805

The Global Precipitation Climatology Project (GPCP)

Current Status and Transfer to Operations at NCDC

Mathew R. P. Sapiano[1], Robert F. Adler[1], George J. Huffman[2], Long Chiu[3], Ralph R. Ferraro[4], Pingping Xie[5], and Udo Schneider[6]

[1] University of Maryland, College Park; [2] GSFC/NASA; [3] George Mason University; [4] NESDIS/NOAA; [5] CPC/NOAA; [6] DWD, Germany

msapiano@umd.edu
radler@umd.edu

GPCP V2.2

The Global Precipitation Climatology Project (GPCP) is an inter-agency, international effort under the auspices of the Global Energy and Water Exchanges project/World Climate Research Programme (GEWEX/WCRP) that started in the 1990s with the purpose of producing global precipitation analyses at monthly and finer time scales.

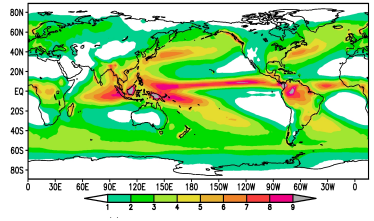

Figure 1. Map of monthly precipitation from GPCP V2.2

The current GPCP Version 2.2 monthly (1979-present), pentad (1979-present) and daily products (1997-present) have been developed by research groups over the last 15 years and are produced by a consortium of those groups (Table 1), funded by various agencies. The products are computed through merging of various data sets in both space and time, with care taken to preserve Climate Data Record characteristics. The monthly product serves as the benchmark, against which the higher resolution products are adjusted, in order to maintain consistency.

Merge Center	George Huffman, Bob Adler	NASA Goddard, U. of Maryland	TOVS/AIRS data from Susskind, Goddard
Gauge Center	Andreas Becker, Udo Schneider	German Weather Service, Global Precipitation Climatology Center (GPCC)	
Microwave-Land Center	Ralph Ferraro	NOAA NESDIS	
Microwave-Ocean Center	Long Chiu	George Mason U.	
Geosynchronous Center	Pingping Xie	NOAA/NWS/CPC	Also does pentad merge

Table 1. Groups involved in the routine production of GPCP V2.2

The suite of GPCP precipitation products has become a science community standard, having been used in over 1200 journal articles, with science results ranging from examining global and regional variations and trends in precipitation, analyzing the impact on precipitation of ENSO and other large-scale phenomena, to serving as input and validation for regional and continental-scale hydrologic investigations. The GPCP products have also served as a primary validation for global models and are used as a standard of global precipitation climatology. The increasing length of the record (now at 30+ years for the monthly and pentad products) is becoming a powerful tool in climate change research.

Product	Time span	inputs	References
Monthly, 2.5°		PMW (SSMI/SSMIS), Geo-IR,	Adler et al. (2003), J. Hydromet.;
Merged Analysis	1979-present	OLR, TOVS/AIRS, land gauges	Huffman et al. (2009) GRL
Pentad, 2.5°			
Merged Analysis	1979-present	Geo-IR, Monthly GPCP	Xie et al. (2003) J. Climate
Daily, 1°		PMW (SSMI/SSMIS), Geo-IR,	Huffman et al. (2001) J.
Merged Analysis	1997-present	monthly product	Hydromet.

Table 2. List of products for GPCP V2.2 that are included in CDR project

Transfer of research product to NCDC

The current GPCP processing procedure involves the computation of several individual intermediate products by each of the centers listed in table 1. Much of the work to produce these products is manually intensive and each group is responsible for finding research funds to carry out the work. While the data has been successfully produced under this arrangement for many years, it is obviously desirable to pass the operational processing of the GPCP Climate Data Record (CDR) to an agency capable of maintaining production operationally. To this end, we are half way through a three year project to transfer operational processing to NOAA's National Climatic Data Center (NCDC) under their CDR program.

Under this NCDC funding, the GPCP code will be cleaned-up, streamlined, updated, automated and documented, then tested at the University of Maryland before being transferred for operational processing at NCDC in Asheville, NC. All code needed for product production from the level of the satellite-calibrated radiances to the three final merged products is included in the project as is the ability to reprocess the whole dataset if needed. The software is designed to meet NCDC requirements/standards as much as possible, although some processing components will remain at home institutions (GPCC gauge analysis, input pentad precipitation analysis from NOAA/CPC). It is expected that some ongoing support will be required for GPCP scientists to assist in dealing with issues that come up in processing, for evaluation of products and for making software changes to adjust for changes in input data in the future.

Operational CDR code design

The existing algorithms that must be run to produce GPCP V2.2 are written in a mixture of Fortran and C code. These legacy codes are being streamlined and re-written where necessary to comply with NCDC coding standards. Each of the three products (Table 2) will be created separately by the Executive Control Package (ECP), a shell script that calls the various elements of the code. The basic structure of each of the three ECPs is depicted in Figure 2. Data acquisition will be handled outside of the ECP since this will need to be done on a routine basis.

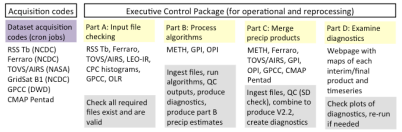

Figure 2. Basic structure if Executive Control Package (ECP)

The code sequence to produce the monthly data is shown in Figure 3. Each of the three ECPs will possess the same basic elements with file checking, integrity checks and diagnostic outputs at every level. The first part of the code will be to check that all input datasets for algorithms. The second part of the ECP will be to run any algorithms to produce interim precipitation estimates in a standard binary format. The third part of the ECP will check that all components are available before the fourth step where the precipitation estimates are merged. The final part of the ECP will be to produce diagnostics that will be made available to the GPCP developer group via a web interface that can be used to diagnose specific problems as they arise.

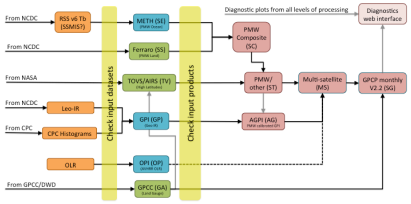

Figure 3. Code sequence for GPCP V2.2 monthly CDR

Implementation

Of the three code elements, the monthly product was the most challenging to implement because it has the most inputs and has the oldest legacy code. The monthly code package has now completed the design and assembly phases and has been streamlined to run in test mode at UMD. The code for the pentad and daily products is still in the design phase. Figure 4 shows the output from the monthly ECP run at UMD.

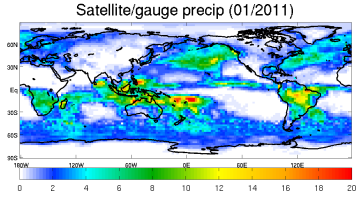

Figure 4. Monthly precipitation for January 2011 from CDR code

Further work

The 3 year project is currently half way through, with the monthly CDR code in test mode. The pentad and daily codes are simpler and will be implemented and tested in the coming year. In addition to implementing these codes, an integrated diagnostic system for all three products is planned so that problems with operationally produced data can be diagnosed quickly by NCDC or GPCP scientists.

The existing product suite is produced with a delay of around two months. We believe it will be possible to use the CDR code to produce a near real-time monthly GPCP V2.2 estimate for climate monitoring using the pertinent data sets (some in preliminary form). We expect that such a preliminary dataset can be made available within approximately 10 days of the end of the month.

As part of the GEWEX re-processing of all global water/energy data sets (e.g., ISCCP, SeaFlux), the GPCP group is developing the next version (Version 3) of GPCP

- GPCP V3 will use a wider array of input data sets that have not been used in GPCP up to now (e.g., TRMM, AMSR)
- GPCP V3 will involve higher time and space resolutions (down to 3-hr and 25 km for part of period) based on existing well-used algorithms
- The development of the new GPCP products will leverage NASA/NOAA Global Precipitation Measurement (GPM) activities
- Several new groups will be involved in development and production (e.g., Colorado State University, University of California-Irvine)
- We plan to include rain/snow discrimination as a product using an algorithm based on temperature