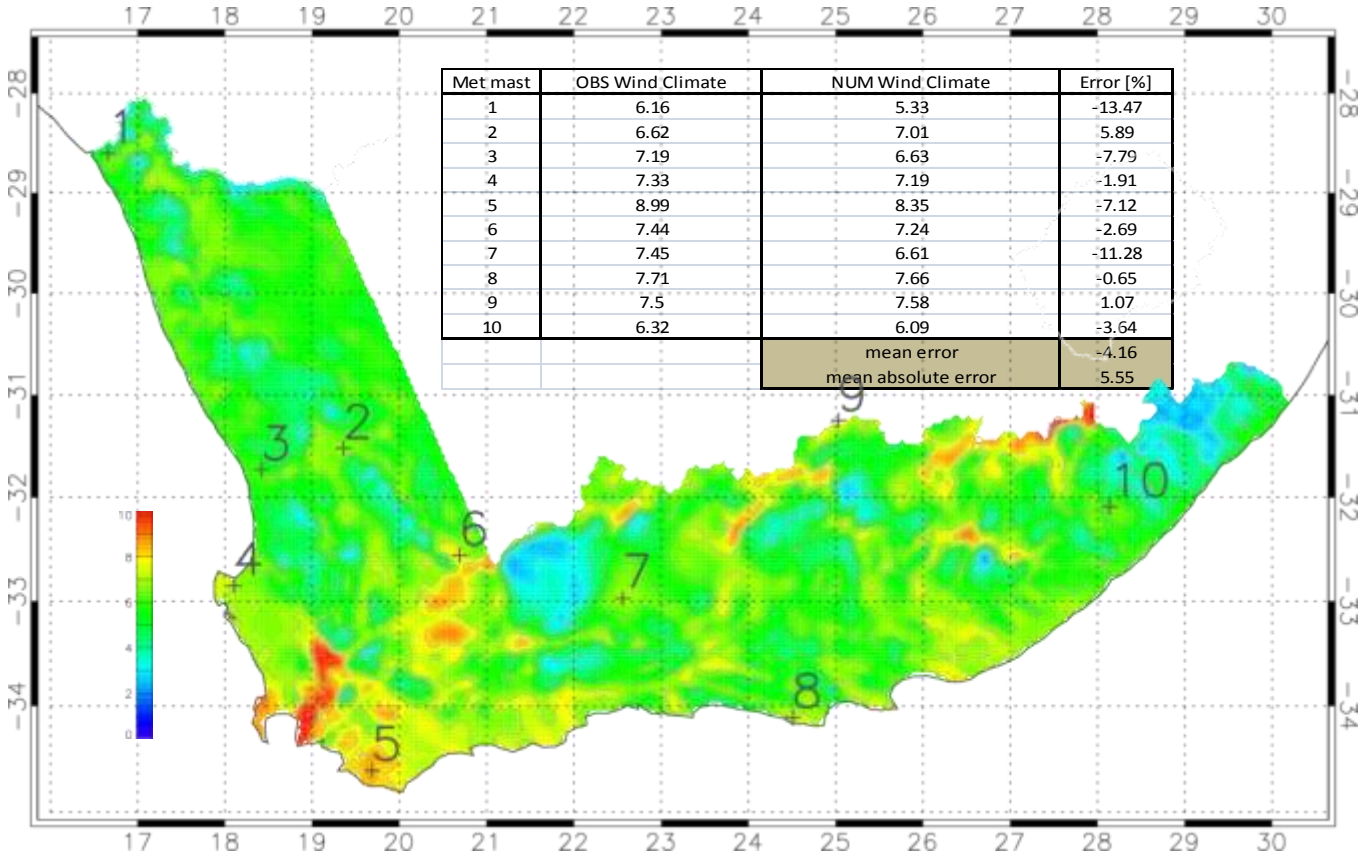
SOUTH AFRICAN WIND ATLAS (WASA) GUIDE

WASA (2009 to 2014) is an initiative of the South African Government, Department of Energy, and the project is co-funded by the UNDP-GEF through the South African Wind Energy Programme (SAWEP), and the Royal Danish Embassy. South African National Energy Research Institute (SANERI) is the Executing Partner, coordinating and contracting contributions from the implementing partners: CSIR, UCT, SAWS, and Risø, now DTU Wind Energy.

Introduction

The Numerical Wind Atlas (NWA) shows the generalised[1], climatological (30-year) annual mean wind speed [m/s] 100 m above ground level, for the Northern Cape, Western Cape and Eastern Cape.



Met mast	OBS Wind Climate	NUM Wind Climate	Error [%]
1	6.16	5.33	-13.47
2	6.62	7.01	5.89
3	7.19	6.63	-7.79
4	7.33	7.19	-1.91
5	8.99	8.35	-7.12
6	7.44	7.24	-2.69
7	7.45	6.61	-11.28
8	7.71	7.66	-0.65
9	7.5	7.58	1.07
10	6.32	6.09	-3.64
		mean error	-4.16
		mean absolute error	5.55

The Numerical Wind Atlas Database contains the generalised[1] wind climate data sets (.lib files) for every 5 km × 5 km, corresponding to approximately 15000 data points ("virtual masts") that can be employed directly with WAsP (licensed version) for wind farm planning and wind resource assessment.

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[1] flat, uniform terrain, no obstacles and with 3 cm roughness (e.g. farmland with open appearances) over the entire area

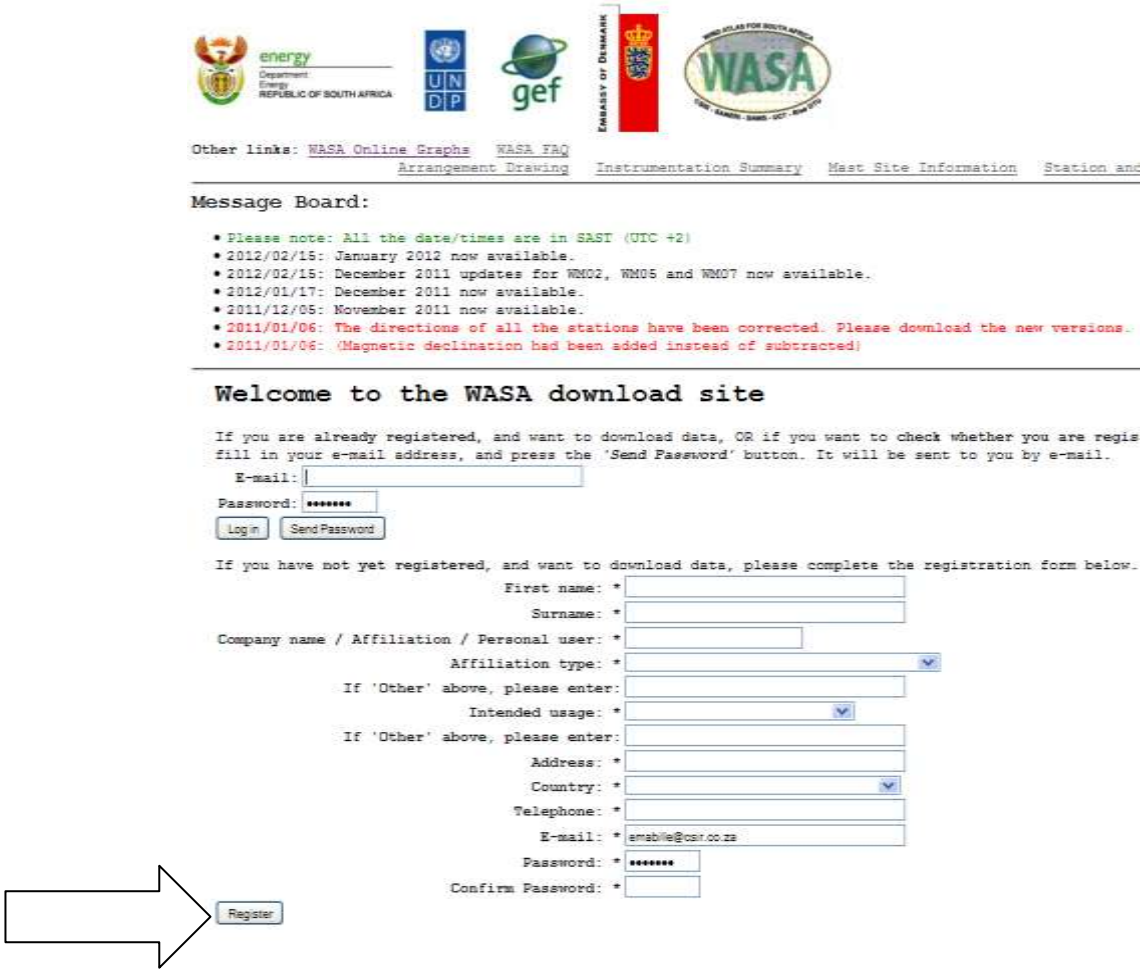
How to access the Numerical Wind Atlas Database

1. **Download WAsP 10.2 from the WAsP website. www.wasp.dk. Install the WAsP software on the hard disc drive (HDD). The unlicensed WAsP will allow you view the Generalised Wind Climate .lib files, but will not allow any calculations to be done.**

2. **Register for data downloads on the WASA website www.wasa.csir.co.za**

   i. **Go to the downloads page**

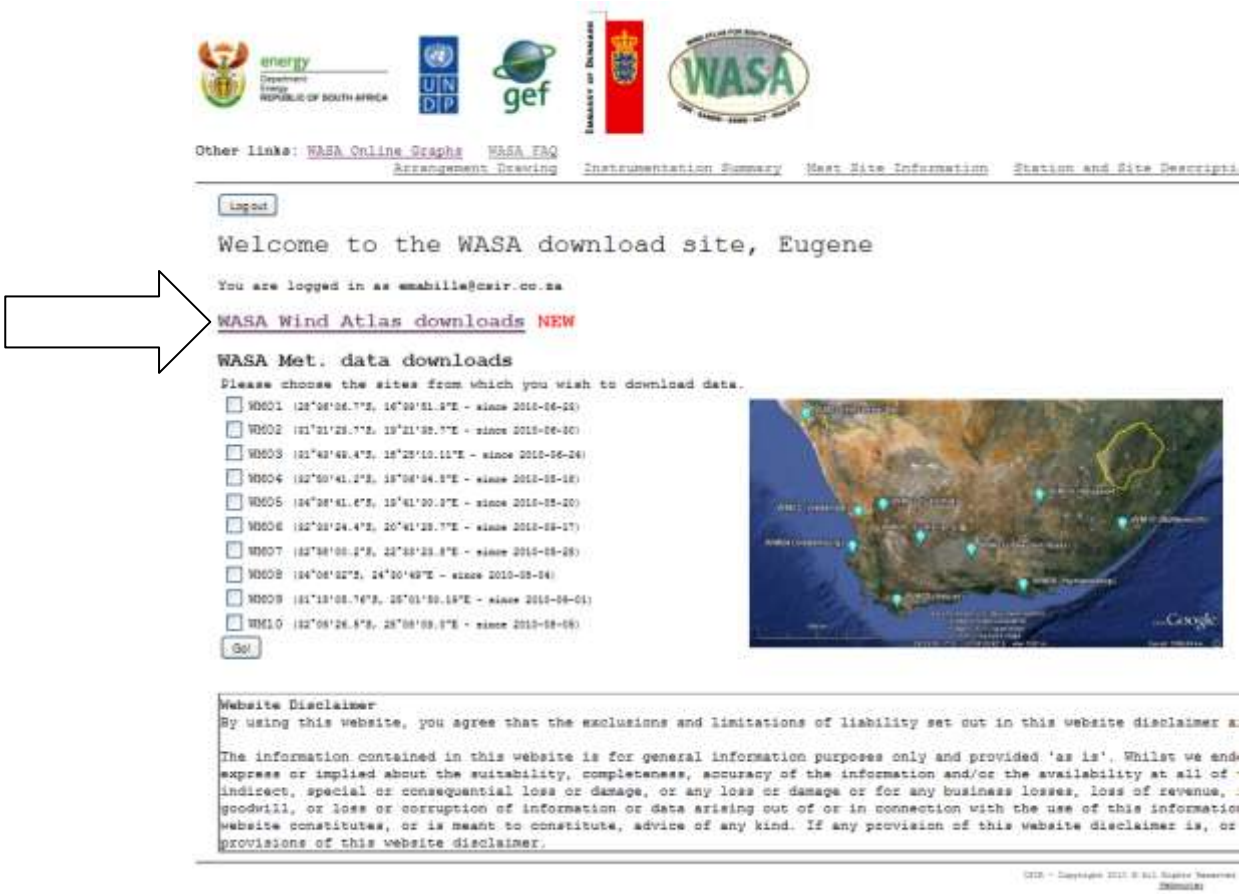
ii. Complete all the required fields



iii. Click on the <Register> button

3. Log in to the data download website using your e-mail address and password provided.

4. Click on the wind atlas link on the data download page.



5. Scroll down to the Tadpole link on the Wind Atlas web page and click on the link.

6. The Tadpole page with the Google Earth plug-in will open.

7. Select the domain on the left side of the Google Earth plug-in that covers your area of interest.

i Measurement masts.

ii South Africa (all domains)

iii Individual modeling domain

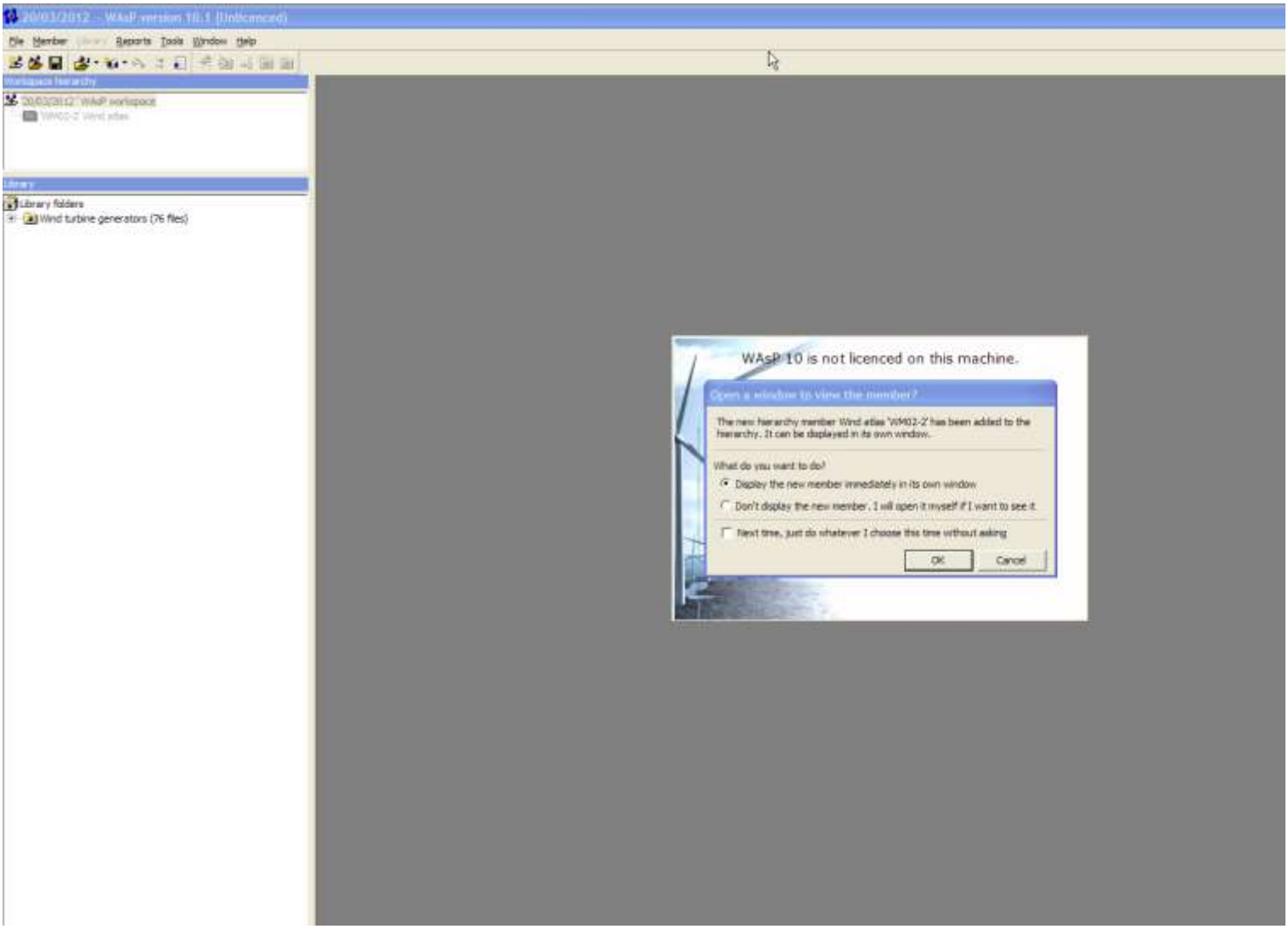
8. Locate your area of interest using the standard Google Earth controls.

9. Click on the wind atlas grid point closest to your area/point of interest.

10. Download the .lib file and save on your hard disk

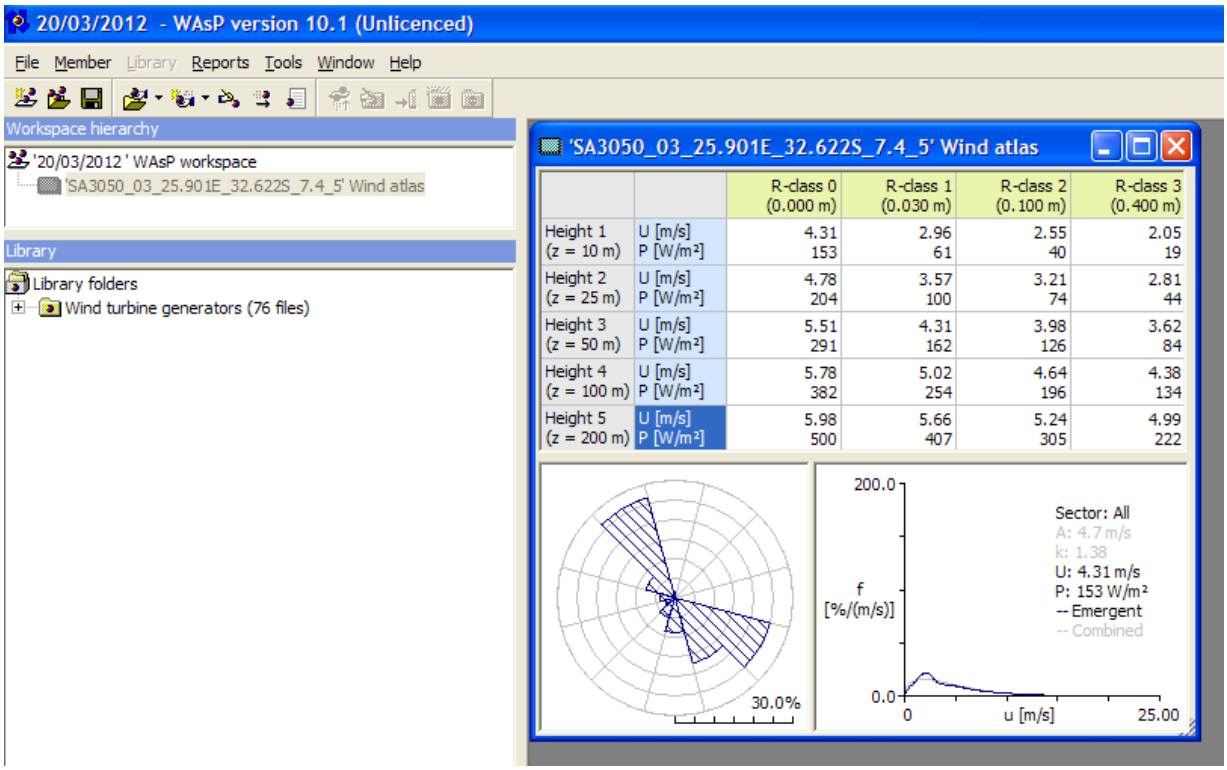
11. View the .lib file by:

i. Double clicking on the saved .lib file or



ii. Run the WAsP 10.2 program. Open the .lib file by using the
File|New Workspace
Right click on Project 1
Insert from File
Select Wind Atlas, locate the file you downloaded and Open.

iii Generalised wind climate at the selected point. Left click on the wind rose sectors to display the sectorised wind speed distribution curve.



12. The .lib file is the Generalised[1] or Geostrophic wind climate for the selected grid point. The .lib file contains the wind direction distribution as well as the sectorised and all wind speed distribution for the selected grid point. The table contains the mean wind speed and power density at five standard heights above ground level (0m, 10m, 25m, 50m, 100m, 200m) and five roughness classes. The roughness classes correspond to ground cover types:
R class 0 (0.000m) water areas, R class 1 (0.030m) farmland with open appearances, very few buildings, trees, airport area with some buildings and trees, R class 2 (0.100m) farmland with closed appearance, R class 3 (0.400m) low forest, suburbs, shelter belts, many trees and/or bushes and R class 4 (1.500m) tall forest

It also shows the Weibull graph and parameters A and k (lower right corner) which is a mathematical fit to the generalised wind data. The Weibull parameters A and k are used in combination with the wind turbine power curve, to calculate e.g. the estimated Annual Energy Production (AEP) etc. of a wind turbine(s) at the site.

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[1] flat, uniform terrain, no obstacles and with 3 cm roughness (e.g. farmland with open appearances) over the entire area

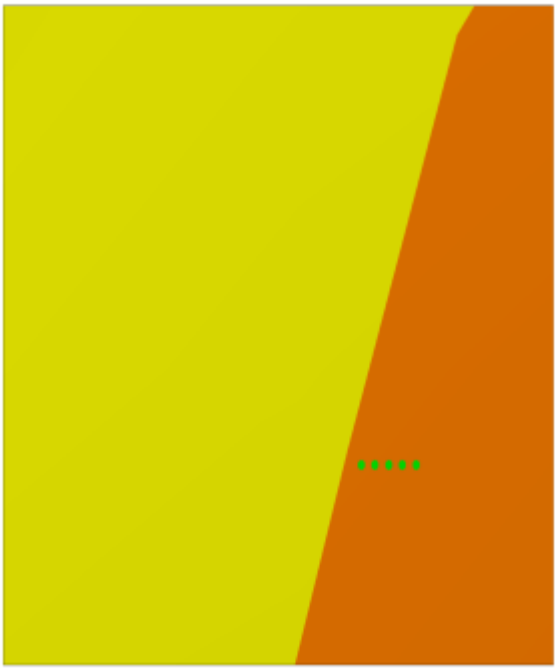
13. **Any further analysis to estimate the actual wind climate, wind farm planning, layout and wind resource assessment at the area/point of interest (e.g. microscale modeling) will require a licensed version of WAsP, see 15. If you are unfamiliar with WAsP or microscale modelling you are urged to contact a reputable wind energy specialist or consultant to help in assessing your needs.**

14. **Note, that although the WAsP software has been used in this guideline it should be possible to use any similar software (WindPro, GH WindFarmer etc.) to view the .lib file.**

15. **Microscale Modeling**

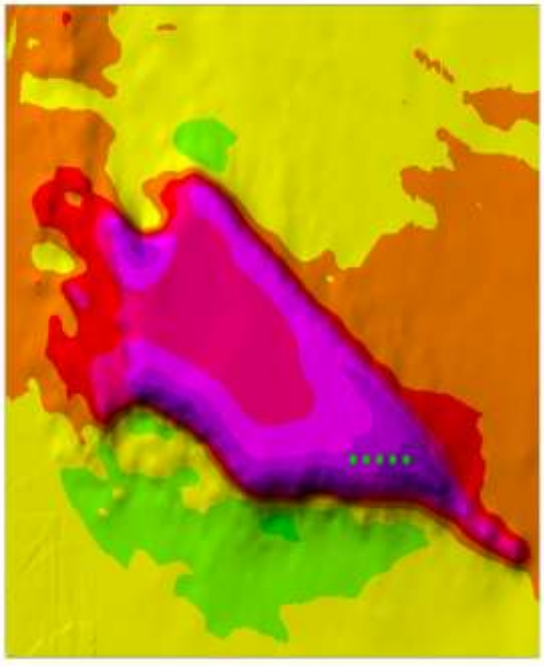
The Numerical Wind Atlas and database assume a flat, uniform terrain, with no obstacles and with 3 cm roughness (e.g. farmland with open appearances) everywhere. I.e. it ignores surface effects such as elevation (e.g. hill that can speed up the wind), roughness (e.g. forest that can slow down the wind), obstacles etc. It is then very likely that the Numerical Wind Atlas will over- or under-predict the mean local wind speed and power density.

Numerical Wind Atlas



Grid cell size 5120 m
Wind farm of five 2 MW turbines
Estimated AEP = 39 GWh

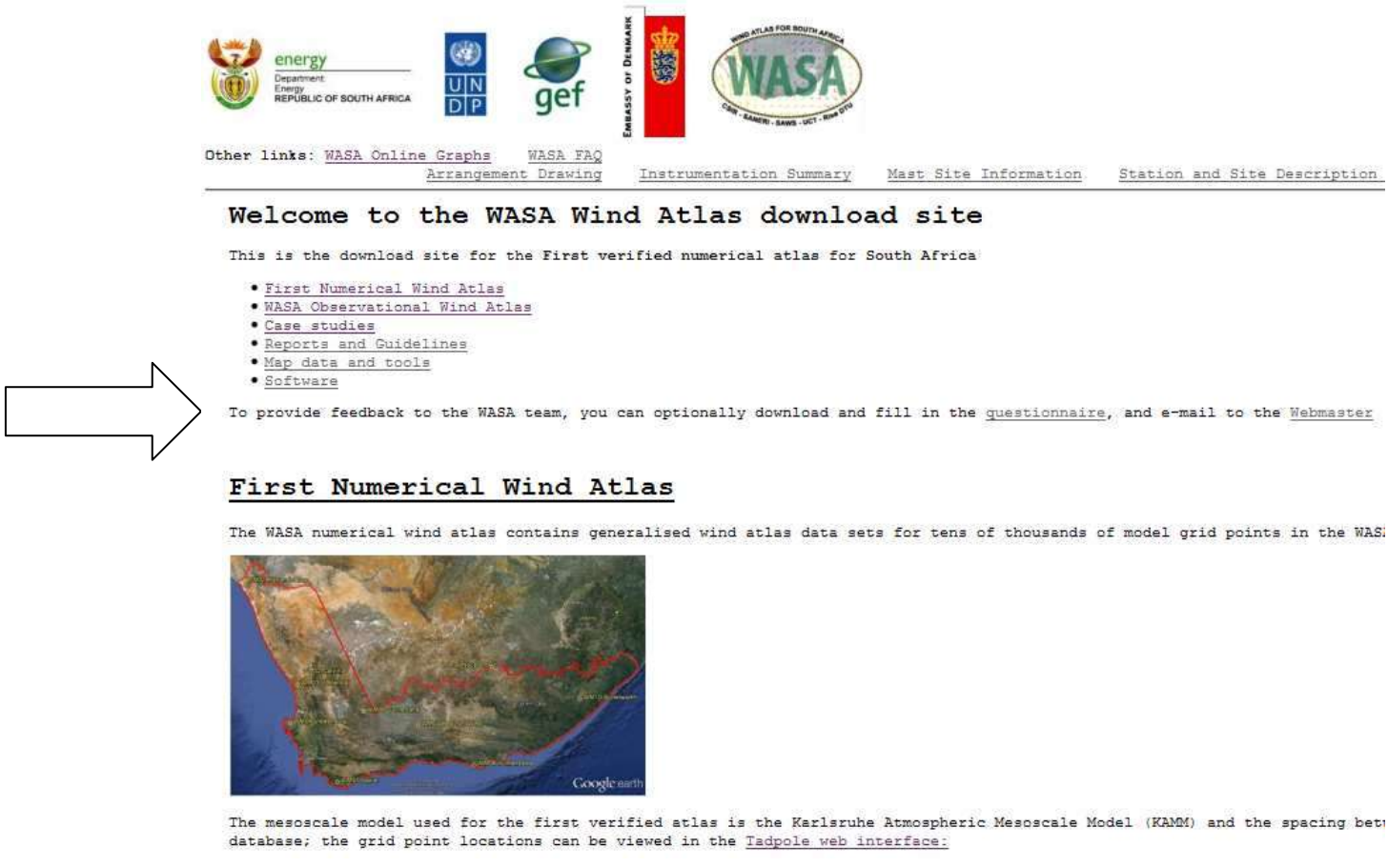
Microscale Modeling



Grid cell size 20 m
Wind farm of five 2 MW turbines
Estimated AEP = 55 GWh

Microscale modeling of the surface effects such as elevation, roughness, obstacles etc. that results in a more accurate prediction of the local wind climate and therefore wind farm planning, layout and wind resource assessment is called downscaling and requires a fully licensed version of WAsP or similar software and professional assistance to set up and run the software. **See Planning and Development of Wind Farms (Risø-I-3272)(ed.2)**

16 Please complete the questionnaire and provide feedback on your experience.



PLEASE NOTE. While the application of the Numerical Wind Atlas NWA assists anyone, for free, to explore the generalised wind climate for every 5km x 5km (about 15000 data points on the NWA), it does not substitute the need for proper wind measurements which is a usual requirement for funding.

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