GPCP Satellite-Gauge Combination (SG)

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DESCRIPTION

The Global Precipitation Climatology Project (GPCP) Version 2 Combined Satellite-Gauge (SG) precipitation estimate uses the "best" quasi-global observational estimators of underlying statistics to adjust quasi-global observational datasets that have desirable time/space coverage (see "Spectral Intervals and Applicable Satellites"). The SG system has three major stages: assembling the input data, computing a multi-satellite (MS) product, and merging the MS product with gauge data to compute the final SG.

The combination of satellite data into the MS product is carried out differently during 3 periods according to data availability. Strong efforts were made to homogenize the data record:

- Mid-1987 to the Present (geo-IR, TOVS, SSM/I) TOVS precipitation estimates are merged in with SSM/I estimates where the SSM/I values are suspect (outside the latitude band 45 N-S) or missing. Then the merged SSM/I-TOVS estimates and geo-GPI are approximately time-matched to compute local coefficients to adjust the full geo-GPI to the bias of the merged SSM/I-TOVS estimates in the latitude 40 N-S band, producing the Adjusted GPI (AGPI). The MS is composed of AGPI in the latitude band 40 N-S and the merged SSM/I-TOVS elsewhere.
- 1986 to Mid-1987 (geo-IR, OPI) The OPI precipitation estimate was calibrated using the 1988-1996 SG. That is, at each gridbox month-to-month OLR anomalies (with respect to monthly climatology) are regressed against SG anomalies, and a fallback direct regression of OLR against SG is computed. The anomaly regression is taken except when the local spatial correlation between the two estimates drops below 0.3, in which case the direct computation is used. The MS is then composed of geo-GPI scaled by SG-scaled OPI in the latitude band 40 N-S and the SG-scaled OPI estimates elsewhere.
- 1979 to 1985 (OPI) The SG-scaled OPI precipitation estimate is taken as the MS.

In each of the periods the MS estimate and a gauge analysis are linearly combined into the final SG combination using weighting by inverse estimated mean-square errors.

Digital Data:
http://lwf.ncdc.noaa.gov/oa/wmo/wdcamet-ncdc.html

Example GIF images and QuickTime movies:
http://precip.gsfc.nasa.gov/rain_pages/global_choice.html

Detailed documentation and programming examples:
http://www1.ncdc.noaa.gov/pub/data/gpcp/v2/documentation/V2_doc

References:

Adler, R.F., G.J. Huffman, A. Chang, R. Ferraro, P. Xie, J. Janowiak, B. Rudolf, U. Schneider, S. Curtis, D. Bolvin, A. Gruber, J. Susskind, and P. Arkin, 2003: The Version 2 Global Precipitation Climatology Project (GPCP) Monthly Precipitation Analysis (1979-Present). *J. Hydrometeor.*, **4**(6), 1147-1167.

Krajewski, W.F., G.J. Ciach, J.R. McCollum, and C. Bacotiu, 2000: Initial Validation of the Global Precipitation Climatology Project Monthly Rainfall over the United States. *J. Appl. Meteor*., **39**, 1071-1086.

SPECTRAL INTERVALS AND APPLICABLE SATELLITES

The input to the GPCP SG is a mix of pre-computed precipitation estimates and single-sensor data. It includes:

1. SSM/I monthly precipitation estimates based on the NOAA Scattering Index algorithm, which use all SSM/I channels on the DMSP F13.
2. SSM/I monthly precipitation estimates based on the Chang-Wilheit emission algorithm, which use low-frequency SSM/I channels on the DMSP F13.
3. Geo-IR 3-hourly Tb histograms from GOES-E, GOES-W, GMS, METEOSAT-5, METEOSAT-7, and predecessor geosynchronous satellites.
4. Leo-IR 3-hourly Tb histograms from all NOAA-series leo-IR Tb's.
5. TOVS-Susskind monthly precipitation estimates, which use Microwave Sounding Unit and High-resolution Infrared Sounder data from NOAA-series satellites.
6. Outgoing Longwave Radiation (OLR) Precipitation Index (OPI) monthly precipitation estimates based on leo-OLR data from all NOAA-series leo-IR Tb's.
7. Rain gauge monthly analyses produced by the Global Precipitation Climatology Centre (1986-present) and the NOAA Climate Prediction Center (1979-1985).

This approach is equally applicable to other reliable sources of the kinds of data listed.

SPATIAL SCALE

2.5×2.5-deg latitude/longitude

TEMPORAL SCALE

Monthly

ANCILLARY DATA

Land/ocean surface type data

ADDITIONAL COMMENTS

Introduction

The Global Precipitation Climatology Project (GPCP) was established by the World Climate Research Program (WCRP) to address the problem of quantifying the distribution of precipitation around the globe over many years. The general approach is to combine the precipitation information available from each of several sources into a final merged product, taking advantage of the strengths of each data type.

File Contents

This data set is the successor to the GPCP Version 1 Combination. The primary product in the Version 2 dataset is a combined observation-only dataset, that is, a gridded analysis based on gauge measurements and satellite estimates of rainfall. There are 27 fields in the data set.

The data set archive consists of unformatted REAL*4 binary files with ASCII headers. Each file holds 12 monthly fields. Each file occupies almost 0.5 MB. The grid on which each field of values is presented is a 2.5x2.5-deg latitude/longitude (Cylindrical Equal Distance) global array of points. It is size 144x72, with X (longitude) incrementing most rapidly West to East from the Prime Meridian, and then Y (latitude) incrementing North to South. Whole- and half-degree values are at grid edges:

First point center = (88.75N, 1.25E)
Second point center = (88.75N, 3.75E)
Last point center = (88.75S, 1.25W)

Missing values are denoted by the value -99999., and the units on the fields depend on the variable. For example, rainfall is carried as mm/day.

Dataset Validation

Combinations are difficult to validate as they tend to include data that would otherwise be independent. An early validation of the predecessor Version 1a data set against the Surface Reference Data Center gauge analysis yields the statistics in Table 4. Overall, the combination appears to be working as expected.

Table 1. Summary statistics for all cells and months comparing the Version 1a SSM/I composite, Multi-satellite, Gauge, and Satellite-Gauge products to the SRDC analysis for July 1987 - December 1991.

Product	Bias mm mo^{-1}	Avg. Diff. mm mo^{-1}	RMS Error mm mo^{-1}
SSM/I composite	4.03	60.10	88.05
Multi-satellite	5.80	44.20	62.47
Gauge (GPCC)	6.77	18.85	35.11
Satellite-gauge	3.70	20.29	32.98

Krajewski et al. (2000) developed and applied a methodology for assessing the expected random error in a gridded precipitation field. Their estimates of expected error agree rather closely with the errors estimated for the multi-satellite and satellite-gauge combinations.

Dataset Status
The currently operational procedure has been computed for the period January 1979 - present (with some delay to allow input fields to be computed).

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