IEA Wind Task 51

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Forecasting for the Weather Driven Energy System

Work Package 1: Weather Prediction

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Numerical weather prediction is the basis for forecasting fluctuating renewable energy resources as well as variations in demand. This WP brings together experts from meteorological services, research institutes, and private forecast providers to push improvements of NWP models with special relevance for renewable energy.

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WS: Atmospheric physics and modelling

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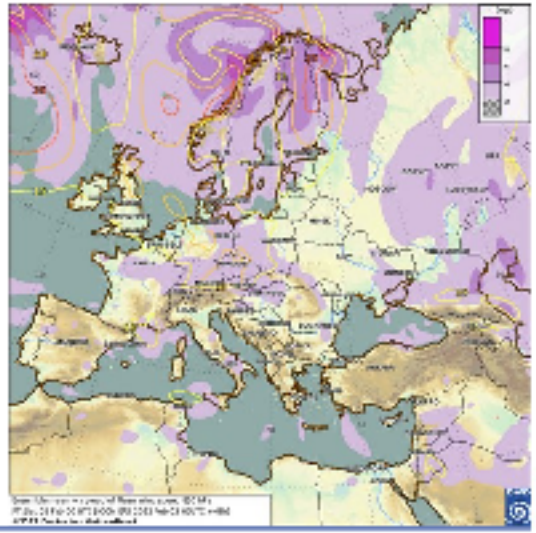
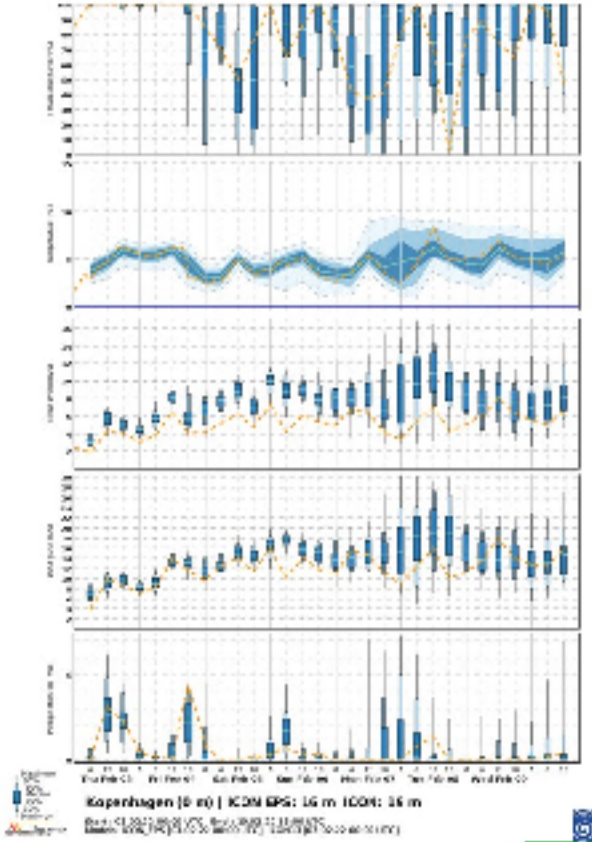
- **Improving NWP forecasts for renewable energies**
  - Wind in the PBL (to approx. 500m)
  - Radiation (clouds, dust)
  - Precipitation
- **Basis for many work streams**
  - Airborne Wind Energy
  - Seasonal forecasts
  - Probabilistic forecasts
  - Design phase





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WS: Atmospheric physics and modelling

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- Promote usage of scores for energy forecasting
  e.g. through report on IEA Wind Task 36 Benchmark Exercise 2021 (https://iea-wind.org/2021/06/03/nwp-benchmark-launched/) organized by NREL
  with WE-Validate (https://github.com/joejoeyjoseph/WE-Validate)

- Maintain list of Field Campaigns, tower data, model data from IEA Wind Task 36
  https://iea-wind.org/task-36/

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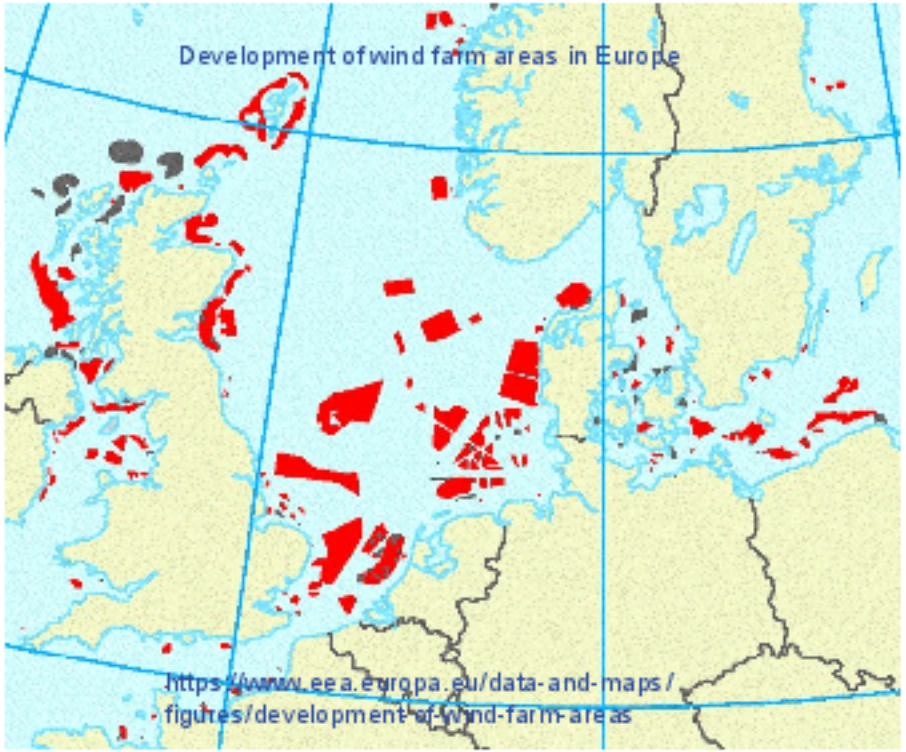
- Wind farm parameterization in NWP models
- Improved ensemble techniques

This WP primarily facilitates communication and efficient application of resources in the global wind forecast community



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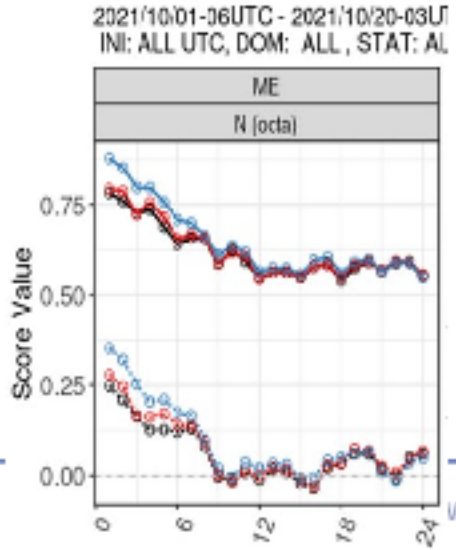
- **Usage of (new) observations for assimilation and verification**

Example: New Mode-S data for ICON-D2

Total cloud cover



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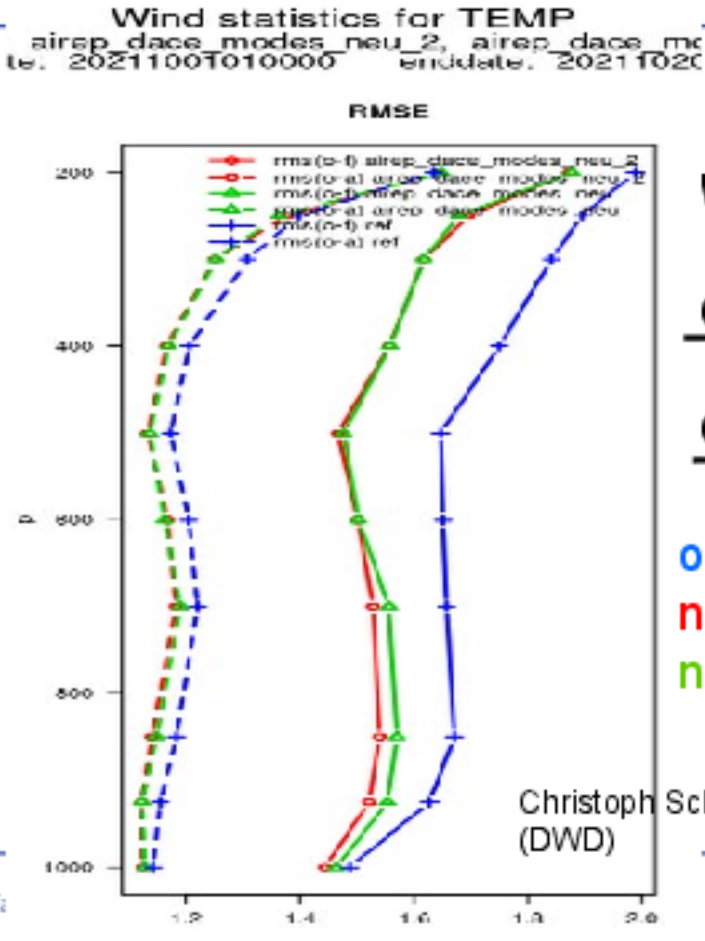

Wind

Obs-FG

Obs-AN

operational
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Christoph Schraff
(DWD)

jeg wind

WS: Airborne Wind Energy Systems

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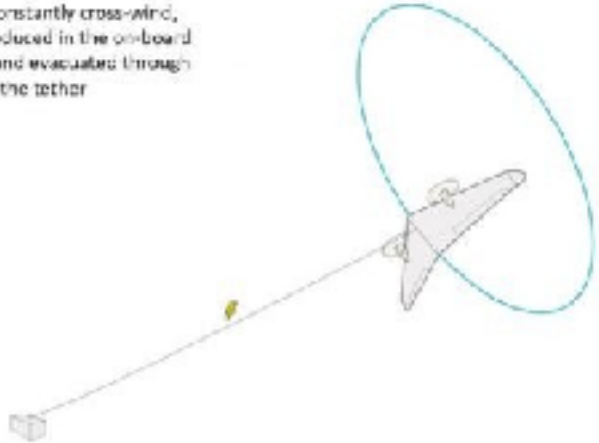
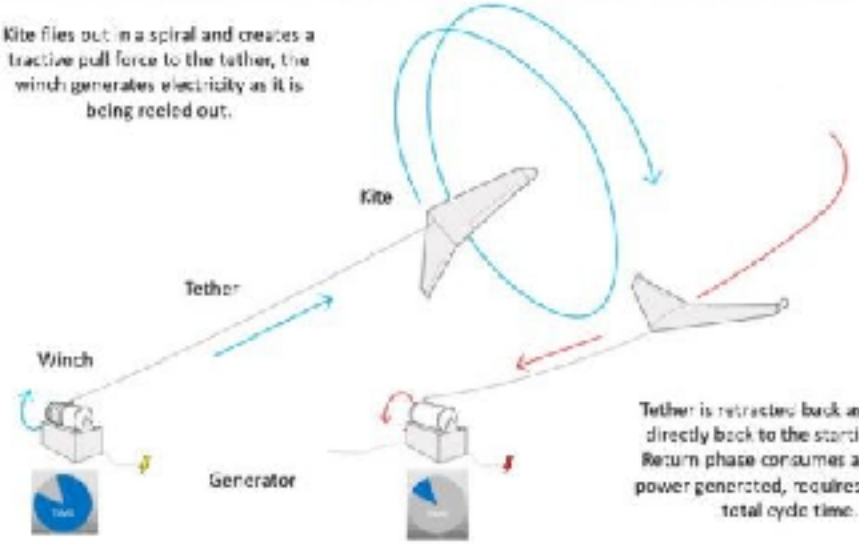
On-board generation ("fly-gen")

Kite flies constantly cross-wind, power is produced in the on-board generators and evacuated through the tether



Ground generation ("ground gen") or yo-yo principle

Kite flies out in a spiral and creates a tractive pull force to the tether, the winch generates electricity as it is being reeled out.



Tether is retracted back as kite flies directly back to the starting point. Return phase consumes a few % of power generated, requires < 10 % of total cycle time.

From https://airbornewindeurope.org/about-airborne-wind-energy/

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WS: Airborne Wind Energy Systems

Advantages of AWE

- **Less material: lower environmental impact**
- **Wind at greater heights, 100m to 500m)**
  - High full load hours
  - Turbulence (?)
- **Low levelized costs of energy (LCOE)**
- **Flexibility: easier logistics, quick set-up**
  - Potential for repowering, floating offshore
  - Work stream "Forecasting for underserved areas"

Forecasting for AWE

What could be different to turbines on towers? (My thoughts with no experience in AWE)

- Wind at greater heights
- Turbulence and gusts more important than for turbines on towers
- Forecast of wind profiles – speed and direction - needed because of variable harvesting height
- Forecast length of too weak or too strong winds. Is it worth to start the system between two periods with no-fly conditions?

WP1: Weather prediction

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Deliverables

- D 1.1: Online summary of major field studies supportive of wind forecast improvement; list of available data (ongoing)
- D 1.2: Report on benchmark exercise carried out in Phase II of IEA Wind Task 36 that illustrates the application of V&V
- D 1.3: Report on forecast horizons and the use of post-processing tools including AI
- D 1.4: Convene meetings with forecast centers to start the discussion of including energy metrics in NWP model upgrades. (Ongoing)
- D 1.5: Convene workshop and develop paper on seasonal forecasting, emphasizing hydro and storage (M19)

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