INSAT-3D Sounder Cloud Mask Validation Report

Validation Criteria :

1. Spatial Collocation : 10km (nominal resolution of INSAT-3D Sounder)

2. Temporal Collocation : 5 minutes

INSAT-3D sounder operational cloud mask product is available at 10km resolution at nadir. MODIS cloud mask product is available at 1 km resolution at nadir. Hence there will be approximately 100 pixels of Modis inside one Sounder Pixels provided both are looking at nadir. In general, there is arround 40-60 pixles of MODIS per sounder pixel.

Furthermore operational MODIS cloud mask has 4 flags : Confident clear, probably clear, probably cloudy and cloudy, while operational sounder cloud mask has only 3 flags : Clear, Cloudy and Uncertain. For validation we follow these steps :

1. Spatial and Temporal Collocation

2. Resampling of MODIS cloud Mask on sounder observation area

3. Conversion of 4 cloud flags of MODIS into 3 cloud flags of sounder

The following methodology is adopted for conversion of MODIS cloud flag to sounder cloud flag

(i) A probability value is assigned to each of the modis cloud flag. Here we have assigned the values of 0.125,0.25,0.5,1 for confident clear, probably clear, probably clouly and cloudy respectively.

(ii) For each collocated sounder pixel , a single probability value for MODIS is obtained using the following 3 methods of averaging :

a) Taking mode of modis pixel probability value

b) Taking weighted average of probability values

c) Taking weighted products of the odds and subtracting the final results from 1

(iii)Based on probabilty value (p) obtained from above mentioned methods, the cloud mask flag for modis is decided for each method as follows :

$p < 0.35$: Cloudy

$p = 0.35\text{-}0.75$: Uncertain

$p > 0.75$: Clear

Based on this flag , confusion matrix and skill scores were computed for each of the 3 methods.

The validation satatistics are presented in follwing order :

1. All Surface

2. Land

3. Ocean

4. Coast

5. Highland (surface height > 2000 m)

For each of the 5 surface types , results are further categorised according to time of the day

1. All times

2. Daytime (0-12 UTC i.e. 05:30-17:30 IST)

3. Nighttime (12-24 UTC i.e. 17:30-05:30 IST)

For each of these cases following statistics are shown :

1. 3X3 Confusion matrices for clear, cloudy and uncertain conditions

2. Following skill scores based on confusion matrices :-

i). False Alarm Ratio (FAR)

ii). Frequency Bias (FB)

iii). Probability of Detection (POD)

iv). False Alarm Rate (F)

v). Proportion Correct (PCr)

vi). Kuiper Skill Score (KSS)

vii). Heidke Skill Score (HSS)

Following plots are also shown :

1. Time series of Total number of collocations obtained for each of the 5 categories

2. Time series of percentage correct pixels (100 * PCr)

3. Sample spatial plot of operational cloud products and collocations on Land and Ocean

INSAT-3D Sounder vs MODIS for October , 2016 (All times (day and night)) on all surface types

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	61285	28351	18144
Sounder Uncertain	12772	4640	13996
Sounder Cloudy	3914	1739	19801

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	54762	38460	14558
Sounder Uncertain	9928	9856	11624
Sounder Cloudy	2902	3819	18733

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48456	42615	16709
Sounder Uncertain	8164	10608	12636
Sounder Cloudy	2202	4133	19119

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37.22	17.22	11.02
Sounder Uncertain	7.76	2.82	8.50
Sounder Cloudy	2.38	1.06	12.03

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	33.26	23.36	8.84
Sounder Uncertain	6.03	5.99	7.06
Sounder Cloudy	1.76	2.32	11.38

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	29.43	25.88	10.15
Sounder Uncertain	4.96	6.44	7.67
Sounder Cloudy	1.34	2.51	11.61

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.43	0.85	0.22
Frequency Bias	1.38	0.90	0.49
Probability of Detection	0.79	0.13	0.38
False Alarm Rate	0.59	0.34	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.521
Kuiper Skill Score	0.193
Heidke Skill Score	0.202

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.49	0.69	0.26
Frequency Bias	1.59	0.60	0.57
Probability of Detection	0.81	0.19	0.42
False Alarm Rate	0.65	0.27	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.506
Kuiper Skill Score	0.205
Heidke Skill Score	0.215

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.55	0.66	0.25
Frequency Bias	1.83	0.55	0.53
Probability of Detection	0.82	0.18	0.39
False Alarm Rate	0.69	0.24	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.475
Kuiper Skill Score	0.194
Heidke Skill Score	0.197

INSAT-3D Sounder vs MODIS for October , 2016 (Day) on all surface types

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39225	11446	8967
Sounder Uncertain	9061	1513	7033
Sounder Cloudy	3667	1529	13773

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	35306	17259	7073
Sounder Uncertain	6894	5167	5546
Sounder Cloudy	2722	3444	12803

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	31141	20479	8018
Sounder Uncertain	5867	5692	6048
Sounder Cloudy	2061	3770	13138

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	40.77	11.90	9.32
Sounder Uncertain	9.42	1.57	7.31
Sounder Cloudy	3.81	1.59	14.31

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	36.70	17.94	7.35
Sounder Uncertain	7.17	5.37	5.76
Sounder Cloudy	2.83	3.58	13.31

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32.37	21.28	8.33
Sounder Uncertain	6.10	5.92	6.29
Sounder Cloudy	2.14	3.92	13.65

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.34	0.91	0.27
Frequency Bias	1.15	1.22	0.64
Probability of Detection	0.76	0.10	0.46
False Alarm Rate	0.49	0.39	0.12

Overall Skill Score

Skill Score	Value
Proportion Correct	0.567
Kuiper Skill Score	0.243
Heidke Skill Score	0.248

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.41	0.71	0.33
Frequency Bias	1.33	0.68	0.75
Probability of Detection	0.79	0.20	0.50
False Alarm Rate	0.57	0.29	0.14

Overall Skill Score

Skill Score	Value
Proportion Correct	0.554
Kuiper Skill Score	0.255
Heidke Skill Score	0.268

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.48	0.68	0.31
Frequency Bias	1.53	0.59	0.70
Probability of Detection	0.80	0.19	0.48
False Alarm Rate	0.62	0.26	0.13

Overall Skill Score

Skill Score	Value

Proportion Correct	0.519
Kuiper Skill Score	0.235
Heidke Skill Score	0.244

INSAT-3D Sounder vs MODIS for October , 2016 (Night) on all surface types

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22060	16905	9177
Sounder Uncertain	3711	3127	6963
Sounder Cloudy	247	210	6028

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	19456	21201	7485
Sounder Uncertain	3034	4689	6078
Sounder Cloudy	180	375	5930

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17315	22136	8691
Sounder Uncertain	2297	4916	6588
Sounder Cloudy	141	363	5981

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32.24	24.70	13.41
Sounder Uncertain	5.42	4.57	10.18
Sounder Cloudy	0.36	0.31	8.81

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28.43	30.98	10.94
Sounder Uncertain	4.43	6.85	8.88
Sounder Cloudy	0.26	0.55	8.67

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	25.30	32.35	12.70
Sounder Uncertain	3.36	7.18	9.63
Sounder Cloudy	0.21	0.53	8.74

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.54	0.77	0.07
Frequency Bias	1.85	0.68	0.29
Probability of Detection	0.85	0.15	0.27
False Alarm Rate	0.70	0.29	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.456
Kuiper Skill Score	0.148
Heidke Skill Score	0.153

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy

False Alarm Ratio	0.60	0.66	0.09
Frequency Bias	2.12	0.53	0.33
Probability of Detection	0.86	0.18	0.30
False Alarm Rate	0.75	0.24	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.440
Kuiper Skill Score	0.154
Heidke Skill Score	0.154

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.64	0.64	0.08
Frequency Bias	2.44	0.50	0.31
Probability of Detection	0.88	0.18	0.28
False Alarm Rate	0.77	0.22	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.412
Kuiper Skill Score	0.150
Heidke Skill Score	0.144

INSAT-3D Sounder vs MODIS for October , 2016 (All times (day and night)) on Land

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy

Sounder Clear	42168	7173	10107
Sounder Uncertain	6134	1389	7810
Sounder Cloudy	2131	1401	11696

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	38231	14157	7060
Sounder Uncertain	4623	4087	6623
Sounder Cloudy	1603	2473	11152

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	33867	17600	7981
Sounder Uncertain	3792	4504	7037
Sounder Cloudy	1078	2750	11400

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	46.85	7.97	11.23
Sounder Uncertain	6.81	1.54	8.68
Sounder Cloudy	2.37	1.56	12.99

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	42.47	15.73	7.84
Sounder Uncertain	5.14	4.54	7.36
Sounder Cloudy	1.78	2.75	12.39

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37.63	19.55	8.87

Sounder Uncertain	4.21	5.00	7.82
Sounder Cloudy	1.20	3.06	12.67

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.29	0.91	0.23
Frequency Bias	1.18	1.54	0.51
Probability of Detection	0.84	0.14	0.39
False Alarm Rate	0.50	0.40	0.10

Overall Skill Score

Skill Score	Value
Proportion Correct	0.614
Kuiper Skill Score	0.299
Heidke Skill Score	0.305

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.36	0.73	0.27
Frequency Bias	1.34	0.74	0.61
Probability of Detection	0.86	0.20	0.45
False Alarm Rate	0.58	0.31	0.11

Overall Skill Score

Skill Score	Value
Proportion Correct	0.594
Kuiper Skill Score	0.290
Heidke Skill Score	0.309

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.43	0.71	0.25

Frequency Bias	1.53	0.62	0.58
Probability of Detection	0.87	0.18	0.43
False Alarm Rate	0.64	0.27	0.10

Overall Skill Score

Skill Score	Value
Proportion Correct	0.553
Kuiper Skill Score	0.264
Heidke Skill Score	0.278

INSAT-3D Sounder vs MODIS for October , 2016 (Day) on Land

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	27176	5622	5115
Sounder Uncertain	4792	994	3562
Sounder Cloudy	2083	1376	6419

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23894	10865	3154
Sounder Uncertain	3413	3365	2570
Sounder Cloudy	1568	2421	5889

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20460	13686	3767

| Sounder Uncertain | 2717 | 3734 | 2897 |
| Sounder Cloudy | 1048 | 2708 | 6122 |

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	47.56	9.84	8.95
Sounder Uncertain	8.39	1.74	6.23
Sounder Cloudy	3.65	2.41	11.23

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	41.82	19.02	5.52
Sounder Uncertain	5.97	5.89	4.50
Sounder Cloudy	2.74	4.24	10.31

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	35.81	23.95	6.59
Sounder Uncertain	4.76	6.53	5.07
Sounder Cloudy	1.83	4.74	10.71

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.28	0.89	0.35
Frequency Bias	1.11	1.17	0.65
Probability of Detection	0.80	0.12	0.43
False Alarm Rate	0.48	0.37	0.15

Overall Skill Score

Skill Score	Value
Proportion Correct	0.605
Kuiper Skill Score	0.255
Heidke Skill Score	0.264

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.37	0.64	0.40
Frequency Bias	1.31	0.56	0.85
Probability of Detection	0.83	0.20	0.51
False Alarm Rate	0.58	0.25	0.17

Overall Skill Score

Skill Score	Value
Proportion Correct	0.580
Kuiper Skill Score	0.262
Heidke Skill Score	0.278

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.46	0.60	0.38
Frequency Bias	1.57	0.46	0.77
Probability of Detection	0.84	0.19	0.48
False Alarm Rate	0.65	0.21	0.14

Overall Skill Score

Skill Score	Value
Proportion Correct	0.531
Kuiper Skill Score	0.237
Heidke Skill Score	0.246

INSAT-3D Sounder vs MODIS for October , 2016 (Night) on Land

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14992	1551	4992
Sounder Uncertain	1342	395	4248
Sounder Cloudy	48	25	5277

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14337	3292	3906
Sounder Uncertain	1210	722	4053
Sounder Cloudy	35	52	5263

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13407	3914	4214
Sounder Uncertain	1075	770	4140
Sounder Cloudy	30	42	5278

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	45.61	4.72	15.19
Sounder Uncertain	4.08	1.20	12.92
Sounder Cloudy	0.15	0.08	16.05

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	43.62	10.02	11.88
Sounder Uncertain	3.68	2.20	12.33
Sounder Cloudy	0.11	0.16	16.01

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	40.79	11.91	12.82
Sounder Uncertain	3.27	2.34	12.60
Sounder Cloudy	0.09	0.13	16.06

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.30	0.93	0.01
Frequency Bias	1.31	3.04	0.37
Probability of Detection	0.92	0.20	0.36
False Alarm Rate	0.54	0.46	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.629
Kuiper Skill Score	0.397
Heidke Skill Score	0.371

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.33	0.88	0.02
Frequency Bias	1.38	1.47	0.40
Probability of Detection	0.92	0.18	0.40
False Alarm Rate	0.57	0.42	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.618
Kuiper Skill Score	0.367
Heidke Skill Score	0.365

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.87	0.01
Frequency Bias	1.48	1.27	0.39
Probability of Detection	0.92	0.16	0.39
False Alarm Rate	0.61	0.39	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.592
Kuiper Skill Score	0.341
Heidke Skill Score	0.339

INSAT-3D Sounder vs MODIS for October , 2016 (All times (day and night)) on Ocean

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13191	17659	5796
Sounder Uncertain	934	739	2936
Sounder Cloudy	130	50	5171

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	11280	19382	5984
Sounder Uncertain	695	1104	2810
Sounder Cloudy	105	108	5138

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	10321	19555	6770
Sounder Uncertain	614	1085	2910
Sounder Cloudy	97	110	5144

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28.30	37.89	12.44
Sounder Uncertain	2.00	1.59	6.30
Sounder Cloudy	0.28	0.11	11.10

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	24.20	41.59	12.84
Sounder Uncertain	1.49	2.37	6.03
Sounder Cloudy	0.23	0.23	11.02

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22.15	41.96	14.53
Sounder Uncertain	1.32	2.33	6.24
Sounder Cloudy	0.21	0.24	11.04

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.64	0.84	0.03
Frequency Bias	2.57	0.25	0.38
Probability of Detection	0.93	0.04	0.37
False Alarm Rate	0.85	0.14	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.410
Kuiper Skill Score	0.145
Heidke Skill Score	0.140

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.69	0.76	0.04
Frequency Bias	3.03	0.22	0.38
Probability of Detection	0.93	0.05	0.37
False Alarm Rate	0.87	0.12	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.376
Kuiper Skill Score	0.145
Heidke Skill Score	0.131

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.72	0.76	0.04
Frequency Bias	3.32	0.22	0.36
Probability of Detection	0.94	0.05	0.35
False Alarm Rate	0.88	0.12	0.01

Overall Skill Score

Skill Score	Value

Proportion Correct	0.355
Kuiper Skill Score	0.137
Heidke Skill Score	0.121

INSAT-3D Sounder vs MODIS for October , 2016 (Day) on Ocean

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8881	5539	3464
Sounder Uncertain	622	433	2483
Sounder Cloudy	124	45	4839

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8503	5689	3692
Sounder Uncertain	525	605	2408
Sounder Cloudy	101	97	4810

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8020	5886	3978
Sounder Uncertain	477	579	2482
Sounder Cloudy	93	100	4815

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	33.60	20.96	13.11
Sounder Uncertain	2.35	1.64	9.39
Sounder Cloudy	0.47	0.17	18.31

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32.17	21.52	13.97
Sounder Uncertain	1.99	2.29	9.11
Sounder Cloudy	0.38	0.37	18.20

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30.34	22.27	15.05
Sounder Uncertain	1.80	2.19	9.39
Sounder Cloudy	0.35	0.38	18.22

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.50	0.88	0.03
Frequency Bias	1.86	0.59	0.46
Probability of Detection	0.92	0.07	0.45
False Alarm Rate	0.73	0.25	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.535
Kuiper Skill Score	0.279
Heidke Skill Score	0.281

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy

Skill Score			
False Alarm Ratio	0.52	0.83	0.04
Frequency Bias	1.96	0.55	0.46
Probability of Detection	0.93	0.09	0.44
False Alarm Rate	0.75	0.23	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.527
Kuiper Skill Score	0.280
Heidke Skill Score	0.278

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.55	0.84	0.04
Frequency Bias	2.08	0.54	0.44
Probability of Detection	0.93	0.09	0.43
False Alarm Rate	0.76	0.23	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.508
Kuiper Skill Score	0.267
Heidke Skill Score	0.261

INSAT-3D Sounder vs MODIS for October , 2016 (Night) on Ocean

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy

MODIS/Sounder			
Sounder Clear	4310	12120	2332
Sounder Uncertain	312	306	453
Sounder Cloudy	6	5	332

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2777	13693	2292
Sounder Uncertain	170	499	402
Sounder Cloudy	4	11	328

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2301	13669	2792
Sounder Uncertain	137	506	428
Sounder Cloudy	4	10	329

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	21.36	60.07	11.56
Sounder Uncertain	1.55	1.52	2.25
Sounder Cloudy	0.03	0.02	1.65

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13.76	67.87	11.36
Sounder Uncertain	0.84	2.47	1.99
Sounder Cloudy	0.02	0.05	1.63

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	11.40	67.75	13.84

Sounder Uncertain	0.68	2.51	2.12
Sounder Cloudy	0.02	0.05	1.63

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.77	0.71	0.03
Frequency Bias	4.05	0.09	0.11
Probability of Detection	0.93	0.02	0.11
False Alarm Rate	0.95	0.05	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.245
Kuiper Skill Score	-0.006
Heidke Skill Score	-0.005

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.85	0.53	0.04
Frequency Bias	6.36	0.08	0.11
Probability of Detection	0.94	0.04	0.11
False Alarm Rate	0.96	0.03	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.179
Kuiper Skill Score	0.006
Heidke Skill Score	0.003

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.88	0.53	0.04

Frequency Bias	7.68	0.08	0.10
Probability of Detection	0.94	0.04	0.09
False Alarm Rate	0.97	0.03	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.155
Kuiper Skill Score	0.006
Heidke Skill Score	0.003

INSAT-3D Sounder vs MODIS for October , 2016 (All times (day and night)) on Coast

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	356	106	83
Sounder Uncertain	117	14	64
Sounder Cloudy	40	10	54

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	332	168	45
Sounder Uncertain	94	58	43
Sounder Cloudy	29	35	40

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	302	186	57

Sounder Uncertain	75	70	50
Sounder Cloudy	24	36	44

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	42.18	12.56	9.83
Sounder Uncertain	13.86	1.66	7.58
Sounder Cloudy	4.74	1.18	6.40

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39.34	19.91	5.33
Sounder Uncertain	11.14	6.87	5.09
Sounder Cloudy	3.44	4.15	4.74

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	35.78	22.04	6.75
Sounder Uncertain	8.89	8.29	5.92
Sounder Cloudy	2.84	4.27	5.21

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.35	0.93	0.48
Frequency Bias	1.06	1.50	0.52
Probability of Detection	0.69	0.11	0.27
False Alarm Rate	0.45	0.43	0.12

Overall Skill Score

Skill Score	Value
Proportion Correct	0.502
Kuiper Skill Score	0.082
Heidke Skill Score	0.083

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.39	0.70	0.62
Frequency Bias	1.20	0.75	0.81
Probability of Detection	0.73	0.22	0.31
False Alarm Rate	0.51	0.33	0.15

Overall Skill Score

Skill Score	Value
Proportion Correct	0.509
Kuiper Skill Score	0.121
Heidke Skill Score	0.127

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.45	0.64	0.58
Frequency Bias	1.36	0.67	0.69
Probability of Detection	0.75	0.24	0.29
False Alarm Rate	0.57	0.29	0.14

Overall Skill Score

Skill Score	Value
Proportion Correct	0.493
Kuiper Skill Score	0.135
Heidke Skill Score	0.142

INSAT-3D Sounder vs MODIS for October , 2016 (Day) on Coast

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	270	50	60
Sounder Uncertain	112	11	35
Sounder Cloudy	39	10	39

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	255	94	31
Sounder Uncertain	91	49	18
Sounder Cloudy	28	35	25

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	236	108	36
Sounder Uncertain	73	63	22
Sounder Cloudy	23	36	29

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	43.13	7.99	9.58
Sounder Uncertain	17.89	1.76	5.59
Sounder Cloudy	6.23	1.60	6.23

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	40.73	15.02	4.95
Sounder Uncertain	14.54	7.83	2.88
Sounder Cloudy	4.47	5.59	3.99

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37.70	17.25	5.75
Sounder Uncertain	11.66	10.06	3.51
Sounder Cloudy	3.67	5.75	4.63

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.29	0.93	0.56
Frequency Bias	0.90	2.23	0.66
Probability of Detection	0.64	0.15	0.29
False Alarm Rate	0.36	0.48	0.16

Overall Skill Score

Skill Score	Value
Proportion Correct	0.511
Kuiper Skill Score	0.090
Heidke Skill Score	0.083

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.33	0.69	0.72
Frequency Bias	1.02	0.89	1.19
Probability of Detection	0.68	0.28	0.34
False Alarm Rate	0.42	0.37	0.21

Overall Skill Score

Skill Score	Value
Proportion Correct	0.526
Kuiper Skill Score	0.136
Heidke Skill Score	0.136

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.60	0.67
Frequency Bias	1.14	0.76	1.01
Probability of Detection	0.71	0.30	0.33
False Alarm Rate	0.48	0.32	0.20

Overall Skill Score

Skill Score	Value
Proportion Correct	0.524
Kuiper Skill Score	0.168
Heidke Skill Score	0.172

INSAT-3D Sounder vs MODIS for October , 2016 (Night) on Coast

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	86	56	23
Sounder Uncertain	5	3	29
Sounder Cloudy	1	0	15

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	77	74	14
Sounder Uncertain	3	9	25
Sounder Cloudy	1	0	15

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	66	78	21
Sounder Uncertain	2	7	28
Sounder Cloudy	1	0	15

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39.45	25.69	10.55
Sounder Uncertain	2.29	1.38	13.30
Sounder Cloudy	0.46	0.00	6.88

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	35.32	33.94	6.42
Sounder Uncertain	1.38	4.13	11.47
Sounder Cloudy	0.46	0.00	6.88

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30.28	35.78	9.63
Sounder Uncertain	0.92	3.21	12.84
Sounder Cloudy	0.46	0.00	6.88

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.48	0.92	0.06
Frequency Bias	1.79	0.63	0.24
Probability of Detection	0.93	0.05	0.22
False Alarm Rate	0.69	0.30	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.477
Kuiper Skill Score	0.136
Heidke Skill Score	0.146

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.53	0.76	0.06
Frequency Bias	2.04	0.45	0.30
Probability of Detection	0.95	0.11	0.28
False Alarm Rate	0.75	0.24	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.463
Kuiper Skill Score	0.151
Heidke Skill Score	0.156

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.60	0.81	0.06
Frequency Bias	2.39	0.44	0.25
Probability of Detection	0.96	0.08	0.23
False Alarm Rate	0.76	0.23	0.01

Overall Skill Score

Skill Score	Value

Proportion Correct	0.404
Kuiper Skill Score	0.115
Heidke Skill Score	0.114

INSAT-3D Sounder vs MODIS for October , 2016 (All times (day and night)) on Highland (>2000 m)

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3851	3017	1787
Sounder Uncertain	5066	2407	2889
Sounder Cloudy	1438	205	2587

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3377	4073	1205
Sounder Uncertain	4076	4363	1923
Sounder Cloudy	1026	1054	2150

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2648	4407	1600
Sounder Uncertain	3294	4681	2387
Sounder Cloudy	884	1083	2263

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	16.57	12.98	7.69
Sounder Uncertain	21.79	10.35	12.43
Sounder Cloudy	6.19	0.88	11.13

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14.53	17.52	5.18
Sounder Uncertain	17.53	18.77	8.27
Sounder Cloudy	4.41	4.53	9.25

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	11.39	18.96	6.88
Sounder Uncertain	14.17	20.14	10.27
Sounder Cloudy	3.80	4.66	9.73

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.56	0.77	0.39
Frequency Bias	0.84	1.84	0.58
Probability of Detection	0.37	0.43	0.36
False Alarm Rate	0.33	0.55	0.11

Overall Skill Score

Skill Score	Value
Proportion Correct	0.380
Kuiper Skill Score	0.077
Heidke Skill Score	0.074

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy

False Alarm Ratio	0.61	0.58	0.49
Frequency Bias	1.02	1.09	0.80
Probability of Detection	0.40	0.46	0.41
False Alarm Rate	0.40	0.45	0.16

Overall Skill Score

Skill Score	Value
Proportion Correct	0.425
Kuiper Skill Score	0.102
Heidke Skill Score	0.104

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.69	0.55	0.47
Frequency Bias	1.27	1.02	0.68
Probability of Detection	0.39	0.46	0.36
False Alarm Rate	0.44	0.42	0.14

Overall Skill Score

Skill Score	Value
Proportion Correct	0.413
Kuiper Skill Score	0.091
Heidke Skill Score	0.092

INSAT-3D Sounder vs MODIS for October , 2016 (Day) on Highland (>2000 m)

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy

MODIS/Sounder			
Sounder Clear	1616	45	122
Sounder Uncertain	3078	28	792
Sounder Cloudy	1251	27	2241

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1489	231	63
Sounder Uncertain	2471	978	449
Sounder Cloudy	890	744	1885

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1406	294	83
Sounder Uncertain	2246	1126	526
Sounder Cloudy	780	776	1963

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17.57	0.49	1.33
Sounder Uncertain	33.46	0.30	8.61
Sounder Cloudy	13.60	0.29	24.36

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	16.18	2.51	0.68
Sounder Uncertain	26.86	10.63	4.88
Sounder Cloudy	9.67	8.09	20.49

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	15.28	3.20	0.90

Sounder Uncertain	24.41	12.24	5.72
Sounder Cloudy	8.48	8.43	21.34

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.09	0.99	0.36
Frequency Bias	0.30	38.98	1.12
Probability of Detection	0.27	0.28	0.71
False Alarm Rate	0.03	0.73	0.24

Overall Skill Score

Skill Score	Value
Proportion Correct	0.422
Kuiper Skill Score	0.347
Heidke Skill Score	0.218

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.16	0.75	0.46
Frequency Bias	0.37	2.00	1.47
Probability of Detection	0.31	0.50	0.79
False Alarm Rate	0.06	0.60	0.34

Overall Skill Score

Skill Score	Value
Proportion Correct	0.473
Kuiper Skill Score	0.298
Heidke Skill Score	0.256

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.21	0.71	0.44

Frequency Bias	0.40	1.78	1.37
Probability of Detection	0.32	0.51	0.76
False Alarm Rate	0.08	0.59	0.33

Overall Skill Score

Skill Score	Value
Proportion Correct	0.489
Kuiper Skill Score	0.296
Heidke Skill Score	0.268

INSAT-3D Sounder vs MODIS for October , 2016 (Night) on Highland (>2000 m)

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2235	2972	1665
Sounder Uncertain	1988	2379	2097
Sounder Cloudy	187	178	346

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1888	3842	1142
Sounder Uncertain	1605	3385	1474
Sounder Cloudy	136	310	265

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1242	4113	1517

Sounder Uncertain	1048	3555	1861
Sounder Cloudy	104	307	300

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	15.91	21.16	11.85
Sounder Uncertain	14.15	16.94	14.93
Sounder Cloudy	1.33	1.27	2.46

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13.44	27.35	8.13
Sounder Uncertain	11.43	24.10	10.49
Sounder Cloudy	0.97	2.21	1.89

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8.84	29.28	10.80
Sounder Uncertain	7.46	25.31	13.25
Sounder Cloudy	0.74	2.19	2.14

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.67	0.63	0.51
Frequency Bias	1.56	1.17	0.17
Probability of Detection	0.51	0.43	0.08
False Alarm Rate	0.51	0.45	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.353
Kuiper Skill Score	0.005
Heidke Skill Score	0.006

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.73	0.48	0.63
Frequency Bias	1.89	0.86	0.25
Probability of Detection	0.52	0.45	0.09
False Alarm Rate	0.59	0.36	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.394
Kuiper Skill Score	0.018
Heidke Skill Score	0.017

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.82	0.45	0.58
Frequency Bias	2.87	0.81	0.19
Probability of Detection	0.52	0.45	0.08
False Alarm Rate	0.63	0.33	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.363
Kuiper Skill Score	0.009
Heidke Skill Score	0.008

Number of Collocations for Oct-2016
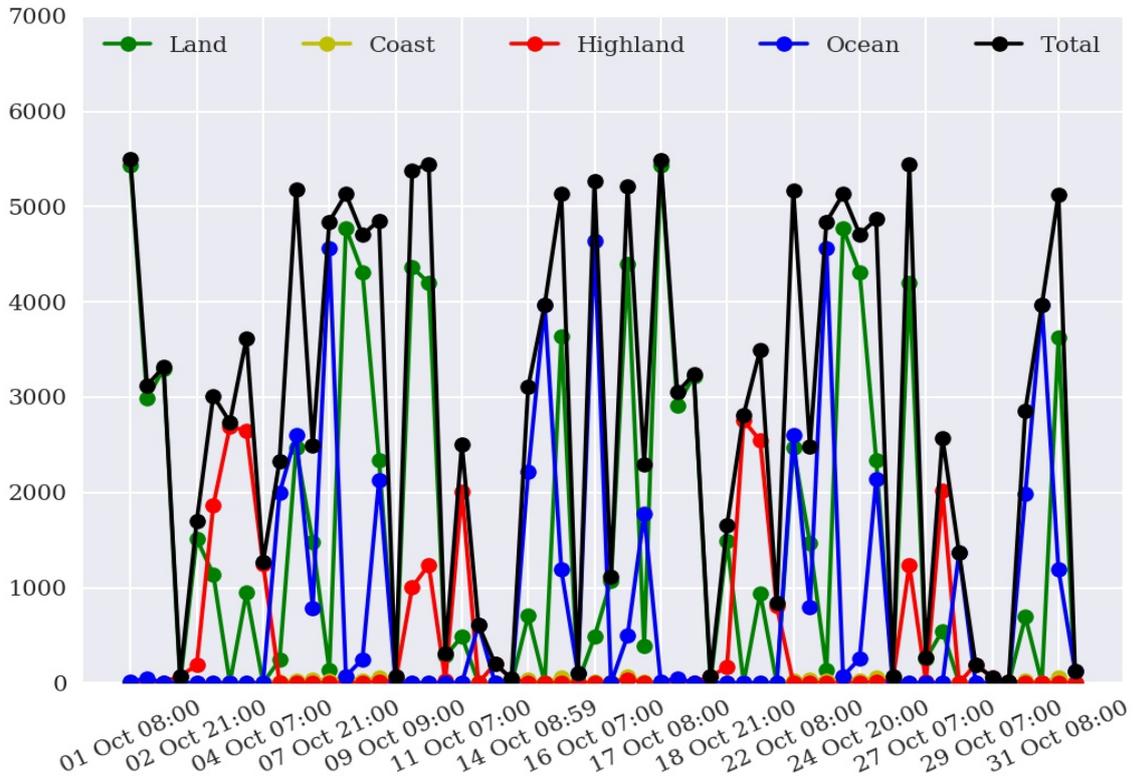
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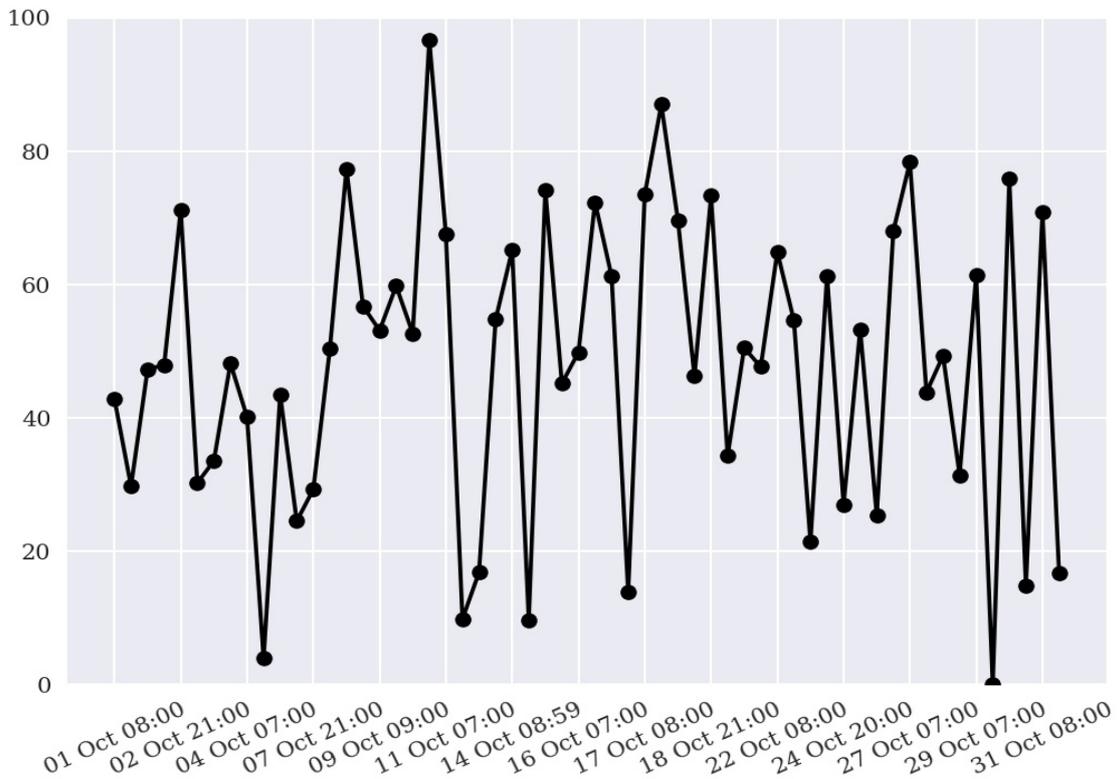
INSAT-3D Sounder Cloud Mask on
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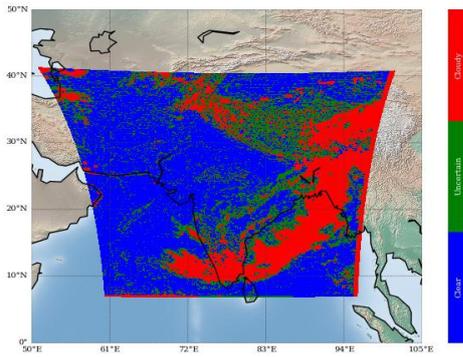
Modis Cloud Mask on
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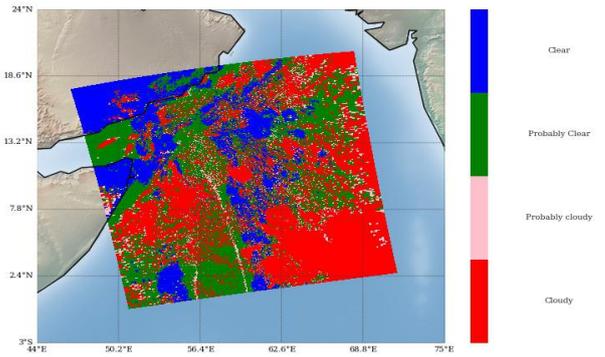
MODIS pass over INSAT-3D Sounder on
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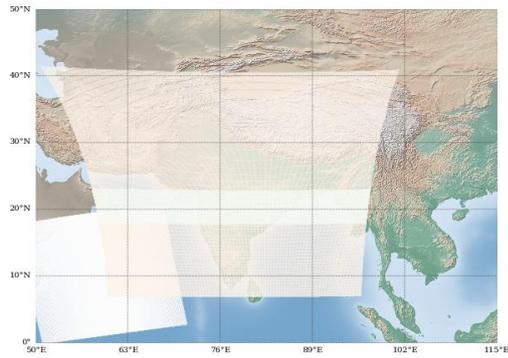
Number of Modis Pixels per Sounder Pixels on a
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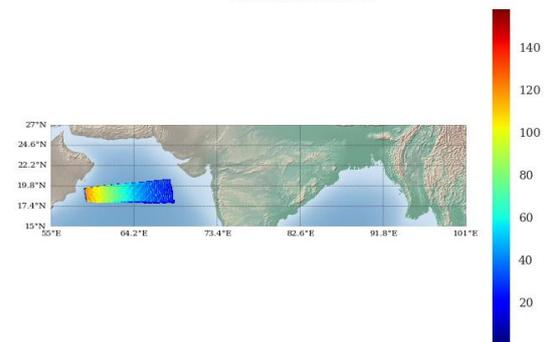
Modis Cloud Mask on Sounder Grid
Method 1 : Mode of Modis pixels
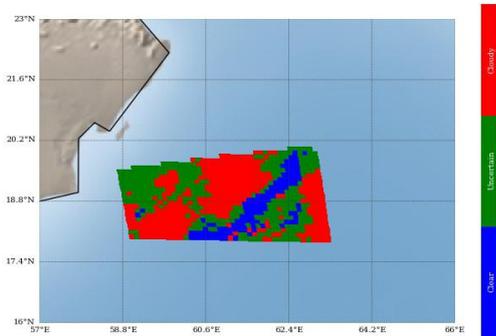
Modis Cloud Mask on Sounder Grid
Method 2 : Weighted Average
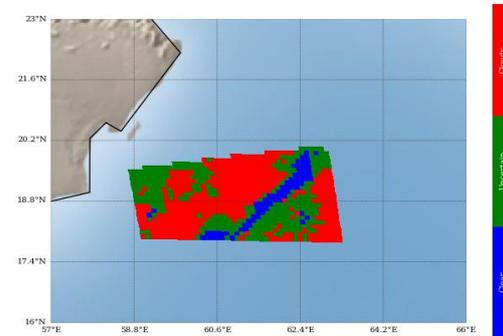
Modis Cloud Mask on Sounder Grid
Method 3 : Weighted Product Average
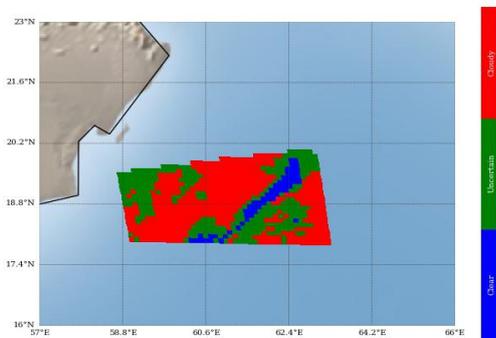
Sounder Cloud Flag on Collocated Area
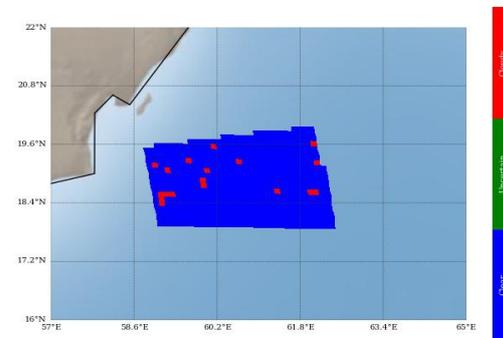
INSAT-3D Sounder Cloud Mask on
18 October, 2016 07:00 UTC
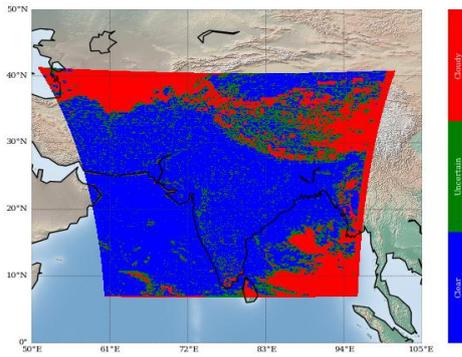
Modis Cloud Mask on
18 October, 2016 07:20 UTC
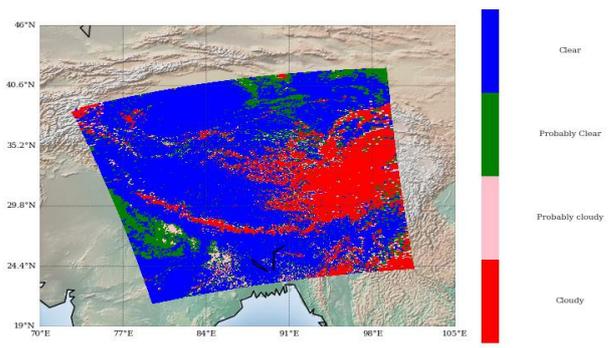
MODIS pass over INSAT-3D Sounder on
18 October, 2016 07:20 UTC
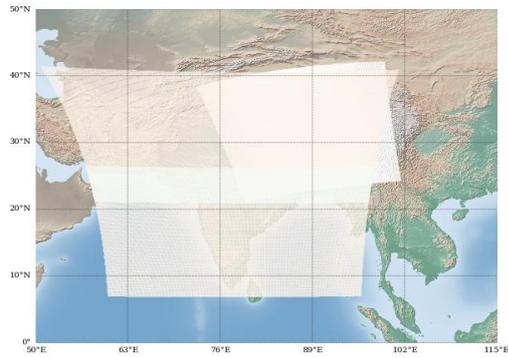
Number of Modis Pixels per Sounder Pixels on a
spatially and Temporally Collocated Domain on
18 October, 2016 07:20 UTC

Modis Cloud Mask on Sounder Grid
Method 1 : Mode of Modis pixels

Modis Cloud Mask on Sounder Grid
Method 2 : Weighted Average

Modis Cloud Mask on Sounder Grid
Method 3 : Weighted Product Average

Sounder Cloud Flag on Collocated Area