

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 around 40-60 pixels 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 cloudy 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 probability 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 statistics are presented in following 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 May , 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	31210	15607	15744
Sounder Uncertain	5706	3395	13365
Sounder Cloudy	20178	5511	63719

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	27719	20556	14286
Sounder Uncertain	4283	5659	12524
Sounder Cloudy	16995	10992	61421

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23804	23153	15604
Sounder Uncertain	3414	5911	13141
Sounder Cloudy	14052	13003	62353

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17.89	8.95	9.03
Sounder Uncertain	3.27	1.95	7.66
Sounder Cloudy	11.57	3.16	36.53

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	15.89	11.78	8.19
Sounder Uncertain	2.46	3.24	7.18
Sounder Cloudy	9.74	6.30	35.21

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13.65	13.27	8.95
Sounder Uncertain	1.96	3.39	7.53
Sounder Cloudy	8.06	7.45	35.75

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.50	0.85	0.29
Frequency Bias	1.10	0.92	0.96
Probability of Detection	0.55	0.14	0.69
False Alarm Rate	0.41	0.25	0.34

Overall Skill Score

Skill Score	Value
Proportion Correct	0.564
Kuiper Skill Score	0.263
Heidke Skill Score	0.263

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.56	0.75	0.31
Frequency Bias	1.28	0.60	1.01
Probability of Detection	0.57	0.15	0.70
False Alarm Rate	0.44	0.21	0.35

Overall Skill Score

Skill Score	Value
Proportion Correct	0.543
Kuiper Skill Score	0.252
Heidke Skill Score	0.255

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.62	0.74	0.30
Frequency Bias	1.52	0.53	0.98
Probability of Detection	0.58	0.14	0.68
False Alarm Rate	0.47	0.20	0.33

Overall Skill Score

Skill Score	Value
Proportion Correct	0.528
Kuiper Skill Score	0.235
Heidke Skill Score	0.234

INSAT-3D Sounder vs MODIS for May , 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	12281	9097	7275
Sounder Uncertain	3293	1740	6413
Sounder Cloudy	19752	4959	45145

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	10780	10949	6924
Sounder Uncertain	2462	2952	6032
Sounder Cloudy	16736	10112	43008

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9016	12051	7586
Sounder Uncertain	1954	3158	6334
Sounder Cloudy	13869	12150	43837

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	11.17	8.27	6.62
Sounder Uncertain	2.99	1.58	5.83
Sounder Cloudy	17.96	4.51	41.06

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9.80	9.96	6.30
Sounder Uncertain	2.24	2.68	5.49
Sounder Cloudy	15.22	9.20	39.11

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8.20	10.96	6.90
Sounder Uncertain	1.78	2.87	5.76
Sounder Cloudy	12.61	11.05	39.87

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.57	0.85	0.35
Frequency Bias	0.81	0.72	1.19
Probability of Detection	0.35	0.11	0.77
False Alarm Rate	0.32	0.19	0.49

Overall Skill Score

Skill Score	Value
Proportion Correct	0.538
Kuiper Skill Score	0.169
Heidke Skill Score	0.177

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.62	0.74	0.38
Frequency Bias	0.96	0.48	1.25
Probability of Detection	0.36	0.12	0.77
False Alarm Rate	0.34	0.16	0.50

Overall Skill Score

Skill Score	Value
Proportion Correct	0.516
Kuiper Skill Score	0.160
Heidke Skill Score	0.170

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.69	0.72	0.37
Frequency Bias	1.15	0.42	1.21
Probability of Detection	0.36	0.12	0.76
False Alarm Rate	0.36	0.15	0.48

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.509
Kuiper Skill Score	0.149
Heidke Skill Score	0.156

INSAT-3D Sounder vs MODIS for May , 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	18929	6510	8469
Sounder Uncertain	2413	1655	6952
Sounder Cloudy	426	552	18574

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	16939	9607	7362
Sounder Uncertain	1821	2707	6492
Sounder Cloudy	259	880	18413

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14788	11102	8018
Sounder Uncertain	1460	2753	6807
Sounder Cloudy	183	853	18516

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	29.36	10.10	13.13
Sounder Uncertain	3.74	2.57	10.78
Sounder Cloudy	0.66	0.86	28.81

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	26.27	14.90	11.42
Sounder Uncertain	2.82	4.20	10.07
Sounder Cloudy	0.40	1.36	28.56

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22.93	17.22	12.43
Sounder Uncertain	2.26	4.27	10.56
Sounder Cloudy	0.28	1.32	28.72

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.44	0.85	0.05
Frequency Bias	1.56	1.26	0.58
Probability of Detection	0.87	0.19	0.55
False Alarm Rate	0.59	0.37	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.607
Kuiper Skill Score	0.418
Heidke Skill Score	0.386

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.50	0.75	0.06
Frequency Bias	1.78	0.84	0.61
Probability of Detection	0.89	0.21	0.57
False Alarm Rate	0.64	0.31	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.590
Kuiper Skill Score	0.400
Heidke Skill Score	0.377

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.56	0.75	0.05
Frequency Bias	2.06	0.75	0.59
Probability of Detection	0.90	0.19	0.56
False Alarm Rate	0.67	0.29	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.559
Kuiper Skill Score	0.373
Heidke Skill Score	0.342

INSAT-3D Sounder vs MODIS for May , 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
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Sounder Clear	18817	5369	5565
Sounder Uncertain	3311	1477	4648
Sounder Cloudy	18885	5033	27227

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17545	7555	4651
Sounder Uncertain	2630	2635	4171
Sounder Cloudy	16111	9700	25334

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14768	9941	5042
Sounder Uncertain	2027	2974	4435
Sounder Cloudy	13318	11714	26113

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20.83	5.94	6.16
Sounder Uncertain	3.67	1.64	5.15
Sounder Cloudy	20.91	5.57	30.14

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	19.42	8.36	5.15
Sounder Uncertain	2.91	2.92	4.62
Sounder Cloudy	17.84	10.74	28.05

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	16.35	11.00	5.58

Sounder Uncertain	2.24	3.29	4.91
Sounder Cloudy	14.74	12.97	28.91

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.37	0.84	0.47
Frequency Bias	0.73	0.79	1.37
Probability of Detection	0.46	0.12	0.73
False Alarm Rate	0.26	0.19	0.56

Overall Skill Score

Skill Score	Value
Proportion Correct	0.526
Kuiper Skill Score	0.212
Heidke Skill Score	0.213

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.41	0.72	0.50
Frequency Bias	0.82	0.47	1.50
Probability of Detection	0.48	0.13	0.74
False Alarm Rate	0.27	0.15	0.58

Overall Skill Score

Skill Score	Value
Proportion Correct	0.504
Kuiper Skill Score	0.208
Heidke Skill Score	0.213

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.50	0.68	0.49

Frequency Bias	0.99	0.38	1.44
Probability of Detection	0.49	0.12	0.73
False Alarm Rate	0.32	0.14	0.54

Overall Skill Score

Skill Score	Value
Proportion Correct	0.485
Kuiper Skill Score	0.188
Heidke Skill Score	0.194

INSAT-3D Sounder vs MODIS for May , 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	8484	1459	2039
Sounder Uncertain	2222	416	1608
Sounder Cloudy	18645	4615	22200

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7722	2598	1662
Sounder Uncertain	1719	1225	1302
Sounder Cloudy	15957	9120	20383

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6447	3723	1812

Sounder Uncertain	1321	1506	1419
Sounder Cloudy	13217	11141	21102

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13.75	2.37	3.31
Sounder Uncertain	3.60	0.67	2.61
Sounder Cloudy	30.22	7.48	35.99

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	12.52	4.21	2.69
Sounder Uncertain	2.79	1.99	2.11
Sounder Cloudy	25.87	14.78	33.04

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	10.45	6.04	2.94
Sounder Uncertain	2.14	2.44	2.30
Sounder Cloudy	21.43	18.06	34.21

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.29	0.90	0.51
Frequency Bias	0.41	0.65	1.76
Probability of Detection	0.29	0.06	0.86
False Alarm Rate	0.11	0.13	0.76

Overall Skill Score

Skill Score	Value
Proportion Correct	0.504
Kuiper Skill Score	0.163
Heidke Skill Score	0.162

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.36	0.71	0.55
Frequency Bias	0.47	0.33	1.95
Probability of Detection	0.30	0.09	0.87
False Alarm Rate	0.13	0.09	0.77

Overall Skill Score

Skill Score	Value
Proportion Correct	0.475
Kuiper Skill Score	0.159
Heidke Skill Score	0.163

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.46	0.65	0.54
Frequency Bias	0.57	0.26	1.87
Probability of Detection	0.31	0.09	0.87
False Alarm Rate	0.17	0.08	0.75

Overall Skill Score

Skill Score	Value
Proportion Correct	0.471
Kuiper Skill Score	0.146
Heidke Skill Score	0.154

INSAT-3D Sounder vs MODIS for May , 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	10333	3910	3526
Sounder Uncertain	1089	1061	3040
Sounder Cloudy	240	418	5027

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9823	4957	2989
Sounder Uncertain	911	1410	2869
Sounder Cloudy	154	580	4951

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8321	6218	3230
Sounder Uncertain	706	1468	3016
Sounder Cloudy	101	573	5011

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	36.07	13.65	12.31
Sounder Uncertain	3.80	3.70	10.61
Sounder Cloudy	0.84	1.46	17.55

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34.29	17.31	10.43
Sounder Uncertain	3.18	4.92	10.02
Sounder Cloudy	0.54	2.02	17.28

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	29.05	21.71	11.28
Sounder Uncertain	2.46	5.12	10.53
Sounder Cloudy	0.35	2.00	17.49

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.42	0.80	0.12
Frequency Bias	1.52	0.96	0.49
Probability of Detection	0.89	0.20	0.43
False Alarm Rate	0.61	0.34	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.573
Kuiper Skill Score	0.325
Heidke Skill Score	0.326

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.45	0.73	0.13
Frequency Bias	1.63	0.75	0.53
Probability of Detection	0.90	0.20	0.46
False Alarm Rate	0.64	0.30	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.565
Kuiper Skill Score	0.322
Heidke Skill Score	0.326

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.53	0.72	0.12
Frequency Bias	1.95	0.63	0.51
Probability of Detection	0.91	0.18	0.45
False Alarm Rate	0.68	0.27	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.517
Kuiper Skill Score	0.286
Heidke Skill Score	0.281

INSAT-3D Sounder vs MODIS for May , 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	10783	9602	8684
Sounder Uncertain	1472	1661	7453
Sounder Cloudy	442	326	31700

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8922	11721	8426
Sounder Uncertain	1018	2240	7328
Sounder Cloudy	293	579	31596

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8034	11802	9233
Sounder Uncertain	895	2098	7593
Sounder Cloudy	227	576	31665

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14.95	13.31	12.04
Sounder Uncertain	2.04	2.30	10.33
Sounder Cloudy	0.61	0.45	43.95

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	12.37	16.25	11.68
Sounder Uncertain	1.41	3.11	10.16
Sounder Cloudy	0.41	0.80	43.81

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	11.14	16.36	12.80
Sounder Uncertain	1.24	2.91	10.53
Sounder Cloudy	0.31	0.80	43.90

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.63	0.84	0.02
Frequency Bias	2.29	0.91	0.68
Probability of Detection	0.85	0.14	0.66
False Alarm Rate	0.65	0.32	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.612
Kuiper Skill Score	0.435
Heidke Skill Score	0.361

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.69	0.79	0.03
Frequency Bias	2.84	0.73	0.69
Probability of Detection	0.87	0.15	0.67
False Alarm Rate	0.69	0.28	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.593
Kuiper Skill Score	0.414
Heidke Skill Score	0.341

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.72	0.80	0.02
Frequency Bias	3.17	0.73	0.67
Probability of Detection	0.88	0.14	0.65
False Alarm Rate	0.69	0.28	0.03

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.580
Kuiper Skill Score	0.399
Heidke Skill Score	0.318

INSAT-3D Sounder vs MODIS for May , 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	3139	7376	4688
Sounder Uncertain	710	1269	4365
Sounder Cloudy	318	200	18988

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2526	7888	4789
Sounder Uncertain	494	1482	4368
Sounder Cloudy	218	362	18926

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2104	7839	5260
Sounder Uncertain	422	1392	4530
Sounder Cloudy	170	371	18965

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7.65	17.97	11.42
Sounder Uncertain	1.73	3.09	10.63
Sounder Cloudy	0.77	0.49	46.25

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6.15	19.21	11.67
Sounder Uncertain	1.20	3.61	10.64
Sounder Cloudy	0.53	0.88	46.10

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.13	19.09	12.81
Sounder Uncertain	1.03	3.39	11.03
Sounder Cloudy	0.41	0.90	46.20

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.79	0.80	0.03
Frequency Bias	3.65	0.72	0.70
Probability of Detection	0.75	0.14	0.68
False Alarm Rate	0.68	0.29	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.570
Kuiper Skill Score	0.366
Heidke Skill Score	0.289

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.83	0.77	0.03
Frequency Bias	4.70	0.65	0.69
Probability of Detection	0.78	0.15	0.67
False Alarm Rate	0.70	0.27	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.559
Kuiper Skill Score	0.357
Heidke Skill Score	0.275

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.86	0.78	0.03
Frequency Bias	5.64	0.66	0.68
Probability of Detection	0.78	0.14	0.66
False Alarm Rate	0.70	0.27	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.547
Kuiper Skill Score	0.342
Heidke Skill Score	0.254

INSAT-3D Sounder vs MODIS for May , 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
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Sounder Clear	7644	2226	3996
Sounder Uncertain	762	392	3088
Sounder Cloudy	124	126	12712

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6396	3833	3637
Sounder Uncertain	524	758	2960
Sounder Cloudy	75	217	12670

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5930	3963	3973
Sounder Uncertain	473	706	3063
Sounder Cloudy	57	205	12700

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	24.60	7.16	12.86
Sounder Uncertain	2.45	1.26	9.94
Sounder Cloudy	0.40	0.41	40.91

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20.59	12.34	11.71
Sounder Uncertain	1.69	2.44	9.53
Sounder Cloudy	0.24	0.70	40.78

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	19.09	12.76	12.79

Sounder Uncertain	1.52	2.27	9.86
Sounder Cloudy	0.18	0.66	40.88

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.45	0.91	0.02
Frequency Bias	1.63	1.55	0.65
Probability of Detection	0.90	0.14	0.64
False Alarm Rate	0.60	0.37	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.668
Kuiper Skill Score	0.523
Heidke Skill Score	0.446

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.54	0.82	0.02
Frequency Bias	1.98	0.88	0.67
Probability of Detection	0.91	0.16	0.66
False Alarm Rate	0.66	0.31	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.638
Kuiper Skill Score	0.477
Heidke Skill Score	0.416

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.57	0.83	0.02

Frequency Bias	2.15	0.87	0.66
Probability of Detection	0.92	0.14	0.64
False Alarm Rate	0.68	0.30	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.622
Kuiper Skill Score	0.460
Heidke Skill Score	0.392

INSAT-3D Sounder vs MODIS for May , 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	221	56	123
Sounder Uncertain	33	7	76
Sounder Cloudy	108	19	403

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	200	100	100
Sounder Uncertain	26	20	70
Sounder Cloudy	95	48	387

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	178	109	113

Sounder Uncertain	23	20	73
Sounder Cloudy	85	52	393

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	21.13	5.35	11.76
Sounder Uncertain	3.15	0.67	7.27
Sounder Cloudy	10.33	1.82	38.53

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	19.12	9.56	9.56
Sounder Uncertain	2.49	1.91	6.69
Sounder Cloudy	9.08	4.59	37.00

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17.02	10.42	10.80
Sounder Uncertain	2.20	1.91	6.98
Sounder Cloudy	8.13	4.97	37.57

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.45	0.94	0.24
Frequency Bias	1.10	1.41	0.88
Probability of Detection	0.61	0.09	0.67
False Alarm Rate	0.43	0.26	0.31

Overall Skill Score

Skill Score	Value
Proportion Correct	0.603
Kuiper Skill Score	0.314
Heidke Skill Score	0.301

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.50	0.83	0.27
Frequency Bias	1.25	0.69	0.95
Probability of Detection	0.62	0.12	0.69
False Alarm Rate	0.46	0.22	0.33

Overall Skill Score

Skill Score	Value
Proportion Correct	0.580
Kuiper Skill Score	0.294
Heidke Skill Score	0.295

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.56	0.83	0.26
Frequency Bias	1.40	0.64	0.92
Probability of Detection	0.62	0.11	0.68
False Alarm Rate	0.49	0.21	0.30

Overall Skill Score

Skill Score	Value
Proportion Correct	0.565
Kuiper Skill Score	0.273
Heidke Skill Score	0.270

INSAT-3D Sounder vs MODIS for May , 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	130	41	83
Sounder Uncertain	25	6	33
Sounder Cloudy	108	18	314

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	118	67	69
Sounder Uncertain	21	13	30
Sounder Cloudy	95	46	299

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	111	66	77
Sounder Uncertain	20	13	31
Sounder Cloudy	85	51	304

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17.15	5.41	10.95
Sounder Uncertain	3.30	0.79	4.35
Sounder Cloudy	14.25	2.37	41.42

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	15.57	8.84	9.10
Sounder Uncertain	2.77	1.72	3.96
Sounder Cloudy	12.53	6.07	39.45

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14.64	8.71	10.16
Sounder Uncertain	2.64	1.72	4.09
Sounder Cloudy	11.21	6.73	40.11

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.49	0.91	0.29
Frequency Bias	0.97	0.98	1.02
Probability of Detection	0.49	0.09	0.73
False Alarm Rate	0.40	0.19	0.41

Overall Skill Score

Skill Score	Value
Proportion Correct	0.594
Kuiper Skill Score	0.256
Heidke Skill Score	0.257

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.54	0.80	0.32
Frequency Bias	1.09	0.51	1.11
Probability of Detection	0.50	0.10	0.75
False Alarm Rate	0.41	0.16	0.43

Overall Skill Score

Skill Score	Value
Proportion Correct	0.567
Kuiper Skill Score	0.241
Heidke Skill Score	0.251

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.56	0.80	0.31
Frequency Bias	1.18	0.49	1.07
Probability of Detection	0.51	0.10	0.74
False Alarm Rate	0.43	0.15	0.41

Overall Skill Score

Skill Score	Value
Proportion Correct	0.565
Kuiper Skill Score	0.234
Heidke Skill Score	0.242

INSAT-3D Sounder vs MODIS for May , 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	91	15	40
Sounder Uncertain	8	1	43
Sounder Cloudy	0	1	89

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	82	33	31
Sounder Uncertain	5	7	40
Sounder Cloudy	0	2	88

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	67	43	36
Sounder Uncertain	3	7	42
Sounder Cloudy	0	1	89

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	31.60	5.21	13.89
Sounder Uncertain	2.78	0.35	14.93
Sounder Cloudy	0.00	0.35	30.90

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28.47	11.46	10.76
Sounder Uncertain	1.74	2.43	13.89
Sounder Cloudy	0.00	0.69	30.56

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23.26	14.93	12.50
Sounder Uncertain	1.04	2.43	14.58
Sounder Cloudy	0.00	0.35	30.90

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.98	0.01
Frequency Bias	1.47	3.06	0.52
Probability of Detection	0.92	0.06	0.52
False Alarm Rate	0.51	0.48	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.628
Kuiper Skill Score	0.492
Heidke Skill Score	0.409

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.44	0.87	0.02
Frequency Bias	1.68	1.24	0.57
Probability of Detection	0.94	0.17	0.55
False Alarm Rate	0.58	0.41	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.615
Kuiper Skill Score	0.451
Heidke Skill Score	0.405

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.54	0.87	0.01
Frequency Bias	2.09	1.02	0.54
Probability of Detection	0.96	0.14	0.53
False Alarm Rate	0.63	0.36	0.01

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.566
Kuiper Skill Score	0.400
Heidke Skill Score	0.346

INSAT-3D Sounder vs MODIS for May , 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	471	226	773
Sounder Uncertain	750	171	858
Sounder Cloudy	307	13	2345

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	278	598	594
Sounder Uncertain	500	627	652
Sounder Cloudy	135	408	2122

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	188	618	664
Sounder Uncertain	377	683	719
Sounder Cloudy	113	382	2170

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7.96	3.82	13.07
Sounder Uncertain	12.68	2.89	14.51
Sounder Cloudy	5.19	0.22	39.65

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.70	10.11	10.04
Sounder Uncertain	8.45	10.60	11.02
Sounder Cloudy	2.28	6.90	35.88

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.18	10.45	11.23
Sounder Uncertain	6.37	11.55	12.16
Sounder Cloudy	1.91	6.46	36.69

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.68	0.90	0.12
Frequency Bias	0.96	4.34	0.67
Probability of Detection	0.31	0.42	0.59
False Alarm Rate	0.34	0.55	0.11

Overall Skill Score

Skill Score	Value
Proportion Correct	0.505
Kuiper Skill Score	0.246
Heidke Skill Score	0.191

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.81	0.65	0.20
Frequency Bias	1.61	1.09	0.79
Probability of Detection	0.30	0.38	0.63
False Alarm Rate	0.41	0.40	0.19

Overall Skill Score

Skill Score	Value
Proportion Correct	0.512
Kuiper Skill Score	0.232
Heidke Skill Score	0.215

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.87	0.62	0.19
Frequency Bias	2.17	1.06	0.75
Probability of Detection	0.28	0.41	0.61
False Alarm Rate	0.45	0.38	0.17

Overall Skill Score

Skill Score	Value
Proportion Correct	0.514
Kuiper Skill Score	0.237
Heidke Skill Score	0.210

INSAT-3D Sounder vs MODIS for May , 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
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Sounder Clear	63	4	51
Sounder Uncertain	242	3	226
Sounder Cloudy	245	6	2027

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34	51	33
Sounder Uncertain	152	155	164
Sounder Cloudy	105	328	1845

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30	50	38
Sounder Uncertain	123	172	176
Sounder Cloudy	88	309	1881

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.20	0.14	1.78
Sounder Uncertain	8.44	0.10	7.88
Sounder Cloudy	8.55	0.21	70.70

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1.19	1.78	1.15
Sounder Uncertain	5.30	5.41	5.72
Sounder Cloudy	3.66	11.44	64.35

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1.05	1.74	1.33

Sounder Uncertain	4.29	6.00	6.14
Sounder Cloudy	3.07	10.78	65.61

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.47	0.99	0.11
Frequency Bias	0.21	36.23	0.99
Probability of Detection	0.11	0.23	0.88
False Alarm Rate	0.07	0.60	0.32

Overall Skill Score

Skill Score	Value
Proportion Correct	0.730
Kuiper Skill Score	0.261
Heidke Skill Score	0.235

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.71	0.67	0.19
Frequency Bias	0.41	0.88	1.12
Probability of Detection	0.12	0.29	0.90
False Alarm Rate	0.10	0.38	0.52

Overall Skill Score

Skill Score	Value
Proportion Correct	0.709
Kuiper Skill Score	0.243
Heidke Skill Score	0.272

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.75	0.63	0.17

Frequency Bias	0.49	0.89	1.09
Probability of Detection	0.12	0.32	0.90
False Alarm Rate	0.11	0.38	0.51

Overall Skill Score

Skill Score	Value
Proportion Correct	0.727
Kuiper Skill Score	0.264
Heidke Skill Score	0.291

INSAT-3D Sounder vs MODIS for May , 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	408	222	722
Sounder Uncertain	508	168	632
Sounder Cloudy	62	7	318

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	244	547	561
Sounder Uncertain	348	472	488
Sounder Cloudy	30	80	277

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	158	568	626

Sounder Uncertain	254	511	543
Sounder Cloudy	25	73	289

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13.39	7.29	23.70
Sounder Uncertain	16.67	5.51	20.74
Sounder Cloudy	2.03	0.23	10.44

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8.01	17.95	18.41
Sounder Uncertain	11.42	15.49	16.02
Sounder Cloudy	0.98	2.63	9.09

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.19	18.64	20.54
Sounder Uncertain	8.34	16.77	17.82
Sounder Cloudy	0.82	2.40	9.48

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.70	0.87	0.18
Frequency Bias	1.38	3.29	0.23
Probability of Detection	0.42	0.42	0.19
False Alarm Rate	0.44	0.53	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.293
Kuiper Skill Score	0.044
Heidke Skill Score	0.035

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.82	0.64	0.28
Frequency Bias	2.17	1.19	0.29
Probability of Detection	0.39	0.43	0.21
False Alarm Rate	0.54	0.41	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.326
Kuiper Skill Score	0.039
Heidke Skill Score	0.036

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.88	0.61	0.25
Frequency Bias	3.09	1.14	0.27
Probability of Detection	0.36	0.44	0.20
False Alarm Rate	0.57	0.38	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.314
Kuiper Skill Score	0.046
Heidke Skill Score	0.039