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Developing a wind atlas for South Africa

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The generation of the first verified Wind Atlas for South Africa (WASA) has been a joint undertaking between South African and Danish scientists to provide stakeholders with the best possible information about the wind climate over South Africa. The project is funded by the Royal Danish Embassy, the United Nations Development Programme, the South African Wind Energy Programme and the South African National Energy Development Institute.

The project has focused on the western and southern regions of the country and includes a number of activities:
1. An observation campaign during which ten 65 metre masts were erected at selected sites with instruments at 4 levels that have recorded 2 years of data so far, this is ongoing.
2. Mesoscale and micro-scale modelling that consists of two phases. The first phase is complete and used the Karlsruhe Atmospheric Mesoscale Model (KAMM) run at 5 km with the Wind Atlas Analysis and Application Program (WAsP) to generate a wind atlas for the western and southern parts of South Africa. This is a statistical-dynamical method that assumes there is a robust relationship between meteorological situations at the large-scale and meteorological situations at the small-scale. The second phase, to be completed by the end of 2013, will develop a numerical wind atlas using the Weather Research and Forecasting model (WRF) to develop the mesoscale wind climate (4 km resolution) with a continuous 30 year integration from 1980 to 2010. This is a fully dynamical method. The WAsP model will again be used to develop the micro-scale wind climate.
3. An extreme wind climate assessment has identified extreme wind producing synoptic systems, their seasonal and spatial characteristics as well as regions in South Africa particularly prone to extreme wind conditions.
4. New wind climate assessment techniques have been developed in the production of the wind atlas and new techniques to produce the numerical wind atlas will be formulated.
5. Dissemination of all data from the mast observation data as well as the wind atlas itself through a web-based interface to the stakeholders and the general public at no cost.

Verification of the KAMM-WAsP wind atlas against mast data has indicated that error values are in line with international norms (average mean error of -4.16%) and that wind resources in many parts of the country have favourable capacity factors (average of 30%). However, this method does not capture well the observed wind climate in a region where the wind regime is strongly diurnal and thermally driven. Here, initial tests with WRF have indicated better results. We will present results from each of the project sections above, including the verified wind atlas, as well as some preliminary results from the development of the numerical wind atlas.