COMPARISON OF PRELIMINARY RESULTS FROM AIRBORNE ASTER SIMULATOR(AAS) WITH TIMS DATA

Yoshiaki Kannari, Franklin Mills, Hiroshi Watanabe,
Teruya Ezaka, Tatsuhiko Narita, and *Sheng-Huei Chang
JAPEX Geoscience Institute, Inc.
Akasaka Twin Tower, East Wing Third Floor,2-17-22,Akasaka,
Minato-ku,Tokyo, Japan
* Geophysical Environmental Research Corp.
1 Bennett Common Millbrook, New York 12545

1.INTRODUCTION

The Japanese Advanced Spaceborne Thermal Emission and Reflection radiometer(ASTER), being developed for a NASA EOS-A satelite, will have 3 VNIR, 6 SWIR, and 5 TIR (8-12um) bands. An Airborne ASTER Simulator(AAS) has been developed for Japan Resources Observation System Organization (JAROS) by the Geophysical Environmental Research(GER) Corp. to research surface temperature and emission features in the MWIR/TIR, to simulate ASTER's TIR bands, and to study further possibility of MWIR/TIR bands.

ASTER Simulator has 1 VNIR, 3 MWIR (3-5um), and 20 (currently 24) TIR bands. We collected data over 3 sites -- Cuprite, Nevada; Long Valley/Mono Lake,California; and Death Valley, California --with simultaneous ground truth measurements. We present preliminary data collected by AAS for Cuprite, Nevada and compare AAS data with TIMS data.

2.AIRBORNE ASTER SIMULATOR DATA

The AAS data were acquired during the afternoon of Dec.5,1991. Each image is 495 lines of 544 pixels(512 data, 16 heated reference black body, 16 ambient reference blackbody). Each pixel is signed 15 bit data. Table 1 lists the approximate center wavelength and full-width at half- maximum(FWHM) for each channel based on preliminary laboratory tests. Additional information on the AAS can be found in Watanabe,et.al.(1991). The raw AAS data was converted to radiance by using the following equation:

$$Rad_d = (DN_d - DN_w)/(DN_c - DN_w)*(Rad_c - Rad_w) + Rad_w$$

The radiances for each reference blackbody were calculated based on the temperatures recorded by the operator at the beginning of each image and the center wavelength of the nominal bandpasses. The temperatures of the black bodies were assumed constant for the entire image. DN_w was determined, separately for each scan line, by averaging the DN values of the heated blackbody on that

scan line. DN_c was determined in a similar manner for the ambient black body. After conversion to radiances, the radiances were converted to 8-bit integers and processed to create panchromatic, false color, and decorrelation stretch images. The normalization method was used to determine temperature and emissivity for each pixel and channel.

Performance data for AAS were estimated from approximate spectral tests at NASA Stennis Space Center and laboratory test at GER. Performance was also estimated by the Cuprite data which has good outcrops of quartzite, opalized rocks and carbonate rocks.

3.COMPARISON OF AAS DATA WITH TIMS DATA

TIMS data for the western Cuptite were acquired on Sept.1,1990. This TIMS data covered the same area of AAS CPWA2 data. The performances of TIMS were well known.

Comparison of decorrelation stretch images from TIMS data with those of AAS data shows that the TIMS image of band 1·3·4 is similar to a part of the AAS image of band 2·5·6 or band 2·4·6 or band 2·5·7 for 4 selected sites (Figure 1).

The decorrelation stretch images from the AAS are not as clean as the TIMS decorrelation images. This is caused by several factors. First, the TIMS data was collected over much higher ground temperatures. Second, the bandwidths of the AAS are narrower than TIMS for most channels. Third, the decorrelation stretch amplifies the noise level in an image.

This comparison provides some spectral performances and band characteristics of the current AAS .

4.CONCLUSION

Estimated center wavelengths of the AAS in its Dec. 1991 configuration are listed in table 1. The FWHM bandwidth for the Dec. 1991 AAS was 0.2-0.6μm, varying with channel. The Dec. 1991 FWHM for most channels is narrower than TIMS. Accordingly, the S/N ratio of the Dec. 1991 AAS field survey data is less than TIMS Sept. 1990 field survey data. The Dec. 1991 AAS NEdT, estimated from field survey data, is about 0.3-1.0K in the TIR bands.

Following approximate calibration measurements at SSC in April 1992, GER will adjust and modify the AAS to improve its performance before the Sept. 1992 data collections.

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Table 1. Estimated Characteristics Of AAS For Dec. 1991 Survey Flight.

Channel	Detector System	Estimated Center Wavelength(Dec.91)	Estimated FWHM(Dec.91)
1	TIR1	----	-----
2	TIR1	8.2	0.6
3	TIR1	8.6	0.5
4	TIR1	8.9	0.5
5	TIR1	9.3	0.3
6	TIR1	9.6	0.25
7	TIR1	9.8	0.2
8	TIR1	9.9	0.25
9	TIR1	10.3	0.2
10	TIR1	10.5	0.2
11	TIR1	10.7	0.2
12	TIR1	----	----
13	TIR2	----	----
14	TIR2	9.8	0.2
15	TIR2	9.9	0.2
16	TIR2	10.1	0.2
17	TIR2	10.3	0.2
18	TIR2	10.5	0.2
19	TIR2	10.7	0.2
20	TIR2	11.0	0.4
21	TIR2	----	---
22	TIR2	11.5	0.3
23	TIR2	----	---
24	TIR2	----	---
25	MWIR	3.0-3.6	
26	MWIR	3.6-4.2	
27	MWIR	4.4-5.0	
28	VNIR	0.75-0.85	

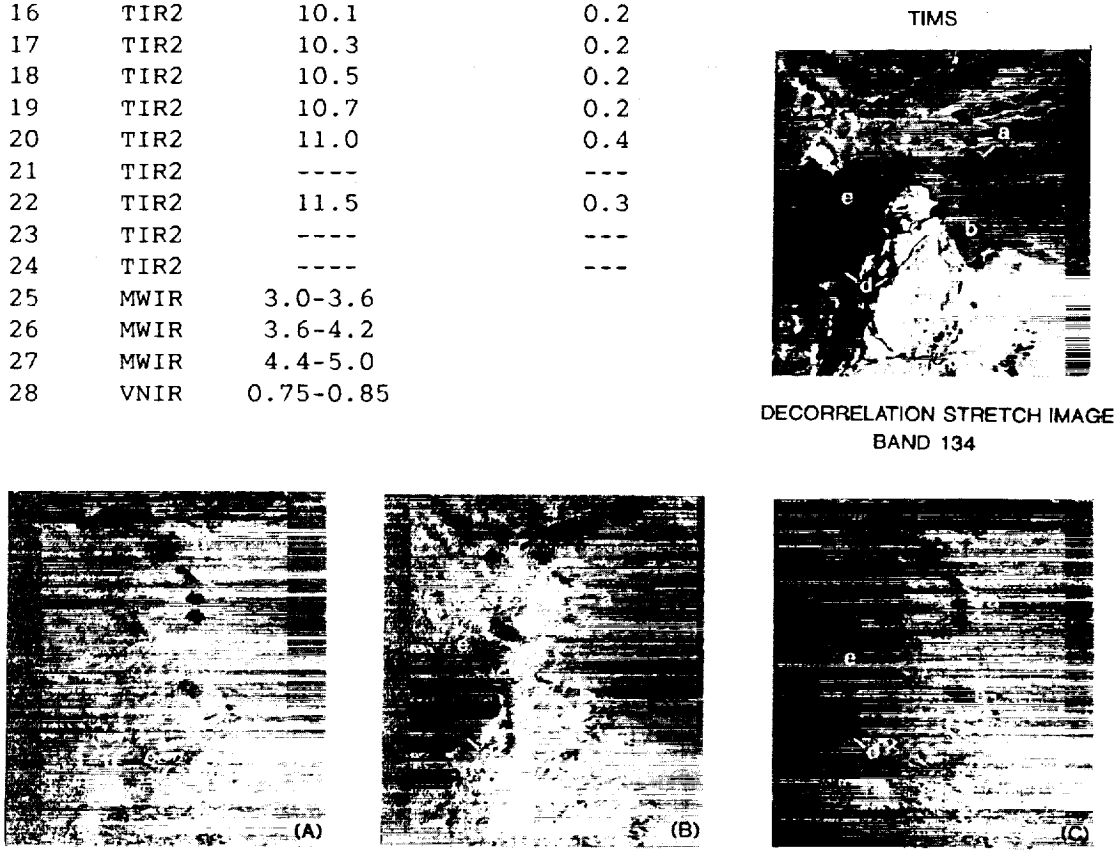

Figure 1. Decorrelation Stretch Image of TIMS Band 134 and Those Images of AAS. (A) Band 256 (B) Band 246 (C) Band 257