

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 June , 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	10081	8104	16261
Sounder Uncertain	2421	2185	16241
Sounder Cloudy	7680	3656	108394

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7630	11974	14842
Sounder Uncertain	1410	4047	15390
Sounder Cloudy	5426	7924	106380

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6321	12302	15823
Sounder Uncertain	1109	3832	15906
Sounder Cloudy	4233	8125	107372

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.76	4.63	9.29
Sounder Uncertain	1.38	1.25	9.28
Sounder Cloudy	4.39	2.09	61.93

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.36	6.84	8.48
Sounder Uncertain	0.81	2.31	8.79
Sounder Cloudy	3.10	4.53	60.78

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.61	7.03	9.04
Sounder Uncertain	0.63	2.19	9.09
Sounder Cloudy	2.42	4.64	61.35

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.71	0.90	0.09
Frequency Bias	1.71	1.49	0.85
Probability of Detection	0.50	0.16	0.77
False Alarm Rate	0.45	0.34	0.21

Overall Skill Score

Skill Score	Value
Proportion Correct	0.689
Kuiper Skill Score	0.321
Heidke Skill Score	0.255

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.78	0.81	0.11
Frequency Bias	2.38	0.87	0.88
Probability of Detection	0.53	0.17	0.78
False Alarm Rate	0.47	0.29	0.23

Overall Skill Score

Skill Score	Value
Proportion Correct	0.675
Kuiper Skill Score	0.296
Heidke Skill Score	0.249

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.82	0.82	0.10
Frequency Bias	2.95	0.86	0.86
Probability of Detection	0.54	0.16	0.77
False Alarm Rate	0.49	0.30	0.21

Overall Skill Score

Skill Score	Value
Proportion Correct	0.671
Kuiper Skill Score	0.285
Heidke Skill Score	0.230

INSAT-3D Sounder vs MODIS for June , 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	5536	4625	7401
Sounder Uncertain	1460	1046	8075
Sounder Cloudy	7440	3137	69002

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4397	6232	6933
Sounder Uncertain	851	2111	7619
Sounder Cloudy	5275	7248	67056

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3688	6410	7464
Sounder Uncertain	665	2021	7895
Sounder Cloudy	4123	7508	67948

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.14	4.29	6.87
Sounder Uncertain	1.36	0.97	7.50
Sounder Cloudy	6.91	2.91	64.06

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.08	5.79	6.44
Sounder Uncertain	0.79	1.96	7.07
Sounder Cloudy	4.90	6.73	62.25

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.42	5.95	6.93
Sounder Uncertain	0.62	1.88	7.33
Sounder Cloudy	3.83	6.97	63.08

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.68	0.90	0.13
Frequency Bias	1.22	1.20	0.94
Probability of Detection	0.38	0.12	0.82
False Alarm Rate	0.37	0.30	0.33

Overall Skill Score

Skill Score	Value
Proportion Correct	0.702
Kuiper Skill Score	0.257
Heidke Skill Score	0.237

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.75	0.80	0.16
Frequency Bias	1.67	0.68	0.98
Probability of Detection	0.42	0.14	0.82
False Alarm Rate	0.39	0.25	0.37

Overall Skill Score

Skill Score	Value
Proportion Correct	0.683
Kuiper Skill Score	0.235
Heidke Skill Score	0.227

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.79	0.81	0.15
Frequency Bias	2.07	0.66	0.96
Probability of Detection	0.44	0.13	0.82
False Alarm Rate	0.41	0.25	0.34

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.684
Kuiper Skill Score	0.228
Heidke Skill Score	0.212

INSAT-3D Sounder vs MODIS for June , 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	4545	3479	8860
Sounder Uncertain	961	1139	8166
Sounder Cloudy	240	519	39392

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3233	5742	7909
Sounder Uncertain	559	1936	7771
Sounder Cloudy	151	676	39324

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2633	5892	8359
Sounder Uncertain	444	1811	8011
Sounder Cloudy	110	617	39424

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6.75	5.17	13.16
Sounder Uncertain	1.43	1.69	12.13
Sounder Cloudy	0.36	0.77	58.53

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.80	8.53	11.75
Sounder Uncertain	0.83	2.88	11.55
Sounder Cloudy	0.22	1.00	58.43

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.91	8.75	12.42
Sounder Uncertain	0.66	2.69	11.90
Sounder Cloudy	0.16	0.92	58.58

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.73	0.89	0.02
Frequency Bias	2.94	2.00	0.71
Probability of Detection	0.79	0.22	0.70
False Alarm Rate	0.56	0.41	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.670
Kuiper Skill Score	0.481
Heidke Skill Score	0.293

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.81	0.81	0.02
Frequency Bias	4.28	1.23	0.73
Probability of Detection	0.82	0.23	0.71
False Alarm Rate	0.60	0.37	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.661
Kuiper Skill Score	0.447
Heidke Skill Score	0.292

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.84	0.82	0.02
Frequency Bias	5.30	1.23	0.72
Probability of Detection	0.83	0.22	0.71
False Alarm Rate	0.61	0.36	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.652
Kuiper Skill Score	0.429
Heidke Skill Score	0.266

INSAT-3D Sounder vs MODIS for June , 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	4916	3819	6528
Sounder Uncertain	955	1090	5871
Sounder Cloudy	6878	3141	56236

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4140	5171	5952
Sounder Uncertain	610	1772	5534
Sounder Cloudy	4932	6755	54568

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3312	5613	6338
Sounder Uncertain	465	1684	5767
Sounder Cloudy	3867	7002	55386

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.50	4.27	7.30
Sounder Uncertain	1.07	1.22	6.56
Sounder Cloudy	7.69	3.51	62.88

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.63	5.78	6.66
Sounder Uncertain	0.68	1.98	6.19
Sounder Cloudy	5.51	7.55	61.01

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.70	6.28	7.09

Sounder Uncertain	0.52	1.88	6.45
Sounder Cloudy	4.32	7.83	61.93

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.68	0.86	0.15
Frequency Bias	1.20	0.98	0.97
Probability of Detection	0.39	0.14	0.82
False Alarm Rate	0.38	0.25	0.37

Overall Skill Score

Skill Score	Value
Proportion Correct	0.696
Kuiper Skill Score	0.249
Heidke Skill Score	0.238

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.73	0.78	0.18
Frequency Bias	1.58	0.58	1.00
Probability of Detection	0.43	0.13	0.83
False Alarm Rate	0.38	0.21	0.40

Overall Skill Score

Skill Score	Value
Proportion Correct	0.676
Kuiper Skill Score	0.231
Heidke Skill Score	0.231

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.78	0.79	0.16

Frequency Bias	2.00	0.55	0.98
Probability of Detection	0.43	0.12	0.82
False Alarm Rate	0.41	0.21	0.37

Overall Skill Score

Skill Score	Value
Proportion Correct	0.675
Kuiper Skill Score	0.220
Heidke Skill Score	0.212

INSAT-3D Sounder vs MODIS for June , 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	3504	1231	2997
Sounder Uncertain	725	330	2404
Sounder Cloudy	6729	2690	37004

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2830	2323	2579
Sounder Uncertain	444	874	2141
Sounder Cloudy	4848	6203	35372

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2332	2586	2814

Sounder Uncertain	348	854	2257
Sounder Cloudy	3817	6495	36111

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6.08	2.14	5.20
Sounder Uncertain	1.26	0.57	4.17
Sounder Cloudy	11.68	4.67	64.23

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.91	4.03	4.48
Sounder Uncertain	0.77	1.52	3.72
Sounder Cloudy	8.41	10.77	61.39

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.05	4.49	4.88
Sounder Uncertain	0.60	1.48	3.92
Sounder Cloudy	6.63	11.27	62.68

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.55	0.90	0.20
Frequency Bias	0.71	0.81	1.09
Probability of Detection	0.32	0.08	0.87
False Alarm Rate	0.25	0.19	0.56

Overall Skill Score

Skill Score	Value
Proportion Correct	0.709
Kuiper Skill Score	0.206
Heidke Skill Score	0.228

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.63	0.75	0.24
Frequency Bias	0.95	0.37	1.16
Probability of Detection	0.35	0.09	0.88
False Alarm Rate	0.26	0.14	0.60

Overall Skill Score

Skill Score	Value
Proportion Correct	0.678
Kuiper Skill Score	0.189
Heidke Skill Score	0.216

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.70	0.75	0.22
Frequency Bias	1.19	0.35	1.13
Probability of Detection	0.36	0.09	0.88
False Alarm Rate	0.29	0.14	0.56

Overall Skill Score

Skill Score	Value
Proportion Correct	0.682
Kuiper Skill Score	0.181
Heidke Skill Score	0.202

INSAT-3D Sounder vs MODIS for June , 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	1412	2588	3531
Sounder Uncertain	230	760	3467
Sounder Cloudy	149	451	19232

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1310	2848	3373
Sounder Uncertain	166	898	3393
Sounder Cloudy	84	552	19196

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	980	3027	3524
Sounder Uncertain	117	830	3510
Sounder Cloudy	50	507	19275

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.44	8.13	11.10
Sounder Uncertain	0.72	2.39	10.90
Sounder Cloudy	0.47	1.42	60.44

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.12	8.95	10.60
Sounder Uncertain	0.52	2.82	10.66
Sounder Cloudy	0.26	1.73	60.33

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.08	9.51	11.07
Sounder Uncertain	0.37	2.61	11.03
Sounder Cloudy	0.16	1.59	60.58

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.81	0.83	0.03
Frequency Bias	4.20	1.17	0.76
Probability of Detection	0.79	0.20	0.73
False Alarm Rate	0.59	0.35	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.673
Kuiper Skill Score	0.425
Heidke Skill Score	0.282

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.83	0.80	0.03
Frequency Bias	4.83	1.04	0.76
Probability of Detection	0.84	0.21	0.74
False Alarm Rate	0.60	0.34	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.673
Kuiper Skill Score	0.426
Heidke Skill Score	0.290

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.87	0.81	0.03
Frequency Bias	6.57	1.02	0.75
Probability of Detection	0.85	0.19	0.73
False Alarm Rate	0.61	0.34	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.663
Kuiper Skill Score	0.404
Heidke Skill Score	0.262

INSAT-3D Sounder vs MODIS for June , 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	4770	3775	8181
Sounder Uncertain	1107	817	8693
Sounder Cloudy	309	246	46481

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3248	6011	7467
Sounder Uncertain	603	1662	8352
Sounder Cloudy	206	425	46405

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2840	5927	7959
Sounder Uncertain	508	1548	8561
Sounder Cloudy	159	411	46466

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6.41	5.08	11.00
Sounder Uncertain	1.49	1.10	11.69
Sounder Cloudy	0.42	0.33	62.49

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.37	8.08	10.04
Sounder Uncertain	0.81	2.23	11.23
Sounder Cloudy	0.28	0.57	62.39

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.82	7.97	10.70
Sounder Uncertain	0.68	2.08	11.51
Sounder Cloudy	0.21	0.55	62.47

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.71	0.92	0.01
Frequency Bias	2.70	2.19	0.74
Probability of Detection	0.77	0.17	0.73
False Alarm Rate	0.54	0.44	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.700
Kuiper Skill Score	0.507
Heidke Skill Score	0.308

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.81	0.84	0.01
Frequency Bias	4.12	1.31	0.76
Probability of Detection	0.80	0.21	0.75
False Alarm Rate	0.58	0.39	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.690
Kuiper Skill Score	0.466
Heidke Skill Score	0.300

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.83	0.85	0.01
Frequency Bias	4.77	1.35	0.75
Probability of Detection	0.81	0.20	0.74
False Alarm Rate	0.59	0.39	0.02

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.684
Kuiper Skill Score	0.455
Heidke Skill Score	0.279

INSAT-3D Sounder vs MODIS for June , 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	1707	3242	3830
Sounder Uncertain	456	693	5096
Sounder Cloudy	230	228	28260

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1378	3546	3855
Sounder Uncertain	260	965	5020
Sounder Cloudy	144	364	28210

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1206	3460	4113
Sounder Uncertain	202	891	5152
Sounder Cloudy	101	358	28259

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.90	7.41	8.76
Sounder Uncertain	1.04	1.58	11.65
Sounder Cloudy	0.53	0.52	64.61

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.15	8.11	8.81
Sounder Uncertain	0.59	2.21	11.48
Sounder Cloudy	0.33	0.83	64.49

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.76	7.91	9.40
Sounder Uncertain	0.46	2.04	11.78
Sounder Cloudy	0.23	0.82	64.60

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.81	0.89	0.02
Frequency Bias	3.67	1.50	0.77
Probability of Detection	0.71	0.17	0.76
False Alarm Rate	0.54	0.42	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.701
Kuiper Skill Score	0.446
Heidke Skill Score	0.283

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.84	0.85	0.02
Frequency Bias	4.93	1.28	0.77
Probability of Detection	0.77	0.20	0.76
False Alarm Rate	0.56	0.40	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.698
Kuiper Skill Score	0.441
Heidke Skill Score	0.281

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.86	0.86	0.02
Frequency Bias	5.82	1.33	0.77
Probability of Detection	0.80	0.19	0.75
False Alarm Rate	0.57	0.40	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.694
Kuiper Skill Score	0.432
Heidke Skill Score	0.262

INSAT-3D Sounder vs MODIS for June , 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	3063	533	4351
Sounder Uncertain	651	124	3597
Sounder Cloudy	79	18	18221

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1870	2465	3612
Sounder Uncertain	343	697	3332
Sounder Cloudy	62	61	18195

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1634	2467	3846
Sounder Uncertain	306	657	3409
Sounder Cloudy	58	53	18207

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	10.00	1.74	14.20
Sounder Uncertain	2.12	0.40	11.74
Sounder Cloudy	0.26	0.06	59.47

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6.10	8.05	11.79
Sounder Uncertain	1.12	2.28	10.88
Sounder Cloudy	0.20	0.20	59.39

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.33	8.05	12.55

Sounder Uncertain	1.00	2.14	11.13
Sounder Cloudy	0.19	0.17	59.43

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.61	0.97	0.01
Frequency Bias	2.10	6.48	0.70
Probability of Detection	0.81	0.18	0.70
False Alarm Rate	0.53	0.46	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.699
Kuiper Skill Score	0.600
Heidke Skill Score	0.337

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.76	0.84	0.01
Frequency Bias	3.49	1.36	0.73
Probability of Detection	0.82	0.22	0.72
False Alarm Rate	0.62	0.37	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.678
Kuiper Skill Score	0.493
Heidke Skill Score	0.322

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.79	0.85	0.01

Frequency Bias	3.98	1.38	0.72
Probability of Detection	0.82	0.21	0.72
False Alarm Rate	0.62	0.37	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.669
Kuiper Skill Score	0.477
Heidke Skill Score	0.298

INSAT-3D Sounder vs MODIS for June , 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	54	51	152
Sounder Uncertain	10	9	115
Sounder Cloudy	49	43	590

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32	83	142
Sounder Uncertain	8	15	111
Sounder Cloudy	37	64	581

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22	82	153

Sounder Uncertain	8	14	112
Sounder Cloudy	16	77	589

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.03	4.75	14.17
Sounder Uncertain	0.93	0.84	10.72
Sounder Cloudy	4.57	4.01	54.99

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.98	7.74	13.23
Sounder Uncertain	0.75	1.40	10.34
Sounder Cloudy	3.45	5.96	54.15

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.05	7.64	14.26
Sounder Uncertain	0.75	1.30	10.44
Sounder Cloudy	1.49	7.18	54.89

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.79	0.93	0.13
Frequency Bias	2.27	1.30	0.80
Probability of Detection	0.48	0.09	0.69
False Alarm Rate	0.48	0.30	0.22

Overall Skill Score

Skill Score	Value
Proportion Correct	0.609
Kuiper Skill Score	0.186
Heidke Skill Score	0.140

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.88	0.89	0.15
Frequency Bias	3.34	0.83	0.82
Probability of Detection	0.42	0.09	0.70
False Alarm Rate	0.51	0.27	0.23

Overall Skill Score

Skill Score	Value
Proportion Correct	0.585
Kuiper Skill Score	0.150
Heidke Skill Score	0.117

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.91	0.90	0.14
Frequency Bias	5.59	0.77	0.80
Probability of Detection	0.48	0.08	0.69
False Alarm Rate	0.52	0.27	0.21

Overall Skill Score

Skill Score	Value
Proportion Correct	0.582
Kuiper Skill Score	0.136
Heidke Skill Score	0.100

INSAT-3D Sounder vs MODIS for June , 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	52	36	103
Sounder Uncertain	7	2	64
Sounder Cloudy	49	42	379

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32	69	90
Sounder Uncertain	5	7	61
Sounder Cloudy	37	64	369

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22	70	99
Sounder Uncertain	5	6	62
Sounder Cloudy	16	77	377

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7.08	4.90	14.03
Sounder Uncertain	0.95	0.27	8.72
Sounder Cloudy	6.68	5.72	51.63

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.36	9.40	12.26
Sounder Uncertain	0.68	0.95	8.31
Sounder Cloudy	5.04	8.72	50.27

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.00	9.54	13.49
Sounder Uncertain	0.68	0.82	8.45
Sounder Cloudy	2.18	10.49	51.36

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.73	0.97	0.19
Frequency Bias	1.77	0.91	0.86
Probability of Detection	0.48	0.03	0.69
False Alarm Rate	0.46	0.24	0.30

Overall Skill Score

Skill Score	Value
Proportion Correct	0.590
Kuiper Skill Score	0.156
Heidke Skill Score	0.136

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.83	0.90	0.21
Frequency Bias	2.58	0.52	0.90
Probability of Detection	0.43	0.05	0.71
False Alarm Rate	0.49	0.20	0.31

Overall Skill Score

Skill Score	Value
Proportion Correct	0.556
Kuiper Skill Score	0.126
Heidke Skill Score	0.114

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.88	0.92	0.20
Frequency Bias	4.44	0.48	0.87
Probability of Detection	0.51	0.04	0.70
False Alarm Rate	0.51	0.20	0.28

Overall Skill Score

Skill Score	Value
Proportion Correct	0.552
Kuiper Skill Score	0.112
Heidke Skill Score	0.094

INSAT-3D Sounder vs MODIS for June , 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	2	15	49
Sounder Uncertain	3	7	51
Sounder Cloudy	0	1	211

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	0	14	52
Sounder Uncertain	3	8	50
Sounder Cloudy	0	0	212

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	0	12	54
Sounder Uncertain	3	8	50
Sounder Cloudy	0	0	212

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	0.59	4.42	14.45
Sounder Uncertain	0.88	2.06	15.04
Sounder Cloudy	0.00	0.29	62.24

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	0.00	4.13	15.34
Sounder Uncertain	0.88	2.36	14.75
Sounder Cloudy	0.00	0.00	62.54

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	0.00	3.54	15.93
Sounder Uncertain	0.88	2.36	14.75
Sounder Cloudy	0.00	0.00	62.54

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.97	0.89	0.00
Frequency Bias	13.20	2.65	0.68
Probability of Detection	0.40	0.30	0.68
False Alarm Rate	0.54	0.45	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.649
Kuiper Skill Score	0.392
Heidke Skill Score	0.146

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	1.00	0.87	0.00
Frequency Bias	22.00	2.77	0.68
Probability of Detection	0.00	0.36	0.68
False Alarm Rate	0.55	0.45	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.649
Kuiper Skill Score	0.409
Heidke Skill Score	0.138

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	1.00	0.87	0.00
Frequency Bias	22.00	3.05	0.67
Probability of Detection	0.00	0.40	0.67
False Alarm Rate	0.55	0.45	0.00

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.649
Kuiper Skill Score	0.421
Heidke Skill Score	0.133

INSAT-3D Sounder vs MODIS for June , 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	99	294	739
Sounder Uncertain	271	223	1050
Sounder Cloudy	252	53	1894

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	64	401	667
Sounder Uncertain	146	482	916
Sounder Cloudy	119	388	1692

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	31	375	726
Sounder Uncertain	92	473	979
Sounder Cloudy	92	357	1750

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.03	6.03	15.16
Sounder Uncertain	5.56	4.57	21.54
Sounder Cloudy	5.17	1.09	38.85

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1.31	8.23	13.68
Sounder Uncertain	2.99	9.89	18.79
Sounder Cloudy	2.44	7.96	34.71

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	0.64	7.69	14.89
Sounder Uncertain	1.89	9.70	20.08
Sounder Cloudy	1.89	7.32	35.90

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.91	0.86	0.14
Frequency Bias	1.82	2.71	0.60
Probability of Detection	0.16	0.39	0.51
False Alarm Rate	0.39	0.50	0.11

Overall Skill Score

Skill Score	Value
Proportion Correct	0.455
Kuiper Skill Score	0.118
Heidke Skill Score	0.080

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.94	0.69	0.23
Frequency Bias	3.44	1.21	0.67
Probability of Detection	0.19	0.38	0.52
False Alarm Rate	0.41	0.40	0.19

Overall Skill Score

Skill Score	Value
Proportion Correct	0.459
Kuiper Skill Score	0.121
Heidke Skill Score	0.097

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.97	0.69	0.20
Frequency Bias	5.27	1.28	0.64
Probability of Detection	0.14	0.39	0.51
False Alarm Rate	0.42	0.41	0.17

Overall Skill Score

Skill Score	Value
Proportion Correct	0.462
Kuiper Skill Score	0.125
Heidke Skill Score	0.091

INSAT-3D Sounder vs MODIS for June , 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	47	0	69
Sounder Uncertain	202	4	237
Sounder Cloudy	242	8	1269

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	24	37	55
Sounder Uncertain	103	189	151
Sounder Cloudy	114	331	1074

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	19	38	59
Sounder Uncertain	76	198	169
Sounder Cloudy	90	304	1125

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.26	0.00	3.32
Sounder Uncertain	9.72	0.19	11.41
Sounder Cloudy	11.65	0.38	61.07

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1.15	1.78	2.65
Sounder Uncertain	4.96	9.10	7.27
Sounder Cloudy	5.49	15.93	51.68

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	0.91	1.83	2.84

Sounder Uncertain	3.66	9.53	8.13
Sounder Cloudy	4.33	14.63	54.14

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.59	0.99	0.16
Frequency Bias	0.24	36.92	0.96
Probability of Detection	0.10	0.33	0.81
False Alarm Rate	0.09	0.58	0.33

Overall Skill Score

Skill Score	Value
Proportion Correct	0.635
Kuiper Skill Score	0.181
Heidke Skill Score	0.155

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.79	0.57	0.29
Frequency Bias	0.48	0.80	1.19
Probability of Detection	0.10	0.34	0.84
False Alarm Rate	0.12	0.32	0.56

Overall Skill Score

Skill Score	Value
Proportion Correct	0.619
Kuiper Skill Score	0.197
Heidke Skill Score	0.217

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.84	0.55	0.26

Frequency Bias	0.63	0.82	1.12
Probability of Detection	0.10	0.37	0.83
False Alarm Rate	0.13	0.33	0.54

Overall Skill Score

Skill Score	Value
Proportion Correct	0.646
Kuiper Skill Score	0.219
Heidke Skill Score	0.236

INSAT-3D Sounder vs MODIS for June , 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	52	294	670
Sounder Uncertain	69	219	813
Sounder Cloudy	10	45	625

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	40	364	612
Sounder Uncertain	43	293	765
Sounder Cloudy	5	57	618

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	12	337	667

Sounder Uncertain	16	275	810
Sounder Cloudy	2	53	625

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1.86	10.51	23.95
Sounder Uncertain	2.47	7.83	29.07
Sounder Cloudy	0.36	1.61	22.35

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1.43	13.01	21.88
Sounder Uncertain	1.54	10.48	27.35
Sounder Cloudy	0.18	2.04	22.10

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	0.43	12.05	23.85
Sounder Uncertain	0.57	9.83	28.96
Sounder Cloudy	0.07	1.89	22.35

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.95	0.80	0.08
Frequency Bias	7.76	1.97	0.32
Probability of Detection	0.40	0.39	0.30
False Alarm Rate	0.51	0.46	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.320
Kuiper Skill Score	0.107
Heidke Skill Score	0.058

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.96	0.73	0.09
Frequency Bias	11.55	1.54	0.34
Probability of Detection	0.45	0.41	0.31
False Alarm Rate	0.53	0.44	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.340
Kuiper Skill Score	0.129
Heidke Skill Score	0.077

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.99	0.75	0.08
Frequency Bias	33.87	1.66	0.32
Probability of Detection	0.40	0.41	0.30
False Alarm Rate	0.53	0.44	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.326
Kuiper Skill Score	0.121
Heidke Skill Score	0.064