QUICK GUIDE – PARK WITH SCALER AND MEASURED WIND DATA

Purpose:

To calculate expected AEP (Annual Energy Production) as time-step calculations based on local wind measurements.

Here, PARK calculates in time steps (e.g. 10 min) using measured data, with the SCALER extrapolating the measurements to each turbine position. The SCALER can handle multiple measurement heights and mast positions, and individual displacement heights by sector for individual masts and turbines. The SCALER transfer functions are obtained from WAsP, WASP-CFD or FLOWRES (generalized format open for all model providers) calculations, and include speed up and veering. Also, measured turbulence can be transformed to turbine positions.

This guide assumes the reader is familiar with the basics of windPRO (establishment of Objects and tasks like import of measured data into Meteo Objects).

Outline of Guide:

1. **License and version requirements**

2. **Setup input and data input in PARK**

3. **Calculation**

4. **Results of PARK calculation**

5. **Additional Scaler options**

1.   LICENSE AND VERSION REQUIREMENTS

WindPRO 3.1 or above, with license to the module PARK. Also, WAsP 11 or above must be installed.
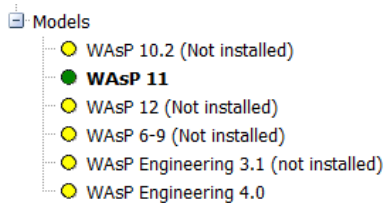


2.   SETUP AND DATA INPUT IN PARK

Establish the site measured wind data in Meteo Objects.

If not already established in project:

- Create the turbines to be calculated (Objects).
- Create micro terrain data (roughness and elevation) and make a Site Data Object with a link to these. The Purpose of the Site Data Object can be e.g. STATGEN, in whose case no wind statistic will be needed in the Object; alternatively, WAsP-CFD or FLOWRES result files can be used.
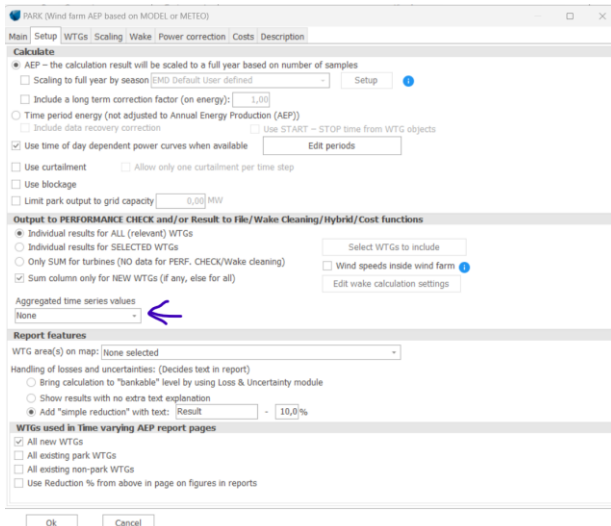
3.   CALCULATION

Upon starting PARK, choose the Time-varying calculation based on measured data.
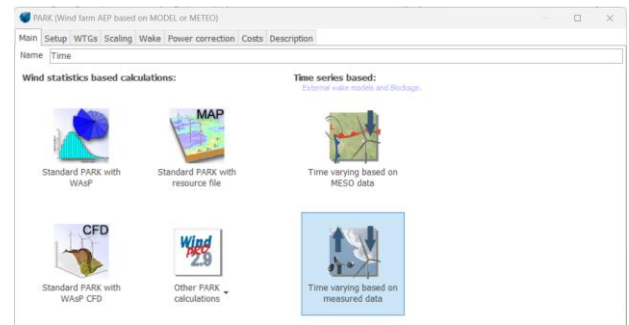
Under **Setup**, note especially the "Aggregate" level. By default, this is set to Month, partly to save memory. If there is a need for e.g. 10' values (for use in PERFORMANCE CHECK or for some detailed calculations in LOSS & UNCERTAINTY), this must be changed to "None".

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Under Report features, the old default of adding a simple 10% reduction to roughly account for losses can be switched to *Bring calculation to "bankable" level*.

In **Wake,** a list of wake models is available. The recommended one is the N.O. Jensen PARK2 (2018), which is default. In this model, the critical parameter is the Wake Decay Constant (WDC), whose default value for onshore sites is set as default (0.090). The WDC should be otherwise chosen based on ambient turbulence. If this is not available, different terrain types are listed together with their roughness class (RC) and length (z0) to help the user choose.

There are more **Advanced** options. If turbulence is available for the entire calculation period, the WDC can be controlled by turbulence in each time step – this is the easy and "safe" choice. For very large wind farms (+5 rows), deep-array model corrections are available.

After choosing the turbines for calculation, go to **Scaling**. Here, select the wind data to be used. The model chosen later in the Scaler will be able to interpolate, if the hub height is between measurement heights, or to extrapolate, if it is above.
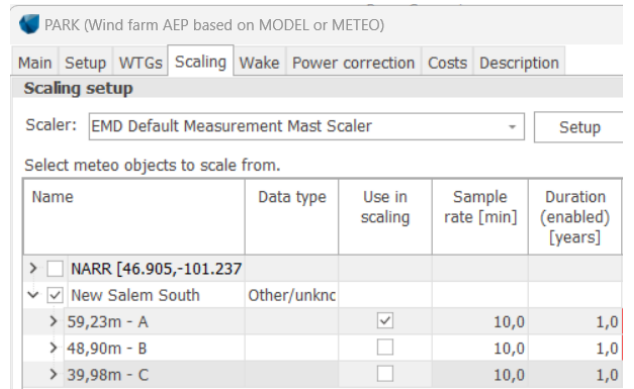
Now choose the "EMD Default Measurement Mast Scaler", and access its Setup.
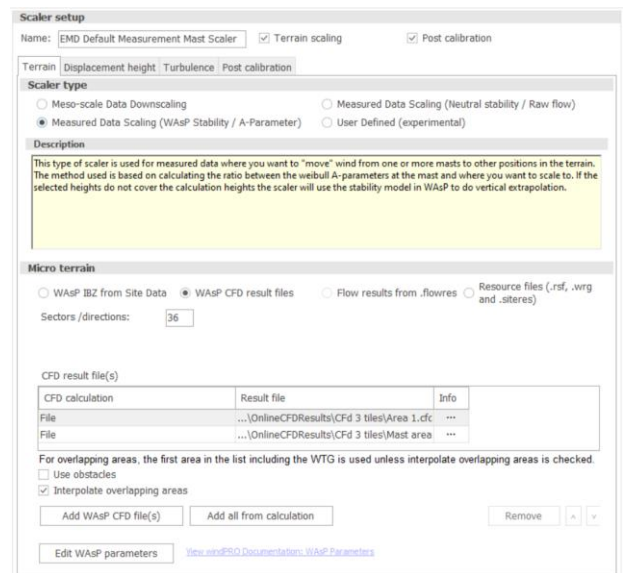
Make sure the correct Site Data Object is chosen – or if WAsP-CFD, .flowres or .rsf files should be used as the model. The number of sectors can be chosen as well (only if you're not using CFD results). This affects how many sectorwise transfer functions shall be calculated and, later, when scaling each time record from the time series. Normally, 12 is recommended. The use of 36 can, in some special cases, improve accuracy, but it requires very good data, e.g., a very high accuracy of the measured direction. Close the Setup with Ok.

More advanced options will be described later.

Finally, the **Power curve correction** is entered. The recommendation here is only to activate the temperature correction, since this gives a more precise month by month calculation.

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If there is no temperature data in the measurements, it is possible to get temperature from mesoscale data out of models such as EMD-WRF, where an interpolation will be made in the hourly data to establish 10' data. The other corrections are more for "experimental use". In general, these do not affect the AEP result significantly.

Now run the calculation.

4. RESULTS OF PARK CALCULATION
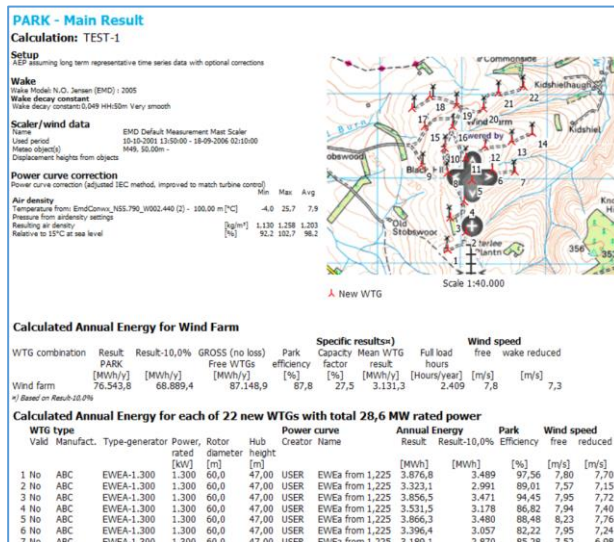
The standard report document provides the calculation assumptions and gives the expected AEP as the average for the period calculated. There will automatically be compensation for data recovery, and, optionally, season unbiasing can be chosen. Note that free as well as wake-reduced wind speeds are shown.

The strongest feature when calculating in time steps is the very detailed validation options offered. With the "result to file" output, the result in time can be taken into Excel for further processing or analyses.

5. ADDITIONAL SCALER OPTIONS

Using the Scaler on local measurements offers additional choices.

- One is to use the "Neutral stability/Raw flow" as alternative to the "WAsP Stability/A Parameter": no atmospheric stability is applied, and a neutral atmosphere is assumed.
- The other is to use WAsP-CFD result files or FLOWRES files (from other CFD providers).