

WIND KNOWLEDGE

IS WIND POWER

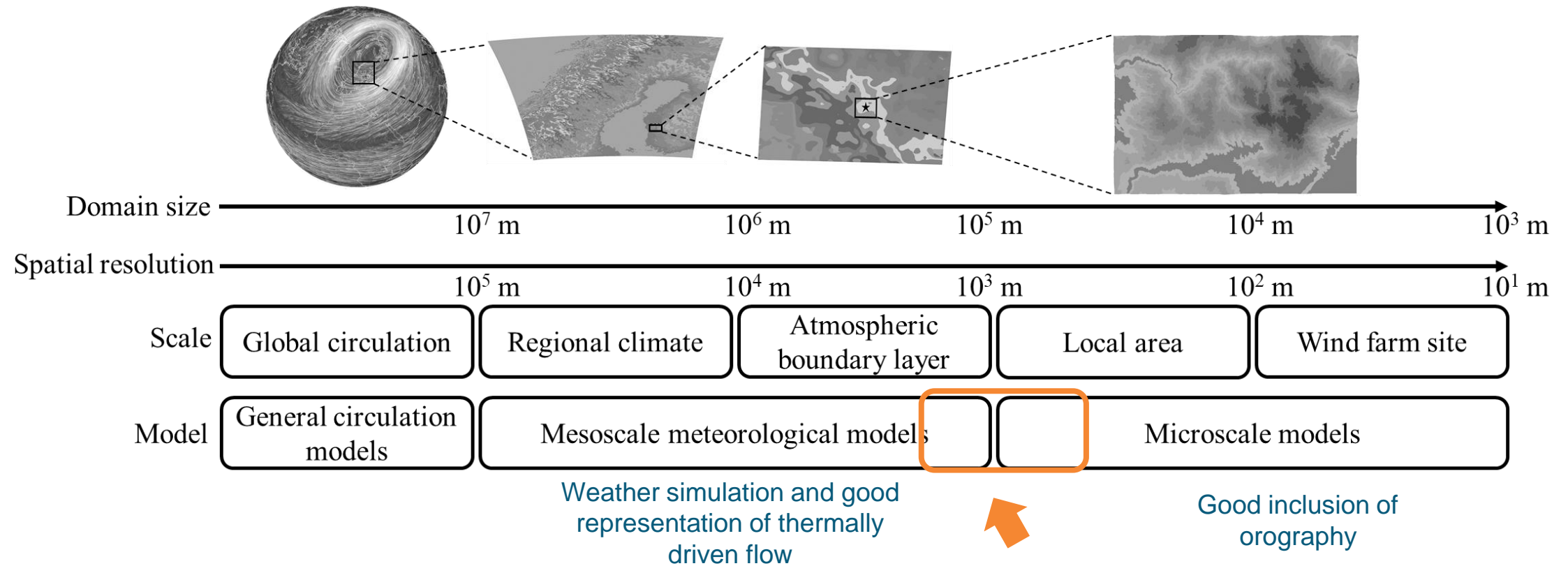


Workshop Introduction: Meso-microscale Coupling

June 2021

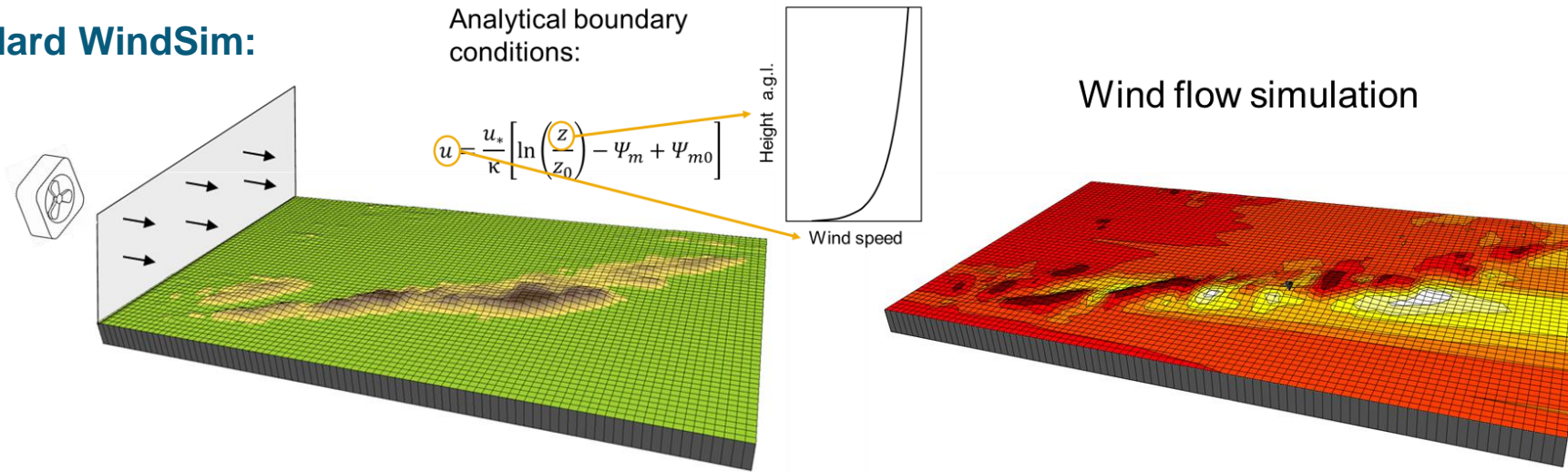
windsim

Meso-microscale coupling (MMC) definition



Physical Meso-microscale Downscaling

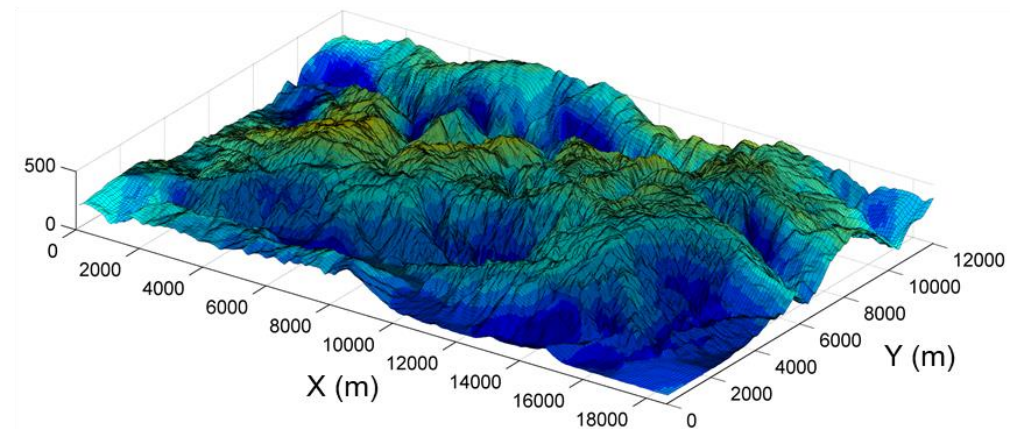
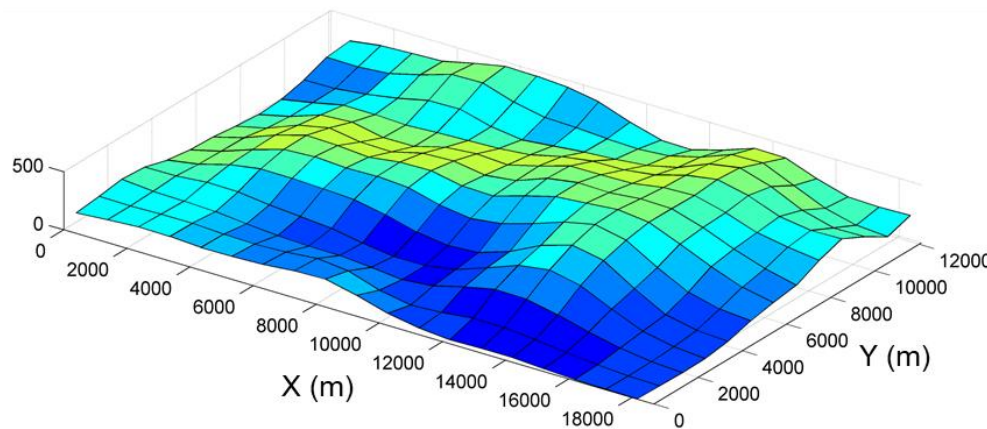
Standard WindSim:



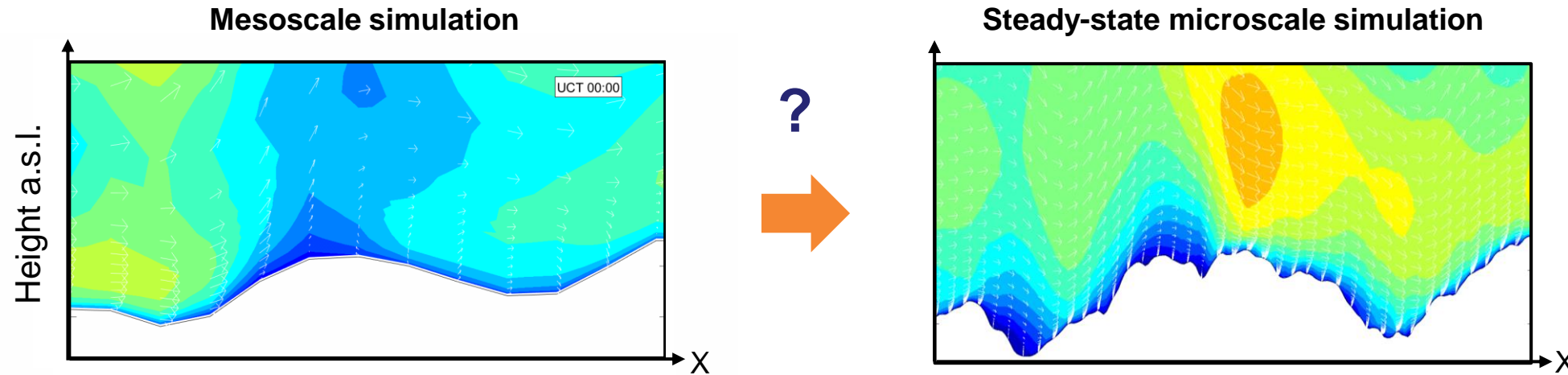
Mesoscale Nested WindSim:

Low resolution (1 km) mesoscale field input

WindSim high resolution (20 m) physical downscaling of the mesoscale field



Physical Meso-microscale Downscaling for WRA



Mesoscale models are transient (time-dependant)

For output time resolution of 1hr = 8760 wind fields!

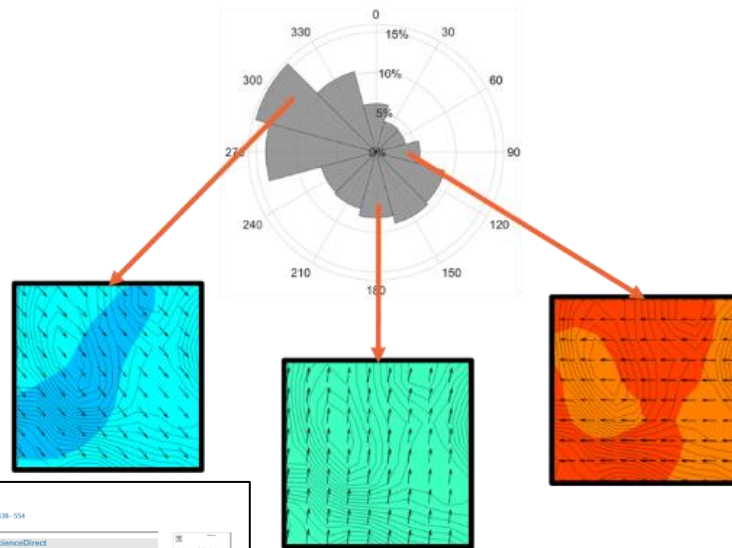
Microscale models are mostly operated as steady-state (static)

Typically 12-16 directions

How can we aggregate the mesoscale data?

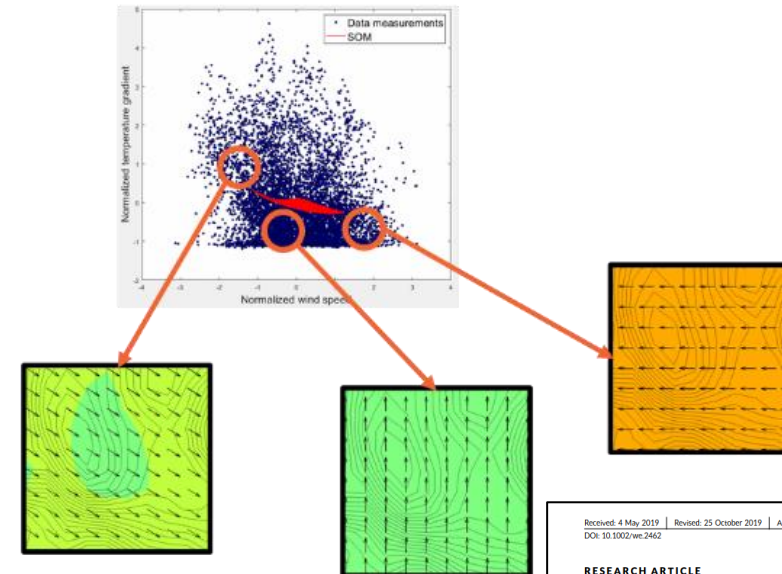
Physical Meso-microscale Downscaling for WRA

Method A: Aggregation by wind direction



From WindSim 11!

Method B: Aggregation by most predominant wind conditions



Available in WindSim 11 up to Wind Fields

Post-processing available for next release

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A new meso-microscale coupled modelling framework for wind resource assessment: A validation study

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ARTICLE INFO

ABSTRACT

In this work the simulation results of a newly developed meso-microscale coupling methodology suited for steady-state computational fluid dynamic models (CFD) are compared with mesoscale and stand-alone microscale simulations at 5 sites. The coupling methodology uses averaged fields of wind speed and potential temperature simulated by the Weather Research and Forecasting model as boundary and initial conditions for the CFD model. In complex terrain, the coupled model reproduces the measured vertical profiles of horizontal wind speed better than the standalone microscale model or the mesoscale model. The coupled model also performs better in the horizontal extrapolation of measurements in complex terrain. In simpler terrain, it is beneficial to use the coupled model when the focus is on areas located downstream of even small terrain features. Otherwise, the mesoscale simulations perform as good or better than the coupled model.

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RESEARCH ARTICLE

Automated classification of simulated wind field patterns from multiphysics ensemble forecasts

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Abstract

In this study, we have proposed an automated classification approach to identify meaningful patterns in wind field data. Utilizing an extensive simulated wind database, we have demonstrated that the proposed approach can identify low-level jets, near-uniform profiles, and other patterns in a reliable manner. We have studied the dependence of these wind profile patterns on locations (eg. offshore vs onshore), seasons, and diurnal cycles. Furthermore, we have found that the probability distributions of some of the patterns depend on the underlying planetary boundary layer schemes in a significant way. The future potential of the proposed approach in wind resource assessment and, more generally, in mesoscale model parameterization improvement is touched upon in this paper.

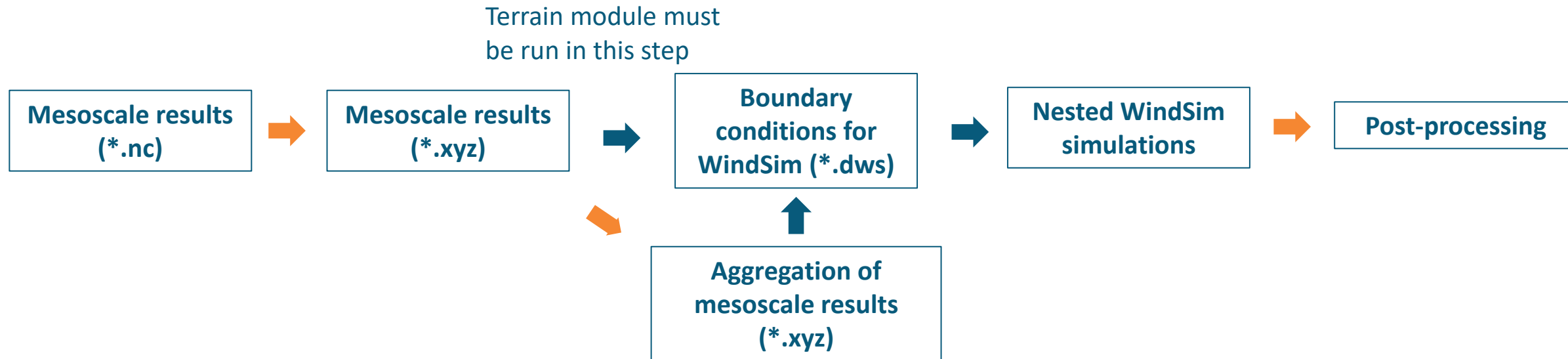
KEYWORDS

low-level jets, mesoscale modeling, neural networks, planetary boundary layer, self-organizing maps, vertical wind profile

Physical Mesoscale Downscaling procedure in WindSim

WindSim 10

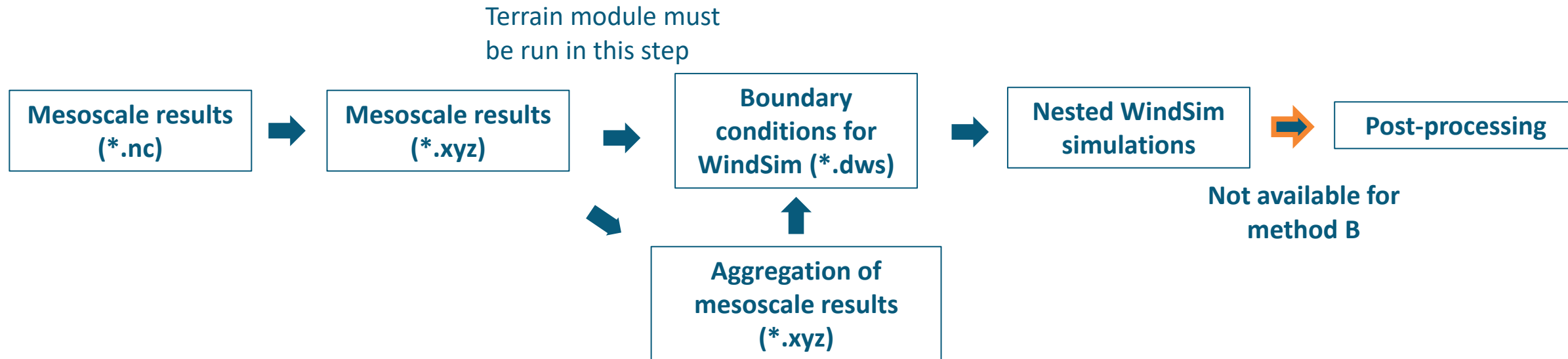
User



Physical Mesoscale Downscaling procedure in WindSim

WindSim 11

User



Physical Mesoscale Downscaling procedure in WindSim

New in WindSim 11

windsim Meso-microscale coupling manager

NC to XYZ converter Mesoscale averaging SOM clustering XYZ to DWS converter Visualization

Folder of the mesoscale files to process:

Destination folder for the averaged file(s):

UTM Zone:

Convert NetCDF data

Status: Waiting for user

windsim Meso-microscale coupling manager

NC to XYZ converter Mesoscale averaging SOM clustering XYZ to DWS converter Visualization

Folder of the mesoscale files to process:

Destination folder for the averaged file(s):

Total number of sectors: 12

Average mesoscale data

Status: Waiting for user

windsim Meso-microscale coupling manager

NC to XYZ converter Mesoscale averaging SOM clustering XYZ to DWS converter Visualization

Step 1: Read mesoscale data (*.xyz) Read data Processing output:

Step 2: Train SOM Start training

Step 3: Data clustering Start clustering

Step 4: Create mesoscale fields Write fields

Run steps 1 to 4 at once

windsim Meso-microscale coupling manager

NC to XYZ converter Mesoscale averaging SOM clustering XYZ to DWS converter Visualization

Select mesoscale data file(s)

List of file(s) to convert:

Remove selected Remove all

Destination folder for the *.dws file(s):

Convert *.xyz to *.dws

Status: Waiting for user