

Global Precipitation Climatology Centre (GPCC)

Reporting Period: 09/2005-08/2006

Project Starting Date: End of 1988

End Date (where appropriate): None (continuous operation by the German Met Service DWD)

URL: <http://gpcc.dwd.de>

Chair(s) and Dates of Terms: Bruno Rudolf (Head of GPCC until 14 May 2006),
Tobias Fuchs (Head of GPCC since 15 May 2006)

Objectives:

Monthly rain gauge-based monitoring and assessment of global precipitation on Earth's land surface; Contributions to GEWEX/GPCP and GCOS.

Past year activities:

The GPCC observational data base has been complemented substantially with regard to spatial as well as temporal coverage. Two new analysis products were developed and published by GPCC on the basis of its enlarged monthly precipitation data base:

- **Reanalysis of the GPCC Full Data Product (current Version 3) for the period 1951 to 2004.** Based on all available monthly *in situ* precipitation data (from a maximum of 42,759 stations for June 1987, and 11,422 stations in January 1951, 25,087 stations in December 2000, and finally 11,313 stations in December 2004).
- **VASCLimO 50-Year Climatology (current Version 1.1).** This new analysis product consists of homogeneity-checked and partly homogenized time-series of monthly precipitation for the period 1951-2000 from 9,343 selected stations with an almost complete coverage over the entire period. The VASCLimO Climatology has been developed at the GPCC within the project "Variability Analysis of Surface Climate Observations (VASCLimO) of the German Climate Research Programme DEKLIM.

While the Full Data Reanalysis Product provides the best spatial data coverage for each individual month, the VASCLimO Climatology is optimized for completeness and homogeneity for the period 1951-2000. Application of the Full Data product is recommended for water budget studies, but the VASCLimO Climatology should be preferred for analysis of temporal climate variability, in particular the spatial distribution of climate change with respect to precipitation. The GPCC VASCLimO product is an input to the IPCC 4AR (in preparation).

GPCC also maintains its two **quasi-operational** analysis products:

- **First Guess Product** -- Monthly global land-surface precipitation (available within 5 days after the end of the month, based on the globally disseminated synoptic weather reports SYNOP).
- **Traditional Monitoring Product** -- Available about 2 months after end of a month, based on the synoptic reports received at DWD and NOAA. Also, globally disseminated monthly climate bulletins (CLIMAT).

Both quasi-operational products are timely available. Due to that they can be affected by typical real-time data deficiencies (sparse spatial data coverage in some regions, missing data, coding errors). The First Guess is used by FAO for drought monitoring applications (an operational FAO product is planned to be released very soon). The Monitoring Product is used by GEWEX/GPCP as a near real-time *in situ* reference for adjustment of satellite-based global precipitation estimates.

All global analysis products mentioned above are available as gridded area-averaged data in geographical lat/long coordinates (highest grid box resolutions 0.5° latitude by 0.5° longitude – aggregated to larger boxes).

Another important achievement has been the implementation of a method for an improved estimation of the systematic gauge measuring error depending on the weather conditions during the month by using daily weather information from SYNOP reports. In addition to this error correction also the rate of the different precipitation types (liquid, solid, mixed) and the number of precipitation days per month is determined for each analysis grid. These supplementary products became quasi-operational from

October 2005 onwards. The documentation still needs to be completed and the products will be soon available on the web. An interim product necessary for the production of these monthly GPCC supplementary products are SYNOP-only based daily gridded global precipitation analyses, corrected for systematic measuring errors.

New directions:

The significant enlargement of GPCC's monthly precipitation data base enables the GPCC to produce a new mean precipitation climatology (period mainly 1961-1990). This new climatology will support to change the analysis method from analysing total precipitation amounts to the analysis of relative anomalies based on this new background climatology even for the quasi-operational products of GPCC (First Guess, Monitoring Product) and the Full Data Reanalysis. An improvement of the VASClimO 50-Year Climatology will be backed by this activity since VASClimO was calculated as relative anomalies from a background climatology based on ca. 28,000 stations; the new climatology will probably reach a number of almost 50.000 stations.

Another positive side effect of the new climatology on the quality of the GPCC products will be a better representation of orographic rainfall effects due to the use of a higher number of stations (which are expected to lead to a better station distribution in different altitudes). Interpolation methods to directly take into account the impact of station altitude and orientation related to orography will be tested and might be implemented, if they show potential for operational applicability and improvement of the quality of the GPCC analyses.

Applicability of the GPCC products for operational monitoring of precipitation extremes leading to flooding and drought will be tested on a European scale. Merging precipitation radar products with real time available *in situ* precipitation data will be tested on a Central European scale.

Future

Continuous update of the monthly GPCC *in situ* database based on data acquisition activities related to the quality needs of the different GPCC products. A major data base update in some regions will be achieved by processing the newest GHCN version 2 plus supplements precipitation data base into the GPCC database. Processing and quality control activities are continuously done after reception of additional national data.

Based on the enlarged GPCC data base new versions of the Full Data Reanalysis (Version 4) and of the VASClimO Climatology (Version 2), as well as the release of a new precipitation climatology are planned for the next year.

The GPCC supplementary products will be operationally visualised and provided on the GPCC website. A new method developed by an Austrian university in context of an EU project to merge the daily analyses of GPCC with GPCP-1DD will be tested and is planned to be operationally implemented at GPCC.

Key results:

- Continuous update and processing of the GPCC *in situ* database;
- Continuous update of the GPCC First Guess and Monitoring Products;
- Development and publication of the new GPCC Reanalysis Product (Version 3) and the VASClimO Product (Version 1.1);
- Development of new GPCC supplementary products related to systematic gauge measuring error, precipitation type, and number of precipitation days per month.

Issues and Recommendations:

- Additional precipitation data contributions to GPCC are continuously needed (using GTS-only data is not sufficient for high quality precipitation analyses);
- Further improvement of error correction related to systematic gauge measuring error could be achieved, if information on gauge type, installation and siting is routinely internationally exchanged;
- Users of rain gauge-based precipitation products should carefully consider, which GPCC product they use for which application;

Contributions to WCRP strategic framework:

GPCC products are adjusted to contribute to WCRP core projects:

- The GPCC full data product is adjusted to support Water balance studies in context of GEWEX;
- The GPCC VASclimO product is adjusted to support climate variability and change studies in context of CLIVAR and contributes also to IPCC Assessment Reports;
- The GPCC Full data product and the supplementary products related to solid/liquid precipitation and systematic error correction are useful to support studies in context of CLIC. In addition GPCC implemented the Arctic Precipitation Data Archive (APDA).

GPCC contributes to the WCRP observation strategy and to WOAP by being an active member of the GCOS AOPC and by its contribution to the development of GTN-H. In addition, GPCC has the function of a GCOS Surface Network Monitoring Center for Precipitation. GPCC products are also used for verification of global and regional climate models and of global reanalysis projects.

Contributions to society and to WCRP/GEWEX visibility:

GPCC makes reference to WCRP/GEWEX and its benefits in all publications, presentations, as well as when contacting NMHSs related to data acquisition. Societal benefits of our work are mentioned when and where it is appropriate (one international activity which highlights societal benefit areas is the Group on Earth Observations – GPCC is mentioned as one potential component of GEOSS, the Global Earth Observation System of Systems)

Summary

GPCC provides global precipitation analyses for monitoring and research of the earth's climate. Its products are gridded data sets of monthly precipitation totals based on observational data. The centre is a German contribution to the World Climate Research Programme (WCRP) and to the Global Climate Observing System (GCOS).

List of key publications:

- Rudolf, B., C. Beck, J. Grieser, U. Schneider (2005): Global Precipitation Analysis Products. Global Precipitation Climatology Centre (GPCC), DWD, Internet publication, 1-8.
- Rudolf, B., U. Schneider (2005): Calculation of Gridded Precipitation Data for the Global Land-Surface using in-situ Gauge Observations, Proceedings of the 2nd Workshop of the International Precipitation Working Group IPWG, Monterey October 2004, EUMETSAT, ISBN 92-9110-070-6, ISSN 1727-432X, 231-247.
- Beck, C., J. Grieser and B. Rudolf (2005): A New Monthly Precipitation Climatology for the Global Land Areas for the Period 1951 to 2000. DWD, Klimastatusbericht KSB 2004, ISSN 1437-7691, ISSN 1616-5063 (Internet), ISBN 3-88148-402-7, 181-190.
- Rudolf, B., F. Rubel (2005): Global Precipitation. Chapter 11 in Hantel (2005): Observed Global Climate, Landolt-Börnstein (Numerical Data and Functional Relationships), Group V: Geophysics, Volume 6, Springer-Verlag, ISSN 0942-8003 (Geophysics), ISBN-10: 3-540-20206-4 Springer Berlin Heidelberg New York, ISBN-13: 978-3-540-20206-6 Springer Berlin Heidelberg New York, 11-22.
- Rudolf, B., H. Hauschild, W. Rueth and U. Schneider (1994): Terrestrial Precipitation Analysis: Operational Method and Required Density of Point Measurements. In: Global Precipitations and Climate Change (Ed. M. Desbois, F. Desalmond), NATO ASI Series I, Vol. 26, Springer-Verlag,

List of meetings, workshops:

GPCC is requested to attend meetings of GEWEX GHP, GEWEX GRP, GEWEX GRP WGDMA, CliC SSG, International Precipitation Working Group, GTOS GTN-H and GRDC Steering Committee. The participation of GPCC at these meetings is usually depending on additional external travel support, because our own travel budget is very limited. In addition it contributes to workshops and scientific conferences related to hydrometeorology and climatology, especially in Europe. Bruno Rudolf is a member of the AOPC (GCOS).

Planned meetings, workshops:

International Precipitation Working Group meeting in November 2006 (only written contribution)
2007 meetings of the panels, groups and committees listed above.

List of members and their term dates:

Permanent GPCC staff of the German Met Service (DWD):

Tobias Fuchs (Scientist, Head of GPCC)

Udo Schneider (Scientist, Operation of GPCC)

Anja Meyer-Christoffer (Scientist, Data processing)

Peter Finger (Programming and Visualisation)

Peter Stender (Data acquisition and quality control of GTS data)

Astrid Heller (Secretary work and web presentation)

In addition, Dr. Bruno Rudolf guides the GPCC-activities