Forecasting and Characterising Grid Connected Solar Energy and Developing Synergies with Wind

An ASI enabling research project involving

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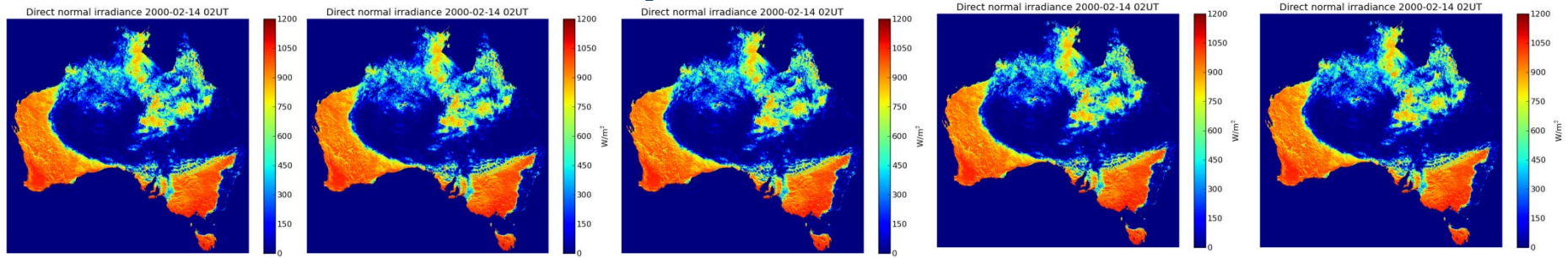
Climate Change Research Centre, UNSW – Steven Sherwood

University of South Australia – John Boland

The Australian PV Association – Muriel Watt

Epuron – Martin Poole

Bureau of Meteorology – Data Services Division – Ian Muirhead



Introduction

- **Stage 1: Data Analysis – Characterising Variability**
  - **Analysing weather data and insolation**
  - **Identifying weather patterns that correlate to periods of high and low power production**
  - **Predictability of these weather events at appropriate levels of aggregation**

- **Stage 2: Develop Forecasting Tools**
  - **Approach 1: predictive model utilising a NWP and climate models**
  - **Approach 2: using classical time series for the sub-hourly timescale**

- **Stage 3: Managing Large Penetrations of Renewables**
  - **Investigate output from individual solar energy systems and groups of systems**
  - **Compare output from systems and electricity loads on the distribution and transmission network**

The Project

- **Stage 1: Data Analysis – Characterising Variability**
  - **Analysing weather data and insolation**
    - **12 years of satellite data (320GB) at 5km x 5km x hourly resolution**
    - **10 years of meteorological station data**

Stage 1

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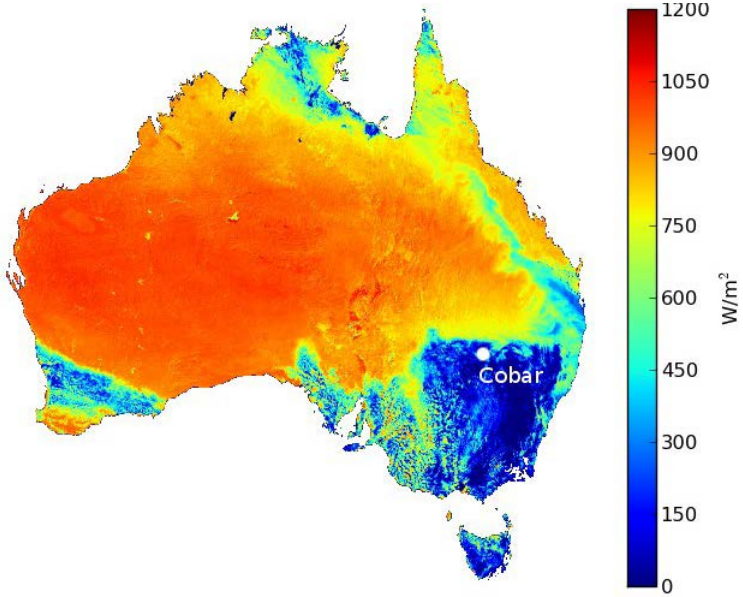

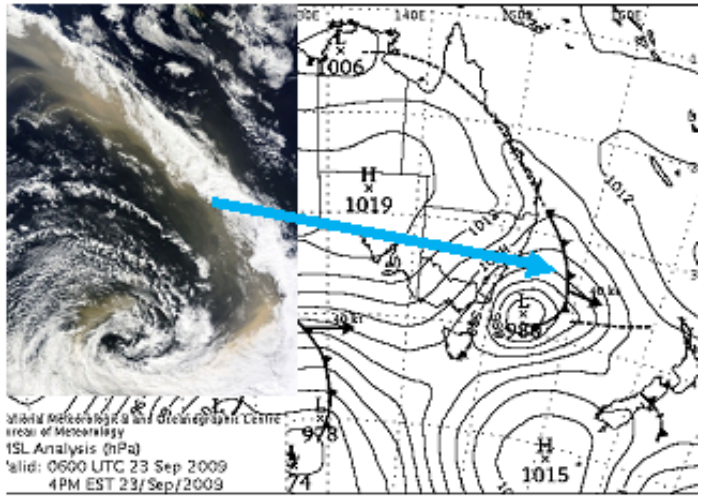

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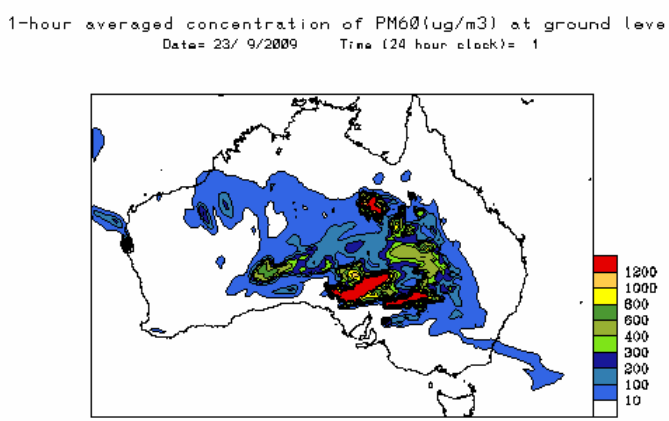

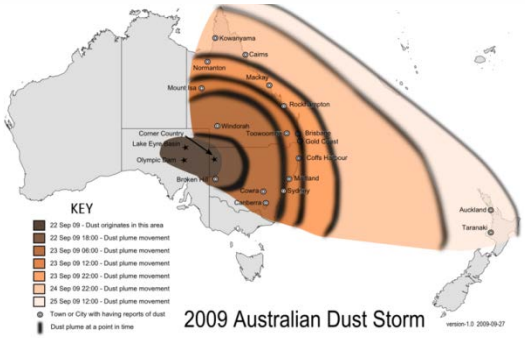

http://www.phys.unsw.edu.au/dust-storms/

http://www.csiro.au/resources/dust-storm-animations.html

http://en.wikipedia.org/wiki/File:2009_Dust_Storm_-_Australia_and_New_Zealand_Map.png

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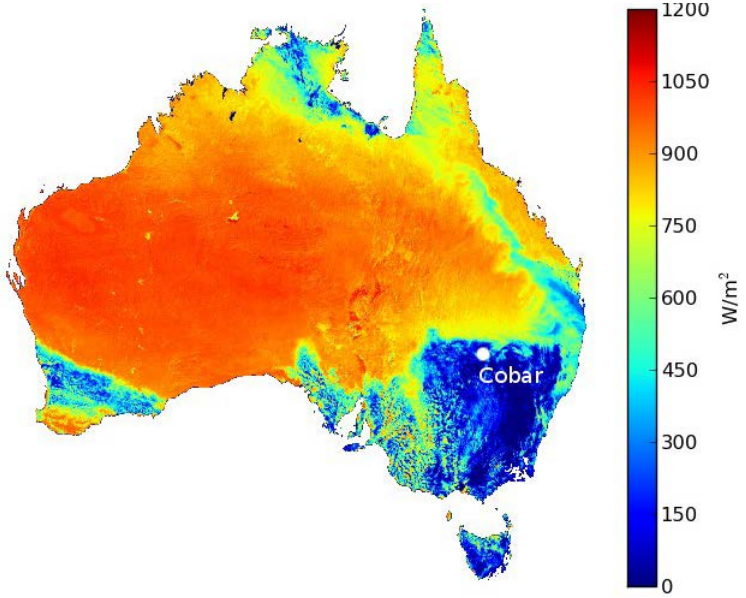

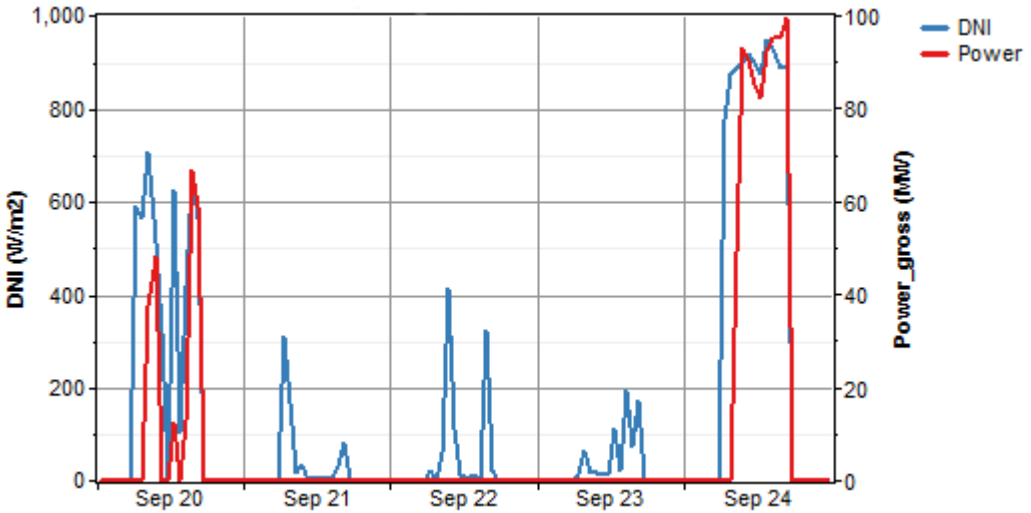

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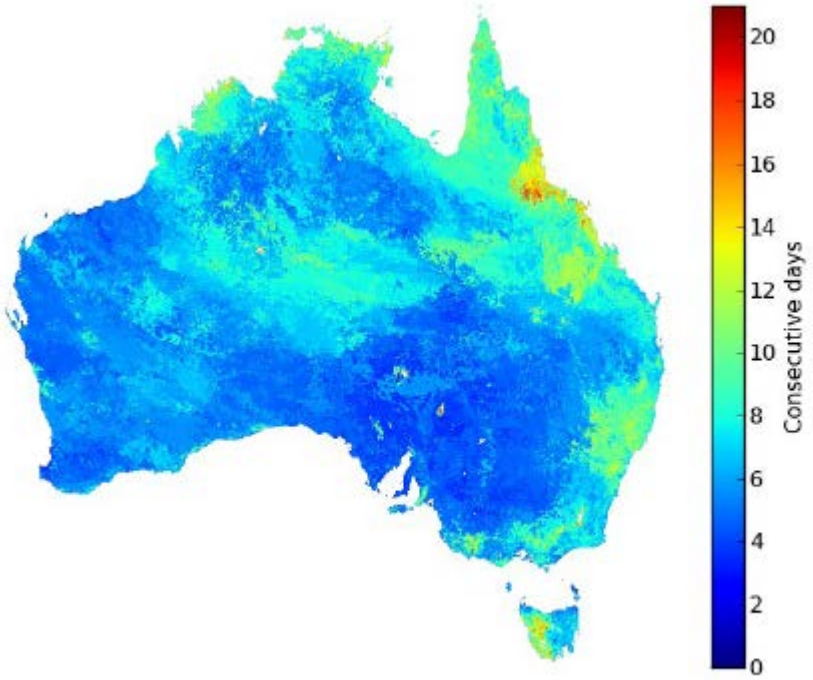

Length of longest 'lulls' – DNI < 400 W/m^2

Activities of the Project

- **Stage 2: Develop Forecasting Tools**
  - **Approach 1: predictive model utilising a NWP and climate models**
  - **Approach 2: using classical time series for the sub-hourly timescale – John Boland/Huang Jing**

- **Stage 3: Managing Large Penetrations of Renewables**
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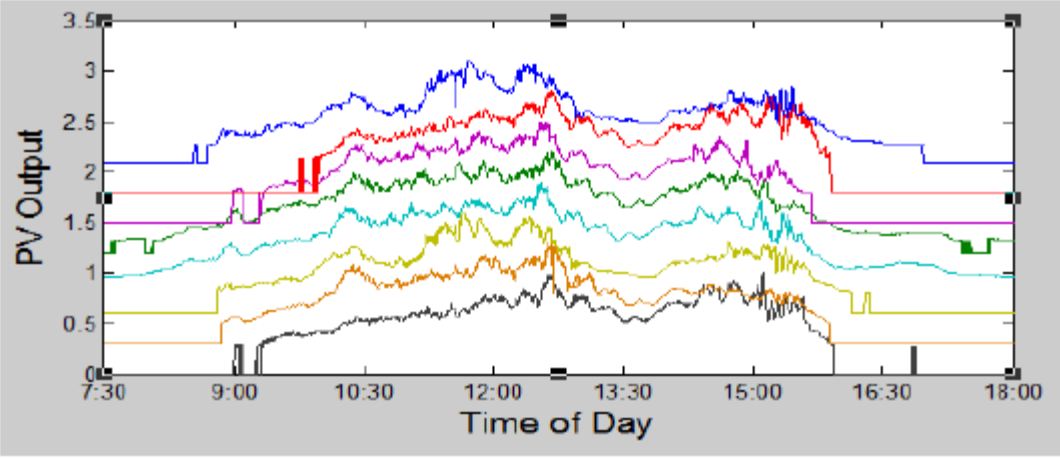

1) Overall Variability of the System

2) Aggregated Variability

3) Variability Hour to Hour

4) Variability According to Cloud Cover

Operational Characteristics of a Cluster of Distributed Photovoltaic Systems
S. F. Heslop and I.F. MacGill

Project Outcomes

- **Develop metrics for deciding suitability of a site for any given configuration of solar and wind technology by examining the characteristics of weather variability – data analysis and characterising variability. Results from this will feed into (ii).**

- **Develop a real-time forecasting scheme for the prediction of energy output from solar technologies in line with National Electricity Market (NEM) dispatch timeframes. This can be used to more efficiently manage resource fluctuations.**

- **Develop strategies to manage high levels of solar penetration under various network conditions.**

Using classical time series for forecasting

- **Stage 2: Develop Forecasting Tools**
  - **Approach 2: using classical time series for the sub-hourly timescale – John Boland/Huang Jing**