Global Precipitation Products at NASA GES DISC for Supporting Agriculture Research and Applications

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Outline

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Introduction

• Key environmental variables for agriculture: precipitation, temperature, water (soil moisture), solar radiation, NDVI, etc.
• Rainfed agriculture – major farming practices that rely on rainfall for water.
• Rainfed agriculture: >95% of farmed land (sub-Saharan Africa); 90% (Latin America); 75% (Near East and North Africa); 65% (East Asia); 60% (South Asia).
• Precipitation is very important for rainfed agriculture. Droughts can cause severe damage. Precipitation information can be used to monitor the growing season.
• The Goddard Earth Sciences (GES) Data and Information Services Center (DISC), one of 12 NASA data centers, located in Greenbelt, Maryland, USA.
• The GES DISC is a major data archive center for global precipitation, water & energy cycles, atmospheric composition, and climate variability.


In Kenya 2016 http://venturesafrica.com/kenya-battles-drought/

Rainfall Product Overview

- GPM (Global Precipitation Measurement)
- TRMM (Tropical Rainfall Measuring Mission)
- GPCP (Global Precipitation Climatology Project) of MEaSUREs
- MERRA-2 (Modern-Era Retrospective analysis for Research and Applications, Version 2)
- NLDAS (North America Land Data Assimilation System)
- FLDAS (Famine Early Warning System Network Land Data Assimilation System)
- GLDAS (Global Land Data Assimilation System).
Global Precipitation Products at NASA GES DISC

- Single sensor (microwave, radar, and combined) products from TRMM (Tropical Rainfall Measuring Mission; 1997 - 2015) and GPM (Global Precipitation Measurement; 2014 - present): orbital and gridded (algorithms, case studies, etc.)
- TRMM Multi-satellite Precipitation Analysis (TMPA, 0.25-deg. 3-hr, monthly, 1998 – present)
- Integrated Multi-satellite Retrievals for GPM (IMERG, 0.1-deg., 0.5-hr, monthly, 2014 – present). Version 4 is coming soon
- GPCP (Global Precipitation Climatology Project). Version-3 is coming soon
- GLDAS (Global Land Data Assimilation System, 0.25-deg., 3-hourly and 1-deg., monthly, 1948-2010 (v 2.0), 2000-present (v 2.1))
- NLDAS (North America Land Data Assimilation System, 0.125-deg., hourly and monthly, 1979 - present)
- FLDAS (Famine Early Warning System Network Land Data Assimilation System, 0.1 deg., daily, monthly, 1982 – present)
- MERRA-2 (Modern-Era Retrospective analysis for Research and Applications, Version-2, 0.5 x 0.625 deg. hourly, 3-hourly, monthly, 1980-present)
Not Entirely Independent

- TMPA (PMW, IR, GPCC, etc.)
- IMERG (PMW, IR, GPCC, etc.)
- GPCC (gauges only, sampling)
- GPCP (PMW, IR, GPCC, etc.)
- GLDAS (TMPA, PERSIANN, CMAP, CMORPH, NRL, GTS)
- MERRA-2 (CMAP, GPCP)
Issues in Satellite-based Precipitation Estimates

• Over oceans, passive microwave (PMW) retrievals are found to rival radar retrievals. Over land, more difficult (variations of the surface emissivity, in particular over snow and ice)
• IR techniques related cloud top temperatures to surface rainfall (underestimation of warm rain, false alarms for anvils and thick cirrus clouds with cold brightness temperatures)
• Precipitation radar: Attenuation correction, complex terrain and minimum detectable signals (snow, light rain, etc.)
• Algorithm changes; multi-satellite, multi-sensor, multi-algorithms, etc.
• Complex terrains, orographic effect, snow and ice surface, lacking gauges and radars, light rain, blowing snow, etc.
• Lack of ground observations for bias correction

Some contents from: http://trmm.chpc.utah.edu/
TRMM (Tropical Rainfall Measuring Mission)

• NASA/JAXA mission (Nov. 1997 – Apr. 2015) to monitor and study tropical rainfall
• Precipitation related instruments (TMI, PR, LIS, VIRS)
• Orbital and gridded datasets
• Single sensor, multi-sensor, multi-satellite datasets.
• NASA/JAXA mission (Feb. 2014 – present) to monitor and study global precipitation (rain and snow)
• Quantify rainfall rates from 0.22 mm h\(^{-1}\) to 110 mm h\(^{-1}\) (60 mm h\(^{-1}\) for microwave imager) and detect falling snow at instrument footprint scales (from Walter Petersen)
• Precipitation related instruments (GMI, PR)
• GPM constellation of international satellites
• Orbital and gridded datasets. Single sensor, multi-sensor, multi-satellite datasets.
Data Services (How to find data?)

- Newly designed Web interface
Data Services

### Data Collections

#### Showing 1 - 32 of 39 datasets associated with TRMM

<table>
<thead>
<tr>
<th>Image</th>
<th>Dataset</th>
<th>Source</th>
<th>Temporal Resolution</th>
<th>Spatial Resolution</th>
<th>Process Level</th>
<th>Begin Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Hover" /></td>
<td>TRMM Attitude and VIRS Packets and Header Record L1A V7 (TRMM_1A01.7) - Infrared</td>
<td>TRMM VIRS</td>
<td>90 minutes</td>
<td>2.2 km x 2.2 km</td>
<td>1A</td>
<td>1997-12-20</td>
<td>2014-03-22</td>
</tr>
<tr>
<td><img src="image2" alt="Hover" /></td>
<td>TRMM Visible and Infrared Scanner Calibrated Radiances L1B 1.5 hours V7 (TRMM_1B01.7) - Infrared</td>
<td>TRMM VIRS</td>
<td>90 minutes</td>
<td>2.2 km x 2.2 km</td>
<td>1B</td>
<td>1997-12-20</td>
<td>2014-03-22</td>
</tr>
<tr>
<td><img src="image3" alt="Hover" /></td>
<td>TMI/TRMM surface soil moisture (LPRM) L2 V001 (LPRM_TMI_SOILM2.001) - Surface Thermal Properties, Soils, Vegetation</td>
<td>TRMM TMI</td>
<td>45 km x 45 km</td>
<td></td>
<td>2</td>
<td>1997-12-07</td>
<td>2015-04-09</td>
</tr>
<tr>
<td><img src="image4" alt="Hover" /></td>
<td>TMI/TRMM surface soil moisture (LPRM) L3 1 day 25 km x 25 km daytime V001 (LPRM_TMI_DY_SOILM3.001) - Surface Thermal Properties, Soils, Vegetation</td>
<td>TRMM TMI</td>
<td>1 day</td>
<td>25 km x 25 km</td>
<td>3</td>
<td>1997-12-07</td>
<td>2015-04-09</td>
</tr>
</tbody>
</table>
TRMM_3B43: TRMM (TMPA/3B43) Rainfall Estimate L3 1 month 0.25 degree x 0.25 degree V7

The 3B43 dataset is the monthly version of the 3B42 dataset.

This product is created using TRMM-adjusted merged microwave-infrared precipitation rate (in mm/hr) and root-mean-square (RMS) precipitation-error estimates.

It provides a "best" precipitation estimate in a latitude band covering 50° N to 50° S, an expansion of the TRMM region, from all global data sources, namely high-quality microwave data, infrared data, and analyses of rain gauges. The granule size is one month.

Product Summary

Shortname: TRMM_3B43
Longname: TRMM (TMPA/3B43) Rainfall Estimate L3 1 month 0.25 degree x 0.25 degree V7
Version: 7
Format: HDF
Spatial Coverage: -180.0,-50.0,180.0,50.0
Temporal Coverage: 1998-01-01 to present
File Size: 4.9 MB per file
Data Resolution
Spatial: 0.25 ° x 0.25 °
Temporal: 1 month
Data Services

- Dataset and information search
- Subsetting (spatial and parameter)
- Format conversion (NetCDF, ASCII)
- Time series (Data Rods)
- Machine to machine (OPeNDAP, https, TRHEDDS, GDS)
- GIS support (in-house GIS specialists)
- Online visualization and analysis (explore and evaluate datasets without downloading software and data)
Data Services

Archive Size: 1,730,758 TB
Archived Data Files: 96,172,819
Files Distributed*: 1,894,565,309
Data Volume Distributed*: 16,872.623 TB

Projects & Missions

A-Train Data Depot (ATDD)
The A-Train Data Depot (ATDD) has been developed to geometrically collocate with CloudSat, and subset, data from the formation satellites p...

ACOS (Atmospheric CO2 Observations from Space)
Immediately after the loss of the Orbiting Carbon Observatory (OCO) mission, the GOSAT Project Team in Japan invited the NASA OCO team to co...

AIRS/AMSU/HSB
The Atmospheric Infrared Sounder (AIRS) is a grating spectrometer (R = 1200) aboard the second Earth Observing System (EOS) polar-orbiting p...

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Featured Gallery Images

CarbonTracker (carbontracker.noaa.gov) xCO2 column average over the entire atmospheric column for the year 2010

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News

Suomi NPP CrIS Full Spectral Resolution (FSR) Level 1B Data Products Released
Aug 2, 2017

AMSR-MODIS Boundary Layer Water Vapor Products Released
Aug 1, 2017

Methane (CH4) Flux for Canada and Mexico’s Oil/Gas Systems Released
Jul 31, 2017

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Science Focus Areas

Atmospheric Composition
Water & Energy Cycles
Climate Variability

Tools

Giovanni
MERRA Subsetter
Data Racks for Hydrology
DQViz
AIRS NRT Viewer
OGC Web Map Service
OPeNDAP and GDS

Resources

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- FAQs, How to (recipes), Glossary, etc.
- Social media (Twitter, YouTube, User forum)
- Help desk (phone, email, online feedback)
- Training materials (ARSET => Applied Remote Sensing Training)
Giovanni (https://giovanni.gsfc.nasa.gov) - Data Visualization and analysis without downloading data and software

Liu, Zhong (GSFC-610.2) (GEORGE MASON UNIVERSITY) Thursday, August 3, 2017 at 5:29:18 PM Eastern Daylight Time
Examples (California Droughts)

NLDAS Total Precipitation Anomaly in Giovanni

2015

2016

2017
Examples (California Droughts)

Winter Precipitation Monthly Total (2014–15) / Climatology

Winter Precipitation Monthly Total (2015–16) / Climatology

Winter Precipitation Monthly Total (2016–17) / Climatology

NLDAS Total Precipitation
Summary

- Global and regional precipitation datasets (satellite-based and data assimilation)
- Data services (subsetting, format conversion, online visualization, etc.)
- User services are available
Information

• Data information and services: https://disc.sci.gsfc.nasa.gov/ Search for: TRMM (GPM, TRMM, NLDAS, GLDAS, MERRA)


• Comments and suggestions: gsfc-help-disc@lists.nasa.gov