

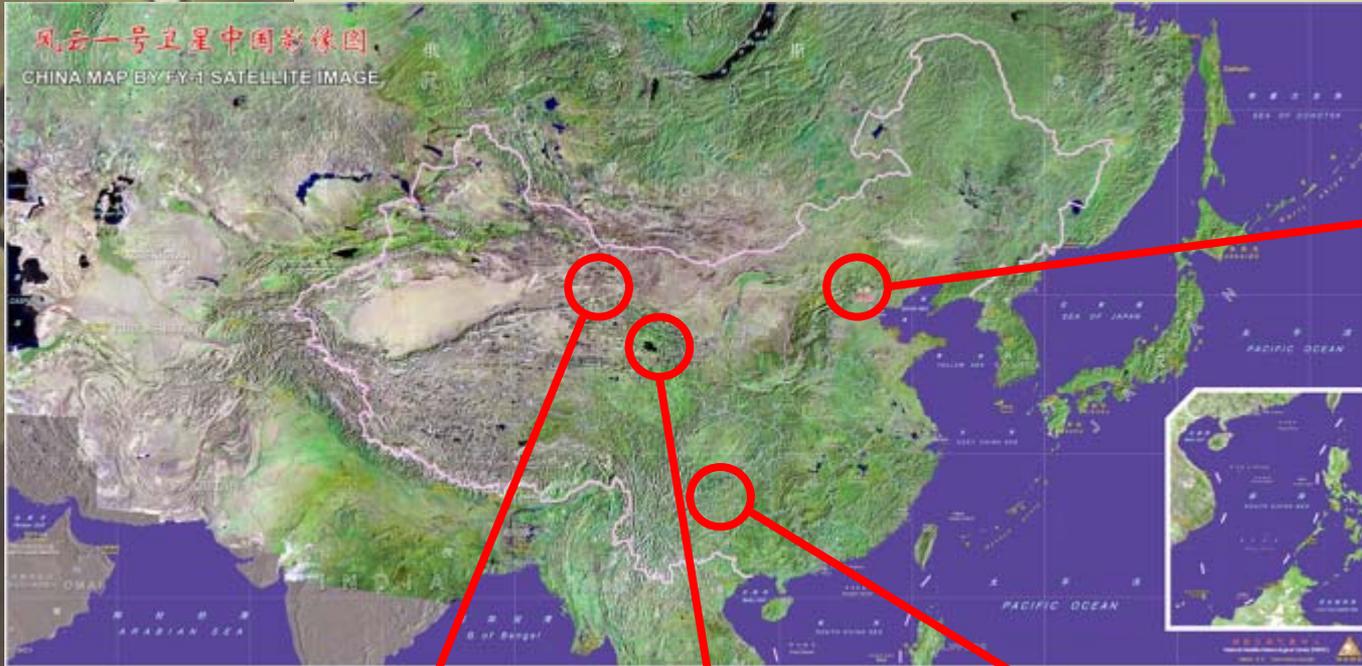


VNIR channels Calibration for Fengyun Series by using of the Earth-based Reference Site field campaign

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Earth-based reference sites and field experiments



Four Earth-based reference sites in China

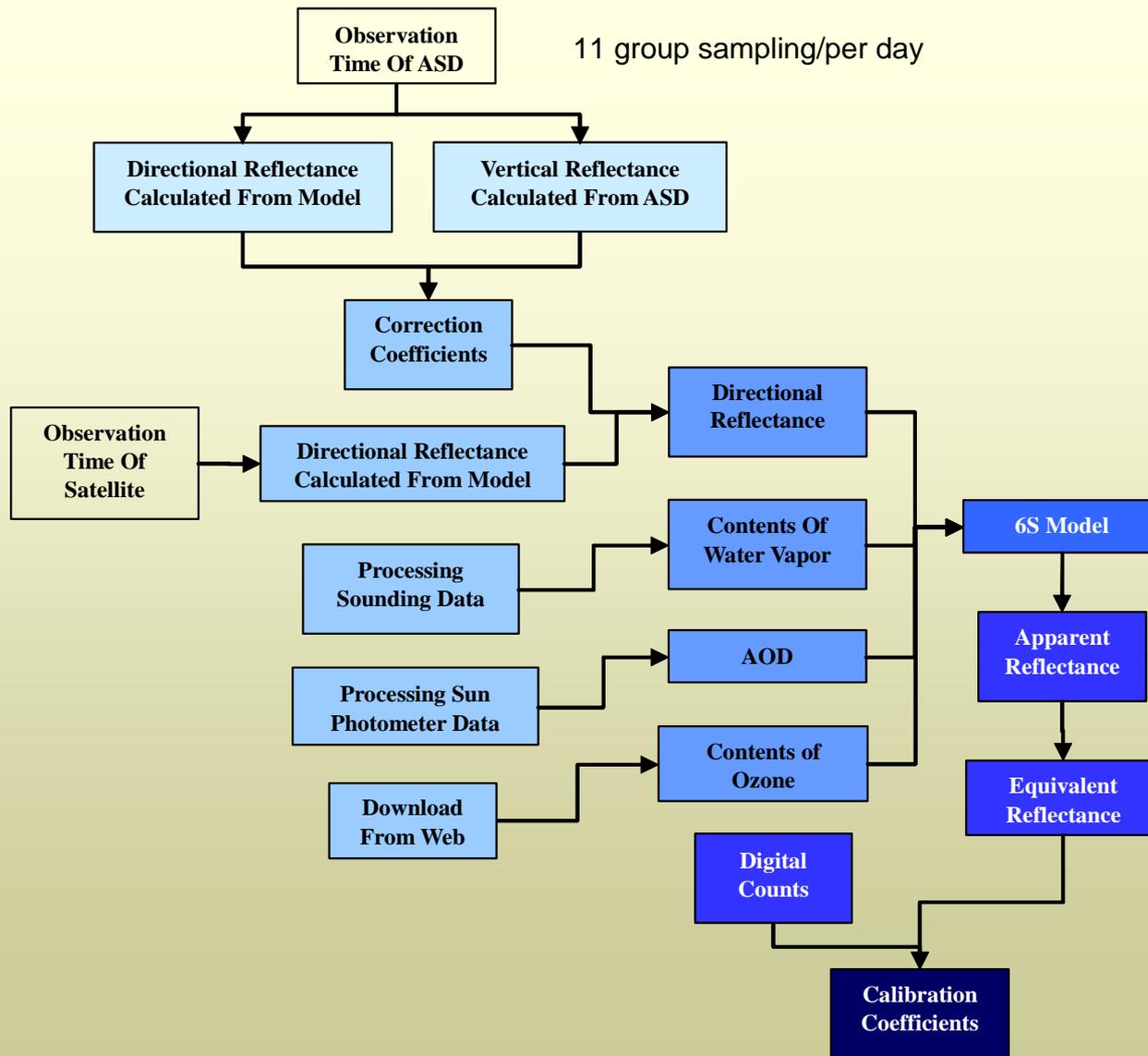
Site	Characteristic	Location	Purpose
Dunhuang	Gebi Desert, homogenous surface, dry atmosphere, and high visibility	40° 10' N, 94° 20' E Elevation: 1176 m	On-orbit calibration for VNIR band
Qinghai	Lake, Good Lambertian feature, dry atmosphere, and high visibility	36° 45' N, 100° 20' E Elevation: 3196 m	On-orbit calibration for TIR band
Beijing	Laboratory on the top of NSMC build	116.46° N, 39.92° E Elevation: 48 m	<ul style="list-style-type: none"> ■ Validation for the calculation from radiation transfer code with very high spectral resolution ■ Benchmark measurements
Lijiang	Local meteorological observation station, dry atmosphere, high visibility	100.25° N, 26.86° E Elevation: 2300 m	Pre-launch calibration for VNIR band of engineering and flight model



Latest Activities in 2008

- The latest China remote satellite radiometric calibration experiment was held in September, 2008 at Dun-huang site, Gan-su province, China.
- In the experiment, the Visible and Near-infrared Channels of FY-3A/VIRR were calibrated.

CALIBRATION FLOW

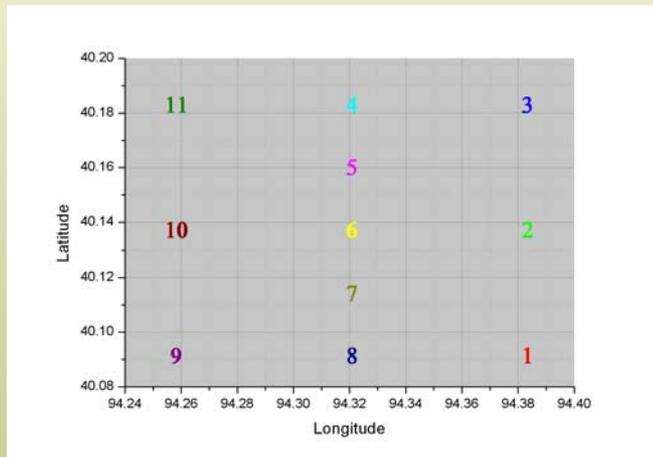




Site & synchronization points



- Dunhuang site is 30 km away from residential area. The distance is far enough to avoid air pollution but convenient for traffic.
- 11 synchronization points were selected in Dunhuang site, covered 10*10km² area.



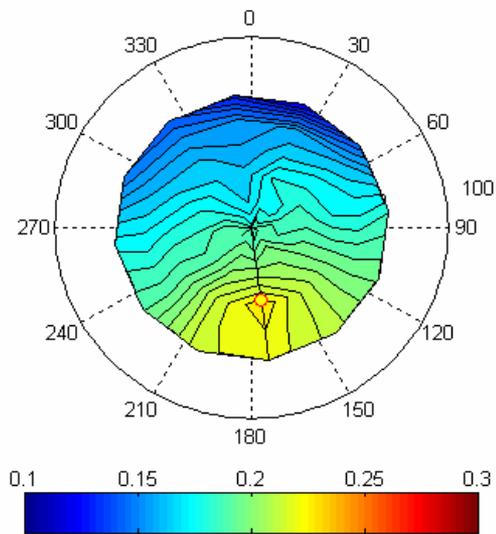
Reflectance Measuring

- The vertical reflectance of 11 synchronization points was measured by ASD FR spectral meter.
- the directional reflectance at the moment the platform passing by was calculated by AMBRALS and corrected by the measured one.
- NSMC bought a new device to measure directional reflectance.

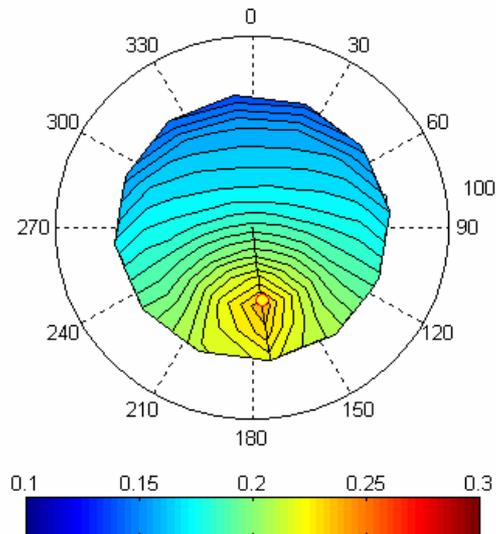


BRF

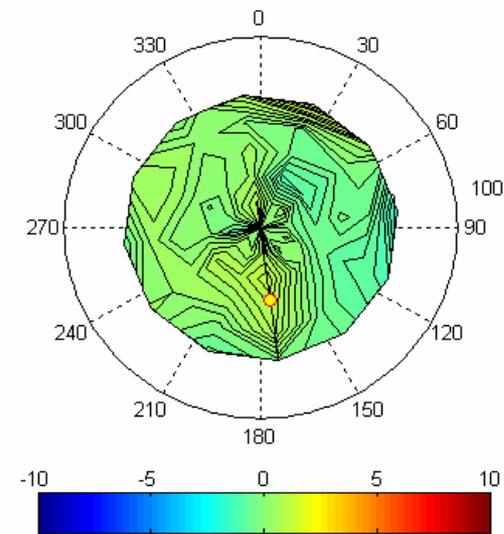
Measured BRF(550nm) @ Ruoqiang Site
20080919, 4th Group



Modelized BRF(550nm) @ Ruoqiang Site
20080919, 4th Group



Bias of two BRF(550nm)(%) @ Ruoqiang Site
20080919, 4th Group



Aerosol optical depth (AOD)



- Aerosol optical depth (AOD) was measured by sun photometer CE318 placed in the Dunhuang national climatic station and the site.
- Normal meteorological observation was also taken in the site

The total water content (TWC)



- The total water content (TWC) was calculated by the sounding data measured by Dunhuang national climatic station synchronously.

Correcting the Reflectance

- The directional reflectance from the payload view was calculated by AMBRALS and corrected by vertical reflectance measured in Dunhuang.
- The correction coefficients were gotten by vertical reflectance measured by ASD and calculated by AMBRALS.

$$\rho_{AMBRALS}(\theta_s, \theta_v, \phi_s - \phi_v) = f_{iso} + f_{vol} RossThick + f_{geo} LiSparse$$

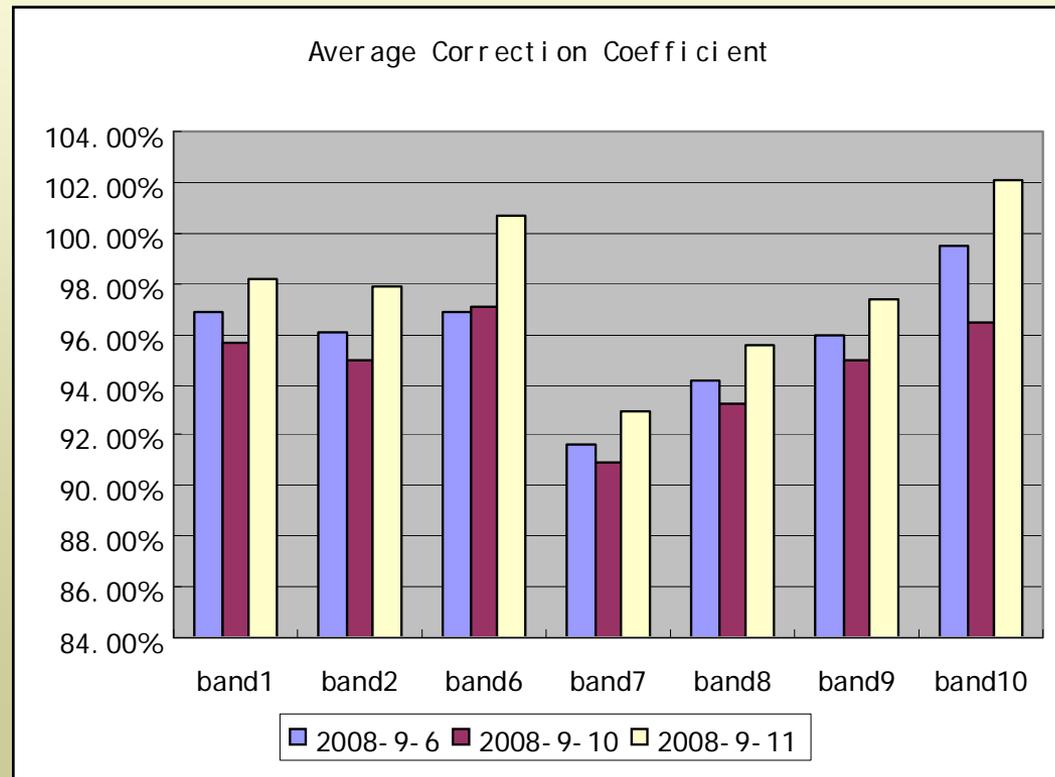
$$\rho_{DIRECTIONAL}(\theta_s, \theta_v, \phi_s - \phi_v) = \left[\frac{1}{n} \sum_{i=1}^n A_i(\theta_s) \right] \rho_{AMBRALS}(\theta_s, \theta_v, \phi_s - \phi_v) \quad n = 11$$

$$A_i(\theta_s) = \frac{\rho_{ASD}(\theta_s, 0, 0)}{\rho_{AMBRALS}(\theta_s, 0, 0)} \quad i = 1, 2, \dots, 11$$



Average correction coefficient

- In some bands of VIRR, the correction coefficient was around 92%, that showed the difference between measured one and calculated one reached about 8%.



Calibration Results

- The relative standard deviation (RSD) of 3 day's calibration slope was below 3% except for the water absorption band.

Slope	2008/09/06	2008/09/10	2008/09/11	Average	RSD
Band1	0.1236	0.1217	0.1254	0.1236	1.50%
Band2	0.1276	0.1253	0.1304	0.1278	2.00%
Band6	0.0965	0.0972	0.1012	0.0983	2.58%
Band7	0.0615	0.0621	0.0622	0.0619	0.61%
Band8	0.0582	0.0577	0.0586	0.0582	0.78%
Band9	0.0561	0.0553	0.0567	0.0560	1.25%
Band10	0.0636	0.0619	0.0683	0.0646	5.13%





Calibration for other payload

- FY-1C, FY-1D, FY-2B, FY-3A/MERSI, FY-2C, FY-2D, CBERS-1, CBERS-02, CBERS-02B, HY-1, HY-1B
- SPOT-4, NOAA17/18/METOP_AVHRR, TERRA_MODIS
- Some calibration results showed below

TERRA_MODIS

MODIS	SLOPE			RELATIVE ERROR WITH THE MODIS 1B		
	Sept. 4, 2008	Sept. 6, 2008	Sept. 11, 2008	Sept. 4, 2008	Sept. 6, 2008	Sept. 11, 2008
BAND1	5.2170E-05	5.2494E-05	5.2687E-05	-0.06%	0.65%	1.28%
BAND2	3.1332E-05	3.1493E-05	3.1622E-05	-1.84%	-1.23%	-0.55%
BAND3	4.1784E-05	4.1991E-05	4.1453E-05	0.81%	1.36%	0.21%
BAND4	3.5386E-05	3.5557E-05	3.5542E-05	-1.10%	-0.53%	-0.36%
BAND5	3.5058E-05	3.4982E-05	3.8998E-05	-8.07%	-8.18%	2.94%
BAND6	3.3719E-05	3.3375E-05	3.4671E-05	-2.29%	-3.21%	0.85%
BAND7	2.9053E-05	2.8603E-05	2.8015E-05	3.59%	2.13%	0.30%

- The red font color showed large difference, that's because of the detector trouble of band 5.

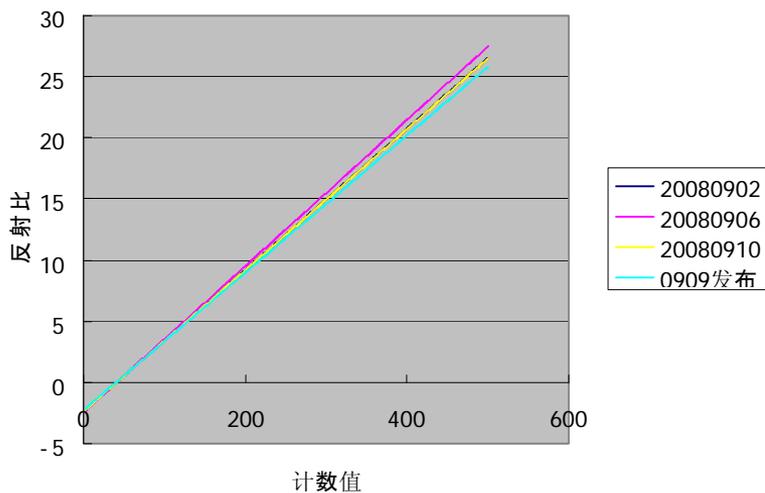


NOAA17_AVHRR

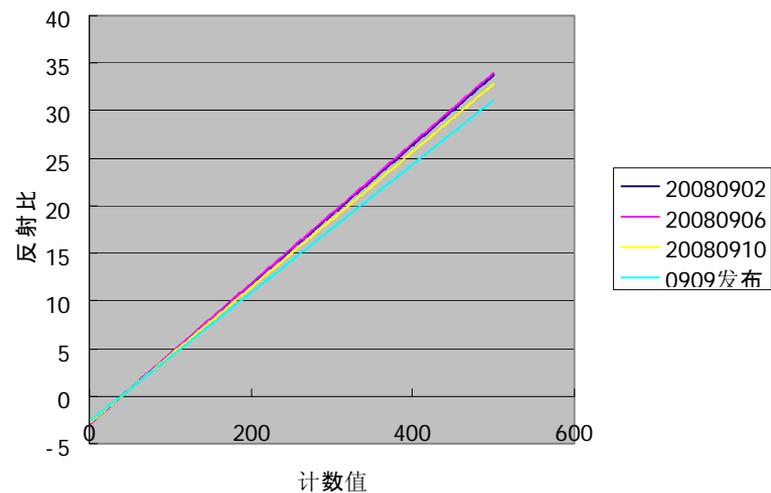
SLOPE	20080902	20080906	20080910	mean	std	0909 RELEASE	RELATIVE ERROR
band1	0.0578	0.0598	0.0577	0.0584	2.0125%	0.0561	4.0183%
band2	0.0733	0.0738	0.0713	0.0728	1.8450%	0.0675	7.5627%

INTERCEPT	20080902	20080906	20080910	mean	std	0909 RELEASE	RELATIVE ERROR
band1	-2.3712	-2.4512	-2.3647	-2.4080	2.5418%	-2.2460	6.9603%
band2	-2.9316	-2.9520	-2.8505	-2.9012	2.4742%	-2.6490	9.0882%

NOAA17- AVHRR通道1低端定标曲线



NOAA17- AVHRR通道2低端定标曲线





Conclusion

- Since there are no calibration system onboard for current VNIR channels in FY series, the earth-base reference site calibration are taken as the operational way to calibrate VNIR channels for FY series (both polar and Geo).
- Earth-base reference site calibration (for example, Dunhuang Gobi desert) can provide consistent and stable information for satellite calibration



The End !