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Weather, Climate and Solar Data

for

Australian Locations

Data Prepared By

Exemplary Energy

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1. Copyright and Licence

Upon payment of invoiced fees, Exemplary Energy grants the client a licence allowing unlimited internal use of the data provided, but the data itself remains the property of the Bureau of Meteorology (BOM) and the data selection for its typicality and its formatting remains the copyright and property of Exemplary Energy.

Satellite-derived solar Global Horizontal (GHI) and Direct Normal Irradiance (DNI) estimates are based on images from the Geostationary Meteorological Satellite GMS-5, Geostationary Operational Environmental Satellite (GOES-9) and MTSAT-1R satellites, which are provided with permission of the Japan Meteorological Agency (JMA) and the United States National Oceanic & Atmospheric Administration (NOAA). Any use of products from this imagery requires acknowledgement of the satellites of JMA and NOAA as the original source of the satellite data, and acknowledgement of the Commonwealth of Australia (Bureau of Meteorology) which received and processed the images.

Acknowledgement should be in the form: *"Solar radiation data derived from satellite imagery processed by the Bureau of Meteorology from the Geostationary Meteorological Satellite and MTSAT series operated by Japan Meteorological Agency and from GOES-9 operated by the National Oceanographic & Atmospheric Administration (NOAA) for the Japan Meteorological Agency."*

2. Location Definition

The client nominates the location(s) by longitude and latitude. Note that the deviation is approximately 0.01 degree per kilometre. For example see below where the Elevation in metres and the BCA Climate Zone have been added to assist in selection of alternative sites with superior data quality.

Location	Latitude	Longitude	Elevation (m)	BCA Climate
Cloudbreak, WA	22.32S	119.39E	470	3
Lake Cargelligo, NSW	33.40S	146.30E	219	4

The solar data time series are extracted from the latest commercially available gridded data sets using the current version of EASEA[i].

3. TMY Selection Algorithm

We develop a Typical Meteorological Year (TMY)[ii] by concatenating the twelve Typical Meteorological Months[iii] (TMM) that each most closely fits the longer term average (currently data from 1990 to 2013).[iv] Note that this is usually a different calendar year for each month for each location.

The solar data available from the BOM includes a 24 month gap as a result of satellite failure which has been patched by the BOM with data of inferior quality and it can be excluded from our calculations. The 2 year gap is from 1st July 2001 to 30th June 2003.

A summary of years chosen in 2013 as TMM for each month can be shown, as in the example Table 1.

	Cloudbreak	**Lake Cargelligo**
Jan	1999	2008
Feb	2006	2009
Mar	2005	2010
Apr	1999	2009
May	2000	2007
Jun	2008	2001
Jul	2000	2006
Aug	1999	1999
Sep	1998	2009
Oct	2007	2009
Nov	2009	1999
Dec	2008	2004

Table 1 – Summary of year chosen as TMY for the corresponding month

4. Hourly Values Capping Algorithm

Prior quality assurance work comparing BOM satellite estimated data with BOM ground-based measurements in Darwin, Alice Springs and Tullamarine (Melbourne) suggest significant overestimation at low solar altitudes. Accordingly, we routinely apply a capping algorithm to reduce this impact as described below. We can include the solar geometry and theoretical indicative (but not maximum) clear sky values in the data sets for client direct comparison.

1. GHI data is capped at 110% of indicative clear sky data generally.
2. Where GHI is capped, Diffuse Irradiance (DIF) is capped proportionally with GHI and Direct Normal Irradiance (DNI) is calculated accordingly (GHI = DHI[v] + DIF) and this DNI value replaces the DNI value in the BOM satellite estimated data.
3. DNI data is capped at 110% of indicative clear sky Direct.

5. Time Stamp Convention

1. Solar data is supplied by BOM at 60 minute intervals but the time of the observation is off the clock hour and is specific to each Location as each scan of the continent takes several minutes.

2. Hourly data provided by Exemplary Energy is stamped for the local standard time (e.g. 0 to 23 hours in CSIRO (ACDB) format and 1 to 24 in both EPW and TMY2 format).

3. In keeping with the convention of the Australian Climate Data Bank (ACDB) for solar data, each hourly value is calculated based on the minute by minute interpolated value from 30 minutes before the hour to 30 minutes after the hour.

4. Hourly values are calculated precisely for the capping algorithm and for the temporal interpolation and the result is recorded as the nearest integer value to avoid spurious implications of accuracy of any individual value.

5. Alternatively, in keeping with the convention of the TMY2 and EPW formats for solar data, each hourly value is calculated based on the minute by minute interpolated value for 60 minutes before the hour stated (1 to 24 hours).

6. Notes

[i] Exemplary Australian Solar Energy Atlas, proprietary software from Exemplary Energy.
[ii] When used for regulatory purposes in Australia these are referred to as Reference Typical Meteorological Years (RMYs).
[iii] This obviates the chance of selecting a calendar year with one or more extraordinary months (like a sunny winter balancing a cloudy summer in the one calendar year).
[iv] Where the file includes more than one weather element we apply the weightings chosen by NREL and published as Marion, W. and Urban, K. 1995, "User Manual for TMY2", National Renewable Energy Laboratory, Colorado, USA. Other weightings can be nominated by the client and have been canvased by Exemplary Energy. See 2011 - IBPSA Building Simulation Conference - Climate Data for Building Optimisation at http://www.exemplary.com.au/publications.html.
[v] Direct Horizontal Irradiance = DHI