

ASTER radiometric parameters

1 Unit Conversion Coefficients: UCC (from DN: Digital Number to radiance)

From the raw data of ASTER instrument data of level 0, level 1A and 1B products are generated. Although the imagery data of level 1A are totally identical to raw data of level 0, level 1A product contains geometric and radiometric correction coefficients which are attached in the header while the level 1B product is geometrically and radiometric corrected data. The level 1B data are in terms of scaled radiance so that users can convert level 1B Digital Number: DN to radiance with the unit conversion coefficients. DN value of 0 is allocated to dummy pixels while DN value of 1 is allocated to zero radiance so that DN of 1 corresponds to the offset value. On the other hands, DN value of 254 is allocated to the maximum radiance for VNIR and SWIR while DN value of 255 is allocated to saturated pixels. Meanwhile quantization bits for TIR are 12 so that 4094 is allocated to the maximum radiance for TIR bands while 4095 is allocated to saturated pixels for TIR bands. Table 1 shows the maximum radiances for VNIR, SWIR and TIR bands.

Radiance: R can be obtained from DN values as follows,

$$R = (DN - 1) UCC \quad (1)$$

where UCC denote Unit Conversion Coefficients shown in Table 2.

Actual conversion coefficients can be found in the header information as a metadata. Because the most appropriate Radiometric Calibration Coefficients: RCC varied for the time being so that users have to take the RCC version (coefficients) then UCC and RCC as well as gain mode have to be considered in the conversion from DN to radiance. RCC, UCC and gain mode are also in the header so that you can find these with importing function in an ERDAS.IMG file via the Tools | View HFA-File Structure| in HDF Global Attributes or HDF Band Attributes, for instance.

2 Radiometric Calibration Coefficients for VNIR

RCC are listed in the Table 3. These are changed in accordance with the version No. If any of the RCC changed 2 %, then RCC coefficients which are applied to the Level 1B are updated together with the version No. RCC updates have been done for TIR for every version numbers except for No.1,2 and 4. RCC of SWIR bands have not been updated so far (up to September 2004). In other words, SWIR gain, in terms of OBC data derived RCC is quite stable.

Table 1 Maximum radiance of ASTER instruments, VNIR (Band 1, 2 and 3N (Nadir) and 3B (Backward telescope), SWIR (Band 4 to 9) and TIR (band 10 to 14)

Band No.	Maximum Radiance (W/m ² str μ m)			
	High Gain	Normal Gain	Low Gain 1	Low Gain 2
1	170.8	427	569	N/A
2	179.0	358	477	N/A
3N and 3B	106.8	218	290	N/A
4	27.5	55.0	73.3	73.3
5	8.8	17.6	23.4	103.5
6	7.9	15.8	21.0	98.7
7	7.55	15.1	20.1	83.8
8	5.27	10.55	14.06	62.0
9	4.02	8.04	10.72	67.0
10	N/A	28.17	N/A	N/A
11	N/A	27.75	N/A	N/A
12	N/A	26.97	N/A	N/A
13	N/A	23.30	N/A	N/A
14	N/A	21.38	N/A	N/A

Table 2 Calculated Unit Conversion Coefficients: UCC

Band No.	Conversion Coefficients (W/m ² str μ m)			
	High Gain	Normal Gain	Low Gain 1	Low Gain 2
1	0.676	1.688	2.25	N/A
2	0.708	1.415	1.89	N/A
3N and 3B	0.423	0.862	1.15	N/A
4	0.1087	0.2174	0.29	0.29
5	0.0348	0.0696	0.0925	0.409
6	0.0313	0.0625	0.083	0.39
7	0.0299	0.0597	0.0795	0.332
8	0.0209	0.0417	0.0556	0.245
9	0.0159	0.0318	0.0424	0.265
10	N/A	0.006822	N/A	N/A
11	N/A	0.00678	N/A	N/A
12	N/A	0.00659	N/A	N/A
13	N/A	0.005693	N/A	N/A
14	N/A	0.005225	N/A	N/A

Table 3 Radiometric Calibration Coefficients as a function of the version No.

Version No.	Band 1	Band 2	Band 3	Since when
1.00-2.00	1	1	1	1996/11/9
2.01	0.972	0.982	0.978	2000/2/2
2.02-2.03	0.948	0.972	0.982	2000/6/4
2.04	0.931	0.966	0.985	2000/11/4
2.05-2.06	0.921	0.959	0.982	2001/2/14
2.07-2.08	0.892	0.95	0.983	2001/12/26
2.09	0.802	0.872	0.917	2002/5/8
2.13	0.779	0.852	0.902	2003/5/15
2.16	0.758	0.831	0.883	2004/1/05

Table 4 OBC RCC

Days since launch	OBC	RCC	
	Band 1	Band 2	Band 3
45	0.967850952	0.980215783	0.978525897
168	0.932147567	0.962826095	0.97189968
185	0.928683828	0.960965781	0.97083594
220	0.921073387	0.956938286	0.970179179
253	0.913949386	0.951147483	0.967449283
270	0.911217747	0.951324803	0.965982271
321	0.899723914	0.943471906	0.962810341
355	0.89075391	0.938467167	0.959967
372	0.88663453	0.935914868	0.958391486
389	0.88451915	0.931394983	0.958432849
423	0.877810088	0.929772371	0.956115676
440	0.875214638	0.927436581	0.954539246
457	0.872967121	0.92580073	0.95479364
474	0.86806205	0.920658348	0.951420879
507	0.861556187	0.916742244	0.94986844
540	0.856819242	0.914271237	0.947435287
573	0.851917525	0.911290004	0.946033483
607	0.849231615	0.908076161	0.943549534
639	0.844962223	0.905161883	0.941892434

672	0.838091408	0.900087405	0.939774859
705	0.830767268	0.894624493	0.935909821
738	0.824604932	0.888946629	0.932364116
771	0.818	0.885	0.927
804	0.813	0.88	0.924
837	0.808	0.876	0.922
871	0.802	0.872	0.917
903	0.798	0.867	0.916
936	0.796	0.866	0.913
969	0.792	0.863	0.911
1002	0.79	0.86	0.908
1035	0.786	0.858	0.906
1068	0.783	0.855	0.904
1101	0.779	0.852	0.902
1134	0.778	0.851	0.9
1167	0.774	0.847	0.897
1193	0.772	0.845	0.897
1197	0.772	0.845	0.896
1198	0.772	0.845	0.896
1212	0.771	0.844	0.895
1215	0.77	0.843	0.894
1216	0.77	0.844	0.894
1226	0.769	0.843	0.895
1259	0.768	0.841	0.893
1292	0.767	0.839	0.891
1325	0.765	0.838	0.89
1358	0.764	0.836	0.889
1390	0.763	0.836	0.887
1424	0.76	0.833	0.886
1457	0.759	0.832	0.884
1490	0.758	0.831	0.883
1523	0.756	0.83	0.882
1556	0.756	0.829	0.881
1589	0.754	0.828	0.88