Solar Radiation Data for Over 100 Australian Sites





Trevor Lee





Solar Irradiation of Key Surfaces in Oodnadatta

Timeline

- **1974 Spencer Tables Spencer**
- **1976 Pioneering work of Paltridge and Proctor**
- 1988 First Edition: Australian Solar Radiation Data Handbook (ASRDH) Frick et al
- **1991** Major error in was first revealed by Lee
- **1992 Second Edition: Corrected Version of the ASRDH**
- **1995** Third Edition of the ASRDH
- **2006** Fourth Edition of the ASRDH
- 2012 Fifth Edition of the ASRDH

Data Source

Australian Government – Bureau of Meteorology – BOM



American Society of Heating, Refrigerating and Air-Conditioning Engineers, ASHRAE



Data Source BOM

Australia divided into a Grid with intervals

- 0.05 degrees Latitude
- •0.05 degrees Longitude
- Almost 280,000 pixels
- Approximately 5km X 5 km each

Data

- •1998 mid 2001
- •mid 2003 2010

Hourly GHI + DNI

- Global Horizontal Irradiance W/m²
- Direct Normal Irradiance W/m²

Data Source ASHRAE

- Selected from 268 sites in Australia
- Monthly Data
- Clear Sky Values of radiation
- Interpolation method relies on ASHRAE data

BCA – Geographic Coverage



Geographic Coverage – New Zealand





ASRDH Version 4 – Geographic Coverage



Legend for Location (listed in descending order of accuracy):

Red G&D Locations using both global and diffuse measurements

Orange G Locations using global radiation measurements only, with the diffuse radiation estimated

Blue EST Locations using only estimated data from cloud cover records

Radiation Network Status 2008

Bureau of Meteorology Radiation Network Status

October 2008



ASRDH Version 5 – Geographic Coverage



Geographic Spread of 99 Sites of the ASRDH Edition 5 plus Willis Island (overlayed on a sample single-hour image from the Exemplary ASEA comprising nearly 280,000 pixels with individual values estimated from satellite observations)

ASRDH Version 5 – Geographic Coverage



Geographic Spread of the 20 extra ASRDH Edition 5 sites (extra in addition to the 80 Sites of the ACDB 2008) (overlayed on a sample single-hour image from the Exemplary ASEA comprising nearly 280,000 pixels with individual values estimated from satellite observations)

Additional Tables

Average Clear Sky

- Clearness Index
- Direct and Global hourly and daily irradiance on a horizontal plane
- Total Hourly and Daily irradiance on a North facing plane inclined at latitude angle for each month
- Total Hourly and Daily Irradiance on a North, East, South, and West facing Vertical Plane

Solar Angles

- Azimuth
- Altitude

AuSolRad Version 3

User selects:

- Orientation in 1° increments
- Tilt in 1° increments (including facing down)
- Depth of overhang
- Reflectivity of the "ground"

AUSOLRAD produces:

 Tables for all geometries of engineering and architectural interest including single and double axis tracking

ASRDH - Sample Graphical Summary



Hobart as a Sample of the Spatial Variation Mapped for Capital Cities

ASRDH - Sample Graphical Summary



Hobart as a Sample of the Spatial Variation Mapped for Capital Cities Seasonal Variation

ASRDH - Sample Graphical Summary



Geographic Spread of the 28 Sites of the ASRDH Edition 4 (overlayed on a sample single-hour image from the Exemplary ASEA comprising nearly 280,000 pixels with individual values estimated from satellite observations)

Exemplary ASEA

The Exemplary Australian Solar Energy Atlas (EASEA, inhouse Exemplary Energy software) was developed to visualise the GHI+DNI data on a PC screen, without an expensive GIS system

Challenge:

- To creating hourly data on the hour, as the locations are read at different times within the hour
- Interpolating the data minute by minute is utilised

Exemplary ASEA - Sample Graphical



Quality Assurance

- Minute-by-minute interpolation
- ACDB or TMY accumulation
- Cap values at 110% Clear Sky
- Cap DNI at DHI = 90% GHI
- Compare with BOM and other reliable ground stations
- Select nearby "pixel" when >50% sea

Detailed Comparisons - Beam



Detailed Comparisons – Diffuse



Conclusions

- Solar and Coincident Weather Data for almost anywhere in Australia
- Can target Large Scale Solar Deployment
- Reduces uncertainty in the peak and average output
- Key sites for publication
- Real time data series
- Exemplary Australian Solar Energy Atlas

Solar and Coincident Weather Data for Large Scale Solar Deployment

Questions?





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Climate Data for Renewable Energy and Energy Conservation Applications

The Australian Solar and Climate Resource

• Australian Solar Radiation Data Handbook background and applications

Beyond TMY: Climate Data for Specific Applications

• Australian Climate Data Bank and using Reference Meteorological Years

Creation of Ersatz Future Weather Data Files

 Measuring energy performance of buildings under predicted future weather conditions

Associated Papers

- CREATION OF ERSATZ FUTURE WEATHER DATA FILES (Solar 08)
 - Trevor Lee and David Ferrari
 - Energy Partners, Master Builders Centre, 1 Iron Knob Street, Fyshwick PO Box 1211, ACT 2609, Australia
- AUSTRALASIAN SOLAR RADIATION DATA PROPOSAL FOR ENHANCED KNOWLEDGE DISSEMINATION (Solar 08)
 - Trevor Lee
 - Energy Partners, Master Builders Centre, 1 Iron Knob Street, Fyshwick PO Box 1211, ACT 2609, Australia
- THE AUSTRALIAN CLIMATIC DATA BANK (Solar 06)
 - Trevor Lee and Mark Snow
 - Energy Partners, Master Builders Centre, 1 Iron Knob Street, Fyshwick PO Box 1211, ACT 2609, Australia
- DEVELOPMENT OF CLIMATE DATA FOR BUILDING RELATED ENERGY RATING SOFTWARE (Solar 05)
 - Barbara Ridley and John Boland
 - Centre for Industrial and Applicable Mathematics University of South Australia Mawson Lakes Boulevard, Mawson Lakes SA 5095, Australia