

Algorithm Inventory - GSMaP_MVK(+)

1. Description/Theory

The GSMaP_MVK(+) (Global Satellite Mapping of Precipitation) algorithm is a combination of the CMORPH technique and Kalman filter. The IR data are used as a means to move the precipitation estimates from microwave observation during periods when microwave data are not available at a location in this study. The microwave sensors which we use are TRMM/TMI, Aqua/AMSR-E, and DMS/SSM/F13, 14, 15) for the GSMaP_MVK product; in addition to these, AMSU-B's are included in the GSMaP_MVK+ product. The technique to have high resolution global precipitation map uses the Kalman filter to compute the estimates of the current surface rain fall rates at each 0.1 degree pixel of the infrared brightness temperature by the GEO-IR satellites. The filter predicts the precipitation rate from the microwave radiometer and its propagated product based on the IR data, and then refine the prediction based on the relationship between the IR brightness temperature and surface rainfall rate. The rain rates from the passive microwave radiometer are generated by Aonashi (2000).

2. Strengths and Weaknesses

Strengths: Though the Geo-IR measurements are not directly related to precipitation, its information on cloud top height is available nearly all the time over the globe and is statistically correlated with surface rainfall rate with large variances. This leads to use of a Kalman filter to provide better feedback information to represent the temporal variation of precipitation systems more accurately.

Weaknesses: Rain areas limited to 60S to 60N.

3. Algorithm Inputs

A. Satellite Data

1. Geostationary

NOAA's CPC (Climate Prediction Center) acquires IR geostationary data and supplies to the public composite data sets through the Man-computer Interactive Data Access System (McIDAS). The resolution of the latitude and longitude of the data are at 0.03635 degree (the equator, 4km). The range of the latitude is 60N-60S. The temporal resolution is 1 hour in this product

2. Low Earth Orbit

We use the data from the microwave radiometer for five or six low earth orbit satellites for the GSMaP_MVK product and several microwave sounders as well for the GSMaP_MVK+(plus) product. I use the converted precipitation data as input from the observed brightness

temperature at microwave frequencies. The algorithms to retrieve the precipitation are Aonashi et al (1996) and Kubota et al. (2007) for microwave radiometers, and Weng et al. (2003) for microwave sounders.

	Height	MWR	frequency
	(km)		(GHz)
TRMM	402	TMI	10,19,21,37,85
AQUA	705	AMSR-E	7,10,19,24,37,89
DMSP-F13	803	SSM/I	19,37,85
DMSP-F14	803	SSM/I	19,37,85
DMSP-F15	803	SSM/I	19,37,85
NOAA-15	816	AMSU-B	89, 150, 183
NOAA-16	847	AMSU-B	89, 150, 183
NOAA-17	815	AMSU-B	89, 150, 183

GSMaP_MVK uses the TMI, AMSR-E, and SSM/I's.

GSMaP_MVK+ uses the TMI, AMSR-E, SSM/I's and AMSU-B's.

B. Ancillary Data

1. Model Data

None

2. In Situ

None

3. Other (i.e. topography data base)

None

4. Processing (i.e. Level 2 processing ingests Level 1 products as input)

A. Product Development Level 1

1. Product 1 Identification

Develop 30 min/ 1 hour, 0.1 degree resolution PMW sensor combined rain fall adjusted to the TRMM/PR

2. Product 2 (if necessary) Identification and Development Steps

Develop 1 hour , 3.6 degree resolution atmospheric motion vector derived from the two successive IR images

Develop the Kalman filter table.

B. Product Development Level 2 (if necessary)

Propagate the PMW rainfall rate and apply the Kalman filter
Propagate in backward and calculate the weighted average

5. Output Products

A. Final Product 1 Identification

1. Temporal/Spatial Resolution
1 hour/ 0.1 degree
2. Spatial Coverage
60S to 60N in latitude, and 360 degree in longitude
3. Dedicated Product Web Page Location
<http://www.radar.aero.osakafu-u.ac.jp/~gsmap/>
4. Processing Specifics (if possible)
 - A. Latency (i.e. hours/days product is produced beyond real time)
 - B. Update Frequency (time between processing, i.e. every 3 hours)
5. Operational Availability of Product (if possible)
 - A. Source
 - B. Latency (i.e. hours/days product is available from real time)
 - C. Update Frequency (i.e. time between availability updates)
 - D. Available Record Length (usually a rotating archive)
6. Historical Availability of Product (if possible)
Now processing

6. Planned Modifications/Improvements

A new product called GSMaP_gauge is now under development, which is calibrated by the GPCC.

7. Capability of Producing Retrospective Data

The data available now is from 2003 to 2006. We are now processing more data sets.

8. Contact Personnel

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9. Additional Comments

References

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