SABER Global Daily Power Data Set ReadMe

1.0 Introduction

This file provides information for the data set of SABER global daily power values of NO and CO_2 cooling derived from the SABER Level 2 version 2.0 standard products.

1.1 Data Location

This file and the data file are available via anonymous ftp from
ftp://saber.gats-inc.com/Version2_0/SABER_cooling/
This file is in the Documentation subdirectory, and the data files are in the Daily Global Power subdirectory.

1.2 Contacts

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1.3 TIMED Data "Rules of the Road & Access Policies"

- Mission scientific and model results are open to all.
- Users should contact the PI or designated team member of an instrument or modeling group early in an analysis project to discuss the appropriate use of instrument data or model results. This applies to TIMED mission team members, guest investigators, and other members of the scientific community or general public.
- Users who wish to publish the results derived from TIMED data should normally offer co-authorship to the PI (Dr. James M. Russell III, JAMES.RUSSELL@HAMPTONU.EDU) or Associate PI (Dr. Martin G. Mlynczak, m.g.mlynczak@nasa.gov) or their designated team member. Co-authorship may be declined. Appropriate acknowledgement to institutions, personnel, data sources, and funding agencies should be given.
- Users should heed the caveats of investigators as to the interpretation and limitations of data or model results. Investigators supplying data or models may insist that such caveats be published, even if co-authorship is declined. Data and model version numbers should also be specified.
- Pre-prints of publications and conference abstracts should be widely distributed to interested parties within the mission and related projects.

See http://www.timed.jhuapl.edu/scripts/mdc_rules.pl

2.0 Data Set Description

This data set contains the time series of Daily Global Infrared Radiated Power values for NO and CO_2 in the thermosphere derived from SABER measurements. There are two files in the data set, one for each species.

The Sounding of the Atmosphere using Broadband Emission Radiometry instrument is a limb scanning radiometer that records vertical profiles of infrared emission from approximately 300 km tangent altitude down to the Earth's surface in ten distinct channels from 1.27 to 15 µm. Infrared radiance profiles (W m^{-2} sr^{-1}) for NO at 5.3 µm are inverted to yield vertical profiles (~1500 per day) of infrared cooling rates (W m^{-3}) between 100 and 250 km at approximately 0.2 km altitude spacing. For CO_2, SABER processes radiative cooling rates in Kelvin per day; cooling rate profiles in W m^{-3} are then calculated from 100 to 140 km by applying the first law of thermodynamics.

The cooling rate profiles are vertically integrated to yield the flux (W m^{-2}) of infrared emission exiting the thermosphere, either to the atmosphere below or to space above. NO is integrated from 100-250 km and CO_2 is integrated from 100-139 km. Further integration around latitude circles gives the power (W) radiated by NO and CO_2 at specific latitudes. A final integration from pole to pole gives the total global average power radiated by these molecules on a daily basis. Details of this methodology can be found in the Mlynczak (2010) cited below. A copy of the paper is included in the Documentation subdirectory of this project on the GATS ftp site.

2.1 Version History

V1.0 is the original version. Version changes for subsequent versions will be documented here.

3.0 Data Format and Packaging

The Daily Global Power files are ASCII text files with header text indicated by a # character in the first column. There are 12 header lines in the NO file and 13 header lines in the CO_2 file.
The last line of the header has data column heading text. Below that, the data values are organized in the indicated columns. Examples of the file headers are included at the end of this document.

4.0 Science Parameters

The daily global infrared radiated power is the primary product in these files. Intermediate results in the calculation of the global power are also included.

The TIMED satellite undergoes a yaw maneuver every 60 days to keep the SABER instrument on the cold side of the spacecraft. There are six yaw periods each year. Latitudinal coverage ranges from 54°S to 82°N or 82°S to 54°N depending on the yaw period. The data files included the power measured in the latitude region observed on the given day and the values derived for four latitude subregions, 90N-55N, 55N to the Equator, Equator to 55S and 55S to 90S. One of the 55 to 90 values is interpolated from the measured results for the regions viewed in the yaw. This methodology is more thoroughly discussed in the referenced papers.

5.0 Read Software

An IDL program, read_global_power.pro, is provided in the Software subdirectory to illustrate reading the data in the file and creating a plot of the global daily power values. . It can be run at the IDL command line (i.e., at the IDL> prompt) either within the IDLDE or in a terminal window where IDL has been started, with a string giving the full path and file name of the data file to be read as the first and only argument, e.g.,
IDL > read_global_power,'/Saber_cooling/Daily_Global_Power/ SABER_NO_POWER_20180309.txt

6.0 Additional Information

6.1 Data Set Updates

This data set will be updated quarterly (January, April, July, October) once all orbits through the end of the previous quarter are available from the SABER processing system.

6.2 References

- Russell, J. M., III, M. G. Mlynczak, L. L. Gordley, J. J. Tansock Jr., and R. W. Esplin (1999), Overview of the SABER experiment and preliminary calibration results, Proc. SPIE, 3756, 277, doi:10.1117/12.366382.

- Mlynczak, M., et al. (2003), The natural thermostat of nitric oxide emission at 5.3 mm in the thermosphere observed during the solar storms of April 2002, Geophys. Res. Lett., 30(21), 2100, doi:10.1029/2003GL017693.
- Mlynczak, M. G., et al. (2005), Energy transport in the thermosphere during the solar storms of April 2002, J. Geophys. Res., 110, A12S25, doi:10.1029/2005JA011141. (Correction, J. Geophys. Res., 112, A02303, doi:10.1029/2006JA012008, 2007.)
- Mlynczak, M. G., et al. (2010), Observations of infrared radiative cooling in the thermosphere on daily to multiyear timescales from the TIMED/SABER instrument, J. Geophys. Res., 115, A03309, doi:10.1029/2009JA014713.

6.3 Project Metadata

Platform: TIMED: Themosphere Ionosphere Mesosphere Energetics and Dynamics
Platform URL: http://www.timed.jhuapl.edu/WWW/index.php
Instrument: SABER: Sounding of the Atmosphere Using Broadband Emission Radiometry
Instrument URL: http://saber.gats-inc.com
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Institution: NASA Langley Research Center

Data File Headers

Example header from the NO Daily Global Power file:

```
# SABER_NO_POWER run 2017-05-15 11:27:58
#
# Data version: Version_20
# Lower bound altitude:      100
# Upper bound altitude:      250
# Latitude bin size:       11
# Maximum good value of NO VER:   5.00000e-05
# Nominal NO VER:   1.20000e-08
# Maximum good flux:    0.00700000
# Maximum number of negative cooling values:      999
#
# Year Day  MeasuredPower  GlobalPower   PowNH_55-90   Pow_NH0-55    Pow_SH0-55    Pow_SH55-90
  2002  25  2.979055E+11  3.296843E+11  2.504316E+10  1.202589E+11  1.526035E+11  3.177873E+10
  2002  26  3.229795E+11  3.655038E+11  3.346201E+10  1.274943E+11  1.620231E+11  4.252441E+10
```

Example header from the CO_2 Daily Global Power file:

```
# SABER_CO2_POWER run 2017-05-16 11:21:08
#
# Data version: Version_20
# CO2 cooling rate: CO2_cool_626_01101_00001
# Lower bound altitude:      100
# Upper bound altitude:      139
# Latitude bin size:       11
# Maximum good value of CO2 wm3:   1.00000e-05
# Nominal CO2 wm3:   6.00000e-08
# Maximum good flux:    0.00600000
# Maximum number of positive cooling values:       10
#
# Year Day  MeasuredPower  GlobalPower   PowNH_55-90   Pow_NH0-55    Pow_SH0-55    Pow_SH55-90
```

2002	25	8.116397E+11	8.916715E+11	7.167354E+10	3.495989E+11	3.903672E+11	8.003171E+10
2002	26	8.484328E+11	9.424250E+11	8.495379E+10	3.624580E+11	4.010210E+11	9.399230E+10