Data

TCTE/TIM Status

(updated 13 Jan. 2015)

Daily Observations Resumed: Starting in 2015 the TCTE resumed daily observations, making these latest data the most useful for solar and climate research while continuing the TCTE's original intent as a calibration transfer experiment. (See Summary of TCTE Observations.)

TCTE TIM measurements are updated daily about 7 days after acquisition.

TCTE TSI Data Files

Full mission downloadable data files updated nightly.

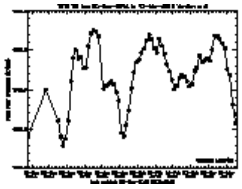
Instrument	Time Cadence	Spectral Coverage	Level	Version	Data Info	Full Mission Download	Interactive Access	File Readers(Listed by Language)
TIM	Daily	All	3	2	?	100 KB		IDL
TIM	6-Hourly	All	3	2	?	500 KB		IDL

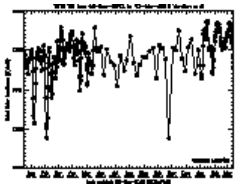
– text file – Interactive

If you use the IDL programming environment, the IDL routine read_lasp_ascii_file.pro may be used to read the above text files into IDL.

TCTE TSI Plots (Updated Daily)

Plots of the spaceborne TSI record and other TSI science nuggets are updated monthly here.





Most Recent 3 Month Plot	Full TCTE Mission Plot

See more TCTE TSI plots.

Data Product Description

The TIM instrument measures the total solar irradiance (TSI), monitoring changes in incident sunlight at the top of the Earth's atmosphere using an ambient temperature active cavity radiometer to an ultimate expected absolute accuracy of 350 parts per million (ppm, 1 ppm=0.0001%) (1-sigma) (although the V.1 accuracy is estimated at 1000 ppm) and a precision and long-term relative accuracy of 10 ppm per year. The standard Level 3 TSI data products produced by the TCTE program consist of daily and 6-hourly average irradiances reported at a mean solar distance of 1 astronomical unit (AU) and zero relative line-of-sight velocity with respect to the Sun. Two TSI data products are produced – one containing the daily means and the other containing the four 6-hourly means. Both delivered TSI products contain science results for the entire mission. Updates to Level 3 TSI data occur daily. Lower-level data products (e.g. Level 2) are primarily considered diagnostic with limited scientific value for climate studies. Short duration time periods of these data can be made available upon request by the TCTE science team.

Data Quality Description

On-orbit instrument characterization is an on-going effort, as the TIM team regularly tracks instrument degradation and calibrates the instrument servo system on-orbit, periodically updating the data processing system with new calibration values. Many such needed corrections are anticipated at this early phase in the TCTE/TIM mission, and are being acquired via on-orbit characterizations to be implemented in upcoming data versions.

Measurement Objectives

The primary objective of the TCTE Total Irradiance Monitor (TIM) instrument is to make precise and accurate measurements of total solar irradiance (TSI), adding to previous TSI measurements in order to continue the long-term climate record. Once on-orbit instrument characterization is complete, these TSI measurements are anticipated to have a relative standard uncertainty (absolute accuracy) of approximately 0.035% (350 parts per million, ppm) based on SI units and with a long-term precision (relative accuracy) of 0.001%/yr (10 ppm/yr).

Data Production Overview

The TIM measures the absolute intensity of solar radiation integrated over the entire solar irradiance spectrum. To construct this product, high time cadence measurements (approximately every 50 seconds during sunlit portions of the STP-Sat3 spacecraft orbit) from the instrument are combined to produce representative daily and 6-hourly values of the TSI. Four TIM radiometer channels track on-orbit degradation in the primary channel and additionally provide a limited degree of redundancy. Shuttered operation of the instrument corrects for thermal background, and state-of-the-art phase sensitive detection algorithms applied to the data at the shutter fundamental reduce noise and sensitivity to drifts. The TIM shutter period is 100 seconds; four such cycles are weighted to give a single irradiance measurement at a cadence of 50 seconds. These so-called "Level 2" data are averaged over an entire day as well as over each 6-hour interval to formulate the two primary TCTE TSI data products that are released to the GES DISC. The TSI value and the time stamp reported are means of the TSI measurements acquired during the interval.

Research and Applications

Measurements of TSI are known to be linked to Earth climate and temperature. Proxies of the TSI based on sunspot observations, tree ring records, ice cores, and cosmogenic isotopes have given estimates of the solar influence on the Earth that extend back thousands of years, and correlate with major climatic events on the Earth. These estimates extrapolate many recent detailed observations to long-term observations of fewer (or even one) measurement. For example, accurate TSI measurements from the last 36 years are correlated with solar measurements of sunspots and faculae; these correlations can then be used to extrapolate the TSI to time periods prior to accurate space-borne TSI measurements, since solar records extend back approximately 100 years for faculae and over 400 years for sunspots. Over this extended time range, the extrapolated TSI record can be compared with longer term records, such as tree rings or ice cores, and correlation with these allows extension of the estimated TSI to more distant historical times, albeit with decreasing certainty. This extrapolation is important for understanding the relationship between TSI and the Earth's climate; yet the extrapolation begins with the comparison of solar surface features to accurate TSI measurements, a record which is currently only 36 years long. Good accuracy and stability in this recent record are thus of high importance and drive the measurement objectives of the TIM.

TSI Measurement History

Attempts to measure the TSI began in earnest in the 1830's, with independent measurements by Claude Pouillet and John Herschel, yet were nearly a factor of two low because of atmospheric absorption. Even balloon-borne measurements in the 1900's lacked the instrumental accuracy to detect the ~0.1% changes in the TSI. It was not until long-duration measurements from space were available that changes in TSI were accurately measured and the misconception of a "solar constant" changed. TSI monitoring using electrical substitution radiometers (ESRs) from the vantage point of space began with the launch of the Nimbus 7 satellite in November 1978. This was soon followed by an Active Cavity Radiometer Irradiance Monitor (ACRIM) instrument on the Solar Maximum Mission and by the Earth Radiation Budget Experiment (ERBE). More recently, second and third ACRIM instruments have been launched, in addition to the launch of the VIRGO on the NASA/ESA Solar and Heliospheric Observatory (SoHO). The SORCE/TIM was launched in early 2003 with a higher accuracy than all preceding instruments, and established a lower value of the TSI (Kopp & Lean, 2011). Other on-orbit TSI instrument values have now been lowered to match those of the SORCE/TIM. The various data sets are in basic agreement and show conclusively that variations of TSI track the passage of sunspots across the solar disk with an amplitude of about 0.2%, and that

long-term solar cycle variations are only on the order of 0.1%. The TCTE TSI data set continues these important observations with anticipated accuracy of ±0.035%.

Of the mentioned TSI instruments, the VIRGO and SORCE are the only ones from prior to the TCTE launch that continue to make observations.

Instrument Description

For a description of the TIM instrument go to the SORCE TIM overview page.

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