A Climatology-Based Scheme for Special Sensor Microwave Imager (SSM/I) Quality Control: An Application to Monthly Rainfall Rates

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INTRODUCTION

The development of rainfall estimates from passive microwave satellite measurements, specifically, those from the Defense Meteorological Satellite Program (DMSP) series, Special Sensor Microwave Imager (SSM/I) have been one of the most important sources of data because: a) the length of the dataset (e.g. SSM/I has been in operation since June 1987 to present); b) the operating frequency range (from 19 GHz to 85 GHz), and c) the conical scan viewing geometry allows to maintain a fixed viewing angle and a constant footprint size along the scan for each frequency

GOALS

Perform a statistical-based QC procedure on the input data (1/3 degree daily antenna temperature files) to remove spurious values not detected in the original database and reprocess the rainfall product using the current version of the algorithm for the period 1992-2007

Assess the discrepancies associated with the SSM/I derived monthly rainfall products through comparisons with various gauge-based and other satellite-derived rainfall estimates.

THE STATISTICAL-BASED QUALITY CONTROL PROCEDURE

$$\Delta T^{*}_{k} = \frac{T_k - \mu_k}{\sigma_k}$$
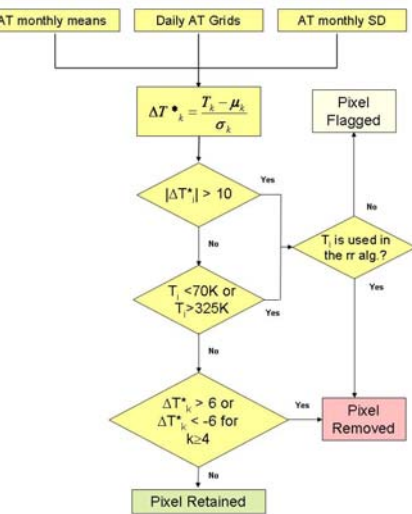
✓ This procedure was performed based on the mean (μ) and standard deviation (σ) in each grid box for the period 1992-2007.

✓ The standardized temperature bias ΔT^* for each channel is performed for each pixel every day

✓ The outlier points are defined as:

✓ $|\Delta T^*_k| > 10$

✓ $\Delta T^*_k > 6$ for $k \geq 4$
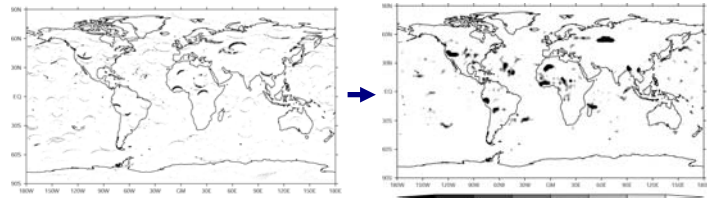
✓ $\Delta T^*_k > 6$ for $k \geq 4$
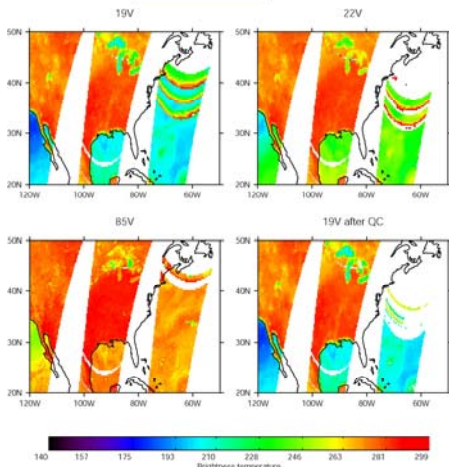
(a) Original data for SSM/I F13 19 GHz V descending orbits on August 02, 2005 over eastern US, (b) idem for 22 GHz H, (c) idem for 85 GHz V, (d) SSM/I F13 85 GHz V descending orbits on August 02, 2005 over eastern US *after* QC procedure

RESULTS

August 2005

Pixels detected w/QC procedure

Monthly bias (reprocessed –original) for 2.5° grid.

Zonal Mean
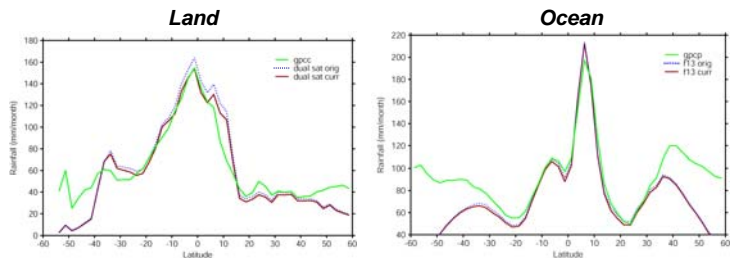
Land   **Ocean**

Rainfall zonal annual mean (in mm mon-1) for the period 1992-2007 over land (left) and ocean (right) for three different estimates including the original (original) and reprocessed data (current).

Running Mean
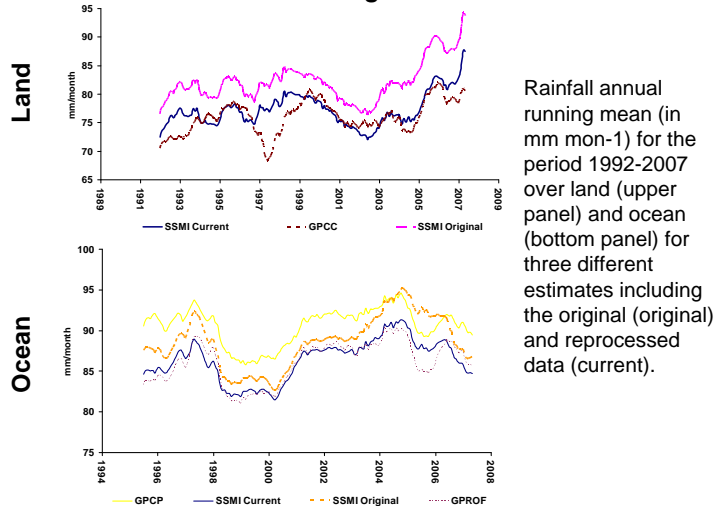
Rainfall annual running mean (in mm mon-1) for the period 1992-2007 over land (upper panel) and ocean (bottom panel) for three different estimates including the original (original) and reprocessed data (current).

SUMMARY AND CONCLUSIONS

➤ After removing all spurious data, the mean bias between the original and the reprocessed dataset is around 3 mm mon-1, but on regional scale studies large amount of rainfall (more than 60 mm mon-1) could be erroneously placed due to the existence of spurious data in the original AT database.

➤ A good agreement between the annual zonal mean for GPCC and the dual-satellite estimates is found for the period 1992-1997 in the region between 30N and 30S. Beyond this region, the difference becomes larger due to limitations of the scattering approach used in this study.

➤ Similar results are observed over ocean where the agreement between SSM/I estimates and GPCP can be observed in the annual zonal mean and the time series.