

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 February , 2017 (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	91058	24322	13529
Sounder Uncertain	8098	1710	9816
Sounder Cloudy	7044	1417	14431

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	86573	30974	11362
Sounder Uncertain	6107	5221	8296
Sounder Cloudy	5702	4081	13109

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	79823	36314	12772
Sounder Uncertain	5136	5594	8894
Sounder Cloudy	5060	4181	13651

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	53.12	14.19	7.89
Sounder Uncertain	4.72	1.00	5.73
Sounder Cloudy	4.11	0.83	8.42

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	50.50	18.07	6.63
Sounder Uncertain	3.56	3.05	4.84
Sounder Cloudy	3.33	2.38	7.65

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	46.56	21.18	7.45
Sounder Uncertain	3.00	3.26	5.19
Sounder Cloudy	2.95	2.44	7.96

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.29	0.91	0.37
Frequency Bias	1.21	0.71	0.61
Probability of Detection	0.86	0.06	0.38
False Alarm Rate	0.59	0.28	0.13

Overall Skill Score

Skill Score	Value
Proportion Correct	0.625
Kuiper Skill Score	0.206
Heidke Skill Score	0.230

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.33	0.73	0.43
Frequency Bias	1.31	0.49	0.70
Probability of Detection	0.88	0.13	0.40
False Alarm Rate	0.64	0.22	0.15

Overall Skill Score

Skill Score	Value
Proportion Correct	0.612
Kuiper Skill Score	0.221
Heidke Skill Score	0.248

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.71	0.40
Frequency Bias	1.43	0.43	0.65
Probability of Detection	0.89	0.12	0.39
False Alarm Rate	0.68	0.19	0.13

Overall Skill Score

Skill Score	Value
Proportion Correct	0.578
Kuiper Skill Score	0.205
Heidke Skill Score	0.228

INSAT-3D Sounder vs MODIS for February , 2017 (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	50970	10410	4687
Sounder Uncertain	6149	1167	4384
Sounder Cloudy	1958	377	10079

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48887	13491	3689
Sounder Uncertain	4691	3633	3376
Sounder Cloudy	1301	1638	9475

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	43579	18118	4370
Sounder Uncertain	3896	4067	3737
Sounder Cloudy	1054	1670	9690

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	56.52	11.54	5.20
Sounder Uncertain	6.82	1.29	4.86
Sounder Cloudy	2.17	0.42	11.18

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	54.21	14.96	4.09
Sounder Uncertain	5.20	4.03	3.74
Sounder Cloudy	1.44	1.82	10.51

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48.32	20.09	4.85
Sounder Uncertain	4.32	4.51	4.14
Sounder Cloudy	1.17	1.85	10.75

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.23	0.90	0.19
Frequency Bias	1.12	0.98	0.65
Probability of Detection	0.86	0.10	0.53
False Alarm Rate	0.54	0.38	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.690
Kuiper Skill Score	0.322
Heidke Skill Score	0.345

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.26	0.69	0.24
Frequency Bias	1.20	0.62	0.75
Probability of Detection	0.89	0.19	0.57
False Alarm Rate	0.61	0.29	0.10

Overall Skill Score

Skill Score	Value
Proportion Correct	0.687
Kuiper Skill Score	0.343
Heidke Skill Score	0.377

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.34	0.65	0.22
Frequency Bias	1.36	0.49	0.70
Probability of Detection	0.90	0.17	0.54
False Alarm Rate	0.68	0.23	0.08

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.636
Kuiper Skill Score	0.299
Heidke Skill Score	0.331

INSAT-3D Sounder vs MODIS for February , 2017 (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	40088	13912	8842
Sounder Uncertain	1949	543	5432
Sounder Cloudy	5086	1040	4352

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37686	17483	7673
Sounder Uncertain	1416	1588	4920
Sounder Cloudy	4401	2443	3634

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	36244	18196	8402
Sounder Uncertain	1240	1527	5157
Sounder Cloudy	4006	2511	3961

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	49.34	17.12	10.88
Sounder Uncertain	2.40	0.67	6.69
Sounder Cloudy	6.26	1.28	5.36

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	46.39	21.52	9.44
Sounder Uncertain	1.74	1.95	6.06
Sounder Cloudy	5.42	3.01	4.47

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	44.61	22.40	10.34
Sounder Uncertain	1.53	1.88	6.35
Sounder Cloudy	4.93	3.09	4.88

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.36	0.93	0.58
Frequency Bias	1.33	0.51	0.56
Probability of Detection	0.85	0.04	0.23
False Alarm Rate	0.63	0.20	0.17

Overall Skill Score

Skill Score	Value
Proportion Correct	0.554
Kuiper Skill Score	0.099
Heidke Skill Score	0.113

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.40	0.80	0.65
Frequency Bias	1.44	0.37	0.65
Probability of Detection	0.87	0.07	0.22
False Alarm Rate	0.66	0.17	0.18

Overall Skill Score

Skill Score	Value
Proportion Correct	0.528
Kuiper Skill Score	0.103
Heidke Skill Score	0.117

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.42	0.81	0.62
Frequency Bias	1.51	0.36	0.60
Probability of Detection	0.87	0.07	0.23
False Alarm Rate	0.67	0.16	0.16

Overall Skill Score

Skill Score	Value
Proportion Correct	0.514
Kuiper Skill Score	0.104
Heidke Skill Score	0.117

INSAT-3D Sounder vs MODIS for February , 2017 (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	67022	6074	5255
Sounder Uncertain	5511	943	4738
Sounder Cloudy	2277	265	4907

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	64567	10043	3741
Sounder Uncertain	4292	3055	3845
Sounder Cloudy	1924	951	4574

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	59239	14828	4284
Sounder Uncertain	3590	3449	4153
Sounder Cloudy	1732	1016	4701

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	69.10	6.26	5.42
Sounder Uncertain	5.68	0.97	4.88
Sounder Cloudy	2.35	0.27	5.06

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	66.57	10.35	3.86
Sounder Uncertain	4.43	3.15	3.96
Sounder Cloudy	1.98	0.98	4.72

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	61.08	15.29	4.42

Sounder Uncertain	3.70	3.56	4.28
Sounder Cloudy	1.79	1.05	4.85

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.14	0.92	0.34
Frequency Bias	1.05	1.54	0.50
Probability of Detection	0.90	0.13	0.33
False Alarm Rate	0.47	0.42	0.11

Overall Skill Score

Skill Score	Value
Proportion Correct	0.751
Kuiper Skill Score	0.287
Heidke Skill Score	0.302

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.18	0.73	0.39
Frequency Bias	1.11	0.80	0.61
Probability of Detection	0.91	0.22	0.38
False Alarm Rate	0.56	0.33	0.12

Overall Skill Score

Skill Score	Value
Proportion Correct	0.744
Kuiper Skill Score	0.298
Heidke Skill Score	0.334

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.24	0.69	0.37

Frequency Bias	1.21	0.58	0.57
Probability of Detection	0.92	0.18	0.36
False Alarm Rate	0.65	0.26	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.695
Kuiper Skill Score	0.248
Heidke Skill Score	0.288

INSAT-3D Sounder vs MODIS for February , 2017 (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	33625	5816	2326
Sounder Uncertain	4331	881	2005
Sounder Cloudy	750	228	3557

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32419	7831	1517
Sounder Uncertain	3420	2381	1416
Sounder Cloudy	518	700	3317

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	27830	12034	1903

Sounder Uncertain	2800	2787	1630
Sounder Cloudy	419	695	3421

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	62.83	10.87	4.35
Sounder Uncertain	8.09	1.65	3.75
Sounder Cloudy	1.40	0.43	6.65

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	60.57	14.63	2.83
Sounder Uncertain	6.39	4.45	2.65
Sounder Cloudy	0.97	1.31	6.20

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	52.00	22.49	3.56
Sounder Uncertain	5.23	5.21	3.05
Sounder Cloudy	0.78	1.30	6.39

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.19	0.88	0.22
Frequency Bias	1.08	1.04	0.57
Probability of Detection	0.87	0.13	0.45
False Alarm Rate	0.53	0.41	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.711
Kuiper Skill Score	0.266
Heidke Skill Score	0.288

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.22	0.67	0.27
Frequency Bias	1.15	0.66	0.73
Probability of Detection	0.89	0.22	0.53
False Alarm Rate	0.61	0.31	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.712
Kuiper Skill Score	0.299
Heidke Skill Score	0.335

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.33	0.61	0.25
Frequency Bias	1.35	0.47	0.65
Probability of Detection	0.90	0.18	0.49
False Alarm Rate	0.72	0.23	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.636
Kuiper Skill Score	0.237
Heidke Skill Score	0.268

INSAT-3D Sounder vs MODIS for February , 2017 (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	33397	258	2929
Sounder Uncertain	1180	62	2733
Sounder Cloudy	1527	37	1350

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32148	2212	2224
Sounder Uncertain	872	674	2429
Sounder Cloudy	1406	251	1257

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	31409	2794	2381
Sounder Uncertain	790	662	2523
Sounder Cloudy	1313	321	1280

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	76.82	0.59	6.74
Sounder Uncertain	2.71	0.14	6.29
Sounder Cloudy	3.51	0.09	3.11

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	73.95	5.09	5.12
Sounder Uncertain	2.01	1.55	5.59
Sounder Cloudy	3.23	0.58	2.89

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	72.25	6.43	5.48
Sounder Uncertain	1.82	1.52	5.80
Sounder Cloudy	3.02	0.74	2.94

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.09	0.98	0.54
Frequency Bias	1.01	11.13	0.42
Probability of Detection	0.93	0.17	0.19
False Alarm Rate	0.37	0.45	0.18

Overall Skill Score

Skill Score	Value
Proportion Correct	0.801
Kuiper Skill Score	0.318
Heidke Skill Score	0.312

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.12	0.83	0.57
Frequency Bias	1.06	1.27	0.49
Probability of Detection	0.93	0.21	0.21
False Alarm Rate	0.47	0.35	0.18

Overall Skill Score

Skill Score	Value
Proportion Correct	0.784
Kuiper Skill Score	0.291
Heidke Skill Score	0.320

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.14	0.83	0.56
Frequency Bias	1.09	1.05	0.47
Probability of Detection	0.94	0.18	0.21
False Alarm Rate	0.51	0.33	0.16

Overall Skill Score

Skill Score	Value
Proportion Correct	0.767
Kuiper Skill Score	0.267
Heidke Skill Score	0.302

INSAT-3D Sounder vs MODIS for February , 2017 (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	18191	16727	5679
Sounder Uncertain	507	351	2605
Sounder Cloudy	32	13	1588

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17050	17845	5702
Sounder Uncertain	334	618	2511
Sounder Cloudy	26	23	1584

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	16282	18045	6270
Sounder Uncertain	300	558	2605
Sounder Cloudy	25	23	1585

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39.81	36.61	12.43
Sounder Uncertain	1.11	0.77	5.70
Sounder Cloudy	0.07	0.03	3.48

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37.31	39.05	12.48
Sounder Uncertain	0.73	1.35	5.50
Sounder Cloudy	0.06	0.05	3.47

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	35.63	39.49	13.72
Sounder Uncertain	0.66	1.22	5.70
Sounder Cloudy	0.05	0.05	3.47

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.55	0.90	0.03
Frequency Bias	2.17	0.20	0.17
Probability of Detection	0.97	0.02	0.16
False Alarm Rate	0.88	0.12	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.441
Kuiper Skill Score	0.062
Heidke Skill Score	0.067

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.58	0.82	0.03
Frequency Bias	2.33	0.19	0.17
Probability of Detection	0.98	0.03	0.16
False Alarm Rate	0.89	0.11	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.421
Kuiper Skill Score	0.069
Heidke Skill Score	0.071

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.60	0.84	0.03
Frequency Bias	2.44	0.19	0.16
Probability of Detection	0.98	0.03	0.15
False Alarm Rate	0.89	0.11	0.00

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.403
Kuiper Skill Score	0.064
Heidke Skill Score	0.065

INSAT-3D Sounder vs MODIS for February , 2017 (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	14551	4365	1993
Sounder Uncertain	421	125	1328
Sounder Cloudy	32	9	1505

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13953	4992	1964
Sounder Uncertain	284	354	1236
Sounder Cloudy	26	18	1502

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13453	5240	2216
Sounder Uncertain	253	336	1285
Sounder Cloudy	25	19	1502

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	59.81	17.94	8.19
Sounder Uncertain	1.73	0.51	5.46
Sounder Cloudy	0.13	0.04	6.19

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	57.35	20.52	8.07
Sounder Uncertain	1.17	1.46	5.08
Sounder Cloudy	0.11	0.07	6.17

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	55.30	21.54	9.11
Sounder Uncertain	1.04	1.38	5.28
Sounder Cloudy	0.10	0.08	6.17

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.30	0.93	0.03
Frequency Bias	1.39	0.42	0.32
Probability of Detection	0.97	0.03	0.31
False Alarm Rate	0.78	0.21	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.665
Kuiper Skill Score	0.198
Heidke Skill Score	0.244

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.33	0.81	0.03
Frequency Bias	1.47	0.35	0.33
Probability of Detection	0.98	0.07	0.32
False Alarm Rate	0.82	0.18	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.650
Kuiper Skill Score	0.205
Heidke Skill Score	0.250

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.36	0.82	0.03
Frequency Bias	1.52	0.33	0.31
Probability of Detection	0.98	0.06	0.30
False Alarm Rate	0.82	0.17	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.629
Kuiper Skill Score	0.192
Heidke Skill Score	0.233

INSAT-3D Sounder vs MODIS for February , 2017 (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	3640	12362	3686
Sounder Uncertain	86	226	1277
Sounder Cloudy	0	4	83

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3097	12853	3738
Sounder Uncertain	50	264	1275
Sounder Cloudy	0	5	82

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2829	12805	4054
Sounder Uncertain	47	222	1320
Sounder Cloudy	0	4	83

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17.04	57.86	17.25
Sounder Uncertain	0.40	1.06	5.98
Sounder Cloudy	0.00	0.02	0.39

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14.50	60.16	17.50
Sounder Uncertain	0.23	1.24	5.97
Sounder Cloudy	0.00	0.02	0.38

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13.24	59.94	18.98

Sounder Uncertain	0.22	1.04	6.18
Sounder Cloudy	0.00	0.02	0.39

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.82	0.86	0.05
Frequency Bias	5.28	0.13	0.02
Probability of Detection	0.98	0.02	0.02
False Alarm Rate	0.92	0.08	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.185
Kuiper Skill Score	-0.037
Heidke Skill Score	-0.026

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.84	0.83	0.06
Frequency Bias	6.26	0.12	0.02
Probability of Detection	0.98	0.02	0.02
False Alarm Rate	0.93	0.07	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.161
Kuiper Skill Score	-0.039
Heidke Skill Score	-0.026

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.86	0.86	0.05

Frequency Bias	6.85	0.12	0.02
Probability of Detection	0.98	0.02	0.02
False Alarm Rate	0.92	0.07	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.147
Kuiper Skill Score	-0.044
Heidke Skill Score	-0.029

INSAT-3D Sounder vs MODIS for February , 2017 (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	487	112	79
Sounder Uncertain	91	24	76
Sounder Cloudy	11	1	68

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	424	214	40
Sounder Uncertain	67	61	63
Sounder Cloudy	9	8	63

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	357	271	50

Sounder Uncertain	57	69	65
Sounder Cloudy	7	9	64

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51.32	11.80	8.32
Sounder Uncertain	9.59	2.53	8.01
Sounder Cloudy	1.16	0.11	7.17

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	44.68	22.55	4.21
Sounder Uncertain	7.06	6.43	6.64
Sounder Cloudy	0.95	0.84	6.64

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37.62	28.56	5.27
Sounder Uncertain	6.01	7.27	6.85
Sounder Cloudy	0.74	0.95	6.74

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.28	0.87	0.15
Frequency Bias	1.15	1.39	0.36
Probability of Detection	0.83	0.18	0.30
False Alarm Rate	0.52	0.45	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.610
Kuiper Skill Score	0.219
Heidke Skill Score	0.232

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.37	0.68	0.21
Frequency Bias	1.36	0.67	0.48
Probability of Detection	0.85	0.22	0.38
False Alarm Rate	0.63	0.32	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.577
Kuiper Skill Score	0.209
Heidke Skill Score	0.230

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.47	0.64	0.20
Frequency Bias	1.61	0.55	0.45
Probability of Detection	0.85	0.20	0.36
False Alarm Rate	0.70	0.27	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.516
Kuiper Skill Score	0.173
Heidke Skill Score	0.185

INSAT-3D Sounder vs MODIS for February , 2017 (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	284	34	26
Sounder Uncertain	68	17	48
Sounder Cloudy	10	1	59

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	264	66	14
Sounder Uncertain	55	39	39
Sounder Cloudy	8	8	54

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	225	103	16
Sounder Uncertain	48	44	41
Sounder Cloudy	6	9	55

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51.92	6.22	4.75
Sounder Uncertain	12.43	3.11	8.78
Sounder Cloudy	1.83	0.18	10.79

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48.26	12.07	2.56
Sounder Uncertain	10.05	7.13	7.13
Sounder Cloudy	1.46	1.46	9.87

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	41.13	18.83	2.93
Sounder Uncertain	8.78	8.04	7.50
Sounder Cloudy	1.10	1.65	10.05

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.17	0.87	0.16
Frequency Bias	0.95	2.56	0.53
Probability of Detection	0.78	0.33	0.44
False Alarm Rate	0.32	0.62	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.658
Kuiper Skill Score	0.380
Heidke Skill Score	0.354

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.23	0.71	0.23
Frequency Bias	1.05	1.18	0.65
Probability of Detection	0.81	0.35	0.50
False Alarm Rate	0.42	0.49	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.653
Kuiper Skill Score	0.359
Heidke Skill Score	0.367

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.35	0.67	0.21
Frequency Bias	1.23	0.85	0.62
Probability of Detection	0.81	0.28	0.49
False Alarm Rate	0.53	0.40	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.592
Kuiper Skill Score	0.285
Heidke Skill Score	0.302

INSAT-3D Sounder vs MODIS for February , 2017 (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	203	78	53
Sounder Uncertain	23	7	28
Sounder Cloudy	1	0	9

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	160	148	26
Sounder Uncertain	12	22	24
Sounder Cloudy	1	0	9

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	132	168	34
Sounder Uncertain	9	25	24
Sounder Cloudy	1	0	9

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	50.50	19.40	13.18
Sounder Uncertain	5.72	1.74	6.97
Sounder Cloudy	0.25	0.00	2.24

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39.80	36.82	6.47
Sounder Uncertain	2.99	5.47	5.97
Sounder Cloudy	0.25	0.00	2.24

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32.84	41.79	8.46
Sounder Uncertain	2.24	6.22	5.97
Sounder Cloudy	0.25	0.00	2.24

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.39	0.88	0.10
Frequency Bias	1.47	0.68	0.11
Probability of Detection	0.89	0.08	0.10
False Alarm Rate	0.72	0.28	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.545
Kuiper Skill Score	0.067
Heidke Skill Score	0.080

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.52	0.62	0.10
Frequency Bias	1.93	0.34	0.17
Probability of Detection	0.92	0.13	0.15
False Alarm Rate	0.82	0.17	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.475
Kuiper Skill Score	0.086
Heidke Skill Score	0.092

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.60	0.57	0.10
Frequency Bias	2.35	0.30	0.15
Probability of Detection	0.93	0.13	0.13
False Alarm Rate	0.86	0.14	0.00

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.413
Kuiper Skill Score	0.075
Heidke Skill Score	0.073

INSAT-3D Sounder vs MODIS for February , 2017 (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	3108	928	2063
Sounder Uncertain	1664	328	2118
Sounder Cloudy	4595	1110	7479

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2523	1986	1590
Sounder Uncertain	1139	1323	1648
Sounder Cloudy	3631	3037	6516

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2136	2133	1830
Sounder Uncertain	945	1347	1818
Sounder Cloudy	3196	3067	6921

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13.29	3.97	8.82
Sounder Uncertain	7.11	1.40	9.05
Sounder Cloudy	19.64	4.75	31.97

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	10.79	8.49	6.80
Sounder Uncertain	4.87	5.66	7.04
Sounder Cloudy	15.52	12.98	27.85

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9.13	9.12	7.82
Sounder Uncertain	4.04	5.76	7.77
Sounder Cloudy	13.66	13.11	29.59

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.49	0.92	0.43
Frequency Bias	0.65	1.74	1.13
Probability of Detection	0.33	0.14	0.64
False Alarm Rate	0.24	0.30	0.46

Overall Skill Score

Skill Score	Value
Proportion Correct	0.467
Kuiper Skill Score	0.109
Heidke Skill Score	0.106

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.59	0.68	0.51
Frequency Bias	0.84	0.65	1.35
Probability of Detection	0.35	0.21	0.67
False Alarm Rate	0.27	0.21	0.51

Overall Skill Score

Skill Score	Value
Proportion Correct	0.443
Kuiper Skill Score	0.121
Heidke Skill Score	0.124

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.65	0.67	0.48
Frequency Bias	0.97	0.63	1.25
Probability of Detection	0.34	0.21	0.65
False Alarm Rate	0.31	0.21	0.48

Overall Skill Score

Skill Score	Value
Proportion Correct	0.445
Kuiper Skill Score	0.110
Heidke Skill Score	0.113

INSAT-3D Sounder vs MODIS for February , 2017 (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	1178	49	156
Sounder Uncertain	1059	98	832
Sounder Cloudy	1047	125	4642

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1005	306	72
Sounder Uncertain	691	747	551
Sounder Cloudy	644	869	4301

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	920	374	89
Sounder Uncertain	577	782	630
Sounder Cloudy	509	898	4407

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	12.82	0.53	1.70
Sounder Uncertain	11.53	1.07	9.06
Sounder Cloudy	11.40	1.36	50.53

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	10.94	3.33	0.78
Sounder Uncertain	7.52	8.13	6.00
Sounder Cloudy	7.01	9.46	46.82

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	10.02	4.07	0.97

Sounder Uncertain	6.28	8.51	6.86
Sounder Cloudy	5.54	9.78	47.98

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.15	0.95	0.20
Frequency Bias	0.42	7.31	1.03
Probability of Detection	0.36	0.36	0.82
False Alarm Rate	0.06	0.58	0.36

Overall Skill Score

Skill Score	Value
Proportion Correct	0.644
Kuiper Skill Score	0.396
Heidke Skill Score	0.355

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.27	0.62	0.26
Frequency Bias	0.59	1.03	1.18
Probability of Detection	0.43	0.39	0.87
False Alarm Rate	0.12	0.40	0.48

Overall Skill Score

Skill Score	Value
Proportion Correct	0.659
Kuiper Skill Score	0.391
Heidke Skill Score	0.409

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.33	0.61	0.24

Frequency Bias	0.69	0.97	1.13
Probability of Detection	0.46	0.38	0.86
False Alarm Rate	0.15	0.39	0.46

Overall Skill Score

Skill Score	Value
Proportion Correct	0.665
Kuiper Skill Score	0.390
Heidke Skill Score	0.408

INSAT-3D Sounder vs MODIS for February , 2017 (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	1930	879	1907
Sounder Uncertain	605	230	1286
Sounder Cloudy	3548	985	2837

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1518	1680	1518
Sounder Uncertain	448	576	1097
Sounder Cloudy	2987	2168	2215

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1216	1759	1741

Sounder Uncertain	368	565	1188
Sounder Cloudy	2687	2169	2514

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13.58	6.19	13.42
Sounder Uncertain	4.26	1.62	9.05
Sounder Cloudy	24.97	6.93	19.97

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	10.68	11.83	10.68
Sounder Uncertain	3.15	4.05	7.72
Sounder Cloudy	21.02	15.26	15.59

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8.56	12.38	12.25
Sounder Uncertain	2.59	3.98	8.36
Sounder Cloudy	18.91	15.27	17.70

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.59	0.89	0.62
Frequency Bias	0.78	1.01	1.22
Probability of Detection	0.32	0.11	0.47
False Alarm Rate	0.30	0.21	0.49

Overall Skill Score

Skill Score	Value
Proportion Correct	0.352
Kuiper Skill Score	-0.053
Heidke Skill Score	-0.053

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.68	0.73	0.70
Frequency Bias	0.95	0.48	1.53
Probability of Detection	0.31	0.13	0.46
False Alarm Rate	0.32	0.16	0.52

Overall Skill Score

Skill Score	Value
Proportion Correct	0.303
Kuiper Skill Score	-0.053
Heidke Skill Score	-0.053

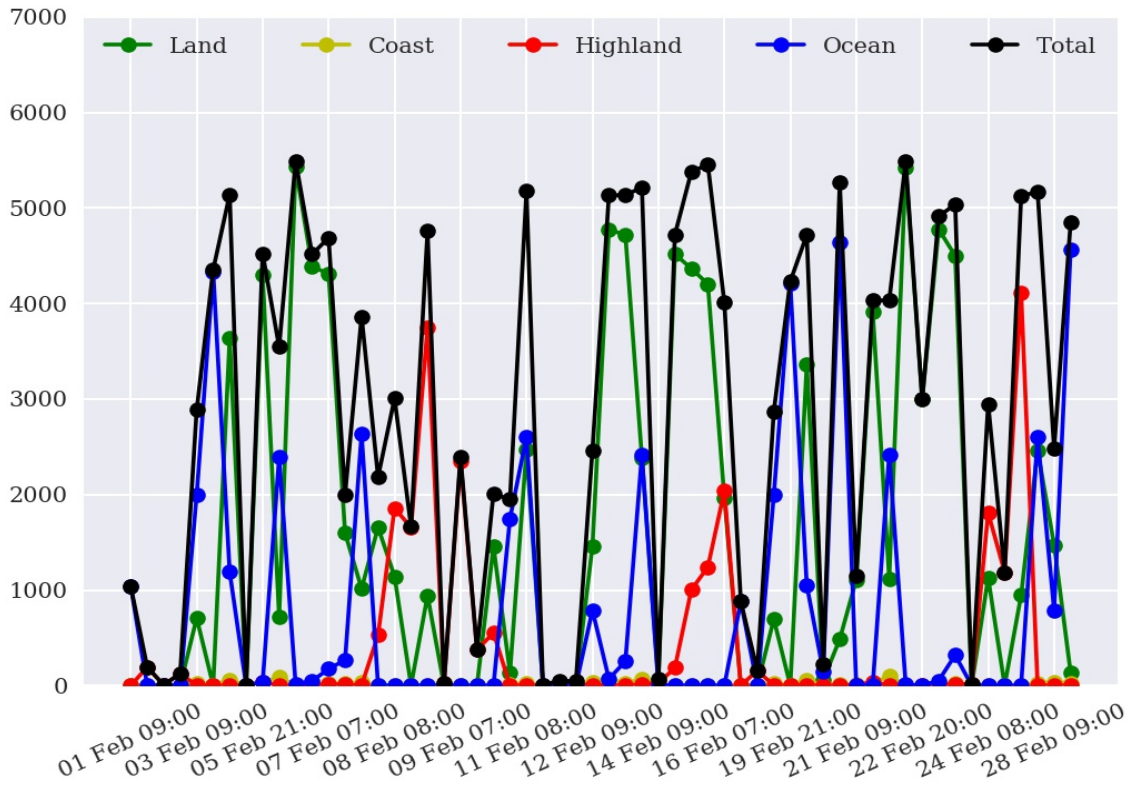
Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.74	0.73	0.66
Frequency Bias	1.10	0.47	1.35
Probability of Detection	0.28	0.13	0.46
False Alarm Rate	0.35	0.16	0.49

Overall Skill Score

Skill Score	Value
Proportion Correct	0.302
Kuiper Skill Score	-0.066
Heidke Skill Score	-0.066

Number of Collocations for Feb-2017



Percentage Correct for Feb-2017

