VICARIOUS CALIBRATION OF THE VISIBLE AND NEAR-INFRARED CHANNELS OF VARIOUS IN-FLIGHT RADIOMETERS BY DUNHUANG SITE IN 2008

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1. INTRODUCTION

2008/09/02~2008/09/13 the vicarious calibration experiment was carried out in Dunhuang radiometric calibration site, Gansu province, China. Totally 5 days' (2008/09/02, 2008/09/04, 2008/09/06, 2008/09/10 and 2008/09/11) effective synchronization experiment data was gotten. During those days, FY3A-MERSI, FY3A-VIRR, TERRA-MOEIS, NOAA17-AVHRR and NOAA18-AVHRR had passed through the top of Dunhuang several times by small enough observation zeniths. So the vicarious calibration could be made and the calibration slope and intercept had been gotten.

2. CALIBRATION METHOD

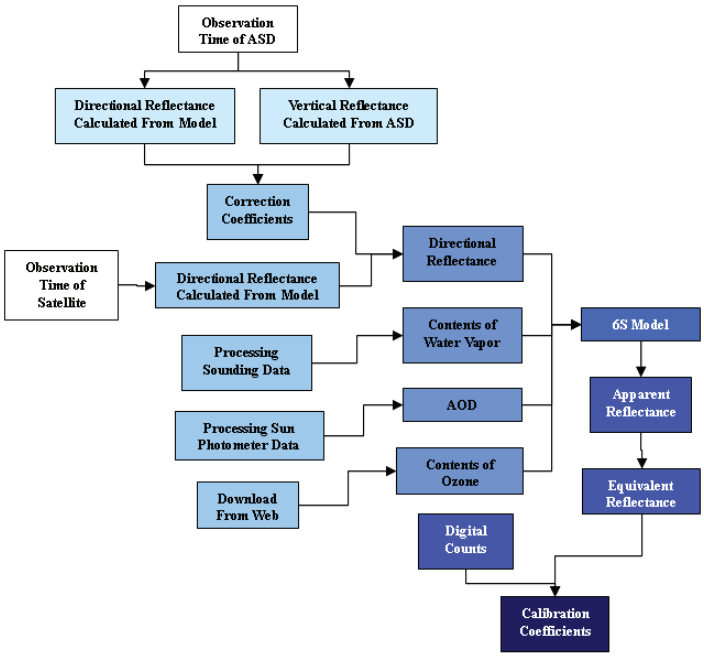

Figure 1 site vicarious calibration flow of the visible and near-infrared channels

The calibration is based on the reflectance based method[1~8]:The vertical reflectance of 11 synchronization points in Dunhuang site was measured by ASD FR spectral meter less than 1 hour fore-and-aft the satellite passing by. The vertical reflectance could also be calculated by the algorithm for modeling bidirectional reflectance anisotropies of the land surface (AMBRALS) [9] invented by MODIS land group. The difference between the measured one and the calculated one was divided and averaged to get the correction coefficient *A*. *A* corrected the directional reflectance calculated by AMBRALS at the moment the platform passing by.

$$A_i(\theta_{si}) = \frac{\rho_{MEASURE}(\theta_{si},0,0)}{\rho_{AMBRALS}(\theta_{si},0,0)} \quad i = 1,2\cdots 11 \tag{1}$$

$$A = \frac{1}{n}\sum_{i=1}^{n} A_i(\theta_{si}) \tag{2}$$

$$\rho_{DIRECTION}(\theta_s,\theta_v,\phi_s-\phi_v) = A\rho_{AMBRALS}(\theta_s,\theta_v,\phi_s-\phi_v) \quad n = 11 \tag{3}$$

In the formula, θ_s is the solar zenith, θ_{si} is the solar zenith at different synchronization points, ϕ_s is the solar azimuth, θ_v is the observation zenith, and ϕ_v is the observation azimuth.

The aerosol optical depth (AOD) is measured by sun photometer CE318 placed beside the synchronization points. The total water content was calculated by the sounding data measured by Dunhuang national climatic station (No. 52418). The apparent reflectance was calculated by the use of 6S [10] model and was corrected by the sun zenith cosine and sun-earth distance.

3. TYPICAL RESULTS

The calibration slopes and intercepts of FY3A-MERSI, FY3A-VIRR, TERRA-MOEIS, NOAA17-AVHRR and NOAA18-AVHRR were calculated. The relative standard deviation were below 3% of FY3A-MERSI and FY3A-VIRR; below 2% of TERRA-MODIS; below 2.5% of NOAA17-AVHRR; below 0.6% of NOAA18-AVHRR. The relative error of slopes compared with the publicized one were below 3.5% of TERRA-MODIS; were 4.0183 %(BAND1) and 7.5627 %(BAND2) of NOAA17-AVHRR; were 12.14% (BAND1) and 14.00 %(BAND2) of NOAA18-AVHRR.

Table 1 site vicarious calibration of TERRA-MODIS

	SI STD (%)			SITE SCALES				RELATIVE ERROR COMPARED TO THE L1B DATA		
bands	2008-9-4	2008-9-6	2008-9-11	2008-9-4	2008-9-6	2008-9-11	STD	2008-9-4	2008-9-6	2008-9-11
1	3.2781	3.1246	3.1829	5.21E-05	5.25E-05	5.25E-05	0.37%	-0.12%	0.59%	0.89%
2	4.7665	4.5171	4.2692	3.13E-05	3.15E-05	3.15E-05	0.33%	-1.88%	-1.26%	-0.91%
3	1.7188	1.4299	2.3028	4.18E-05	4.20E-05	4.14E-05	0.67%	0.88%	1.38%	0.19%
4	2.0751	1.9477	2.3857	3.54E-05	3.55E-05	3.56E-05	0.28%	-1.12%	-0.58%	-0.34%
5	18.403	17.3986	5.4489	3.50E-05	3.50E-05	3.86E-05	0%	-8.12%	-8.27%	1.84%
6	4.4705	4.2822	3.5894	3.37E-05	3.34E-05	3.45E-05	1.65%	-2.22%	-3.14%	0.33%
7	4.5953	4.4565	3.6744	2.90E-05	2.86E-05	2.79E-05	1.98%	3.47%	1.96%	-0.13%
8	1.5286	1.8215	1.6425	2.29E-05	2.25E-05	2.29E-05	1.10%	0.55%	-1.34%	0.67%
9	1.7985	1.5392	2.2277	1.24E-05	1.24E-05	1.23E-05	0.55%	2.38%	2.09%	1.49%
10	1.6899	1.5513	2.2443	7.06E-06	7.10E-06	7.08E-06	0.31%	0.41%	1.09%	1.01%
11	1.8469	16.3128	2.272	5.28E-06	2.81E-06	5.28E-06	0%	-1.44%	-62.34%	-1.05%

Emphasized data is the abnormity data in some bands; it was induced by the bad pixel on detectors.

4. DISCUSSION

The results showed the stability and veracity of the calibration arithmetic except for the water vapor absorption bands. It could also be found that the relative error of MODIS is lower than AVHRR.

5. REFERENCES

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