National Aeronautics and Space Administration Goddard Earth Science Data Information and Services Center (GES DISC)

README Document for Legates Surface and Ship Observation of Precipitation

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Revision History

Revision Date	*Changes*	*Author*
June 16, 2016	This document was first created	Zhong Liu
October 5, 2016	More contents were added	Zhong Liu

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1.0 Introduction

This document provides basic information for using the Legates Surface and Ship Observation of Precipitation product.

The Legates Surface and Ship Observation of Precipitation consists of monthly precipitation using traditional land-based gauge measurements and shipboard estimates spanning the period from 1920 to 1980.

1.1 Dataset/Mission Instrument Description

1.1.1 Dataset/Instrument

Observation of Precipitation data set consists of a global climatology of monthly mean precipitation values, using traditional land-based gauge measurements and shipboard estimates spanning the period from 1920 to 1980. The data are corrected for gauge-induced systematic errors caused by wind, wetting on the interior walls of the gauge and evaporation from the gauge. The corrected monthly precipitation values are then interpolated to a 0.5 degree latitude by 0.5 degree longitude grid using a spherically based interpolation procedure (Legates and Willmott, 1990). This global precipitation climatology is used in: a) verification of climate model predictions of precipitation cycles; b) large scale hydrological cycle and ecological studies; and c) evaluating climate change.

Basic characteristics:

Variable name: Accumulated surface precipitation

Units: mm/month

Date range: January 1920 - December 1980

Data range: 0 – 5500 mm/month

Spatial coverage: Global (90N to 90S and 180W to 180E)

Spatial resolution: 0.5 degree (latitude) x 0.5 degree (longitude)

File size: 21 Mb (uncompressed)

File format: ASCII

1.2 Algorithm Background

Data are compiled from terrestrial precipitation gauge measurements in their traditional setting (elevated above the ground and possibly with a gauge shield) and the indirect oceanic precipitation estimation technique of Dorman and Bourke. This procedure estimates precipitation using a statistically-derived relationship between gauge catch and the current weather code of the surface synoptic record taken on board ships (see references). Long-term monthly mean values were compiled from these measurements and estimates. Biases (underestimates) resulting from the effect of the precipitation gauge were subsequently estimated and removed from these monthly mean precipitation data by taking into account local variations in gauge type, height of the gauge above the ground, air temperature, wind speed, and general regional sheltering.

The rain gauges used for the terrestrial gauge measurements were used in their traditional setting (elevated above the ground and possibly with a gauge shield). The data is based upon 24,635 independent stations which provided a dense network in the industrialized countries of North America, Europe, and East Asia. Station distribution in the arid, mountainous, and polar regions, however, are less dense.

The Legates Surface and Ship Observation of Precipitation data set consists of a global climatology of monthly mean precipitation values spanning the period from 1920 to 1980.The data set is based on rain gauge measurements and shipboard estimates consisting of 24,635 spatially independent terrestrial station records and 2,223 oceanic grid point records.

Terrestrial precipitation measurements:

Global archives of monthly precipitation compiled by Wernstedt (1972), Willmott et al. (1981), and the National Center for Atmospheric Research (Spangler and Jenne, 1984) provided most of the data for this climatology data set. The Wernstedt and Willmott et al. data contain monthly averages for 17,347 and 13,659 stations, respectively. The Spangler and Jenne data, however, contain monthly time-series for 3,679 stations, from which monthly averages were computed. Wernstedt's Canadian data were not used because snowfall was excluded from the averaging. These three data sets provide adequate spatial coverage for much of the terrestrial surface; however, Australia, New Guinea, China, parts of the Far East, and Antarctica are underrepresented.

To improve the spatial resolution in the above-mentioned regions, monthly precipitation averages were obtained from an additional 208 stations in Australia, New Guinea, and Indonesia; 584 stations in China and the Far East; 10 stations in Antarctica; and five stations in the Sahara.

Virtually all station records were used even though they are based on differing time periods. Most of the data, however, were observed between 1920 and 1980; thus, this climatology is

largely representative of this 60-year period, with greater weight given to the more recent (data-rich) years.

Oceanic precipitation estimates:

Shipboard gauges are adversely influenced by the aerodynamic effects due to the superstructure of the ship, the influence of roll and pitch, the capture of spray, and the movement of the ship, in addition to the same biases that affect land-based gauges. Averaged shipboard estimates also have a "fair-weather bias"; that is, ships tend to avoid storms and other severe weather. Thus, a serious deficiency of reliable precipitation measurements exists over the oceans, and alternative oceanic precipitation estimates are needed.

These estimates, from Dorman and Bourke (1979, 1981) and Jaeger (1983), contain systematic differences that are resolved by applying multiple linear regression to data from the Atlantic and Pacific Oceans north of 30 degree south latitude. Discrepancies are assumed to be highly correlated with air temperature.

The rain gauge measurements were collected from existing sources, coding errors were corrected and redundant station information removed. The result of these steps provided a data base of 24,635 spatially independent terrestrial station records and 2223 oceanic grid records. A procedure for correcting the gauge-induced basis was implemented to remove the systematic errors associated with traditional rain gauge collection methods.

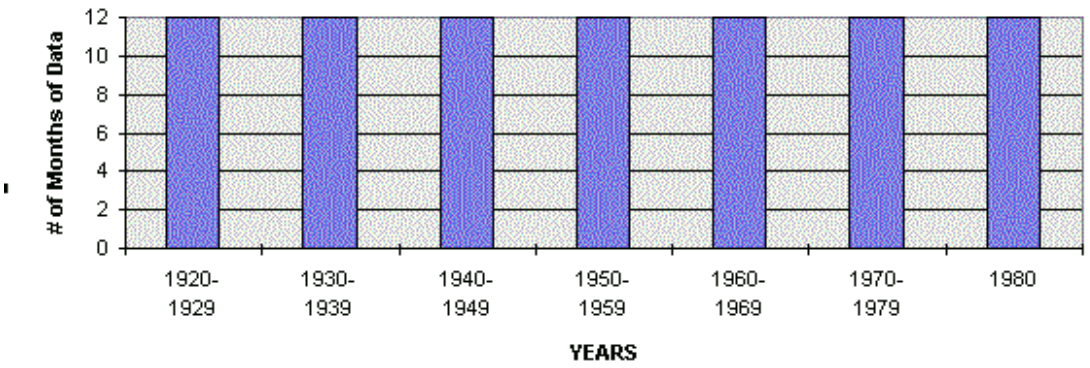
For this data set, the oceanic precipitation is estimated using the method of Dorman and Bourke (1979). Their method was derived from a technique proposed by J. S. Sawyer and later refined by Tucker (1961).

The method of Tucker has been determined to be suitable for estimating oceanic preipitation only in the mid-latitudes. In the tropics, the increased rainfall intensity reduced the effectiveness of Tucker's method. Dorman and Bourke (1978) also observed that the error was systematic and highly correlated to air temperature. They developed a set of regression equations, one for each month, to remove the error from Tucker's estimates. Dorman and Bourke used shipboard observations from 1950 to 1972 to estimate average monthly precipitation for the Pacific and Atlantic Oceans north of 30 degrees South at the vertices of a 2 degree latitude by 5 degree longitude lattice. These estimates were used in the development of this data set.

Dorman and Bourke could not obtain reliable estimates for the Indian and Southern Ocean south of 30 degrees South. For these regions, this data set used the estimates of Jaeger's (1983) global precipitation climatology. Jeager used a variation of the typical precipitation frequency approach to generate his estimates.

The estimates of Jaeger and those of Dorman and Bourke are not commensurate. Systematic differences between the two approaches had to be resolved before the estimates could be used for this data set. Jaeger's estimates were converted into values compariable with Dorman and Bourke by applying multiple linear regression to data from the Atlantic and Pacific Oceans north of 30 degrees South.

The climatology contains monthly mean precipitation for each month of the 60-year period.



Applications: This data set can be used to verify general circulation model (GCM) prognostications of the seasonal precipitation cycle and GCM dynamics, as ground truth for evaluating and calibrating precipitation estimates obtained from radars and satellites, and as a basis for evaluating climate change.

1.3 Data Disclaimer

N/A

1.3.1 Acknowledgement

Please see, http://disc.sci.gsfc.nasa.gov/additional/ges_disc_data_policy

1.3.2 Contact Information

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For assistance with our data and services, please write or call us at:

Email: gsfc-help-disc@lists.nasa.gov

Voice: 301-614-5224

Fax: 301-614-5268

2.0 Data Organization

The data consist of monthly precipitation in mm/month in one ASCII file.

2.1 File Naming Convention

The data are stored in one ASCII file, legates.cor.Z

Size: 5.4 Megabytes (ASCII)

2.2 File Format and Structure

This data file, in ASCII format, contains integer values in a 361 x 721 element array. Each element represents a gridded mean for a 0.5 x 0.5 degree grid cell, beginning at 90 degree north latitude, 180 degree west longitude and extending to 90 degree south latitude, 180 degree east longitude.

The data file contents are arranged as follows:

Latitude	Longitude	Jan Mean	Feb Mean	...	Dec Mean	Annual Mean
90.0	-180.0	15	11		17	241
89.5	-180.0	15	10		16	234
.						
.						
-89.5	180.0	1	4		1	16
-90.0	180.0	0	2		0	2

where the monthly means are for the time period from 1920 through 1980.

The data record format is:

Variable	Format
Latitude (decimal degrees)	F7.2
Longitude (decimal degrees)	F7.2
Corrected precipitation	12I5
Annual corrected precipitation (mm)	I6

2.3 Key Science Data Fields

Monthly mean precipitation

3.0 Data Contents

3.1 Dimensions

See Sec. 2.

3.2 Global Attributes

See Sec. 2.

3.3 Products/Parameters

Product name: Legates Surface and Ship Observation of Precipitation

Parameter: Monthly mean precipitation

4.0 Options for Reading the Data

4.1 Command Line Utilities

4.1.1 more

more is a command to view (but not modify) the contents of a text file:

$more legates.cor

4.1.2 vi

vi is a text editor to view and modify the contents of a text file:

$vi legates.cor

4.2 Tools/Programming

N/A

5.0 Data Services

If you need assistance or wish to report a problem:
Email: gsfc-help-disc@lists.nasa.gov
Voice: 301-614-5224
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6.0 More Information

N/A.

7.0 Acknowledgements

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