

INSAT-3D Sounder Cloud Mask Validation Report

Validation Criteria :

1. Spatial Collocation : 10km (nominal resolution of INSAT-3D Sounder)
2. Temporal Collocation : 5 minutes

INSAT-3D sounder operational cloud mask product is available at 10km resolution at nadir. MODIS cloud mask product is available at 1 km resolution at nadir. Hence there will be approximately 100 pixels of Modis inside one Sounder Pixels provided both are looking at nadir. In general, there is around 40-60 pixels of MODIS per sounder pixel.

Furthermore operational MODIS cloud mask has 4 flags : Confident clear, probably clear, probably cloudy and cloudy, while operational sounder cloud mask has only 3 flags : Clear, Cloudy and Uncertain. For validation we follow these steps :

1. Spatial and Temporal Collocation
2. Resampling of MODIS cloud Mask on sounder observation area
3. Conversion of 4 cloud flags of MODIS into 3 cloud flags of sounder

The following methodology is adopted for conversion of MODIS cloud flag to sounder cloud flag

(i) A probability value is assigned to each of the modis cloud flag. Here we have assigned the values of 0.125,0.25,0.5,1 for confident clear, probably clear, probably cloudy and cloudy respectively.

(ii) For each collocated sounder pixel , a single probability value for MODIS is obtained using the following 3 methods of averaging :

- a) Taking mode of modis pixel probability value
- b) Taking weighted average of probability values
- c) Taking weighted products of the odds and subtracting the final results from 1

(iii)Based on probability value (p) obtained from above mentioned methods, the cloud mask flag for modis is decided for each method as follows :

$p < 0.35$: Cloudy

$p = 0.35-0.75$: Uncertain

$p > 0.75$: Clear

Based on this flag , confusion matrix and skill scores were computed for each of the 3 methods.

The validation statistics are presented in following order :

1. All Surface
2. Land
3. Ocean
4. Coast
5. Highland (surface height > 2000 m)

For each of the 5 surface types , results are further categorised according to time of the day

1. All times
2. Daytime (0-12 UTC i.e. 05:30-17:30 IST)
3. Nighttime (12-24 UTC i.e. 17:30-05:30 IST)

For each of these cases following statistics are shown :

1. 3X3 Confusion matrices for clear, cloudy and uncertain conditions
2. Following skill scores based on confusion matrices :-
 - i). False Alarm Ratio (FAR)
 - ii). Frequency Bias (FB)
 - iii). Probability of Detection (POD)
 - iv). False Alarm Rate (F)
 - v). Proportion Correct (PCr)
 - vi). Kuiper Skill Score (KSS)
 - vii). Heidke Skill Score (HSS)

Following plots are also shown :

1. Time series of Total number of collocations obtained for each of the 5 categories
2. Time series of percentage correct pixels ($100 * PCr$)
3. Sample spatial plot of operational cloud products and collocations on Land and Ocean

INSAT-3D Sounder vs MODIS for May , 2016 (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	66363	34935	25131
Sounder Uncertain	13692	5609	27724
Sounder Cloudy	13341	4861	70425

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	57831	45293	23305
Sounder Uncertain	10406	10803	25816
Sounder Cloudy	10266	10115	68246

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51047	49418	25964
Sounder Uncertain	8648	11366	27011
Sounder Cloudy	8135	11304	69188

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	25.32	13.33	9.59
Sounder Uncertain	5.22	2.14	10.58
Sounder Cloudy	5.09	1.85	26.87

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22.07	17.28	8.89
Sounder Uncertain	3.97	4.12	9.85
Sounder Cloudy	3.92	3.86	26.04

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	19.48	18.86	9.91
Sounder Uncertain	3.30	4.34	10.31
Sounder Cloudy	3.10	4.31	26.40

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.48	0.88	0.21
Frequency Bias	1.35	1.04	0.72
Probability of Detection	0.71	0.12	0.57
False Alarm Rate	0.50	0.35	0.15

Overall Skill Score

Skill Score	Value
Proportion Correct	0.543
Kuiper Skill Score	0.292
Heidke Skill Score	0.284

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.54	0.77	0.23
Frequency Bias	1.61	0.71	0.76
Probability of Detection	0.74	0.16	0.58
False Alarm Rate	0.55	0.29	0.16

Overall Skill Score

Skill Score	Value
Proportion Correct	0.522
Kuiper Skill Score	0.280
Heidke Skill Score	0.275

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.60	0.76	0.22
Frequency Bias	1.86	0.65	0.73
Probability of Detection	0.75	0.16	0.57
False Alarm Rate	0.58	0.27	0.15

Overall Skill Score

Skill Score	Value
Proportion Correct	0.502
Kuiper Skill Score	0.266
Heidke Skill Score	0.255

INSAT-3D Sounder vs MODIS for May , 2016 (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	32253	17301	13841
Sounder Uncertain	7873	2717	13837
Sounder Cloudy	12467	4256	40022

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28046	22126	13223
Sounder Uncertain	6024	5547	12856
Sounder Cloudy	9688	8867	38190

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23983	24513	14899
Sounder Uncertain	4841	6109	13477
Sounder Cloudy	7647	10142	38956

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22.31	11.97	9.57
Sounder Uncertain	5.45	1.88	9.57
Sounder Cloudy	8.62	2.94	27.68

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	19.40	15.31	9.15
Sounder Uncertain	4.17	3.84	8.89
Sounder Cloudy	6.70	6.13	26.42

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	16.59	16.96	10.31
Sounder Uncertain	3.35	4.23	9.32
Sounder Cloudy	5.29	7.02	26.95

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.49	0.89	0.29
Frequency Bias	1.21	1.01	0.84
Probability of Detection	0.61	0.11	0.59
False Alarm Rate	0.45	0.31	0.24

Overall Skill Score

Skill Score	Value
Proportion Correct	0.519
Kuiper Skill Score	0.237
Heidke Skill Score	0.234

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.56	0.77	0.33
Frequency Bias	1.45	0.67	0.88
Probability of Detection	0.64	0.15	0.59
False Alarm Rate	0.49	0.26	0.25

Overall Skill Score

Skill Score	Value
Proportion Correct	0.497
Kuiper Skill Score	0.227
Heidke Skill Score	0.226

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.62	0.75	0.31
Frequency Bias	1.74	0.60	0.84
Probability of Detection	0.66	0.15	0.58
False Alarm Rate	0.52	0.24	0.24

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.478
Kuiper Skill Score	0.213
Heidke Skill Score	0.207

INSAT-3D Sounder vs MODIS for May , 2016 (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	34110	17634	11290
Sounder Uncertain	5819	2892	13887
Sounder Cloudy	874	605	30403

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	29785	23167	10082
Sounder Uncertain	4382	5256	12960
Sounder Cloudy	578	1248	30056

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	27064	24905	11065
Sounder Uncertain	3807	5257	13534
Sounder Cloudy	488	1162	30232

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	29.03	15.01	9.61
Sounder Uncertain	4.95	2.46	11.82
Sounder Cloudy	0.74	0.51	25.87

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	25.35	19.71	8.58
Sounder Uncertain	3.73	4.47	11.03
Sounder Cloudy	0.49	1.06	25.58

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23.03	21.19	9.42
Sounder Uncertain	3.24	4.47	11.52
Sounder Cloudy	0.42	0.99	25.73

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.46	0.87	0.05
Frequency Bias	1.54	1.07	0.57
Probability of Detection	0.84	0.14	0.55
False Alarm Rate	0.58	0.39	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.574
Kuiper Skill Score	0.360
Heidke Skill Score	0.345

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.53	0.77	0.06
Frequency Bias	1.81	0.76	0.60
Probability of Detection	0.86	0.18	0.57
False Alarm Rate	0.63	0.33	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.554
Kuiper Skill Score	0.348
Heidke Skill Score	0.335

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.57	0.77	0.05
Frequency Bias	2.01	0.72	0.58
Probability of Detection	0.86	0.17	0.55
False Alarm Rate	0.65	0.32	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.532
Kuiper Skill Score	0.330
Heidke Skill Score	0.311

INSAT-3D Sounder vs MODIS for May , 2016 (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	36778	6955	4903
Sounder Uncertain	7892	2337	5660
Sounder Cloudy	11589	4165	26128

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34974	9615	4047
Sounder Uncertain	6430	4616	4843
Sounder Cloudy	9042	8366	24474

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	31055	13068	4513
Sounder Uncertain	5236	5415	5238
Sounder Cloudy	7055	9632	25195

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34.56	6.54	4.61
Sounder Uncertain	7.42	2.20	5.32
Sounder Cloudy	10.89	3.91	24.55

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32.87	9.04	3.80
Sounder Uncertain	6.04	4.34	4.55
Sounder Cloudy	8.50	7.86	23.00

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	29.19	12.28	4.24

Sounder Uncertain	4.92	5.09	4.92
Sounder Cloudy	6.63	9.05	23.68

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.24	0.85	0.38
Frequency Bias	0.86	1.18	1.14
Probability of Detection	0.65	0.17	0.71
False Alarm Rate	0.29	0.33	0.38

Overall Skill Score

Skill Score	Value
Proportion Correct	0.613
Kuiper Skill Score	0.370
Heidke Skill Score	0.359

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.28	0.71	0.42
Frequency Bias	0.96	0.70	1.26
Probability of Detection	0.69	0.20	0.73
False Alarm Rate	0.32	0.27	0.41

Overall Skill Score

Skill Score	Value
Proportion Correct	0.602
Kuiper Skill Score	0.364
Heidke Skill Score	0.367

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.36	0.66	0.40

Frequency Bias	1.12	0.57	1.20
Probability of Detection	0.72	0.19	0.72
False Alarm Rate	0.39	0.23	0.37

Overall Skill Score

Skill Score	Value
Proportion Correct	0.580
Kuiper Skill Score	0.342
Heidke Skill Score	0.348

INSAT-3D Sounder vs MODIS for May , 2016 (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	19593	2428	2935
Sounder Uncertain	5988	713	2737
Sounder Cloudy	11369	3723	18553

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17993	4818	2145
Sounder Uncertain	4702	2787	1949
Sounder Cloudy	8867	7857	16921

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	15364	7156	2436

Sounder Uncertain	3757	3519	2162
Sounder Cloudy	6924	9147	17574

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28.80	3.57	4.31
Sounder Uncertain	8.80	1.05	4.02
Sounder Cloudy	16.71	5.47	27.27

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	26.45	7.08	3.15
Sounder Uncertain	6.91	4.10	2.86
Sounder Cloudy	13.03	11.55	24.87

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22.58	10.52	3.58
Sounder Uncertain	5.52	5.17	3.18
Sounder Cloudy	10.18	13.44	25.83

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.21	0.92	0.45
Frequency Bias	0.68	1.38	1.39
Probability of Detection	0.53	0.10	0.77
False Alarm Rate	0.18	0.30	0.52

Overall Skill Score

Skill Score	Value
Proportion Correct	0.571
Kuiper Skill Score	0.320
Heidke Skill Score	0.298

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.28	0.70	0.50
Frequency Bias	0.79	0.61	1.60
Probability of Detection	0.57	0.18	0.81
False Alarm Rate	0.23	0.22	0.55

Overall Skill Score

Skill Score	Value
Proportion Correct	0.554
Kuiper Skill Score	0.313
Heidke Skill Score	0.309

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.63	0.48
Frequency Bias	0.96	0.48	1.52
Probability of Detection	0.59	0.18	0.79
False Alarm Rate	0.30	0.19	0.51

Overall Skill Score

Skill Score	Value
Proportion Correct	0.536
Kuiper Skill Score	0.293
Heidke Skill Score	0.295

INSAT-3D Sounder vs MODIS for May , 2016 (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	17185	4527	1968
Sounder Uncertain	1904	1624	2923
Sounder Cloudy	220	442	7575

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	16981	4797	1902
Sounder Uncertain	1728	1829	2894
Sounder Cloudy	175	509	7553

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	15691	5912	2077
Sounder Uncertain	1479	1896	3076
Sounder Cloudy	131	485	7621

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	44.79	11.80	5.13
Sounder Uncertain	4.96	4.23	7.62
Sounder Cloudy	0.57	1.15	19.74

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	44.26	12.50	4.96
Sounder Uncertain	4.50	4.77	7.54
Sounder Cloudy	0.46	1.33	19.69

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	40.90	15.41	5.41
Sounder Uncertain	3.85	4.94	8.02
Sounder Cloudy	0.34	1.26	19.86

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.27	0.75	0.08
Frequency Bias	1.23	0.98	0.66
Probability of Detection	0.89	0.25	0.61
False Alarm Rate	0.54	0.40	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.688
Kuiper Skill Score	0.455
Heidke Skill Score	0.471

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.28	0.72	0.08
Frequency Bias	1.25	0.90	0.67
Probability of Detection	0.90	0.26	0.61
False Alarm Rate	0.56	0.39	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.687
Kuiper Skill Score	0.457
Heidke Skill Score	0.475

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.34	0.71	0.07
Frequency Bias	1.37	0.78	0.64
Probability of Detection	0.91	0.23	0.60
False Alarm Rate	0.61	0.35	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.657
Kuiper Skill Score	0.424
Heidke Skill Score	0.441

INSAT-3D Sounder vs MODIS for May , 2016 (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	26630	27049	18500
Sounder Uncertain	4628	2882	20340
Sounder Cloudy	811	525	40402

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20326	34014	17839
Sounder Uncertain	3067	5273	19510
Sounder Cloudy	519	1103	40116

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17779	34495	19905
Sounder Uncertain	2672	4993	20185
Sounder Cloudy	469	991	40278

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	18.78	19.08	13.05
Sounder Uncertain	3.26	2.03	14.35
Sounder Cloudy	0.57	0.37	28.50

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14.34	23.99	12.58
Sounder Uncertain	2.16	3.72	13.76
Sounder Cloudy	0.37	0.78	28.30

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	12.54	24.33	14.04
Sounder Uncertain	1.88	3.52	14.24
Sounder Cloudy	0.33	0.70	28.41

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.63	0.90	0.03
Frequency Bias	2.25	0.91	0.53
Probability of Detection	0.83	0.09	0.51
False Alarm Rate	0.63	0.35	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.493
Kuiper Skill Score	0.290
Heidke Skill Score	0.253

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.72	0.81	0.04
Frequency Bias	3.02	0.69	0.54
Probability of Detection	0.85	0.13	0.52
False Alarm Rate	0.68	0.30	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.464
Kuiper Skill Score	0.272
Heidke Skill Score	0.231

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.75	0.82	0.03
Frequency Bias	3.45	0.69	0.52
Probability of Detection	0.85	0.12	0.50
False Alarm Rate	0.69	0.29	0.02

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.445
Kuiper Skill Score	0.255
Heidke Skill Score	0.209

INSAT-3D Sounder vs MODIS for May , 2016 (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	11234	14470	9955
Sounder Uncertain	1286	1857	10240
Sounder Cloudy	200	375	18541

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8870	16479	10310
Sounder Uncertain	890	2310	10183
Sounder Cloudy	148	398	18570

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7577	16436	11646
Sounder Uncertain	727	2112	10544
Sounder Cloudy	135	356	18625

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	16.48	21.23	14.61
Sounder Uncertain	1.89	2.72	15.02
Sounder Cloudy	0.29	0.55	27.20

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13.01	24.18	15.13
Sounder Uncertain	1.31	3.39	14.94
Sounder Cloudy	0.22	0.58	27.25

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	11.12	24.11	17.09
Sounder Uncertain	1.07	3.10	15.47
Sounder Cloudy	0.20	0.52	27.33

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.68	0.86	0.03
Frequency Bias	2.80	0.80	0.49
Probability of Detection	0.88	0.11	0.48
False Alarm Rate	0.67	0.32	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.464
Kuiper Skill Score	0.273
Heidke Skill Score	0.229

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.75	0.83	0.03
Frequency Bias	3.60	0.70	0.49
Probability of Detection	0.90	0.12	0.48
False Alarm Rate	0.70	0.29	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.436
Kuiper Skill Score	0.253
Heidke Skill Score	0.204

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.79	0.84	0.03
Frequency Bias	4.23	0.71	0.47
Probability of Detection	0.90	0.11	0.46
False Alarm Rate	0.70	0.28	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.415
Kuiper Skill Score	0.234
Heidke Skill Score	0.180

INSAT-3D Sounder vs MODIS for May , 2016 (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	15396	12579	8545
Sounder Uncertain	3342	1025	10100
Sounder Cloudy	611	150	21861

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	11456	17535	7529
Sounder Uncertain	2177	2963	9327
Sounder Cloudy	371	705	21546

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	10202	18059	8259
Sounder Uncertain	1945	2881	9641
Sounder Cloudy	334	635	21653

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20.92	17.09	11.61
Sounder Uncertain	4.54	1.39	13.72
Sounder Cloudy	0.83	0.20	29.70

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	15.56	23.82	10.23
Sounder Uncertain	2.96	4.03	12.67
Sounder Cloudy	0.50	0.96	29.27

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13.86	24.53	11.22

Sounder Uncertain	2.64	3.91	13.10
Sounder Cloudy	0.45	0.86	29.42

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.58	0.93	0.03
Frequency Bias	1.89	1.05	0.56
Probability of Detection	0.80	0.07	0.54
False Alarm Rate	0.60	0.38	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.520
Kuiper Skill Score	0.310
Heidke Skill Score	0.277

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.69	0.80	0.05
Frequency Bias	2.61	0.68	0.59
Probability of Detection	0.82	0.14	0.56
False Alarm Rate	0.67	0.31	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.489
Kuiper Skill Score	0.291
Heidke Skill Score	0.257

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.72	0.80	0.04

Frequency Bias	2.93	0.67	0.57
Probability of Detection	0.82	0.13	0.55
False Alarm Rate	0.68	0.30	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.472
Kuiper Skill Score	0.277
Heidke Skill Score	0.238

INSAT-3D Sounder vs MODIS for May , 2016 (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	455	122	181
Sounder Uncertain	80	36	152
Sounder Cloudy	64	17	376

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	390	223	145
Sounder Uncertain	64	63	141
Sounder Cloudy	54	42	361

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	343	254	161

Sounder Uncertain	51	73	144
Sounder Cloudy	42	50	365

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30.68	8.23	12.20
Sounder Uncertain	5.39	2.43	10.25
Sounder Cloudy	4.32	1.15	25.35

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	26.30	15.04	9.78
Sounder Uncertain	4.32	4.25	9.51
Sounder Cloudy	3.64	2.83	24.34

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23.13	17.13	10.86
Sounder Uncertain	3.44	4.92	9.71
Sounder Cloudy	2.83	3.37	24.61

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.40	0.87	0.18
Frequency Bias	1.27	1.53	0.64
Probability of Detection	0.76	0.21	0.53
False Alarm Rate	0.49	0.38	0.13

Overall Skill Score

Skill Score	Value
Proportion Correct	0.585
Kuiper Skill Score	0.353
Heidke Skill Score	0.335

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.49	0.76	0.21
Frequency Bias	1.49	0.82	0.71
Probability of Detection	0.77	0.19	0.56
False Alarm Rate	0.55	0.31	0.14

Overall Skill Score

Skill Score	Value
Proportion Correct	0.549
Kuiper Skill Score	0.310
Heidke Skill Score	0.307

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.55	0.73	0.20
Frequency Bias	1.74	0.71	0.68
Probability of Detection	0.79	0.19	0.54
False Alarm Rate	0.59	0.28	0.13

Overall Skill Score

Skill Score	Value
Proportion Correct	0.527
Kuiper Skill Score	0.297
Heidke Skill Score	0.288

INSAT-3D Sounder vs MODIS for May , 2016 (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	244	54	98
Sounder Uncertain	52	28	90
Sounder Cloudy	58	17	213

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	200	126	70
Sounder Uncertain	41	49	80
Sounder Cloudy	48	42	198

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	176	141	79
Sounder Uncertain	30	59	81
Sounder Cloudy	38	48	202

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28.57	6.32	11.48
Sounder Uncertain	6.09	3.28	10.54
Sounder Cloudy	6.79	1.99	24.94

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23.42	14.75	8.20
Sounder Uncertain	4.80	5.74	9.37
Sounder Cloudy	5.62	4.92	23.19

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20.61	16.51	9.25
Sounder Uncertain	3.51	6.91	9.48
Sounder Cloudy	4.45	5.62	23.65

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.84	0.26
Frequency Bias	1.12	1.72	0.72
Probability of Detection	0.69	0.28	0.53
False Alarm Rate	0.41	0.38	0.20

Overall Skill Score

Skill Score	Value
Proportion Correct	0.568
Kuiper Skill Score	0.327
Heidke Skill Score	0.310

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.49	0.71	0.31
Frequency Bias	1.37	0.78	0.83
Probability of Detection	0.69	0.23	0.57
False Alarm Rate	0.48	0.30	0.22

Overall Skill Score

Skill Score	Value
Proportion Correct	0.523
Kuiper Skill Score	0.273
Heidke Skill Score	0.272

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.56	0.65	0.30
Frequency Bias	1.62	0.69	0.80
Probability of Detection	0.72	0.24	0.56
False Alarm Rate	0.53	0.27	0.21

Overall Skill Score

Skill Score	Value
Proportion Correct	0.512
Kuiper Skill Score	0.273
Heidke Skill Score	0.268

INSAT-3D Sounder vs MODIS for May , 2016 (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	211	68	83
Sounder Uncertain	28	8	62
Sounder Cloudy	6	0	163

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	190	97	75
Sounder Uncertain	23	14	61
Sounder Cloudy	6	0	163

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	167	113	82
Sounder Uncertain	21	14	63
Sounder Cloudy	4	2	163

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	33.55	10.81	13.20
Sounder Uncertain	4.45	1.27	9.86
Sounder Cloudy	0.95	0.00	25.91

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30.21	15.42	11.92
Sounder Uncertain	3.66	2.23	9.70
Sounder Cloudy	0.95	0.00	25.91

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	26.55	17.97	13.04
Sounder Uncertain	3.34	2.23	10.02
Sounder Cloudy	0.64	0.32	25.91

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.42	0.92	0.04
Frequency Bias	1.48	1.29	0.55
Probability of Detection	0.86	0.11	0.53
False Alarm Rate	0.61	0.36	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.607
Kuiper Skill Score	0.392
Heidke Skill Score	0.372

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.48	0.86	0.04
Frequency Bias	1.65	0.88	0.57
Probability of Detection	0.87	0.13	0.55
False Alarm Rate	0.66	0.32	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.583
Kuiper Skill Score	0.367
Heidke Skill Score	0.354

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.54	0.86	0.04
Frequency Bias	1.89	0.76	0.55
Probability of Detection	0.87	0.11	0.53
False Alarm Rate	0.68	0.29	0.02

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.547
Kuiper Skill Score	0.332
Heidke Skill Score	0.314

INSAT-3D Sounder vs MODIS for May , 2016 (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	533	139	780
Sounder Uncertain	742	186	927
Sounder Cloudy	484	18	1741

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	429	374	649
Sounder Uncertain	573	551	731
Sounder Cloudy	333	337	1573

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	362	393	697
Sounder Uncertain	469	572	814
Sounder Cloudy	299	334	1610

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9.60	2.50	14.05
Sounder Uncertain	13.37	3.35	16.70
Sounder Cloudy	8.72	0.32	31.37

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7.73	6.74	11.69
Sounder Uncertain	10.32	9.93	13.17
Sounder Cloudy	6.00	6.07	28.34

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6.52	7.08	12.56
Sounder Uncertain	8.45	10.31	14.67
Sounder Cloudy	5.39	6.02	29.01

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.63	0.90	0.22
Frequency Bias	0.83	5.41	0.65
Probability of Detection	0.30	0.54	0.50
False Alarm Rate	0.30	0.54	0.16

Overall Skill Score

Skill Score	Value
Proportion Correct	0.443
Kuiper Skill Score	0.174
Heidke Skill Score	0.137

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.70	0.70	0.30
Frequency Bias	1.09	1.47	0.76
Probability of Detection	0.32	0.44	0.53
False Alarm Rate	0.34	0.44	0.22

Overall Skill Score

Skill Score	Value
Proportion Correct	0.460
Kuiper Skill Score	0.175
Heidke Skill Score	0.164

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.75	0.69	0.28
Frequency Bias	1.28	1.43	0.72
Probability of Detection	0.32	0.44	0.52
False Alarm Rate	0.36	0.43	0.21

Overall Skill Score

Skill Score	Value
Proportion Correct	0.458
Kuiper Skill Score	0.170
Heidke Skill Score	0.155

INSAT-3D Sounder vs MODIS for May , 2016 (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	150	2	453
Sounder Uncertain	292	7	411
Sounder Cloudy	474	8	1663

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	101	116	388
Sounder Uncertain	197	189	324
Sounder Cloudy	326	319	1500

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	83	124	398
Sounder Uncertain	168	198	344
Sounder Cloudy	294	315	1536

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.34	0.06	13.09
Sounder Uncertain	8.44	0.20	11.88
Sounder Cloudy	13.70	0.23	48.06

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.92	3.35	11.21
Sounder Uncertain	5.69	5.46	9.36
Sounder Cloudy	9.42	9.22	43.35

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.40	3.58	11.50

Sounder Uncertain	4.86	5.72	9.94
Sounder Cloudy	8.50	9.10	44.39

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.75	0.99	0.22
Frequency Bias	0.66	41.76	0.85
Probability of Detection	0.16	0.41	0.66
False Alarm Rate	0.28	0.43	0.29

Overall Skill Score

Skill Score	Value
Proportion Correct	0.526
Kuiper Skill Score	0.065
Heidke Skill Score	0.052

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.83	0.73	0.30
Frequency Bias	0.97	1.14	0.97
Probability of Detection	0.16	0.30	0.68
False Alarm Rate	0.30	0.31	0.39

Overall Skill Score

Skill Score	Value
Proportion Correct	0.517
Kuiper Skill Score	0.100
Heidke Skill Score	0.098

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.86	0.72	0.28

Frequency Bias	1.11	1.11	0.94
Probability of Detection	0.15	0.31	0.67
False Alarm Rate	0.32	0.31	0.37

Overall Skill Score

Skill Score	Value
Proportion Correct	0.525
Kuiper Skill Score	0.102
Heidke Skill Score	0.098

INSAT-3D Sounder vs MODIS for May , 2016 (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	383	137	327
Sounder Uncertain	450	179	516
Sounder Cloudy	10	10	78

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	328	258	261
Sounder Uncertain	376	362	407
Sounder Cloudy	7	18	73

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	279	269	299

Sounder Uncertain	301	374	470
Sounder Cloudy	5	19	74

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	18.33	6.56	15.65
Sounder Uncertain	21.53	8.56	24.69
Sounder Cloudy	0.48	0.48	3.73

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	15.69	12.34	12.49
Sounder Uncertain	17.99	17.32	19.47
Sounder Cloudy	0.33	0.86	3.49

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13.35	12.87	14.31
Sounder Uncertain	14.40	17.89	22.49
Sounder Cloudy	0.24	0.91	3.54

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.55	0.84	0.20
Frequency Bias	1.00	3.51	0.11
Probability of Detection	0.45	0.55	0.08
False Alarm Rate	0.32	0.67	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.306
Kuiper Skill Score	0.059
Heidke Skill Score	0.050

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.61	0.68	0.26
Frequency Bias	1.19	1.79	0.13
Probability of Detection	0.46	0.57	0.10
False Alarm Rate	0.39	0.59	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.365
Kuiper Skill Score	0.065
Heidke Skill Score	0.064

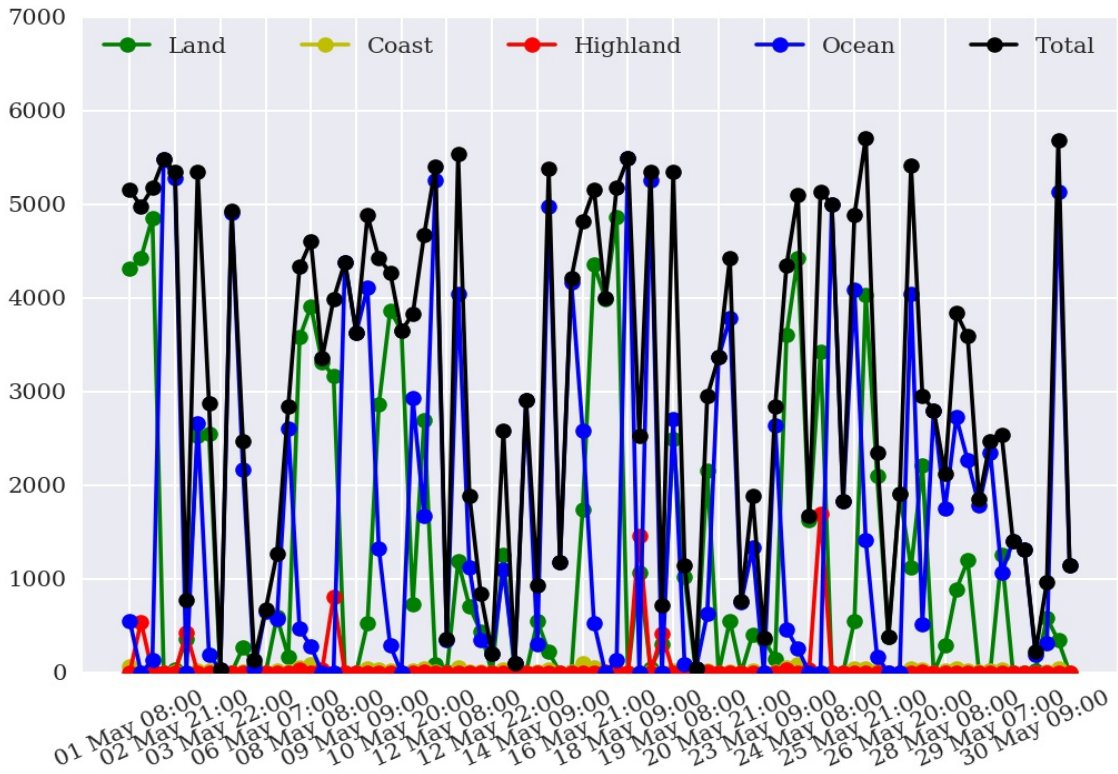
Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.67	0.67	0.24
Frequency Bias	1.45	1.73	0.12
Probability of Detection	0.48	0.56	0.09
False Alarm Rate	0.42	0.57	0.02

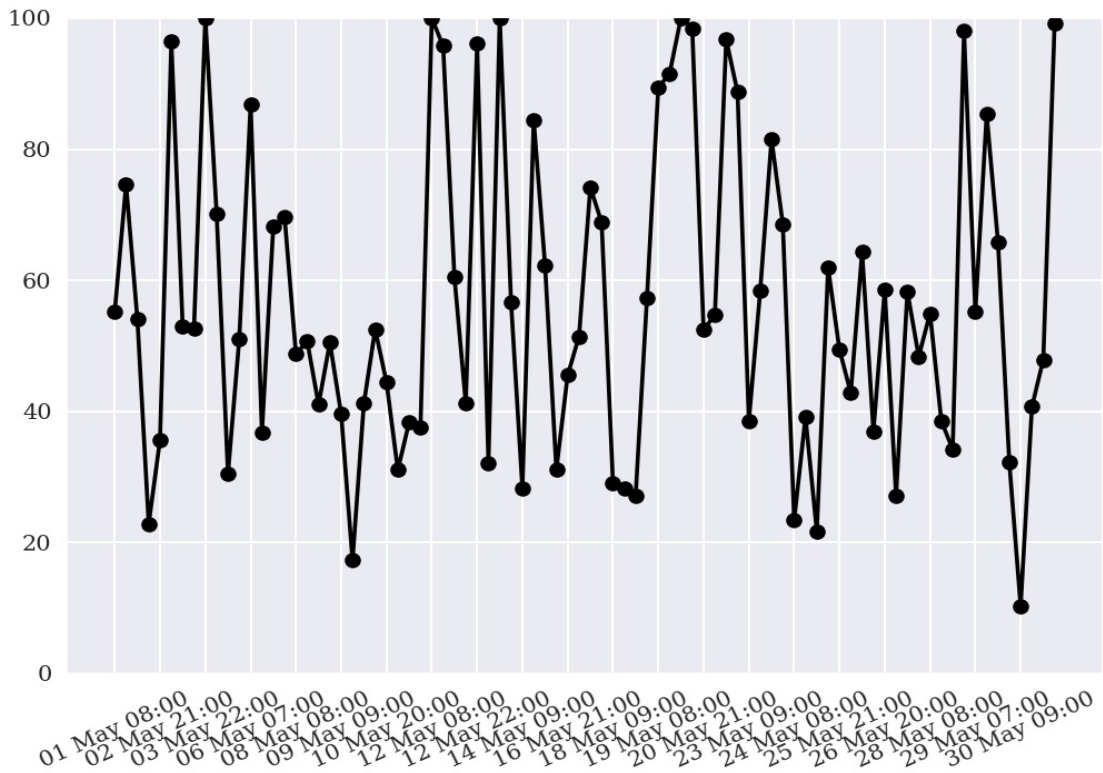
Overall Skill Score

Skill Score	Value
Proportion Correct	0.348
Kuiper Skill Score	0.064
Heidke Skill Score	0.060

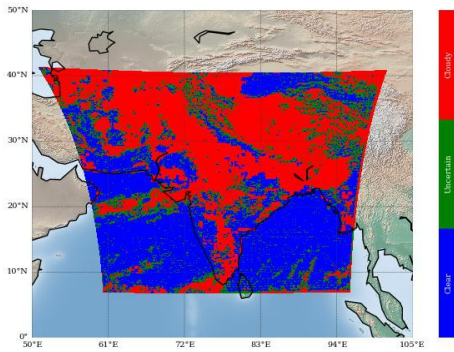
Number of Collocations for May-2016



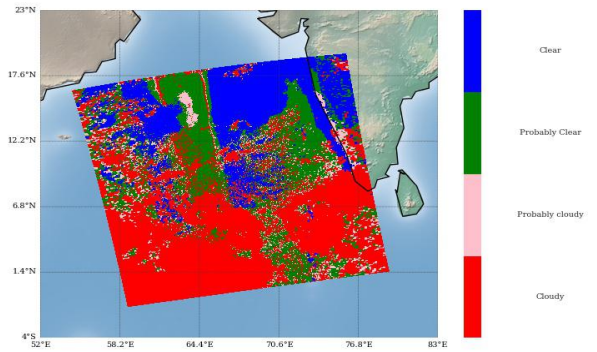
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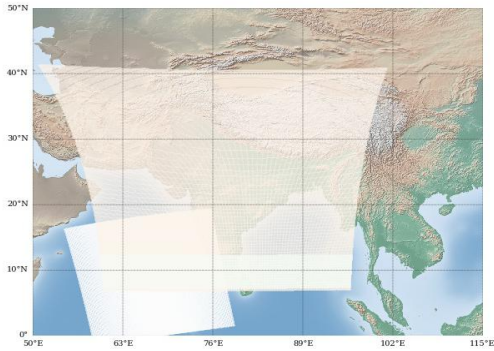
INSAT-3D Sounder Cloud Mask on
02 May, 2016 09:00 UTC



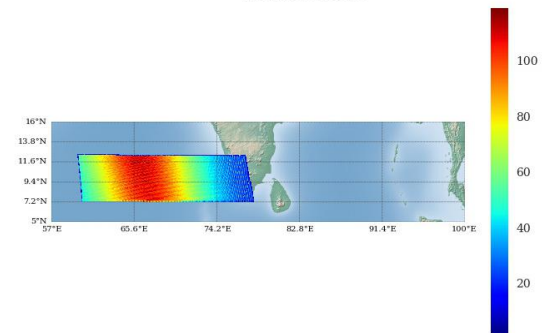
Modis Cloud Mask on
02 May, 2016 09:00 UTC



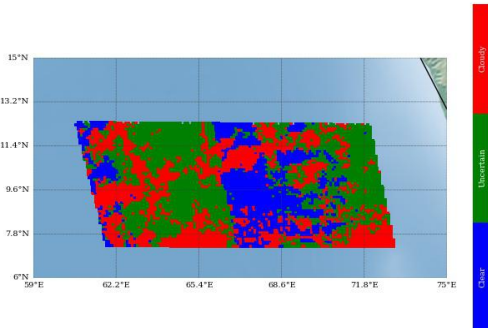
MODIS pass over INSAT-3D Sounder on
02 May, 2016 09:00 UTC



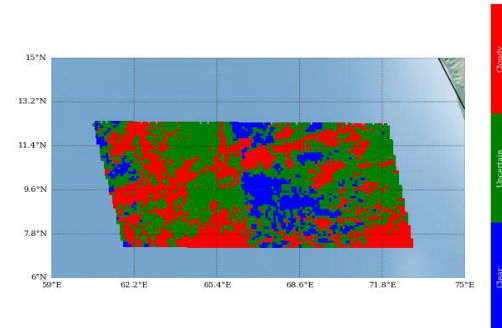
Number of Modis Pixels per Sounder Pixels on a
spatially and Temporally Collocated Domain on
02 May, 2016 09:00 UTC



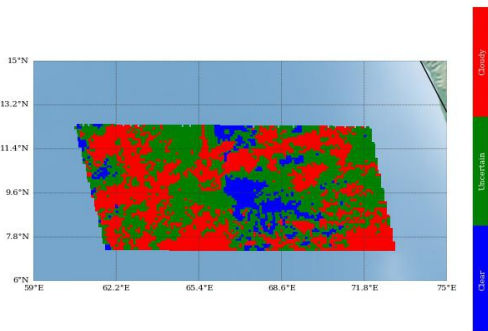
Modis Cloud Mask on Sounder Grid
Method 1 : Mode of Modis pixels



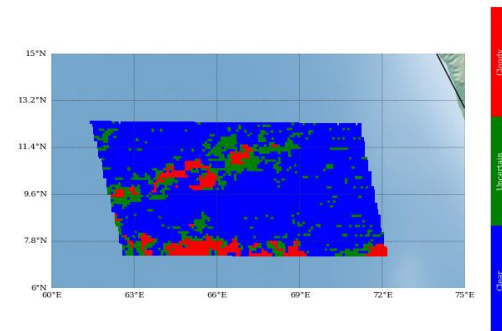
Modis Cloud Mask on Sounder Grid
Method 2 : Weighted Average



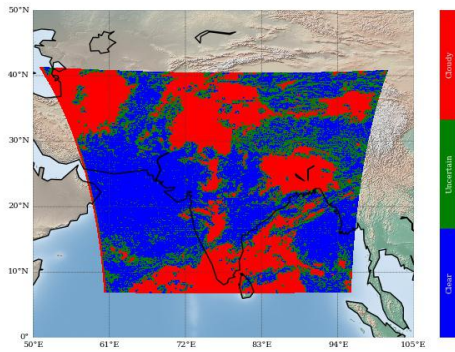
Modis Cloud Mask on Sounder Grid
Method 3 : Weighted Product Average



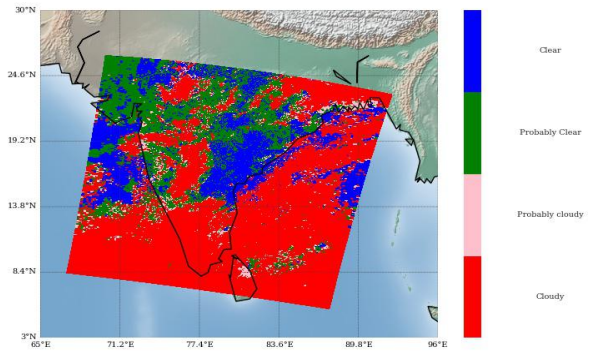
Sounder Cloud Flag on Collocated Area



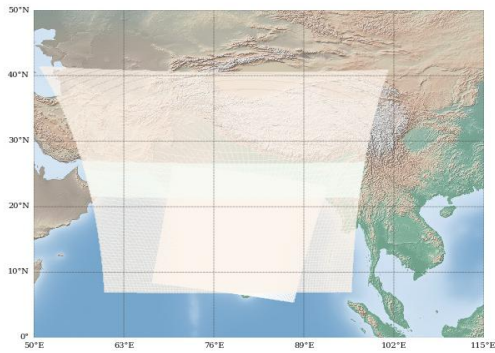
INSAT-3D Sounder Cloud Mask on 10 May, 2016 20:00 UTC



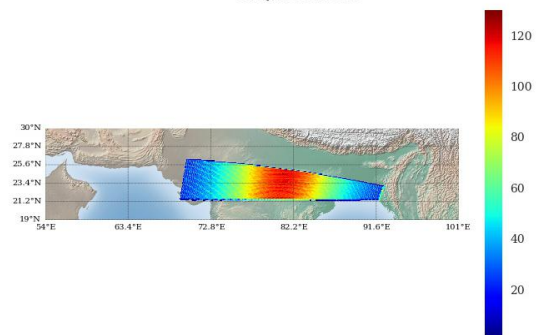
Modis Cloud Mask on 10 May, 2016 20:25 UTC



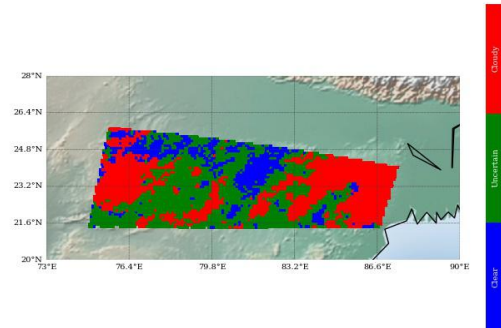
MODIS pass over INSAT-3D Sounder on 10 May, 2016 20:25 UTC



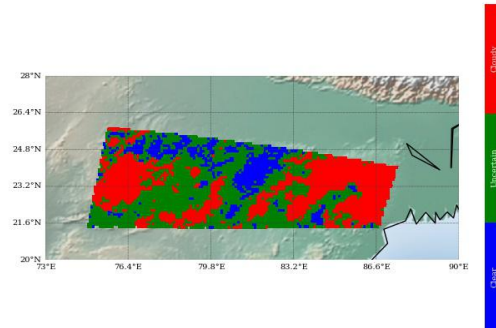
Number of Modis Pixels per Sounder Pixels on a spatially and Temporally Collocated Domain on 10 May, 2016 20:25 UTC



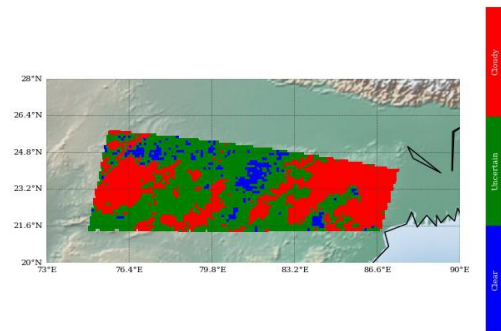
Modis Cloud Mask on Sounder Grid Method 1 : Mode of Modis pixels



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

