



Gridded Hourly Solar Global Horizontal Irradiance Metadata

Dataset	
Title	Hourly solar global horizontal irradiance
Custodian	
Custodian	Bureau of Meteorology
Jurisdiction	Australia
Description	
Abstract	Solar global horizontal irradiance (GHI) is the instantaneous intensity of solar energy falling on a horizontal surface. This product is derived from hourly satellite data. It gives a single instantaneous GHI value for every hour, at the time of the satellite observation. Typical values for GHI are up to around 1000 W/m ² (watts per square metre). The values are usually highest in the middle of the day and around summer, with localised variations caused mainly by variations in atmospheric conditions, primarily cloudiness. See LINEAGE below for more information.
Search Word(s)	Gridded, satellite, solar, radiation, irradiance, GHI, meteorology
Geographic Extent Names(s)	Australia
General Category	Gridded data
General Custodian	Australian Government
Jurisdiction	Australia
Geographic Extent Polygon	Not applicable
Geographic Bounding Box	See below
North Bounding Latitude	-10.05
South Bounding Latitude	-43.95
East Bounding Longitude	153.95
West Bounding Longitude	112.05
Beginning Date	1 January 1990
Ending Date	Ongoing
Dataset Status	
Progress	Completed
Maintenance and Update frequency	Extensions will be issued three-monthly. A revision of the entire dataset is planned for July 2013. Infrequent subsequent revisions may be issued.

Access												
Stored Data Format		Arc/Info grids – all Australia										
Available Format Type		ASCII row major.										
Access Constraint		<p>Satellite-derived solar global horizontal irradiance estimates are based on images from the Geostationary Meteorological Satellites GMS-4 and GMS-5, Geostationary Operational Environmental Satellite (GOES-9), and the MTSAT-1R and MTSAT-2 satellites, which are provided with permission of the Japan Meteorological Agency (JMA) and the United States National Oceanic & Atmospheric Administration (NOAA).</p> <p>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.</p> <p>Acknowledgement should be in the form: “<i>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</i>”</p> <p>Please contact us (see details below) for more information.</p>										
Data Quality												
Lineage		<p>The Bureau of Meteorology’s computer radiation model uses hourly visible images from geostationary meteorological satellites to estimate hourly instantaneous solar global horizontal irradiance (GHI) at ground level.</p> <p>At each location in each satellite acquired image, the brightnesses are averaged over each grid cell and used to estimate GHI at the ground. Essentially, the GHI at the ground can be calculated from the GHI at the top of the earth’s atmosphere, the amount absorbed in the atmosphere (dependant on the amount of water vapour present), the amount reflected from the surface (surface albedo) and the amount reflected from clouds (cloud albedo). These GHI values were produced by reprocessing archived raw satellite data using software that was extensively rewritten in 2006, but based on the two-band physical model (Weymouth and Le Marshall, 2001) that has been the basis of the Bureau of Meteorology’s satellite solar radiation system since 2000. Thumbnail images of all GHI grids were inspected and anomalous grids, due to satellite images that were noisy or otherwise anomalous, were rejected.</p> <p>The August 2012 release of this dataset introduced a bias correction of the GHI values. The previous version of this dataset had no bias correction. The GHI bias is corrected by a model derived from comparisons of the satellite estimates with ground-based radiation observations from the Bureau of Meteorology’s radiation monitoring network. The model is fitted on an annual basis as a function of the cosine of the solar zenith angle and the atmospheric transmittance (also known as clearness index). The bias correction is imperfect.</p> <p>The satellite data were acquired from the following satellites and instruments.</p> <table><tr><td>Start date</td><td>End date</td><td>Satellite</td><td>Instrument</td></tr><tr><td>1990-01-01</td><td>1995-06-10</td><td>GMS-4</td><td>VISSR</td></tr></table>			Start date	End date	Satellite	Instrument	1990-01-01	1995-06-10	GMS-4	VISSR
Start date	End date	Satellite	Instrument									
1990-01-01	1995-06-10	GMS-4	VISSR									

1995-06-11	2003-05-20	GMS-5	VISSR
2003-05-21	2005-10-31	GOES-9	GOES I-M Imager
2005-11-01	2010-06-30	MTSAT-1R	JAMI
2010-07-01	2012-06-30	MTSAT-2	JAMI

GMS is the Geostationary Meteorological Satellite series operated by the Japan Meteorological Agency.

GOES is the Geostationary Operational Environmental Satellite system operated by the US National Oceanic and Atmospheric Administration.

MTSAT is the Multi-Functional Transport Satellite series operated by the Japan Meteorological Agency.

VISSR is the Visible and Infrared Spin Scan Radiometer.

JAMI is the Japanese Advanced Meteorological Imager.

The hourly irradiance gridded datasets cover Australia with a resolution of 0.05 degrees in latitude and longitude. For each day there are grids for up to eighteen times, labelled by the UT date and hour (without minutes) of the observation time. The grids for a particular local date start at 18 UT on the preceding UT date and end at 11 UT of the date. The irradiance units are watts per square metre (W/m^2).

The number of minutes of the observation time after the start of the hour varies smoothly with latitude in a manner that is fixed for each satellite and hour of the day, but which differs between satellites, and for some satellites between hours of the day. The number of minutes after the hour for each satellite and hour of the day is given by the following tables at 5-degree latitude increments. For GMS-4 (first table) separate scan times apply to three different date ranges.

Start date	1990-01-01		1993-01-01		1994-07-01	
End date	1992-12-31		1994-06-30		1995-06-10	
Latitude	GMS-4 A	GMS-4 B	GMS-4 A	GMS-4 B	GMS-4 A	GMS-4 B
-10.0	45.7	38.7	47.2	40.7	46.7	40.5
-15.0	46.7	39.7	48.2	41.7	47.7	41.5
-20.0	47.7	40.7	49.3	42.8	48.8	42.6
-25.0	48.7	41.7	50.2	43.7	49.7	43.5
-30.0	49.6	42.6	51.1	44.6	50.6	44.4
-35.0	50.5	43.5	52.0	45.5	51.5	45.3
-40.0	51.2	44.2	52.7	46.2	52.2	46.0
-44.0	51.8	44.8	53.3	46.8	52.8	46.6

Start date	1995-06-11		2003-05-21		2005-11-01	2010-07-01
End date	2003-05-20		2005-10-31		2010-06-30	Ongoing
Latitude	GMS-5 A	GMS-5 B	GOES-9 A	GOES-9 B	MTSAT-1R	MTSAT-2
-10.0	46.7	39.7	39.9	27.9	46.2	44.7
-15.0	47.7	40.7	41.0	29.0	47.2	45.7
-20.0	48.8	41.8	42.0	30.0	48.3	46.8
-25.0	49.7	42.7	43.0	31.0	49.2	47.7
-30.0	50.6	43.6	43.9	31.9	50.1	48.6
-35.0	51.5	44.5	44.7	32.7	51.0	49.5
-40.0	52.2	45.2	45.5	33.5	51.7	50.2
-44.0	52.8	45.8	46.0	34.0	52.3	50.8

A: UT hours 18 19 20 21 23 00 01 02 03 05 06 07 08 09 11

B: UT hours 22 04 10

	<i>Reference:</i> Weymouth G.T. and Le Marshall J.F. 2001. Estimate of daily surface solar exposure using GMS-5 stretched-VISSR observations. The system and basic results. Aust. Meteor. Mag., 50, 263-278.
Positional Accuracy	The satellite data on which the analyses were based have an associated resolution and typical accuracy of 0.01 degrees, although some individual images have errors of several km.
Attribute Accuracy	<p>The accuracy of the satellite-based GHI values is estimated by comparison with 1-minute averaged GHI measurements from Bureau of Meteorology surface-based instruments. The mean bias difference (average of the satellite - surface difference), calculated on an annual basis across all surface sites, is -4 to +2 W/m² and typically around -2 W/m². This is -0.5% of the mean irradiance of around 480 W/m². The root mean square difference, calculated on a similar basis, is around 110 W/m², which is 23% of the mean irradiance.</p> <p>The source of uncertainties associated with calculation of GHI includes uncertainties in:</p> <ul style="list-style-type: none"> • anisotropy of cloud-top reflectance; • water vapour in the atmosphere; and • satellite calibration. <p>It should be noted that a particular GHI value may not be representative of a 1-hour period, due to variations in the solar zenith angle during the hour, and most significantly because of variations in atmospheric conditions such as cloudiness.</p> <p>For more information (metadata) please contact us.</p>
Logical Consistency	Not applicable
Completeness	<p>The temporal coverage is not complete. A grid for a particular time may be missing if no satellite image was available, the image was not processed, or the image was rejected by quality control. Notably:</p> <ul style="list-style-type: none"> • No values are reported for the first two hours and last two hours of the day for the period up until 1994-06-30, due to the absence of satellite images at these times during the initial period of operation of GMS4. • The values are sparser during the period July 2001 to June 2003, which spans the period of reduced imaging frequency at the end of the life of GMS-5, and the initial few weeks of operation of GOES-9 in the Australian region.

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Metadata date	
Metadata date	28 February 2013
Additional Metadata	Additional information available on request (see contact above)