heights between 100 m and 200 m in present and future
(appropriate land use and climate forcing scenario respectively)

TRY: test reference year

Preliminary work DWD - TRY Project

Interpolation cannot be performed only by observations → Simulation with CCLM



COSMO CLM (a,c) ; (b) SYNOP station observations (12.01.1995, 13 MEZ).
a) model output; c) after bias correction and aerodynamic roughness modification

Comparison with wind measurements

- Collect and analyse existing wind data (> 50 m)
- Extensive measurement campaign:
  - SODAR
  - tethered balloon (Tharandt)
  - data from wind farm site (Hunsrück)

Cooperation with EVO AG

- Compare and evaluate the predicted energy yield potential based on current methods and results based on the new wind climatology

Summary - Intended results of QuWind100

- No consistently mapping of wind field data in heights > 100 m available

Wind atlas	**Database**	**Statistical model**
evaluated Mapping of statistical parameters of wind fields in various heights for Germany	evaluated numerical results for wind potential (horizontal resolution 100 m) → Derive wind field density	for downscaling CCLM wind data (application for mesoscale model data in the future)

Thank you for your attention!