Introduction

As part of the Suomi National Polar-orbiting Partnership (NPP), Crosstrack Infrared and Microwave Sounding Suite (CrIMSS), a joint system that utilizes the Crosstrack Infrared Sounder (CrIS) and the Advanced Technology Microwave Sounder (ATMS) in synergy, an ATMS only rain flag is utilized to edit out potentially rain contaminated scenes that will lead to degraded temperature and moisture profiles.

Comparing to MIRS, the standard NOAA rainrate product via NESDIS, the current CriMSS rain flag has shown several deficiencies, e.g.,
1. Little rain detected in the ITCZ (rainiest region on the globe);
2. Little precipitation over land is detected;
3. Too much mid-latitude rain over ocean (Note that recent relaxation of Chi-Sq convergence term has improved this problem – not shown)
4. Little high-latitude rain.

Possible reasons for the inadequacy of the rain flag algorithm may be attributed to
1. Outdated nature of the AMSU-A algorithm,
2. The algorithm was not implemented properly

To improve the CriMSS rain flag algorithm, a more accurate scheme that utilizes both AMSU-A and AMSU-B/MHS channels through MSPPS heritage has been introduced, in particular, measurements at above 89 GHz which is more sensitive to precipitation than those which use more traditional channels at or below 89 GHz. To apply the scheme correctly, the ATMS channels are retrofitted to AMSU counterparts.

Current CriMSS Rain Flag, May 15, 2012

Simulating AMSU Channels Utilizing ATMS

To build the relationship between AMSU and ATMS channels, a bunch of atmospheric profiles (approximately 240,000) from ERA-Interim are selected, and CRTM is used to simulate brightness temperature at ATMS and AMSU-A/B frequencies, for ocean and land, under clear-sky. The simulated brightness temperatures are compared with respect to frequencies and sensor scan angles, and following channels and approaches are selected for final regression, note B stands for AMSU channels and S for ATMS:

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B3 = a_0 + a_1 S_3 + a_2 S_3^2
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\[
B17 = a_0 + a_6 S_1 + a_7 S_1^2 + a_8 S_1^2 + a_9 S_1 + a_10 S_1^2 + a_11 S_1^2
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Angular Comparison Given the Same Profile

Evaluation Utilizing Other Rain Products

MIRS Rain Rate for ATMS, May 15, 2012

MSPPS Rain Rate for ATMS, May 15, 2012