TRMM Combined HQ/VAR (3B42RT)

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DESCRIPTION

This algorithm provides a combination of the TRMM real-time merged passive microwave (HQ; 3B40RT) and microwave-calibrated IR (VAR; 3B41RT). The current scheme is simple replacement - for each gridbox the HQ value is used if available, and otherwise the VAR value is used.

Digital data:
ftp://aeolus.nascom.nasa.gov/pub/merged/mergeIRMicro

Example GIF images and QuickTime movies:
http://trmm.gsfc.nasa.gov/

Detailed documentation (3B4XRT_doc) and programming examples:
ftp://aeolus.nascom.nasa.gov/pub/merged/software

Reference:

Huffman, G.J., R.F. Adler, E.F. Stocker, D.T. Bolvin, and E.J. Nelkin, 2003: Analysis of TRMM 3-Hourly Multi-Satellite Precipitation Estimates Computed in Both Real and Post-Real Time. Combined Preprints CD-ROM, 83rd AMS Annual Meeting, Poster P4.11 in: 12th Conf. on Sat. Meteor. and Oceanog., 9-13 February 2003, Long Beach, CA, 6 pp.

SPECTRAL INTERVALS AND APPLICABLE SATELLITES

The input for the combined HQ/VAR (3B42RT) consists of the TRMM real-time HQ merged passive microwave precipitation estimates and the TRMM real-time VAR microwave-calibrated IR.
The approach is equally applicable to other gridded "high-quality" precipitation estimates and/or other sources of gridded lower-quality estimates, as long as the two sets of input were well-calibrated to each other.

SPATIAL SCALE

0.25×0.25-deg latitude/longitude

TEMPORAL SCALE

3 hours

ANCILLARY DATA

None

ADDITIONAL COMMENTS

Introduction
The Merged HQ/VAR is the third stage of a system to produce the "TRMM and Other Data" estimates in real time. The system was developed to apply new concepts in merging quasi-global precipitation estimates and to take advantage of the increasing availability of input data sets in near real time. The overall system is referred to as the real-time Multi-Satellite Precipitation Analysis (MPA-RT). The MPA-RT is run quasi-operationally on a best-effort basis at the TRMM Science Data and Information System (TSDIS), with on-going scientific development by the research team led by Dr. Robert Adler in the GSFC Laboratory for Atmospheres. Estimates are posted to the web about 6 hours after observation time, although processing issues may delay or prevent this schedule. Due to the experimental nature of these estimates, users are encouraged to report their experiences with the data, and they should expect episodic upgrades or outages as the system develops.

File Contents
Each file starts with a header that is one 2-byte-integer row in length, or 2880 bytes. The header is ASCII in a "PARAMETER=VALUE" format that makes the file self-documenting (e.g., "algorithm_id=3B42RT").
Thereafter three data fields follow. All the fields are on a 0.25-deg lat./long. grid that increments most rapidly to the east (from the Prime Meridian) and then to the south (from the northern edge). Grid box edges are on multiples of 0.25 deg. The data fields are written as binary data in big-endian byte order. The data fields are:

Precipitation	(2-byte integer)
precipitation_error	(2-byte integer)
source	(1-byte integer; -1, 0, 100 stand for none, HQ, VAR)

All fields are 1440x480 gridboxes (0-360 deg. E, 60 deg. N-S). The first grid box center is at (0.125 deg. E, 59.875 deg. N). Files are produced every 3 hours on synoptic observation hours (00 UTC, 03 UTC,..., 21 UTC) using that hour's 3B40RT and 3B41RT data sets. Valid estimates are only provided in the band 50 deg. N-S.
Note that we use the term "gridbox" to denote the values on Level 3 data (i.e., gridded data), while we use the term "pixel" to denote individual values of Level 2 data (i.e., instrument footprints). Thus, there can be many pixels contributing to a gridbox.
Both precipitation and random error are scaled by 100 before conversion to 2-byte integer. Thus, units are 0.01 mm/h. To recover the original floating-point values in mm/h, divide by 100. Missings are given the 2-byte-integer missing value, -31999. The source variable is dimensionless.

Currently the random error fields are all set to the 2-byte-integer missing value, -31999. This placeholder will be replaced with actual estimates as development proceeds. The originating machine on which the data files are written is a Silicon Graphics, Inc. Unix workstation, which uses the "big-endian" IEEE 754-1985 representation of 4-byte floating-point unformatted binary numbers. Some CPUs, including PCs and DEC machines, might require a change of representation (i.e., byte swapping) before using the data. In some cases, the gunzip routine, used to uncompress the data, will change representations automatically.

Dataset Validation

These datasets represent a new initiative and should be considered experimental. Formal validation studies are underway, but are not yet available. The combined microwave-IR fields (3B42RT) contain data boundaries between the regions of microwave and IR coverage. Instantaneously the boundaries are usually subtle, but are more noticeable in movie loops, since the regions of coverage change with each image. We encourage early users to report successes and problems in applying these datasets to their particular applications.

Dataset Status

Beta testing began in early December 2001. An official (experimental) version was instituted in late January 2002. Processing changes occurred on 6 February and 12 March 2002. The ambiguous screening was upgraded for the HQ (3B40RT) as of 09Z 28 February 2003 and for the VAR (3B41RT) as of 00Z 2 March 2003. The GPROF estimates for SSM/I over land and coast were upgraded on 12 February 2004. Fractional coverage by precipitation, volume rain, and ambiguous screening upgrades were made to the calibration of other microwave estimates to the TMI starting 00Z 6 April 2004, and cold land and high rainrate improvements were made to the IR calibration beginning 04Z 15 April 2004.

Users should anticipate a series of versions as the algorithm is developed further. We definitely plan to transition to the new TRMM versions of input (which governs calibration of the SSM/I and IR) when they become available in early 2005. As well, an improved non-real-time MPA is being instituted in the official Version 6 TRMM operational product 3B42.

Example Programs

The data fields are all written with C-language code as blocks of bytes, so there are no extraneous bytes in the files. Because the first two fields are 2-byte integers and the rest are 1-byte integers in each file (to save space), users must exercise care in using FORTRAN direct access to read the data. The FORTRAN example programs read all fields with a single OPEN. Alternatively, the files can be opened with different logical record sizes depending on whether one is reading 2-byte-integer or 1-byte-integer fields. Note as well that the units of the logical record size is not part of the FORTRAN 77 standard. On SGI machines it is in 4-byte words, but some other systems expect it in bytes. Also, to repeat an earlier comment, the originating machine on which the data files are written is a Silicon Graphics, Inc. Unix workstation. It uses the "big-endian" IEEE 754-1985 representation of 4-byte floating-point unformatted binary numbers, and some CPUs, such as PCs and DEC machines, might require a change of representation (i.e., byte swapping) before using the data.

The FTP site ftp://aeolus.nascom.nasa.gov/pub/merged/software provides several example programs:

read3B4XRT.c	C example
read_header.f	FORTRAN header-read example
read_rt_file.f	FORTRAN single-read example
read_rt_file.pro	IDL example
read_rt_lines.f	FORTRAN line-by-line example

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