

Wind Atlas for South Africa (WASA)

Western Cape and areas of Northern and Eastern Cape

Project brief – November 2012

Acknowledgements

The Wind Atlas for South Africa project is an initiative of the South African Government, Department of Energy (DoE), 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 Development Institute (SANEDI) is the Executing Partner, coordinating and contracting contributions from the implementing partners: CSIR, UCT, SAWS, and DTU Wind Energy.

Immediate objectives

To improve knowledge and quality of wind resource assessment methods and tools, as well as to ensure availability of tools and data for planning and application for wind farm developments, off-grid electrification and extreme wind studies.

Main outputs

The project will provide an updated overview of the wind climate based on reliable wind data using contemporary models and the following main results:

- Measurement stations, data acquisition systems and data for verification for a total of 3-years

- First Verified Numerical Wind Atlas according to standard proven and tested method after 1 year of measurements
- Researched wind atlas after 3 years of measurements

All results in public domain

Roles

SANEDI – coordination and dissemination

UCT – mesoscale modelling

CSIR – measurements and microscale modelling

SAWS – extreme wind assessment

DTU Wind Energy* – partner in all activities

* DTU Wind Energy: previously Risø DTU



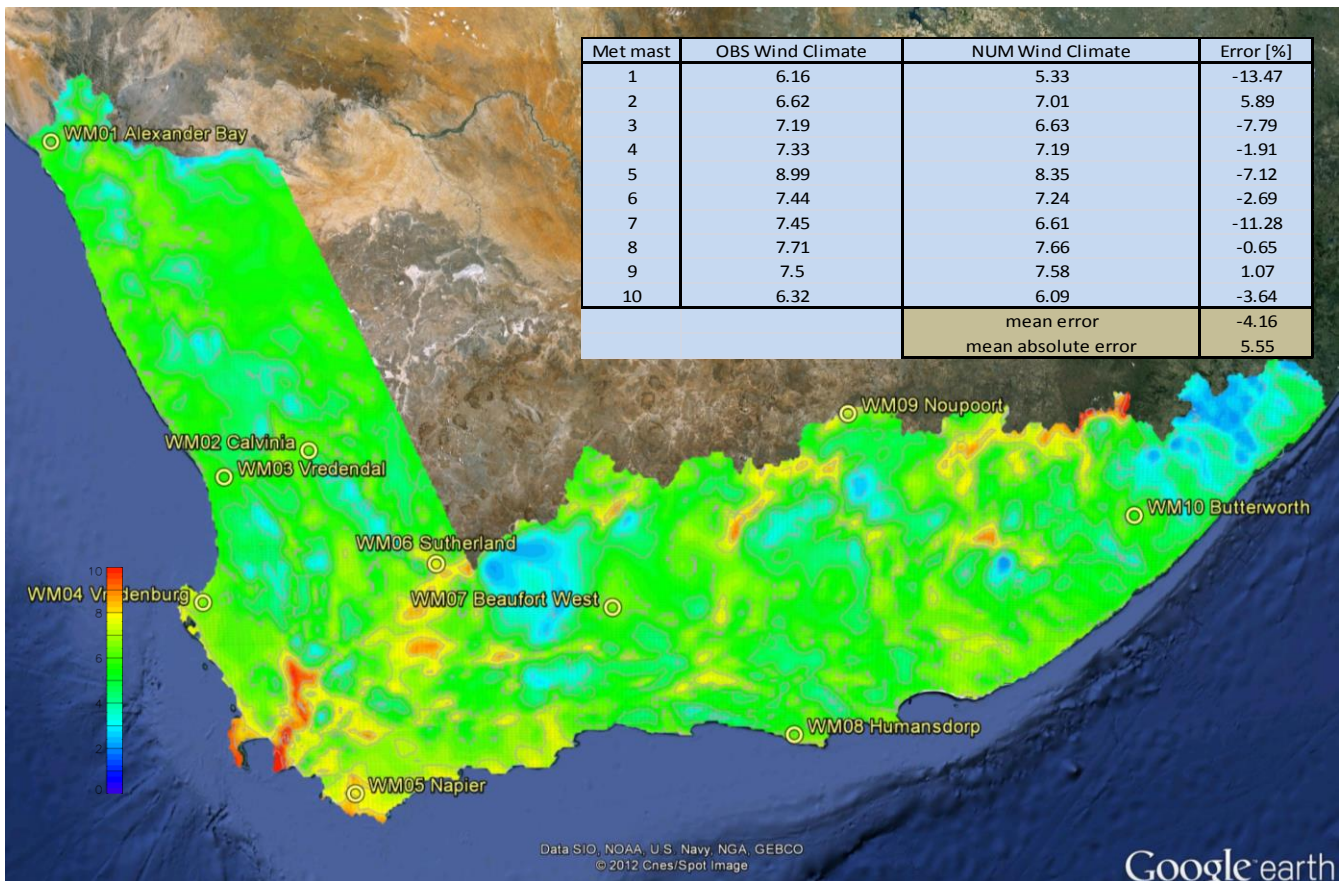
Project plan and selected initial highlights

Milestones according to work plan

30 June 2009	Project Commencement at contract signature
March 2010	First public project workshop presenting <ul style="list-style-type: none"> • Project plans, methods and tools • First unverified wind atlas
July/August 2010	10 WASA measurement stations in operation
September 2010	Monthly wind data publishing on web-site activated
September 2011	1 year of data QA'ed. Site and station description reports for microscale modelling at the 10 WASA measurement stations.
March 2012	Midterm Workshop presenting <ul style="list-style-type: none"> • First Verified Numerical Wind Atlas for South Africa – standard proven and tested method after 1 year of measurements
February 2014	Final Workshop and Wind Seminar presenting <ul style="list-style-type: none"> • Researched wind atlas • Extreme wind atlas

Work Package 1: Mesoscale modelling

Model set up and calculations have been made both at DTU (KAMM and WRF) and at UCT (WRF). WRF wind forecasts are available on: <http://veaonline.risoe.dk/wasa>. Work to refine model set up, terrain descriptions and parameterisation as well as the verification shown in table below has been done based on 1 year of measured WASA data. 2nd year of data available by Oct2012 leads to small change in mean error. Measured mean wind speeds at 61.5 m height for 1 Year and 2 Years are shown in table p. 3 (Work Package 2). The KAMM based Verified Numerical Wind Atlas (VNWA) database, report, verification and guide how to use it is available on the WASA data download site <http://wasadata.csir.co.za/wasa1/WASAData>.



First Verified Numerical Wind Atlas for South Africa - Generalized climatological (30-year) annual mean wind speed [m/s] 100 m above ground level, flat terrain, 3 cm roughness everywhere

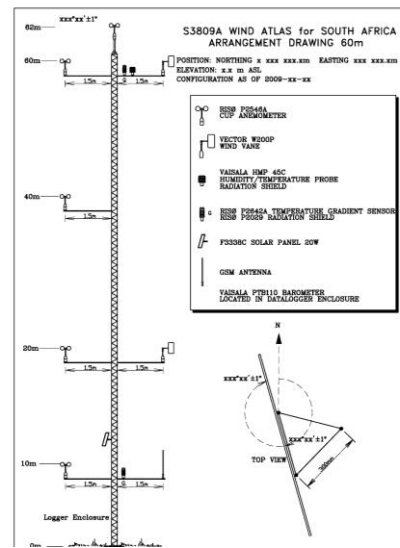
Work Package 2: Wind measurements

Ten lattice-type, 60-m wind masts installed at sites selected primarily for their use for verification of mesoscale modelling in the project areas of Western, Northern and Eastern Cape. Mast locations and numbering is shown in the map. 10 minutes statistics data are collected at CSIR, and graphs are made available automatically for viewing online on the project web site <http://www.wasa.csir.co.za>.



WASA	Data recovery (%)	U _{mean} @ 61.5m (m/s) 1 Year	U _{mean} @ 61.5m (m/s) 2 Years
WM01	100.0	5.86	6.02
WM02	100.0	6.21	6.10
WM03	100.0	7.09	7.09
WM04	100.0	6.59	6.65
WM05	97.9	8.64	8.57
WM06	100.0	7.02	7.13
WM07	100.0	6.85	6.87
WM08	100.0	7.36	7.38
WM09	98.1	7.58	7.81
WM10	92.4	6.55	6.55

Some photos from the installation work and a sketch of the instrumentation on the 10 measurement masts are shown below. Further details are also available on the project web site <http://www.wasa.csir.co.za>.



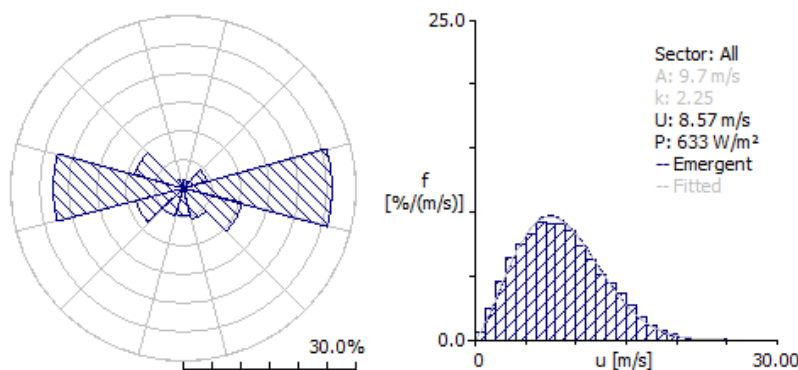
Monthly data files are made available for download for anyone entering their registration information. Registration includes your coordinates, affiliation and the intended type of use. About a week after the end of each month, the wind data from each station (after some QA by the project team) will be made available from <http://wasadata.csir.co.za/wasa1/WASAData>. More than 2 years of data is available.

Please always make sure to get the latest version of any dataset reflecting findings of the ongoing QA process.

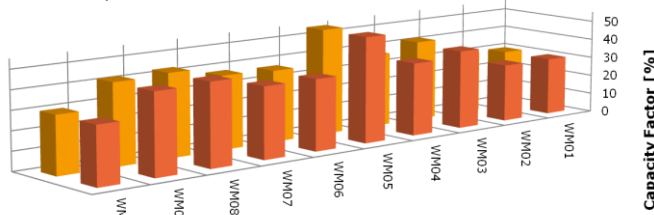
Work Package 3: Microscale modelling

A microscale workshop for all project partners was held in November 2009, introducing and discussing tools and methods. WASP and the Wind Atlas Method is being used for wind data analysis and wind resource mapping. Some guidance how to do this is available on <http://www.wasa.csir.co.za>.

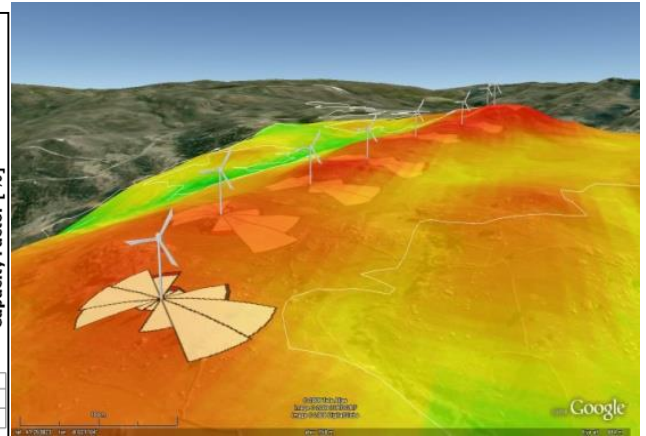
Land-use data have been extracted and further detailing of stations and surroundings at the 10 WASA masts have been made. Databases of statistical distributions and observational wind atlases for 1 year as well as after 2 years of measurements are available in the Observational Wind Atlas (OWA) for 10 met. stations in Northern, Western and Eastern Cape provinces at <http://wasadata.csir.co.za/wasa1/WASAData>. See WM05 wind rose and wind speed distribution for 2 years (Oct2012-Sep2012) below:



Capacity Factors - WASP predictions based on 1 year and 2 years of WASA data. Theoretical values for a 2-MW wind turbine assuming 100% availability, no wakes, no losses



	WM01	WM02	WM03	WM04	WM05	WM06	WM07	WM08	WM09	WM10
■ 2-MW YEAR 1	30	32	42	38	55	37	38	43	42	30
■ 2-MW YEAR1+YEAR2	30	30	41	38	55	37	37	43	42	30



Work Package 4: Application

First Verified NWA and OWA at 10 WASA mast locations were launched and available for application from 13 March 2012. Calculations for 2-MW wind turbine (80 m hub height, 90 m rotor diameter) at each mast position using the OWA (1 year and 2 years) are shown in table above. Application of the NWA enables and extends, beyond the 10 WASA mast areas to the entire WASA modeling domain with data available every 5 km x 5 km – corresponding to approximately 15000 virtual masts. SAWEP Workshop, 4 March 2010, and Mid-term Workshops 14 and 16 March 2012 as well as guidance on the WASAData web site describe WASA methods, tools, products and their application - http://www.saneri.org.za/wind_atlas.htm and <http://wasadata.csir.co.za/wasa1/WASAData>.

Work Package 5: Extreme winds

PhD work initiated by SAWS and supported by this project since June 2009 was completed - “Wind Climatology of South Africa relevant to the Design of the Built Environment” in 2010. The PhD research contains a.o. study of prevailing macroclimate, extreme value theory, statistical analysis of strong wind data with different approaches and methodologies, development of new 1:50 year maps. The WASA project will further develop and apply methods related to exploitation of the results of WP1, WP2 and WP3.

Work Package 6: Documentation and dissemination

The WASA project is presented at conferences and seminars, e.g.

- Wind Energy Seminar, Pretoria, 23 January 2009,
- Wind Power Africa conferences, Cape Town, 2010, 2011, 2012
- Windaba conferences, Cape Town, 2011, 2012

Presentations and links to information are available at the SANEDI web site

<http://www.wasaproject.info/>.

Disclaimer

It should be noted that any use of any WASA data is at own risk according to disclaimer on the web sites.