

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 November , 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	72685	16520	13754
Sounder Uncertain	7758	1743	10446
Sounder Cloudy	1747	510	10705

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	68712	23633	10614
Sounder Uncertain	6104	4839	9004
Sounder Cloudy	1144	1690	10128

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	61829	29100	12030
Sounder Uncertain	5200	5167	9580
Sounder Cloudy	921	1672	10369

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	53.50	12.16	10.12
Sounder Uncertain	5.71	1.28	7.69
Sounder Cloudy	1.29	0.38	7.88

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	50.57	17.39	7.81
Sounder Uncertain	4.49	3.56	6.63
Sounder Cloudy	0.84	1.24	7.45

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	45.51	21.42	8.85
Sounder Uncertain	3.83	3.80	7.05
Sounder Cloudy	0.68	1.23	7.63

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.29	0.91	0.17
Frequency Bias	1.25	1.06	0.37
Probability of Detection	0.88	0.09	0.31
False Alarm Rate	0.60	0.36	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.627
Kuiper Skill Score	0.225
Heidke Skill Score	0.248

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.33	0.76	0.22
Frequency Bias	1.36	0.66	0.44
Probability of Detection	0.90	0.16	0.34
False Alarm Rate	0.66	0.29	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.616
Kuiper Skill Score	0.235
Heidke Skill Score	0.265

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.40	0.74	0.20
Frequency Bias	1.52	0.56	0.41
Probability of Detection	0.91	0.14	0.32
False Alarm Rate	0.70	0.25	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.569
Kuiper Skill Score	0.207
Heidke Skill Score	0.231

INSAT-3D Sounder vs MODIS for November , 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	49442	14995	8070
Sounder Uncertain	5347	1039	3867
Sounder Cloudy	1235	410	5878

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	46805	19331	6371
Sounder Uncertain	4272	2851	3130
Sounder Cloudy	731	1353	5439

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	41044	24173	7290
Sounder Uncertain	3679	3152	3422
Sounder Cloudy	556	1352	5615

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	54.76	16.61	8.94
Sounder Uncertain	5.92	1.15	4.28
Sounder Cloudy	1.37	0.45	6.51

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51.84	21.41	7.06
Sounder Uncertain	4.73	3.16	3.47
Sounder Cloudy	0.81	1.50	6.02

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	45.46	26.77	8.07
Sounder Uncertain	4.07	3.49	3.79
Sounder Cloudy	0.62	1.50	6.22

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.32	0.90	0.22
Frequency Bias	1.29	0.62	0.42
Probability of Detection	0.88	0.06	0.33
False Alarm Rate	0.68	0.27	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.624
Kuiper Skill Score	0.164
Heidke Skill Score	0.191

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.35	0.72	0.28
Frequency Bias	1.40	0.44	0.50
Probability of Detection	0.90	0.12	0.36
False Alarm Rate	0.73	0.21	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.610
Kuiper Skill Score	0.184
Heidke Skill Score	0.214

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.43	0.69	0.25
Frequency Bias	1.60	0.36	0.46
Probability of Detection	0.91	0.11	0.34
False Alarm Rate	0.78	0.18	0.05

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.552
Kuiper Skill Score	0.159
Heidke Skill Score	0.179

INSAT-3D Sounder vs MODIS for November , 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	23243	1525	5684
Sounder Uncertain	2411	704	6579
Sounder Cloudy	512	100	4827

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	21907	4302	4243
Sounder Uncertain	1832	1988	5874
Sounder Cloudy	413	337	4689

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20785	4927	4740
Sounder Uncertain	1521	2015	6158
Sounder Cloudy	365	320	4754

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	50.99	3.35	12.47
Sounder Uncertain	5.29	1.54	14.43
Sounder Cloudy	1.12	0.22	10.59

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48.06	9.44	9.31
Sounder Uncertain	4.02	4.36	12.89
Sounder Cloudy	0.91	0.74	10.29

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	45.60	10.81	10.40
Sounder Uncertain	3.34	4.42	13.51
Sounder Cloudy	0.80	0.70	10.43

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.24	0.93	0.11
Frequency Bias	1.16	4.16	0.32
Probability of Detection	0.89	0.30	0.28
False Alarm Rate	0.43	0.53	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.631
Kuiper Skill Score	0.364
Heidke Skill Score	0.343

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.28	0.79	0.14
Frequency Bias	1.26	1.46	0.37
Probability of Detection	0.91	0.30	0.32
False Alarm Rate	0.50	0.45	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.627
Kuiper Skill Score	0.343
Heidke Skill Score	0.353

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.32	0.79	0.13
Frequency Bias	1.34	1.33	0.35
Probability of Detection	0.92	0.28	0.30
False Alarm Rate	0.54	0.43	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.604
Kuiper Skill Score	0.324
Heidke Skill Score	0.333

INSAT-3D Sounder vs MODIS for November , 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	54783	10892	7295
Sounder Uncertain	3011	810	5026
Sounder Cloudy	232	348	6345

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	52718	14889	5363
Sounder Uncertain	2445	1888	4514
Sounder Cloudy	149	512	6264

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	47207	19602	6161
Sounder Uncertain	2040	2091	4716
Sounder Cloudy	93	513	6319

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	61.73	12.27	8.22
Sounder Uncertain	3.39	0.91	5.66
Sounder Cloudy	0.26	0.39	7.15

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	59.41	16.78	6.04
Sounder Uncertain	2.76	2.13	5.09
Sounder Cloudy	0.17	0.58	7.06

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	53.20	22.09	6.94

Sounder Uncertain	2.30	2.36	5.31
Sounder Cloudy	0.10	0.58	7.12

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.25	0.91	0.08
Frequency Bias	1.26	0.73	0.37
Probability of Detection	0.94	0.07	0.34
False Alarm Rate	0.68	0.30	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.698
Kuiper Skill Score	0.256
Heidke Skill Score	0.301

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.28	0.79	0.10
Frequency Bias	1.32	0.51	0.43
Probability of Detection	0.95	0.11	0.39
False Alarm Rate	0.73	0.25	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.686
Kuiper Skill Score	0.259
Heidke Skill Score	0.308

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.35	0.76	0.09

Frequency Bias	1.48	0.40	0.40
Probability of Detection	0.96	0.09	0.37
False Alarm Rate	0.78	0.20	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.627
Kuiper Skill Score	0.219
Heidke Skill Score	0.258

INSAT-3D Sounder vs MODIS for November , 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	35052	10577	4052
Sounder Uncertain	2161	760	1242
Sounder Cloudy	177	338	2758

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	33858	12772	3051
Sounder Uncertain	1856	1274	1033
Sounder Cloudy	114	460	2699

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28991	17078	3612

Sounder Uncertain	1547	1463	1153
Sounder Cloudy	66	459	2748

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	61.37	18.52	7.09
Sounder Uncertain	3.78	1.33	2.17
Sounder Cloudy	0.31	0.59	4.83

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	59.28	22.36	5.34
Sounder Uncertain	3.25	2.23	1.81
Sounder Cloudy	0.20	0.81	4.73

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	50.76	29.90	6.32
Sounder Uncertain	2.71	2.56	2.02
Sounder Cloudy	0.12	0.80	4.81

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.29	0.82	0.16
Frequency Bias	1.33	0.36	0.41
Probability of Detection	0.94	0.07	0.34
False Alarm Rate	0.79	0.18	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.675
Kuiper Skill Score	0.163
Heidke Skill Score	0.203

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.32	0.69	0.18
Frequency Bias	1.39	0.29	0.48
Probability of Detection	0.95	0.09	0.40
False Alarm Rate	0.82	0.15	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.662
Kuiper Skill Score	0.173
Heidke Skill Score	0.213

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.42	0.65	0.16
Frequency Bias	1.62	0.22	0.44
Probability of Detection	0.95	0.08	0.37
False Alarm Rate	0.87	0.11	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.581
Kuiper Skill Score	0.143
Heidke Skill Score	0.166

INSAT-3D Sounder vs MODIS for November , 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	19731	315	3243
Sounder Uncertain	850	50	3784
Sounder Cloudy	55	10	3587

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	18860	2117	2312
Sounder Uncertain	589	614	3481
Sounder Cloudy	35	52	3565

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	18216	2524	2549
Sounder Uncertain	493	628	3563
Sounder Cloudy	27	54	3571

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	62.39	1.00	10.25
Sounder Uncertain	2.69	0.16	11.97
Sounder Cloudy	0.17	0.03	11.34

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	59.64	6.69	7.31
Sounder Uncertain	1.86	1.94	11.01
Sounder Cloudy	0.11	0.16	11.27

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	57.60	7.98	8.06
Sounder Uncertain	1.56	1.99	11.27
Sounder Cloudy	0.09	0.17	11.29

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.15	0.99	0.02
Frequency Bias	1.13	12.49	0.34
Probability of Detection	0.96	0.13	0.34
False Alarm Rate	0.43	0.56	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.739
Kuiper Skill Score	0.472
Heidke Skill Score	0.455

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.19	0.87	0.02
Frequency Bias	1.20	1.68	0.39
Probability of Detection	0.97	0.22	0.38
False Alarm Rate	0.52	0.47	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.729
Kuiper Skill Score	0.433
Heidke Skill Score	0.456

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.22	0.87	0.02
Frequency Bias	1.24	1.46	0.38
Probability of Detection	0.97	0.20	0.37
False Alarm Rate	0.55	0.44	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.709
Kuiper Skill Score	0.408
Heidke Skill Score	0.433

INSAT-3D Sounder vs MODIS for November , 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	9969	4286	3803
Sounder Uncertain	728	217	2040
Sounder Cloudy	95	10	1112

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8904	5855	3299
Sounder Uncertain	500	617	1868
Sounder Cloudy	62	73	1082

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8282	6163	3613
Sounder Uncertain	416	622	1947
Sounder Cloudy	53	72	1092

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	44.78	19.25	17.08
Sounder Uncertain	3.27	0.97	9.16
Sounder Cloudy	0.43	0.04	5.00

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	40.00	26.30	14.82
Sounder Uncertain	2.25	2.77	8.39
Sounder Cloudy	0.28	0.33	4.86

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37.21	27.69	16.23
Sounder Uncertain	1.87	2.79	8.75
Sounder Cloudy	0.24	0.32	4.91

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.45	0.93	0.09
Frequency Bias	1.67	0.66	0.17
Probability of Detection	0.92	0.05	0.16
False Alarm Rate	0.74	0.25	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.508
Kuiper Skill Score	0.112
Heidke Skill Score	0.124

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.51	0.79	0.11
Frequency Bias	1.91	0.46	0.19
Probability of Detection	0.94	0.09	0.17
False Alarm Rate	0.79	0.20	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.476
Kuiper Skill Score	0.117
Heidke Skill Score	0.128

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.54	0.79	0.10
Frequency Bias	2.06	0.44	0.18
Probability of Detection	0.95	0.09	0.16
False Alarm Rate	0.80	0.19	0.01

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.449
Kuiper Skill Score	0.110
Heidke Skill Score	0.116

INSAT-3D Sounder vs MODIS for November , 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	9703	4165	3581
Sounder Uncertain	719	196	1703
Sounder Cloudy	95	10	891

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8655	5713	3081
Sounder Uncertain	496	584	1538
Sounder Cloudy	62	72	862

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8053	6007	3389
Sounder Uncertain	412	593	1613
Sounder Cloudy	53	71	872

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	46.07	19.77	17.00
Sounder Uncertain	3.41	0.93	8.09
Sounder Cloudy	0.45	0.05	4.23

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	41.09	27.12	14.63
Sounder Uncertain	2.35	2.77	7.30
Sounder Cloudy	0.29	0.34	4.09

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	38.23	28.52	16.09
Sounder Uncertain	1.96	2.82	7.66
Sounder Cloudy	0.25	0.34	4.14

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.44	0.93	0.11
Frequency Bias	1.66	0.60	0.16
Probability of Detection	0.92	0.04	0.14
False Alarm Rate	0.75	0.24	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.512
Kuiper Skill Score	0.095
Heidke Skill Score	0.108

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.50	0.78	0.13
Frequency Bias	1.89	0.41	0.18
Probability of Detection	0.94	0.09	0.16
False Alarm Rate	0.80	0.19	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.480
Kuiper Skill Score	0.104
Heidke Skill Score	0.115

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.54	0.77	0.12
Frequency Bias	2.05	0.39	0.17
Probability of Detection	0.95	0.09	0.15
False Alarm Rate	0.81	0.18	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.452
Kuiper Skill Score	0.098
Heidke Skill Score	0.105

INSAT-3D Sounder vs MODIS for November , 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	266	121	222
Sounder Uncertain	9	21	337
Sounder Cloudy	0	0	221

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	249	142	218
Sounder Uncertain	4	33	330
Sounder Cloudy	0	1	220

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	229	156	224
Sounder Uncertain	4	29	334
Sounder Cloudy	0	1	220

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22.22	10.11	18.55
Sounder Uncertain	0.75	1.75	28.15
Sounder Cloudy	0.00	0.00	18.46

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20.80	11.86	18.21
Sounder Uncertain	0.33	2.76	27.57
Sounder Cloudy	0.00	0.08	18.38

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	19.13	13.03	18.71

Sounder Uncertain	0.33	2.42	27.90
Sounder Cloudy	0.00	0.08	18.38

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.56	0.94	0.00
Frequency Bias	2.21	2.58	0.28
Probability of Detection	0.97	0.15	0.28
False Alarm Rate	0.50	0.50	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.424
Kuiper Skill Score	0.297
Heidke Skill Score	0.208

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.59	0.91	0.00
Frequency Bias	2.41	2.09	0.29
Probability of Detection	0.98	0.19	0.29
False Alarm Rate	0.52	0.48	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.419
Kuiper Skill Score	0.284
Heidke Skill Score	0.203

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.62	0.92	0.00

Frequency Bias	2.61	1.97	0.28
Probability of Detection	0.98	0.16	0.28
False Alarm Rate	0.53	0.47	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.399
Kuiper Skill Score	0.257
Heidke Skill Score	0.181

INSAT-3D Sounder vs MODIS for November , 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	404	32	42
Sounder Uncertain	45	6	44
Sounder Cloudy	6	2	31

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	376	78	24
Sounder Uncertain	39	17	39
Sounder Cloudy	5	4	30

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	351	97	30

Sounder Uncertain	35	20	40
Sounder Cloudy	5	4	30

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	66.01	5.23	6.86
Sounder Uncertain	7.35	0.98	7.19
Sounder Cloudy	0.98	0.33	5.07

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	61.44	12.75	3.92
Sounder Uncertain	6.37	2.78	6.37
Sounder Cloudy	0.82	0.65	4.90

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	57.35	15.85	4.90
Sounder Uncertain	5.72	3.27	6.54
Sounder Cloudy	0.82	0.65	4.90

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.15	0.94	0.21
Frequency Bias	1.05	2.38	0.33
Probability of Detection	0.89	0.15	0.26
False Alarm Rate	0.43	0.52	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.721
Kuiper Skill Score	0.289
Heidke Skill Score	0.296

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.21	0.82	0.23
Frequency Bias	1.14	0.96	0.42
Probability of Detection	0.90	0.17	0.32
False Alarm Rate	0.54	0.41	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.691
Kuiper Skill Score	0.251
Heidke Skill Score	0.280

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.27	0.79	0.23
Frequency Bias	1.22	0.79	0.39
Probability of Detection	0.90	0.17	0.30
False Alarm Rate	0.60	0.36	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.655
Kuiper Skill Score	0.219
Heidke Skill Score	0.250

INSAT-3D Sounder vs MODIS for November , 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	368	31	26
Sounder Uncertain	40	6	14
Sounder Cloudy	5	2	14

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	343	68	14
Sounder Uncertain	35	15	10
Sounder Cloudy	5	3	13

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	319	88	18
Sounder Uncertain	31	18	11
Sounder Cloudy	5	3	13

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	72.73	6.13	5.14
Sounder Uncertain	7.91	1.19	2.77
Sounder Cloudy	0.99	0.40	2.77

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	67.79	13.44	2.77
Sounder Uncertain	6.92	2.96	1.98
Sounder Cloudy	0.99	0.59	2.57

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	63.04	17.39	3.56
Sounder Uncertain	6.13	3.56	2.17
Sounder Cloudy	0.99	0.59	2.57

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.13	0.90	0.33
Frequency Bias	1.03	1.54	0.39
Probability of Detection	0.89	0.15	0.26
False Alarm Rate	0.48	0.46	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.767
Kuiper Skill Score	0.214
Heidke Skill Score	0.225

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.19	0.75	0.38
Frequency Bias	1.11	0.70	0.57
Probability of Detection	0.90	0.17	0.35
False Alarm Rate	0.61	0.33	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.733
Kuiper Skill Score	0.189
Heidke Skill Score	0.218

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.25	0.70	0.38
Frequency Bias	1.20	0.55	0.50
Probability of Detection	0.90	0.17	0.31
False Alarm Rate	0.68	0.27	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.692
Kuiper Skill Score	0.162
Heidke Skill Score	0.192

INSAT-3D Sounder vs MODIS for November , 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	36	1	16
Sounder Uncertain	5	0	30
Sounder Cloudy	1	0	17

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	33	10	10
Sounder Uncertain	4	2	29
Sounder Cloudy	0	1	17

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32	9	12
Sounder Uncertain	4	2	29
Sounder Cloudy	0	1	17

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	33.96	0.94	15.09
Sounder Uncertain	4.72	0.00	28.30
Sounder Cloudy	0.94	0.00	16.04

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	31.13	9.43	9.43
Sounder Uncertain	3.77	1.89	27.36
Sounder Cloudy	0.00	0.94	16.04

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30.19	8.49	11.32
Sounder Uncertain	3.77	1.89	27.36
Sounder Cloudy	0.00	0.94	16.04

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.32	1.00	0.06
Frequency Bias	1.26	35.00	0.29
Probability of Detection	0.86	0.00	0.27
False Alarm Rate	0.32	0.66	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.500
Kuiper Skill Score	0.404
Heidke Skill Score	0.284

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.94	0.06
Frequency Bias	1.43	2.69	0.32
Probability of Detection	0.89	0.15	0.30
False Alarm Rate	0.37	0.61	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.491
Kuiper Skill Score	0.318
Heidke Skill Score	0.267

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.40	0.94	0.06
Frequency Bias	1.47	2.92	0.31
Probability of Detection	0.89	0.17	0.29
False Alarm Rate	0.38	0.60	0.02

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.481
Kuiper Skill Score	0.316
Heidke Skill Score	0.259

INSAT-3D Sounder vs MODIS for November , 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	5654	1125	2290
Sounder Uncertain	3743	678	3044
Sounder Cloudy	1390	144	3051

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4981	2385	1703
Sounder Uncertain	2931	2208	2326
Sounder Cloudy	908	1082	2595

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4372	2717	1980
Sounder Uncertain	2532	2323	2610
Sounder Cloudy	752	1065	2768

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	26.77	5.33	10.84
Sounder Uncertain	17.72	3.21	14.41
Sounder Cloudy	6.58	0.68	14.45

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23.59	11.29	8.06
Sounder Uncertain	13.88	10.46	11.01
Sounder Cloudy	4.30	5.12	12.29

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20.70	12.87	9.38
Sounder Uncertain	11.99	11.00	12.36
Sounder Cloudy	3.56	5.04	13.11

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.91	0.33
Frequency Bias	0.84	3.83	0.55
Probability of Detection	0.52	0.35	0.36
False Alarm Rate	0.29	0.58	0.13

Overall Skill Score

Skill Score	Value
Proportion Correct	0.444
Kuiper Skill Score	0.185
Heidke Skill Score	0.160

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.45	0.70	0.43
Frequency Bias	1.03	1.32	0.69
Probability of Detection	0.56	0.39	0.39
False Alarm Rate	0.36	0.46	0.18

Overall Skill Score

Skill Score	Value
Proportion Correct	0.463
Kuiper Skill Score	0.185
Heidke Skill Score	0.184

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.52	0.69	0.40
Frequency Bias	1.18	1.22	0.62
Probability of Detection	0.57	0.38	0.38
False Alarm Rate	0.40	0.44	0.16

Overall Skill Score

Skill Score	Value
Proportion Correct	0.448
Kuiper Skill Score	0.173
Heidke Skill Score	0.172

INSAT-3D Sounder vs MODIS for November , 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	2649	53	214
Sounder Uncertain	2210	53	820
Sounder Cloudy	937	56	2163

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2400	409	107
Sounder Uncertain	1703	893	487
Sounder Cloudy	533	802	1821

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2237	543	136
Sounder Uncertain	1518	989	576
Sounder Cloudy	417	803	1936

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28.94	0.58	2.34
Sounder Uncertain	24.14	0.58	8.96
Sounder Cloudy	10.23	0.61	23.63

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	26.22	4.47	1.17
Sounder Uncertain	18.60	9.75	5.32
Sounder Cloudy	5.82	8.76	19.89

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	24.43	5.93	1.49

Sounder Uncertain	16.58	10.80	6.29
Sounder Cloudy	4.55	8.77	21.15

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.09	0.98	0.31
Frequency Bias	0.50	19.03	0.99
Probability of Detection	0.46	0.33	0.68
False Alarm Rate	0.06	0.71	0.23

Overall Skill Score

Skill Score	Value
Proportion Correct	0.531
Kuiper Skill Score	0.427
Heidke Skill Score	0.303

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.18	0.71	0.42
Frequency Bias	0.63	1.47	1.31
Probability of Detection	0.52	0.42	0.75
False Alarm Rate	0.13	0.54	0.33

Overall Skill Score

Skill Score	Value
Proportion Correct	0.559
Kuiper Skill Score	0.369
Heidke Skill Score	0.342

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.23	0.68	0.39

Frequency Bias	0.70	1.32	1.19
Probability of Detection	0.54	0.42	0.73
False Alarm Rate	0.17	0.52	0.31

Overall Skill Score

Skill Score	Value
Proportion Correct	0.564
Kuiper Skill Score	0.362
Heidke Skill Score	0.348

INSAT-3D Sounder vs MODIS for November , 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	3005	1072	2076
Sounder Uncertain	1533	625	2224
Sounder Cloudy	453	88	888

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2581	1976	1596
Sounder Uncertain	1228	1315	1839
Sounder Cloudy	375	280	774

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2135	2174	1844

Sounder Uncertain	1014	1334	2034
Sounder Cloudy	335	262	832

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	25.12	8.96	17.35
Sounder Uncertain	12.81	5.22	18.59
Sounder Cloudy	3.79	0.74	7.42

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	21.57	16.52	13.34
Sounder Uncertain	10.26	10.99	15.37
Sounder Cloudy	3.13	2.34	6.47

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17.85	18.17	15.41
Sounder Uncertain	8.48	11.15	17.00
Sounder Cloudy	2.80	2.19	6.95

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.51	0.86	0.38
Frequency Bias	1.23	2.45	0.28
Probability of Detection	0.60	0.35	0.17
False Alarm Rate	0.42	0.50	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.378
Kuiper Skill Score	0.092
Heidke Skill Score	0.083

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.58	0.70	0.46
Frequency Bias	1.47	1.23	0.34
Probability of Detection	0.62	0.37	0.18
False Alarm Rate	0.49	0.42	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.390
Kuiper Skill Score	0.089
Heidke Skill Score	0.088

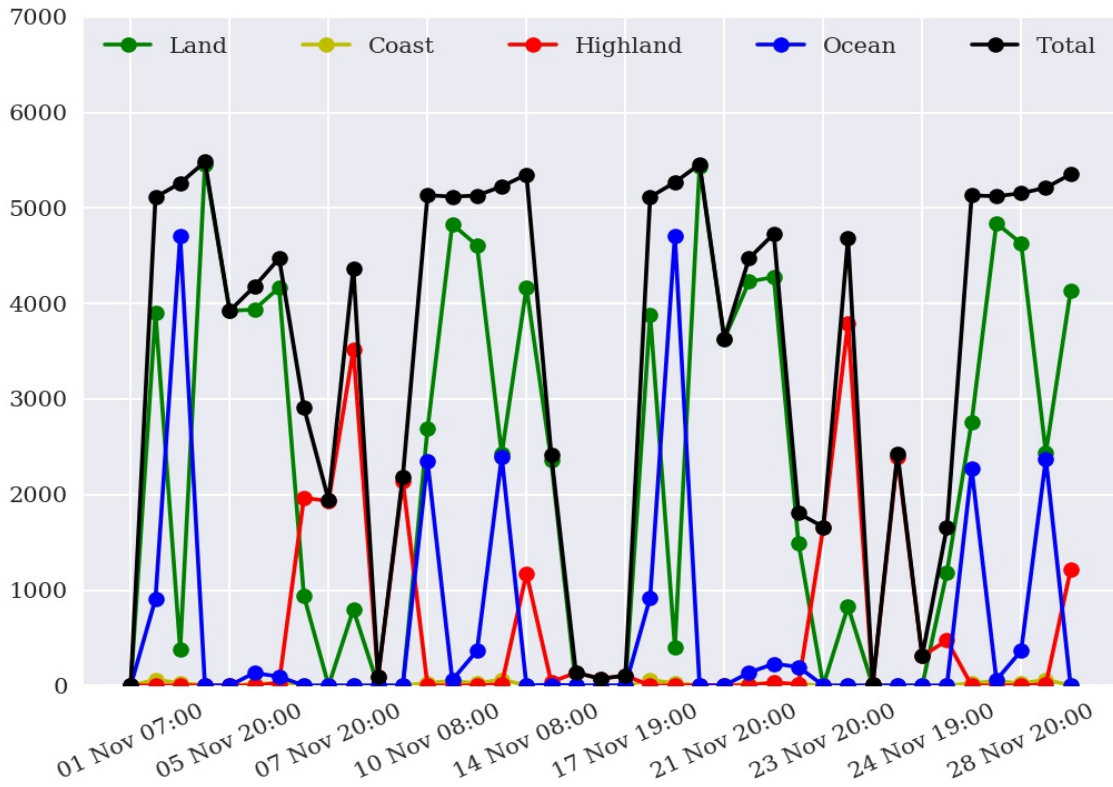
Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.65	0.70	0.42
Frequency Bias	1.77	1.16	0.30
Probability of Detection	0.61	0.35	0.18
False Alarm Rate	0.52	0.40	0.08

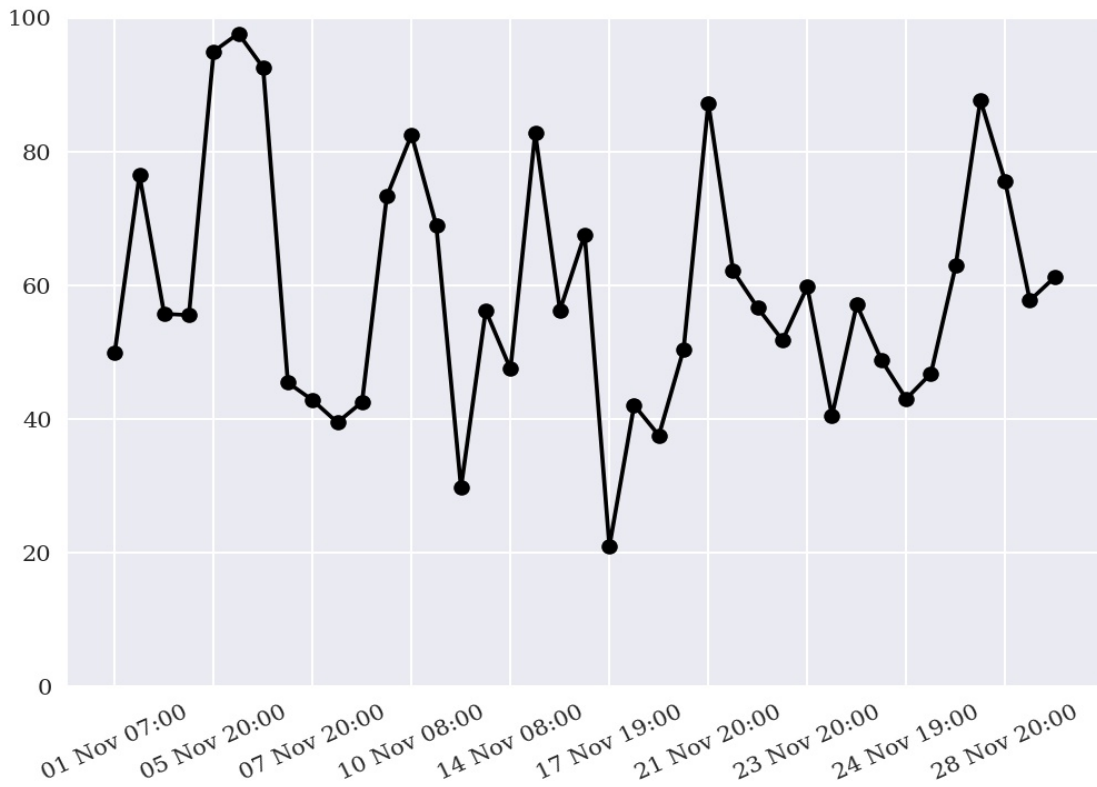
Overall Skill Score

Skill Score	Value
Proportion Correct	0.359
Kuiper Skill Score	0.072
Heidke Skill Score	0.069

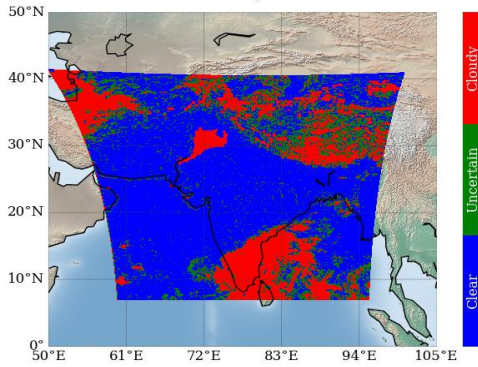
Number of Collocations for Nov-2017



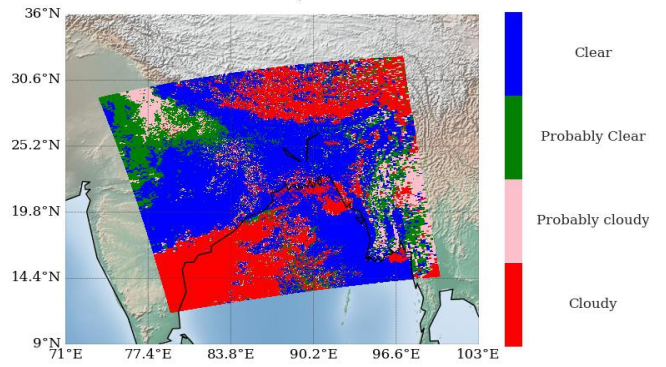
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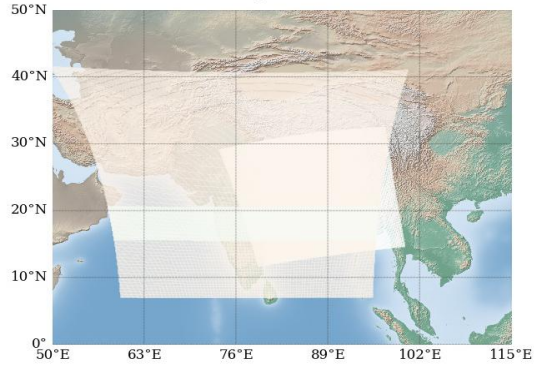
INSAT-3D Sounder Cloud Mask on
04 November, 2017 07:00 UTC



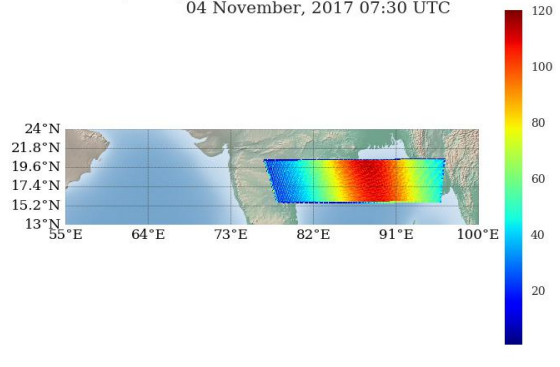
Modis Cloud Mask on
04 November, 2017 07:30 UTC



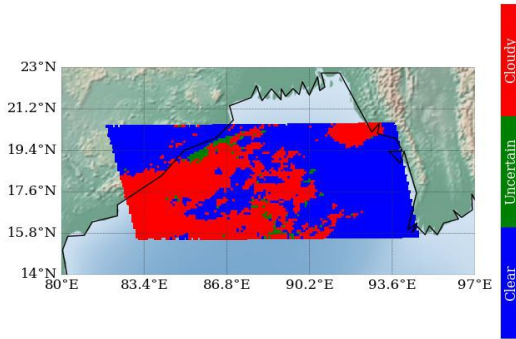
MODIS pass over INSAT-3D Sounder on
04 November, 2017 07:30 UTC



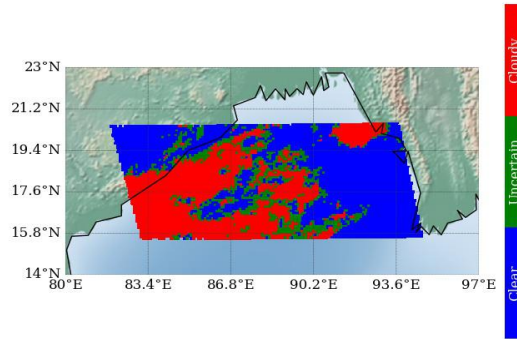
Number of Modis Pixels per Sounder Pixels on a
spatially and Temporally Collocated Domain on
04 November, 2017 07:30 UTC



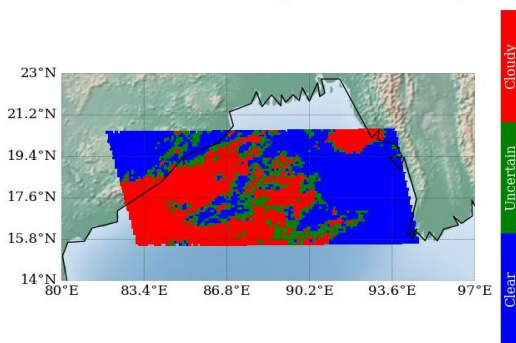
Modis Cloud Mask on Sounder Grid
Method 1 : Mode of Modis pixels



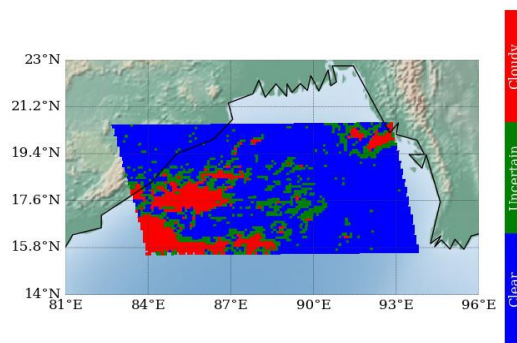
Modis Cloud Mask on Sounder Grid
Method 2 : Weighted Average



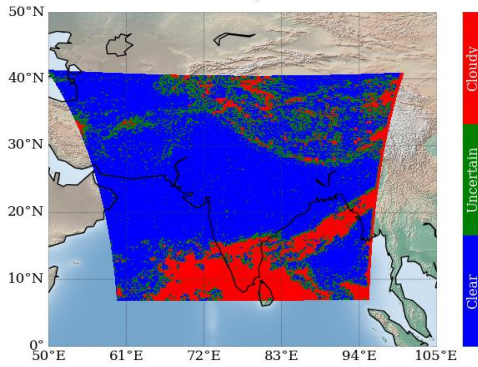
Modis Cloud Mask on Sounder Grid
Method 3 : Weighted Product Average



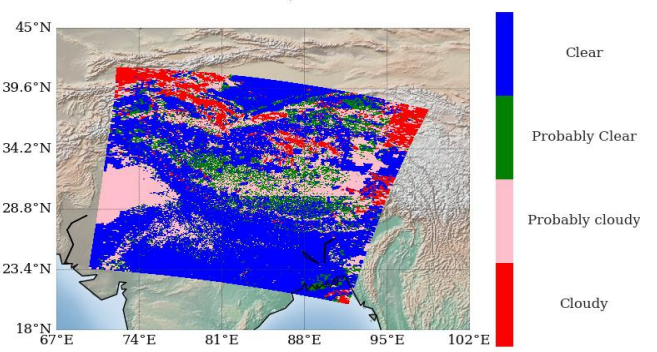
Sounder Cloud Flag on Collocated Area



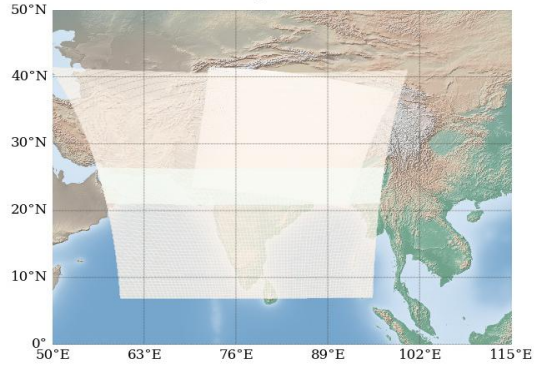
INSAT-3D Sounder Cloud Mask on
05 November, 2017 20:00 UTC



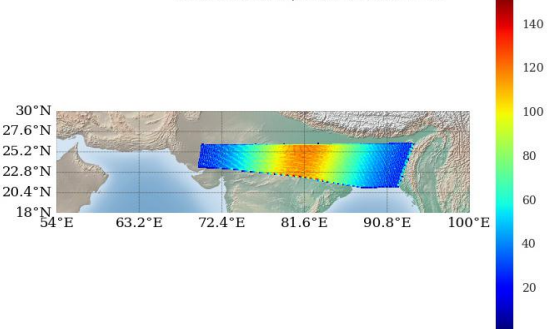
Modis Cloud Mask on
05 November, 2017 20:20 UTC



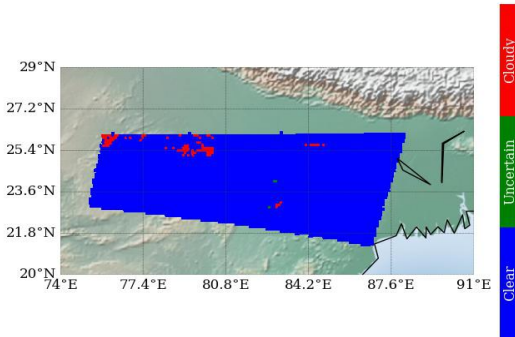
MODIS pass over INSAT-3D Sounder on
05 November, 2017 20:20 UTC



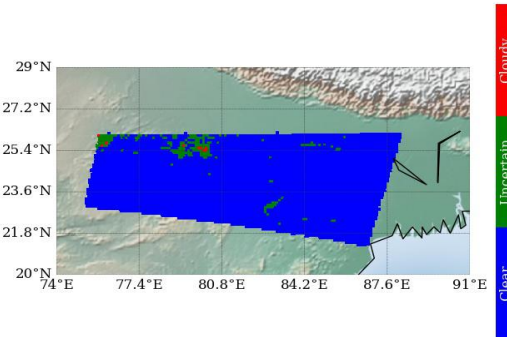
Number of Modis Pixels per Sounder Pixels on a
spatially and Temporally Collocated Domain on
05 November, 2017 20:20 UTC



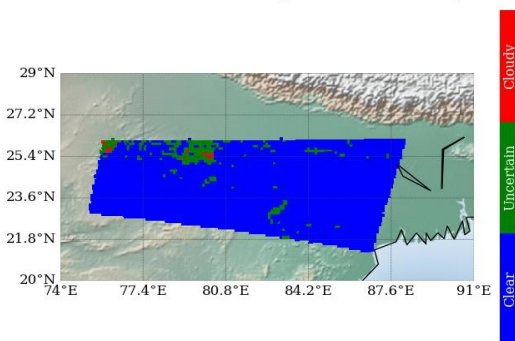
Modis Cloud Mask on Sounder Grid
Method 1 : Mode of Modis pixels



Modis Cloud Mask on Sounder Grid
Method 2 : Weighted Average



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



Sounder Cloud Flag on Collocated Area

