Comparison of different TMI rainfall products over Ocean

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1. BACKGROUND

Many algorithms for rainfall retrieval have been developed in the past years. For TMI, Goddard profiling algorithm (Gprof) is the operational algorithm (Kummerow et al, 2001). The Microwave Integrated Retrieval System (MiRS) developed by JCSDA has added the application of TMI observations in the recent years.

MiRS is a 1-D variational system, which has been developed to process spaceborne measurements (Boukabara et al, 2011). It is an iterative physical inversion system that finds a consistent geophysical solution to fit all radiometric measurements simultaneously. One of the particularities of the system is its applicability in cloudy and precipitating conditions. It inverts the radiative transfer equation by finding radiometrically appropriate profiles of temperature, moisture, liquid cloud, and hydrometeors, as well as the surface emissivity spectrum and skin temperature. And then rainfall rate is derived by profile of hydrometeors.

Gprof algorithm is the current operational rainfall algorithm for TMI and produces 2A12 rainfall product. It retrieves both the instantaneous rainfall and the rainfall vertical structure by using a Bayesian approach to match the observed brightness temperatures to hydrometeor profiles derived from a-priori database, which plays an important role in the retrieval.

Some differences have been found in the comparison of these two rainfall rate results. A typhoon case over ocean is analyzed here in order to compare them.

2. DATA

- TMI 1B11 brightness temperature, orbit number: 79002
- TMI 2A12 rainfall product
- PR 2A25 rainfall product
- Zhanjiang ground-based radar data
- Case:
  - typhoon NESAT
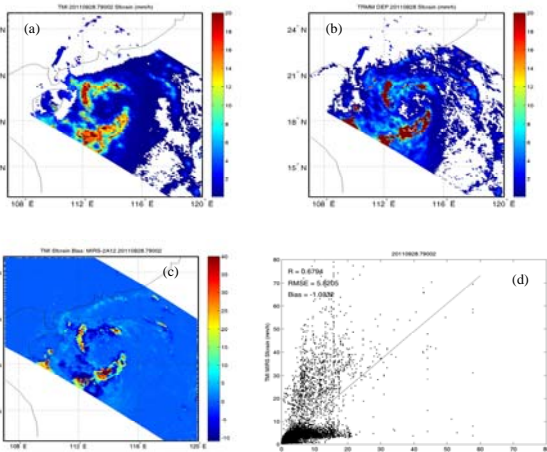 - Date: 28 September 2011

3. COMPARISON

Fig. 1 Comparison results of rainfall rate: from 1D-Var algorithm (a), from GPROF algorithm (b), bias: 1D-Var minus GPROF (c) and error statistics (d)
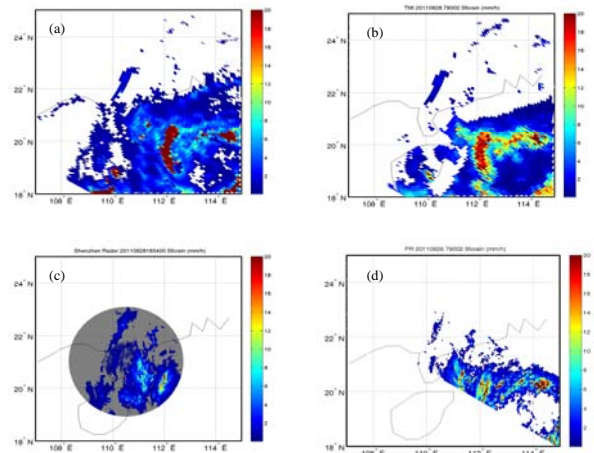
4. VALIDATION

Fig. 2 Comparison of rainfall rate: from 1D-Var algorithm (a), from GPROF algorithm (b), ground-based radar observation (c) and PR 2A25 rainfall product (d)

- **Radar rainfall estimates** A good consistency between ground-based radar observations and PR 2A25 rainfall product can be found. Comparatively, a larger range of heavy rainfall was showed from Fig.2(d)

- **Coastal rainfall** Rainfall rate from 2A12 product missed more rainfall pixels and that from Mirs system had a good consistency with radar observations.

- **Heavy rainfall region** Rainfall rate from Mirs system was much higher than radar observations and that from 2A12 product had a similar intensity with radar observations.

- **Rainless region** Some false estimations occurred for these two algorithms.

5. DISCUSSION

- In addition to rainfall rate, hydrometer profiles were retrieved by these two algorithms. For MiRS system, rainfall rate can be derived from cloud liquid water path, rain water path and ice water path by a statistical relationship, which was generated using a number of runs of the cloud resolving model MM5.

- Three hydrometer water paths were showed here and were compared with those from TMI 2A12 product. A big difference can be found and more analysis will be done in the future work.
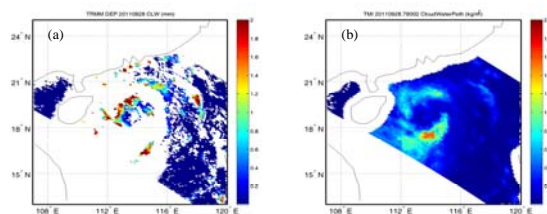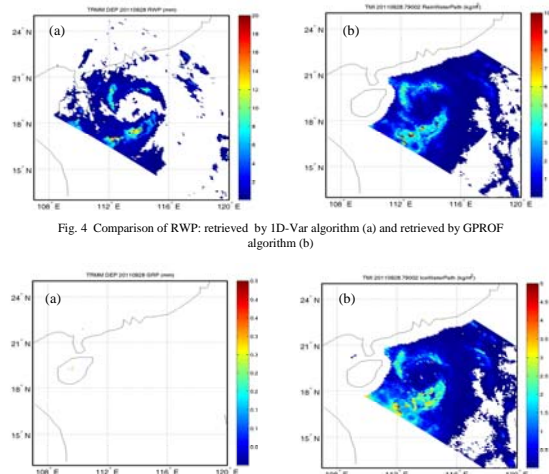

Fig. 4 Comparison of RWP: retrieved by 1D-Var algorithm (a) and retrieved by GPROF algorithm (b)

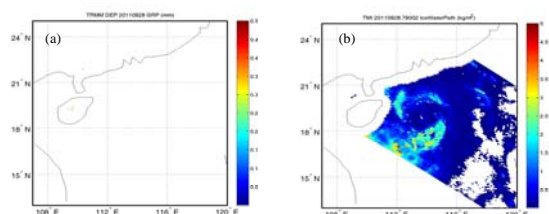Fig. 3 Comparison of CLW: retrieved by 1D-Var algorithm (a) and retrieved by GPROF algorithm (b)

Fig. 5 Comparison of IWP: retrieved by 1D-Var algorithm (a) and retrieved by GPROF algorithm (b)