



# Reanalysis Use Cases (state-of-the-art) Wind & Site

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## EMD – we make windPRO (& energyPRO)

- The most widely used software for projecting of wind farms (PVs & other RE plants)
- 5000+ users in 110+ countries (RWE, EDF, GE, Vestas, Vattenfall, Rambøll, SWECO, ...)
- Easy download of e.g. ERA5, CERRA, MERRA II, NORA3, (NEWA, GWA/GASP)... within windPRO
- 7000+ ERA5 downloads per month
- What our users do in windPRO?
  - Wind measurement analysis (short term mast or LIDAR)
  - Long-term correction of measurements
  - Resource & Energy yield assessment & Value assessment (demand Vs production)
  - Operational performance assessment
  - Siting parameters & Suitability (Loads & Lifetime)
  - Layout optimization
  - Environmental calculations (Noise, flicker)
  - Visualizations
  - PV & Hybrid

~Wind & Site



## Where we have come from...



- **WMO stations**

Strong local effects...



- **NCEP-NCAR (2005\*)**

250km, 6-hourly



- **ERA Interim (2008)**

~79km, 3-hourly



- **MERRA (2009)**

~70km, hourly



- **CFSR (2010)**

~55km, hourly



- **ERA5 (2017) + ...**

~30km, hourly



- **ERA6... (2024)**

~18km, hourly?





## Main use cases of Reanalysis (windPRO user perspective)

- **Long-term correction**
  - Purpose: establish transfer function & predict long-term local series
  - Methods: OLS, Matrix, Q-mapping, ANN, ...
- **Quality assessment/plausibility/verification of observations**
  - Wind measurements & production data
- **Downscaling using LAM (e.g. WRF) – integrating the model chain**
  - Initial & boundary conditions (+nudging)
- **Offshore resource assessment (finer scales less important)**
  - Pre-feasibility, gradients, inputs to wake modelling, ...
- **Wind energy indices (Solar energy indices)**
  - Monthly production indices, monitor asset performance
- **Historic climate analysis (very long-term)**
  - Fluctuations (e.g. ENZO, NAO, AMO), Trends
- **A source of auxiliary signals**
  - Stability & ABL height, Temperature, Pressure, ...



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