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 = 0.35-0.75 : 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 November , 2018 (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	83592	17822	10632
Sounder Uncertain	11993	2843	7638
Sounder Cloudy	3338	578	8374

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	79199	25157	7690
Sounder Uncertain	9937	6576	5961
Sounder Cloudy	2228	2820	7242

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	71081	32032	8933
Sounder Uncertain	8360	7474	6640
Sounder Cloudy	1847	2823	7620

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	56.94	12.14	7.24
Sounder Uncertain	8.17	1.94	5.20
Sounder Cloudy	2.27	0.39	5.70

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	53.95	17.14	5.24
Sounder Uncertain	6.77	4.48	4.06
Sounder Cloudy	1.52	1.92	4.93

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48.42	21.82	6.08
Sounder Uncertain	5.69	5.09	4.52
Sounder Cloudy	1.26	1.92	5.19

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.25	0.87	0.32
Frequency Bias	1.13	1.06	0.46
Probability of Detection	0.85	0.13	0.31
False Alarm Rate	0.55	0.38	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.646
Kuiper Skill Score	0.191
Heidke Skill Score	0.210

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.29	0.71	0.41
Frequency Bias	1.23	0.65	0.59
Probability of Detection	0.87	0.19	0.35
False Alarm Rate	0.61	0.30	0.09

Overall Skill Score

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Skill Score	Value
Proportion Correct	0.634
Kuiper Skill Score	0.206
Heidke Skill Score	0.232

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.37	0.67	0.38
Frequency Bias	1.38	0.53	0.53
Probability of Detection	0.87	0.18	0.33
False Alarm Rate	0.68	0.25	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.587
Kuiper Skill Score	0.183
Heidke Skill Score	0.206

INSAT-3D Sounder vs MODIS for November , 2018 (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	45975	14515	6156
Sounder Uncertain	8569	1851	4583
Sounder Cloudy	2162	412	7578

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	43325	18670	4651
Sounder Uncertain	6981	4519	3503
Sounder Cloudy	1181	2344	6627

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	36821	24445	5380
Sounder Uncertain	5798	5291	3914
Sounder Cloudy	918	2292	6942

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	50.08	15.81	6.71
Sounder Uncertain	9.33	2.02	4.99
Sounder Cloudy	2.36	0.45	8.25

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	47.19	20.34	5.07
Sounder Uncertain	7.60	4.92	3.82
Sounder Cloudy	1.29	2.55	7.22

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	40.11	26.63	5.86
Sounder Uncertain	6.32	5.76	4.26
Sounder Cloudy	1.00	2.50	7.56

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.31	0.88	0.25
Frequency Bias	1.18	0.89	0.55
Probability of Detection	0.81	0.11	0.41
False Alarm Rate	0.57	0.36	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.604
Kuiper Skill Score	0.189
Heidke Skill Score	0.206

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.35	0.70	0.35
Frequency Bias	1.29	0.59	0.69
Probability of Detection	0.84	0.18	0.45
False Alarm Rate	0.62	0.28	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.593
Kuiper Skill Score	0.211
Heidke Skill Score	0.232

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.45	0.65	0.32
Frequency Bias	1.53	0.47	0.63
Probability of Detection	0.85	0.17	0.43
False Alarm Rate	0.70	0.23	0.08

Overall Skill Score

Skill Score	Value

Proportion Correct	0.534
Kuiper Skill Score	0.182
Heidke Skill Score	0.196

INSAT-3D Sounder vs MODIS for November , 2018 (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	37617	3307	4476
Sounder Uncertain	3424	992	3055
Sounder Cloudy	1176	166	796

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	35874	6487	3039
Sounder Uncertain	2956	2057	2458
Sounder Cloudy	1047	476	615

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34260	7587	3553
Sounder Uncertain	2562	2183	2726
Sounder Cloudy	929	531	678

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	68.38	6.01	8.14
Sounder Uncertain	6.22	1.80	5.55
Sounder Cloudy	2.14	0.30	1.45

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	65.21	11.79	5.52
Sounder Uncertain	5.37	3.74	4.47
Sounder Cloudy	1.90	0.87	1.12

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	62.28	13.79	6.46
Sounder Uncertain	4.66	3.97	4.96
Sounder Cloudy	1.69	0.97	1.23

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.17	0.87	0.63
Frequency Bias	1.08	1.67	0.26
Probability of Detection	0.89	0.22	0.10
False Alarm Rate	0.50	0.42	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.716
Kuiper Skill Score	0.173
Heidke Skill Score	0.189

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy

False Alarm Ratio	0.21	0.72	0.71
Frequency Bias	1.14	0.83	0.35
Probability of Detection	0.90	0.23	0.10
False Alarm Rate	0.58	0.33	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.701
Kuiper Skill Score	0.174
Heidke Skill Score	0.202

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.25	0.71	0.68
Frequency Bias	1.20	0.73	0.31
Probability of Detection	0.91	0.21	0.10
False Alarm Rate	0.62	0.30	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.675
Kuiper Skill Score	0.163
Heidke Skill Score	0.194

INSAT-3D Sounder vs MODIS for November , 2018 (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	63250	10680	4688
Sounder Uncertain	5033	1391	2403
Sounder Cloudy	611	160	2631

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	60738	14865	3015
Sounder Uncertain	4435	2467	1925
Sounder Cloudy	478	485	2439

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	54141	20870	3607
Sounder Uncertain	3613	3096	2118
Sounder Cloudy	395	498	2509

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	69.62	11.76	5.16
Sounder Uncertain	5.54	1.53	2.65
Sounder Cloudy	0.67	0.18	2.90

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	66.86	16.36	3.32
Sounder Uncertain	4.88	2.72	2.12
Sounder Cloudy	0.53	0.53	2.68

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	59.60	22.97	3.97

Sounder Uncertain	3.98	3.41	2.33
Sounder Cloudy	0.43	0.55	2.76

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.20	0.84	0.23
Frequency Bias	1.14	0.72	0.35
Probability of Detection	0.92	0.11	0.27
False Alarm Rate	0.65	0.32	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.740
Kuiper Skill Score	0.170
Heidke Skill Score	0.206

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.23	0.72	0.28
Frequency Bias	1.20	0.50	0.46
Probability of Detection	0.93	0.14	0.33
False Alarm Rate	0.71	0.25	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.723
Kuiper Skill Score	0.174
Heidke Skill Score	0.213

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.31	0.65	0.26

Frequency Bias	1.35	0.36	0.41
Probability of Detection	0.93	0.13	0.30
False Alarm Rate	0.79	0.18	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.658
Kuiper Skill Score	0.146
Heidke Skill Score	0.178

INSAT-3D Sounder vs MODIS for November , 2018 (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	31329	10308	3213
Sounder Uncertain	3889	1355	1426
Sounder Cloudy	386	160	2605

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	29721	12931	2198
Sounder Uncertain	3360	2246	1064
Sounder Cloudy	260	469	2422

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23924	18245	2681

Sounder Uncertain	2589	2860	1221
Sounder Cloudy	186	474	2491

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	57.30	18.85	5.88
Sounder Uncertain	7.11	2.48	2.61
Sounder Cloudy	0.71	0.29	4.76

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	54.36	23.65	4.02
Sounder Uncertain	6.15	4.11	1.95
Sounder Cloudy	0.48	0.86	4.43

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	43.76	33.37	4.90
Sounder Uncertain	4.74	5.23	2.23
Sounder Cloudy	0.34	0.87	4.56

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.30	0.80	0.17
Frequency Bias	1.26	0.56	0.43
Probability of Detection	0.88	0.11	0.36
False Alarm Rate	0.70	0.27	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.645
Kuiper Skill Score	0.151
Heidke Skill Score	0.179

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.34	0.66	0.23
Frequency Bias	1.35	0.43	0.55
Probability of Detection	0.89	0.14	0.43
False Alarm Rate	0.75	0.22	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.629
Kuiper Skill Score	0.164
Heidke Skill Score	0.191

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.47	0.57	0.21
Frequency Bias	1.68	0.31	0.49
Probability of Detection	0.90	0.13	0.39
False Alarm Rate	0.82	0.15	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.535
Kuiper Skill Score	0.135
Heidke Skill Score	0.147

INSAT-3D Sounder vs MODIS for November , 2018 (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	31921	372	1475
Sounder Uncertain	1144	36	977
Sounder Cloudy	225	0	26

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	31017	1934	817
Sounder Uncertain	1075	221	861
Sounder Cloudy	218	16	17

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30217	2625	926
Sounder Uncertain	1024	236	897
Sounder Cloudy	209	24	18

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	88.24	1.03	4.08
Sounder Uncertain	3.16	0.10	2.70
Sounder Cloudy	0.62	0.00	0.07

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	85.74	5.35	2.26
Sounder Uncertain	2.97	0.61	2.38
Sounder Cloudy	0.60	0.04	0.05

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	83.53	7.26	2.56
Sounder Uncertain	2.83	0.65	2.48
Sounder Cloudy	0.58	0.07	0.05

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.05	0.98	0.90
Frequency Bias	1.01	5.29	0.10
Probability of Detection	0.96	0.09	0.01
False Alarm Rate	0.44	0.51	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.884
Kuiper Skill Score	0.162
Heidke Skill Score	0.171

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.08	0.90	0.93
Frequency Bias	1.05	0.99	0.15
Probability of Detection	0.96	0.10	0.01
False Alarm Rate	0.56	0.39	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.864
Kuiper Skill Score	0.134
Heidke Skill Score	0.162

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.11	0.89	0.93
Frequency Bias	1.07	0.75	0.14
Probability of Detection	0.96	0.08	0.01
False Alarm Rate	0.62	0.34	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.842
Kuiper Skill Score	0.109
Heidke Skill Score	0.140

INSAT-3D Sounder vs MODIS for November , 2018 (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	10961	5103	3156
Sounder Uncertain	831	293	1506
Sounder Cloudy	84	8	233

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	10131	6347	2742
Sounder Uncertain	691	575	1364
Sounder Cloudy	64	41	220

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9625	6607	2988
Sounder Uncertain	619	577	1434
Sounder Cloudy	56	45	224

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	49.43	23.01	14.23
Sounder Uncertain	3.75	1.32	6.79
Sounder Cloudy	0.38	0.04	1.05

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	45.69	28.62	12.37
Sounder Uncertain	3.12	2.59	6.15
Sounder Cloudy	0.29	0.18	0.99

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	43.40	29.79	13.47
Sounder Uncertain	2.79	2.60	6.47
Sounder Cloudy	0.25	0.20	1.01

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.43	0.89	0.28
Frequency Bias	1.62	0.49	0.07
Probability of Detection	0.92	0.05	0.05
False Alarm Rate	0.77	0.22	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.518
Kuiper Skill Score	0.036
Heidke Skill Score	0.043

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.47	0.78	0.32
Frequency Bias	1.77	0.38	0.08
Probability of Detection	0.93	0.08	0.05
False Alarm Rate	0.81	0.18	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.493
Kuiper Skill Score	0.044
Heidke Skill Score	0.051

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.50	0.78	0.31
Frequency Bias	1.87	0.36	0.07
Probability of Detection	0.93	0.08	0.05
False Alarm Rate	0.82	0.17	0.01

Overall Skill Score

Skill Score	Value

Proportion Correct	0.470
Kuiper Skill Score	0.041
Heidke Skill Score	0.047

INSAT-3D Sounder vs MODIS for November , 2018 (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	10038	4038	2418
Sounder Uncertain	776	270	1266
Sounder Cloudy	70	7	190

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9395	4971	2128
Sounder Uncertain	658	491	1163
Sounder Cloudy	52	35	180

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8983	5190	2321
Sounder Uncertain	596	493	1223
Sounder Cloudy	44	40	183

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	52.63	21.17	12.68
Sounder Uncertain	4.07	1.42	6.64
Sounder Cloudy	0.37	0.04	1.00

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	49.26	26.06	11.16
Sounder Uncertain	3.45	2.57	6.10
Sounder Cloudy	0.27	0.18	0.94

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	47.10	27.21	12.17
Sounder Uncertain	3.12	2.58	6.41
Sounder Cloudy	0.23	0.21	0.96

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.39	0.88	0.29
Frequency Bias	1.52	0.54	0.07
Probability of Detection	0.92	0.06	0.05
False Alarm Rate	0.75	0.24	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.550
Kuiper Skill Score	0.046
Heidke Skill Score	0.056

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy

Skill Score			
False Alarm Ratio	0.43	0.79	0.33
Frequency Bias	1.63	0.42	0.08
Probability of Detection	0.93	0.09	0.05
False Alarm Rate	0.79	0.20	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.528
Kuiper Skill Score	0.053
Heidke Skill Score	0.064

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.46	0.79	0.31
Frequency Bias	1.71	0.40	0.07
Probability of Detection	0.93	0.09	0.05
False Alarm Rate	0.80	0.19	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.506
Kuiper Skill Score	0.050
Heidke Skill Score	0.059

INSAT-3D Sounder vs MODIS for November , 2018 (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	923	1065	738
Sounder Uncertain	55	23	240
Sounder Cloudy	14	1	43

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	736	1376	614
Sounder Uncertain	33	84	201
Sounder Cloudy	12	6	40

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	642	1417	667
Sounder Uncertain	23	84	211
Sounder Cloudy	12	5	41

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	29.75	34.33	23.79
Sounder Uncertain	1.77	0.74	7.74
Sounder Cloudy	0.45	0.03	1.39

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23.73	44.36	19.79
Sounder Uncertain	1.06	2.71	6.48
Sounder Cloudy	0.39	0.19	1.29

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20.70	45.68	21.50

Sounder Uncertain	0.74	2.71	6.80
Sounder Cloudy	0.39	0.16	1.32

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.66	0.93	0.26
Frequency Bias	2.75	0.29	0.06
Probability of Detection	0.93	0.02	0.04
False Alarm Rate	0.85	0.14	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.319
Kuiper Skill Score	-0.007
Heidke Skill Score	-0.006

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.73	0.74	0.31
Frequency Bias	3.49	0.22	0.07
Probability of Detection	0.94	0.06	0.05
False Alarm Rate	0.89	0.10	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.277
Kuiper Skill Score	0.004
Heidke Skill Score	0.003

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.76	0.74	0.29

Frequency Bias	4.03	0.21	0.06
Probability of Detection	0.95	0.06	0.04
False Alarm Rate	0.89	0.10	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.247
Kuiper Skill Score	0.000
Heidke Skill Score	0.000

INSAT-3D Sounder vs MODIS for November , 2018 (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	362	34	45
Sounder Uncertain	44	9	11
Sounder Cloudy	11	0	12

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	340	76	25
Sounder Uncertain	40	14	10
Sounder Cloudy	11	3	9

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	306	103	32

Sounder Uncertain	31	23	10
Sounder Cloudy	9	4	10

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	68.56	6.44	8.52
Sounder Uncertain	8.33	1.70	2.08
Sounder Cloudy	2.08	0.00	2.27

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	64.39	14.39	4.73
Sounder Uncertain	7.58	2.65	1.89
Sounder Cloudy	2.08	0.57	1.70

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	57.95	19.51	6.06
Sounder Uncertain	5.87	4.36	1.89
Sounder Cloudy	1.70	0.76	1.89

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.18	0.86	0.48
Frequency Bias	1.06	1.49	0.34
Probability of Detection	0.87	0.21	0.18
False Alarm Rate	0.54	0.38	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.725
Kuiper Skill Score	0.142
Heidke Skill Score	0.155

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.23	0.78	0.61
Frequency Bias	1.13	0.69	0.52
Probability of Detection	0.87	0.15	0.20
False Alarm Rate	0.61	0.30	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.688
Kuiper Skill Score	0.106
Heidke Skill Score	0.123

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.31	0.64	0.57
Frequency Bias	1.27	0.49	0.44
Probability of Detection	0.88	0.18	0.19
False Alarm Rate	0.71	0.22	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.642
Kuiper Skill Score	0.121
Heidke Skill Score	0.145

INSAT-3D Sounder vs MODIS for November , 2018 (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	292	17	23
Sounder Uncertain	38	8	6
Sounder Cloudy	11	0	9

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	275	43	14
Sounder Uncertain	35	12	5
Sounder Cloudy	11	2	7

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	246	70	16
Sounder Uncertain	28	19	5
Sounder Cloudy	9	3	8

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	72.28	4.21	5.69
Sounder Uncertain	9.41	1.98	1.49
Sounder Cloudy	2.72	0.00	2.23

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	68.07	10.64	3.47
Sounder Uncertain	8.66	2.97	1.24
Sounder Cloudy	2.72	0.50	1.73

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	60.89	17.33	3.96
Sounder Uncertain	6.93	4.70	1.24
Sounder Cloudy	2.23	0.74	1.98

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.12	0.85	0.55
Frequency Bias	0.97	2.08	0.53
Probability of Detection	0.86	0.32	0.24
False Alarm Rate	0.42	0.46	0.12

Overall Skill Score

Skill Score	Value
Proportion Correct	0.765
Kuiper Skill Score	0.213
Heidke Skill Score	0.199

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.17	0.77	0.65
Frequency Bias	1.03	0.91	0.77
Probability of Detection	0.86	0.21	0.27
False Alarm Rate	0.52	0.36	0.12

Overall Skill Score

Skill Score	Value
Proportion Correct	0.728
Kuiper Skill Score	0.155
Heidke Skill Score	0.164

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.26	0.63	0.60
Frequency Bias	1.17	0.57	0.69
Probability of Detection	0.87	0.21	0.28
False Alarm Rate	0.66	0.25	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.676
Kuiper Skill Score	0.149
Heidke Skill Score	0.172

INSAT-3D Sounder vs MODIS for November , 2018 (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	70	17	22
Sounder Uncertain	6	1	5
Sounder Cloudy	0	0	3

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	65	33	11
Sounder Uncertain	5	2	5
Sounder Cloudy	0	1	2

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	60	33	16
Sounder Uncertain	3	4	5
Sounder Cloudy	0	1	2

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	56.45	13.71	17.74
Sounder Uncertain	4.84	0.81	4.03
Sounder Cloudy	0.00	0.00	2.42

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	52.42	26.61	8.87
Sounder Uncertain	4.03	1.61	4.03
Sounder Cloudy	0.00	0.81	1.61

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48.39	26.61	12.90
Sounder Uncertain	2.42	3.23	4.03
Sounder Cloudy	0.00	0.81	1.61

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.36	0.92	0.00
Frequency Bias	1.43	0.67	0.10
Probability of Detection	0.92	0.06	0.10
False Alarm Rate	0.78	0.22	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.597
Kuiper Skill Score	0.070
Heidke Skill Score	0.086

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.40	0.83	0.33
Frequency Bias	1.56	0.33	0.17
Probability of Detection	0.93	0.06	0.11
False Alarm Rate	0.80	0.18	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.556
Kuiper Skill Score	0.050
Heidke Skill Score	0.061

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.45	0.67	0.33
Frequency Bias	1.73	0.32	0.13
Probability of Detection	0.95	0.11	0.09
False Alarm Rate	0.84	0.14	0.02

Overall Skill Score

Skill Score	Value

Proportion Correct	0.532
Kuiper Skill Score	0.084
Heidke Skill Score	0.099

INSAT-3D Sounder vs MODIS for November , 2018 (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	7290	1829	2474
Sounder Uncertain	5873	1107	3564
Sounder Cloudy	2597	405	5399

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6385	3486	1722
Sounder Uncertain	4584	3413	2547
Sounder Cloudy	1645	2274	4482

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5532	3959	2102
Sounder Uncertain	3929	3667	2948
Sounder Cloudy	1359	2261	4781

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23.87	5.99	8.10
Sounder Uncertain	19.23	3.62	11.67
Sounder Cloudy	8.50	1.33	17.68

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20.91	11.42	5.64
Sounder Uncertain	15.01	11.18	8.34
Sounder Cloudy	5.39	7.45	14.68

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	18.12	12.96	6.88
Sounder Uncertain	12.87	12.01	9.65
Sounder Cloudy	4.45	7.40	15.66

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.37	0.90	0.36
Frequency Bias	0.74	3.16	0.73
Probability of Detection	0.46	0.33	0.47
False Alarm Rate	0.26	0.56	0.18

Overall Skill Score

Skill Score	Value
Proportion Correct	0.452
Kuiper Skill Score	0.198
Heidke Skill Score	0.173

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy

False Alarm Ratio	0.45	0.68	0.47
Frequency Bias	0.92	1.15	0.96
Probability of Detection	0.51	0.37	0.51
False Alarm Rate	0.32	0.44	0.24

Overall Skill Score

Skill Score	Value
Proportion Correct	0.468
Kuiper Skill Score	0.195
Heidke Skill Score	0.194

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.52	0.65	0.43
Frequency Bias	1.07	1.07	0.85
Probability of Detection	0.51	0.37	0.49
False Alarm Rate	0.37	0.42	0.22

Overall Skill Score

Skill Score	Value
Proportion Correct	0.458
Kuiper Skill Score	0.185
Heidke Skill Score	0.185

INSAT-3D Sounder vs MODIS for November , 2018 (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

Sounder Clear	2940	68	349
Sounder Uncertain	3678	196	1818
Sounder Cloudy	1668	245	4690

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2663	482	212
Sounder Uncertain	2763	1698	1231
Sounder Cloudy	835	1829	3939

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2501	601	255
Sounder Uncertain	2437	1836	1419
Sounder Cloudy	658	1768	4177

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	18.78	0.43	2.23
Sounder Uncertain	23.50	1.25	11.62
Sounder Cloudy	10.66	1.57	29.96

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17.01	3.08	1.35
Sounder Uncertain	17.65	10.85	7.86
Sounder Cloudy	5.33	11.69	25.17

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	15.98	3.84	1.63

Sounder Uncertain	15.57	11.73	9.07
Sounder Cloudy	4.20	11.30	26.69

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.12	0.97	0.29
Frequency Bias	0.41	11.18	0.96
Probability of Detection	0.35	0.39	0.68
False Alarm Rate	0.05	0.70	0.24

Overall Skill Score

Skill Score	Value
Proportion Correct	0.500
Kuiper Skill Score	0.360
Heidke Skill Score	0.275

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.21	0.70	0.40
Frequency Bias	0.54	1.42	1.23
Probability of Detection	0.43	0.42	0.73
False Alarm Rate	0.09	0.54	0.36

Overall Skill Score

Skill Score	Value
Proportion Correct	0.530
Kuiper Skill Score	0.314
Heidke Skill Score	0.305

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.25	0.68	0.37

Frequency Bias	0.60	1.35	1.13
Probability of Detection	0.45	0.44	0.71
False Alarm Rate	0.12	0.54	0.34

Overall Skill Score

Skill Score	Value
Proportion Correct	0.544
Kuiper Skill Score	0.321
Heidke Skill Score	0.317

INSAT-3D Sounder vs MODIS for November , 2018 (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	4350	1761	2125
Sounder Uncertain	2195	911	1746
Sounder Cloudy	929	160	709

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3722	3004	1510
Sounder Uncertain	1821	1715	1316
Sounder Cloudy	810	445	543

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3031	3358	1847

Sounder Uncertain	1492	1831	1529
Sounder Cloudy	701	493	604

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	29.22	11.83	14.28
Sounder Uncertain	14.75	6.12	11.73
Sounder Cloudy	6.24	1.07	4.76

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	25.00	20.18	10.14
Sounder Uncertain	12.23	11.52	8.84
Sounder Cloudy	5.44	2.99	3.65

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20.36	22.56	12.41
Sounder Uncertain	10.02	12.30	10.27
Sounder Cloudy	4.71	3.31	4.06

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.47	0.81	0.61
Frequency Bias	1.10	1.71	0.39
Probability of Detection	0.58	0.32	0.15
False Alarm Rate	0.44	0.44	0.12

Overall Skill Score

Skill Score	Value
Proportion Correct	0.401
Kuiper Skill Score	0.039
Heidke Skill Score	0.039

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.55	0.65	0.70
Frequency Bias	1.30	0.94	0.53
Probability of Detection	0.59	0.33	0.16
False Alarm Rate	0.51	0.35	0.14

Overall Skill Score

Skill Score	Value
Proportion Correct	0.402
Kuiper Skill Score	0.039
Heidke Skill Score	0.040

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.63	0.62	0.66
Frequency Bias	1.58	0.85	0.45
Probability of Detection	0.58	0.32	0.15
False Alarm Rate	0.55	0.32	0.13

Overall Skill Score

Skill Score	Value
Proportion Correct	0.367
Kuiper Skill Score	0.025
Heidke Skill Score	0.025