WAsP best practices and checklist

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The following list of requirements, best practices and recommendations is not exhaustive, but is meant to provide a brief summary of some important considerations regarding WAsP modelling. More information is available in the WAsP help system and at www.wasp.dk.

Measurement programme

- ❑ Design measurement programme based on preliminary WAsP analysis
  - Use SRTM elevation data and land-use from Google Earth
- ❑ Follow similarity principle as much as possible when siting the masts
- ❑ Height of reference anemometer(s) similar to hub height (preferably > 2/3 h_{hub})
- ❑ Deploy 2 or more masts for horizontal extrapolation analysis
- ❑ Deploy 2 or more masts if RIX and ΔRIX analyses are required
- ❑ Deploy 2 or more levels on masts for vertical wind profile analyses and
- ❑ Deploy 2 or more levels on masts for redundancy in instrumentation
- ❑ Measure temperature and pressure for air density calculations

Wind data analysis

- ❑ Collect required information, e.g. by filling out the WAsP Data Description Form
- ❑ All fields in Climate Analyst protocol editor should correspond to data spec's
- ❑ Plot and inspect time traces of all meteorological measurements
- ❑ Visual inspection of time-series – in particular reference wind speed and direction
- ❑ Visual inspection of polar scatter plot – any patterns or gaps?

Observed wind climate

- ❑ Use an integer number of whole years when calculating the OWC
- ❑ Check Weibull fit: is power density discrepancy < 1%?
- ❑ Check Weibull fit: is mean wind speed discrepancy < a few per cent?
- ❑ Check within context of long-term wind climate (MCP)

Elevation map(s)

- ❑ Size of map: should extend at least max(100×*h*, 10 km) from any site – meteorological masts, reference sites, turbine sites or resource grid points.
- ❑ Coordinates and elevations must be in meters
- ❑ Set projection and datum for map in the Map Editor
- ❑ Add spot heights within wind farm site
- ❑ Check range of elevations in map

Roughness/Land-use map(s)

- ❑ Size: map should extend at least max(100×*h*, 10 km) from any site – meteorological mast, reference site, turbine site or resource grid point.

- ❑ Coordinates and elevations must be in meters
- ❑ Set projection and datum for map in the Map Editor
- ❑ Roughness length of water surfaces = 0.0 m!
- ❑ Check range of roughness values in map
- ❑ Map date should correspond to modelling scenario (met. mast or wind farm)
- ❑ Check for dead ends and cross points – and edit map as needed
- ❑ Check consistency of roughness values – there should be no LFR-errors

Sheltering obstacles

- ❑ Is site closer to obstacle than 50 obstacle heights, and is height lower than about 3 obstacle heights?
- ❑ If yes to both, treat as sheltering obstacle; if no then treat as *roughness element*

WAsP modelling – site visit

- ❑ Go on a site visit! Use e.g. the WAsP Site/Station Inspection Checklist
- ❑ Print and bring the WAsP forms for recording the necessary information
- ❑ Bring GPS and note projection and datum settings – change if required
- ❑ Determine coordinates of all masts, landmarks and other characteristic points on site
- ❑ Take photos of station and surroundings (12 × 30°-sector panorama)
- ❑ Download GPS data and photographs to PC as soon as possible (daily)

WAsP modelling – parameters

- ❑ Wind atlas structure: standard roughness classes should span site conditions
- ❑ Wind atlas structure: standard heights should represent project
- ❑ Adjust off- & on-shore mean- and RMS-heat flux values to site conditions (*caution*)
- ❑ Ambient climate: Set air density to site-specific value (WAsP 10 only)

WAsP modelling – analysis and application

- ❑ Get site-specific wind turbine generator data from manufacturer
- ❑ Within forest: effective height = nominal height minus displacement length
- ❑ Complex or steep terrain is when RIX > 0 for one or more sites (terrain angles > 17°)

WAsP modelling – offshore

- ❑ Roughness length of sea surfaces: set = 0 m in WAsP!
- ❑ Add elevation/roughness change line around wind farm site
- ❑ Change wake decay constant to offshore conditions

WAsP modelling and sensitivity analyses

- ❑ Identify and estimate uncertainties
- ❑ Sensitivity of results to background roughness and other important parameters