



TECHNICAL NOTE: MESORES

Flexible multi-node mesoscale time-series results format

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Figure 1: Data from a MESORES file as part of windPRO.

1. Introduction

Over the last releases of windPRO, EMD has implemented several open-data interchange formats to facilitate easy interaction with 3rd party tools and own internal models - such as CFD-models [1, 2], optimization models [3] and wind atlas and climate data [4]. This document describes the MESORES format, an open and accessible results output-format for mesoscale time-series data. The MESORES format allows wind analysts to import a single, self-contained data-file with time-series information on one or more data-nodes and to obtain the associated geospatial information used in the mesoscale model.

2. Mesoscale Results Format, MESORES

The purpose of the mesoscale results format is to consolidate a self-contained, single file-delivery of mesoscale time-series results. It is an easy-to-use, open and flexible format, that supports:

- One or more mesoscale time series nodes (i.e. virtual masts)
- Unstructured or structured node grids
- Variable horizontal resolution (typically 3 km)
- User defined temporal resolution (typically 1 hour)
- Multiple climate parameters (wind speed, direction, TKE ...)
- User defined vertical heights (from ground to upper-air)
- User defined temporal period (typically 10–20 years)
- Terrain description (model orography and roughness)
- Seamless import into windPRO through the MeteoAnalyzer import option, see Section 3.

EmdMesoResult	xml	841	25/04/2023 09:39
EmdWrf_N64.222_E018.416	txt	81 477 900	04/09/2020 23:37
min_rough	grd	49 204	04/09/2020 09:42
max_rough	grd	49 204	04/09/2020 09:34
oro	grd	64 847	04/09/2020 09:34
import	wls	4 534	28/01/2018 06:02

Figure 2: Part of the contents-listing of the MESORES file.

All information is contained in a single file (a zip-file, with *.mesores extension, see Figure 2). This file contains an xml-file describing the zip-file content (EmdMesoResult.xml), one or a more txt/csv files with time-series mesoscale data and a number of surfer grid files (*.grd) with the orography and roughness information from the mesoscale model runs. The format is self-describing – and allows for inclusion of any mesoscale time-series parameters.

EmdMesoResult.xml

The first part of a MESORES result file is the meta information in the EmdMesoResults.xml file. This file has 3 main sections: 1) Information about the job (or client) that generated the information (<JobInfo>).
2) Information of Model-Setup and windPRO import filter (<ModelSetup>).
3) Links to model results and locations (<Results>).

A complete listing of the EmdMesoResults.xml file is found in Figure 3.

```
<?xml version="1.0" ?>
<EmdMesoResult Version="1.2">
  <JobInfo>
    <JobId></JobId>
    <ClientInformation Name="" UserName="" Version=""/>
    <CalculationDateTime>2020-09-04T23:35:56</CalculationDateTime>
    <ServerName>Cerebrum</ServerName>
  </JobInfo>
  <ModelSetup Config="" EndTime="" Latitude="64.222556" Longitude="18.358111" StartTime="" WindPROImportFilter="import.wls"/>
  <Results>
    <Orography Filename="oro.grd" Name="Orography"/>
    <Roughness EndTime="1900-10-15T00:00:00" Filename="max_rough.grd" Name="Max roughness" Order="MAX" StartTime="1900-04-15T00:00:00"/>
    <Roughness EndTime="1900-10-15T00:00:00" Filename="min_rough.grd" Name="Min roughness" Order="MIN" StartTime="1900-10-15T00:00:00"/>
    <Point Elevation="434.81" Filename="EmdWrf_N64.222_E018.416.txt" Latitude="64.222" Longitude="18.416"/>
  </Results>
</EmdMesoResult>
```

Figure 3: Listing of a EmdMesoResults.xml file.

Example Files

Two examples of MESORES files are available from the EMD:

- Single-Node: http://www.emd.dk/files/flow/MESORES_EXAMPLE-SINGLENODE.mesores
- Multi-Node: http://www.emd.dk/files/flow/MESORES_EXAMPLE-MULTINODE.mesores

Usage Notes

Below some usage-notes related to implementation of this format, aimed for clarification for the advanced user.

- **How-to make the import filter for windPRO?** If you write the MESORES file yourself, please be aware that the "WindPROImportFilter" (import.wls) currently is a binary and static file. It is generated once from within a windPRO meteo-object. So, if you stick to a fixed format for your txt/csv files this will be just fine. If you do not have access to windPRO to generate this file (and need support for this step), feel free to contact any of the authors or the windPRO support hotline (support@emd.dk).
- **Time stamps associated with the roughness descriptions:** The "Year" part of the time stamps associated with the mesoscale-roughness descriptions are not used in post-processing in windPRO. Only the "Month" and "Date" part are used to switch between "winter" and "summer" roughness descriptions for windPRO models that support this type of time-series configuration.
- **Other data sources:** While the format is aimed at mesoscale time-series data, it may also be used for other types of data such as meteorological tower data or met-ocean data.

3. Import and use of MESORES data in windPRO

The MESORES data file is imported through the windPRO meteo-analyser. Use the "Import .mesores" button in WindPRO (Figure 4) and a number of meteo-objects are automatically created using the included import filter. The time-series data, mesoscale-orography (see Figure 5) and mesoscale-roughness will be linked into the meteo-object – and available for further windPRO-modelling in calculations such as downscaling (via the Scaler), long-term-correction (via MCP) or advanced time-series modelling (various modules).

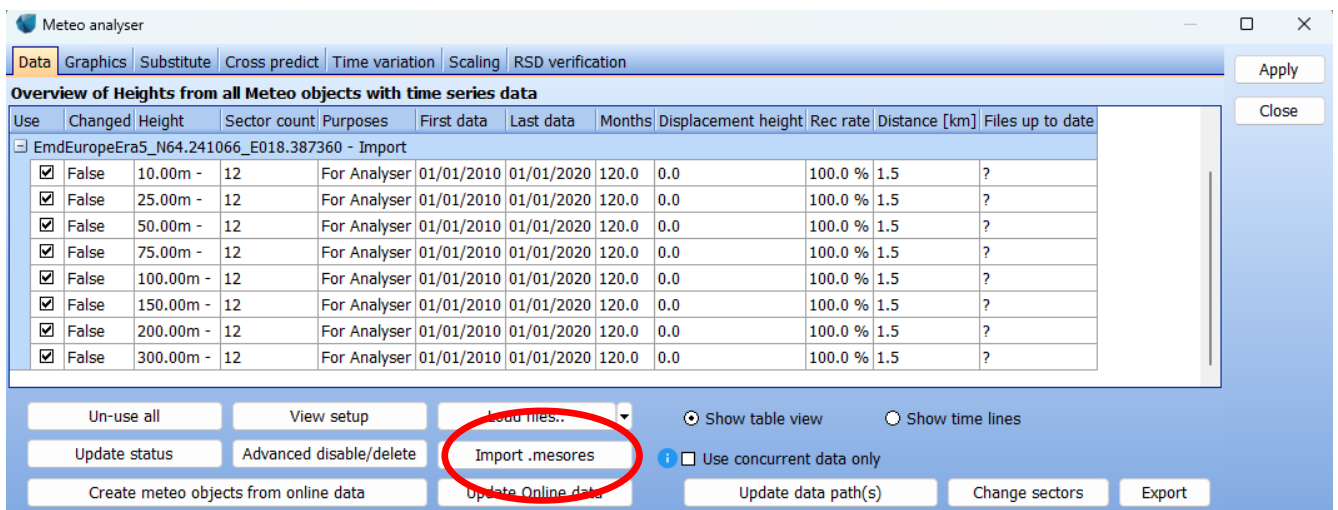


Figure 4: Import of MESORES file in windPRO Meteo-Analyser.

4. References

- [1] Sørensen T.G.: *Generalized Flow request and result format (version 1.4)*, EMD A/S, 2016-10-25, available at: http://www.emd.dk/files/flow/EMD_technote_Generalized_Flow_Request_Result.pdf
- [2] Svenningsen et al: *WASP-CFD Validation Report*, EMD International, 2013-07-10, available at: http://help.emd.dk/knowledgebase/content/TechNotes/TechNote_4_WAsPCFD_EMD_ValidationReport.pdf
- [3] Thøgersen, M.L.: *GIRAFFA Generalized i/o-format for adapting optimization frameworks for windfarm-applications*, EMD A/S, 2017-05-15
- [4] Thøgersen, M.L and T.G. Sørensen: *Technical Note: SITERES - Generalized gridded results format for wind farm site and climate parameters*, EMD International A/S, 2017-05-28, available at: https://www.emd-international.com/files/flow/EMD_technote_SITERES_20170515.pdf

5. Document History

2023-04-25: First draft and review (MLT, TGS, LS)

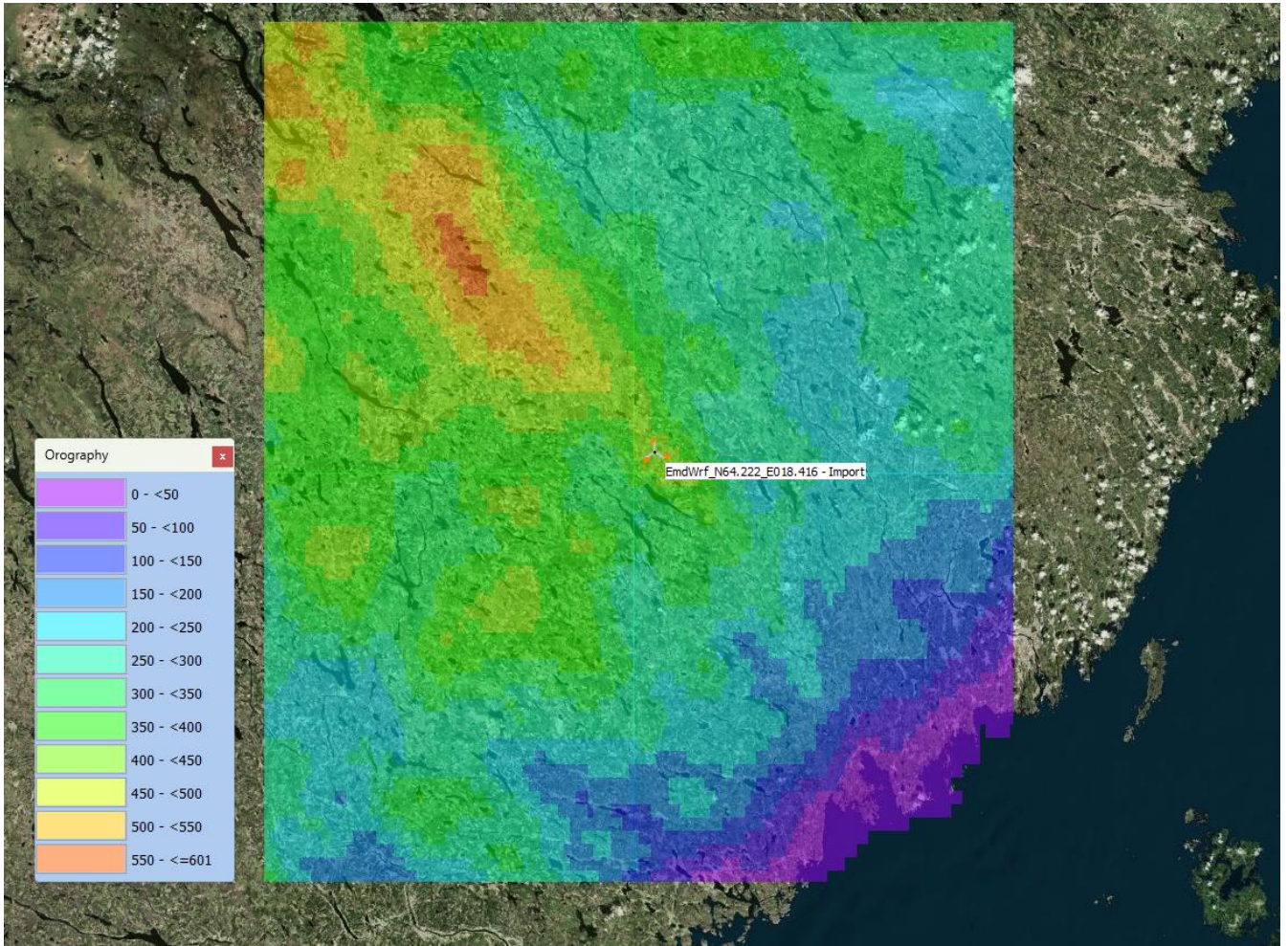


Figure 5: Mesoscale-terrain from a results-layer in windPRO (embedded within windPRO-meteo objects when importing .mesores files).