

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 July , 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	14996	11257	38562
Sounder Uncertain	3564	2482	25344
Sounder Cloudy	2843	1850	149085

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	10927	17689	36199
Sounder Uncertain	2247	4806	24337
Sounder Cloudy	1945	3824	148009

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9444	17481	37890
Sounder Uncertain	1836	4539	25015
Sounder Cloudy	1611	3617	148550

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6.00	4.50	15.43
Sounder Uncertain	1.43	0.99	10.14
Sounder Cloudy	1.14	0.74	59.64

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.37	7.08	14.48
Sounder Uncertain	0.90	1.92	9.74
Sounder Cloudy	0.78	1.53	59.21

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.78	6.99	15.16
Sounder Uncertain	0.73	1.82	10.01
Sounder Cloudy	0.64	1.45	59.42

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.77	0.92	0.03
Frequency Bias	3.03	2.01	0.72
Probability of Detection	0.70	0.16	0.70
False Alarm Rate	0.60	0.35	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.666
Kuiper Skill Score	0.427
Heidke Skill Score	0.252

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.83	0.85	0.04
Frequency Bias	4.29	1.19	0.74
Probability of Detection	0.72	0.18	0.71
False Alarm Rate	0.62	0.31	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.655
Kuiper Skill Score	0.390
Heidke Skill Score	0.247

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.85	0.86	0.03
Frequency Bias	5.03	1.22	0.73
Probability of Detection	0.73	0.18	0.70
False Alarm Rate	0.63	0.31	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.650
Kuiper Skill Score	0.382
Heidke Skill Score	0.228

INSAT-3D Sounder vs MODIS for July , 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	5905	7787	20359
Sounder Uncertain	1456	1399	13528
Sounder Cloudy	2194	1193	72150

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4185	10105	19761
Sounder Uncertain	867	2361	13155
Sounder Cloudy	1609	2449	71479

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3458	9763	20830
Sounder Uncertain	667	2155	13561
Sounder Cloudy	1336	2353	71848

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.69	6.18	16.16
Sounder Uncertain	1.16	1.11	10.74
Sounder Cloudy	1.74	0.95	57.28

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.32	8.02	15.69
Sounder Uncertain	0.69	1.87	10.44
Sounder Cloudy	1.28	1.94	56.74

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.75	7.75	16.54
Sounder Uncertain	0.53	1.71	10.77
Sounder Cloudy	1.06	1.87	57.04

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.83	0.91	0.04
Frequency Bias	3.56	1.58	0.71
Probability of Detection	0.62	0.13	0.68
False Alarm Rate	0.61	0.32	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.631
Kuiper Skill Score	0.340
Heidke Skill Score	0.204

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.88	0.86	0.05
Frequency Bias	5.11	1.10	0.72
Probability of Detection	0.63	0.16	0.68
False Alarm Rate	0.62	0.29	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.619
Kuiper Skill Score	0.313
Heidke Skill Score	0.196

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.90	0.87	0.05
Frequency Bias	6.24	1.15	0.71
Probability of Detection	0.63	0.15	0.68
False Alarm Rate	0.63	0.29	0.08

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.615
Kuiper Skill Score	0.302
Heidke Skill Score	0.177

INSAT-3D Sounder vs MODIS for July , 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	9091	3470	18203
Sounder Uncertain	2108	1083	11816
Sounder Cloudy	649	657	76935

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6742	7584	16438
Sounder Uncertain	1380	2445	11182
Sounder Cloudy	336	1375	76530

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5986	7718	17060
Sounder Uncertain	1169	2384	11454
Sounder Cloudy	275	1264	76702

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7.33	2.80	14.68
Sounder Uncertain	1.70	0.87	9.53
Sounder Cloudy	0.52	0.53	62.04

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.44	6.12	13.26
Sounder Uncertain	1.11	1.97	9.02
Sounder Cloudy	0.27	1.11	61.71

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.83	6.22	13.76
Sounder Uncertain	0.94	1.92	9.24
Sounder Cloudy	0.22	1.02	61.85

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.70	0.93	0.02
Frequency Bias	2.60	2.88	0.73
Probability of Detection	0.77	0.21	0.72
False Alarm Rate	0.59	0.38	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.702
Kuiper Skill Score	0.528
Heidke Skill Score	0.303

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.78	0.84	0.02
Frequency Bias	3.64	1.32	0.75
Probability of Detection	0.80	0.21	0.73
False Alarm Rate	0.63	0.33	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.691
Kuiper Skill Score	0.473
Heidke Skill Score	0.301

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.81	0.84	0.02
Frequency Bias	4.14	1.32	0.74
Probability of Detection	0.81	0.21	0.73
False Alarm Rate	0.64	0.32	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.686
Kuiper Skill Score	0.465
Heidke Skill Score	0.284

INSAT-3D Sounder vs MODIS for July , 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	3271	3000	7533
Sounder Uncertain	1069	867	4699
Sounder Cloudy	1772	1283	67505

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2562	4519	6723
Sounder Uncertain	766	1486	4383
Sounder Cloudy	1380	2163	67017

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2207	4453	7144
Sounder Uncertain	628	1423	4584
Sounder Cloudy	1174	2042	67344

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.59	3.30	8.28
Sounder Uncertain	1.17	0.95	5.16
Sounder Cloudy	1.95	1.41	74.18

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.82	4.97	7.39
Sounder Uncertain	0.84	1.63	4.82
Sounder Cloudy	1.52	2.38	73.65

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.43	4.89	7.85

Sounder Uncertain	0.69	1.56	5.04
Sounder Cloudy	1.29	2.24	74.01

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.76	0.87	0.04
Frequency Bias	2.26	1.29	0.88
Probability of Detection	0.54	0.17	0.85
False Alarm Rate	0.54	0.30	0.16

Overall Skill Score

Skill Score	Value
Proportion Correct	0.787
Kuiper Skill Score	0.417
Heidke Skill Score	0.305

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.81	0.78	0.05
Frequency Bias	2.93	0.81	0.90
Probability of Detection	0.54	0.18	0.86
False Alarm Rate	0.56	0.26	0.18

Overall Skill Score

Skill Score	Value
Proportion Correct	0.781
Kuiper Skill Score	0.400
Heidke Skill Score	0.315

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.84	0.79	0.05

Frequency Bias	3.44	0.84	0.89
Probability of Detection	0.55	0.18	0.85
False Alarm Rate	0.58	0.26	0.16

Overall Skill Score

Skill Score	Value
Proportion Correct	0.780
Kuiper Skill Score	0.396
Heidke Skill Score	0.297

INSAT-3D Sounder vs MODIS for July , 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	1185	605	4318
Sounder Uncertain	463	244	2244
Sounder Cloudy	1605	812	36697

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	605	1840	3663
Sounder Uncertain	228	737	1986
Sounder Cloudy	1256	1598	36260

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	463	1691	3954

Sounder Uncertain	164	667	2120
Sounder Cloudy	1073	1519	36522

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.46	1.26	8.96
Sounder Uncertain	0.96	0.51	4.66
Sounder Cloudy	3.33	1.69	76.18

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1.26	3.82	7.60
Sounder Uncertain	0.47	1.53	4.12
Sounder Cloudy	2.61	3.32	75.27

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	0.96	3.51	8.21
Sounder Uncertain	0.34	1.38	4.40
Sounder Cloudy	2.23	3.15	75.81

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.81	0.92	0.06
Frequency Bias	1.88	1.78	0.90
Probability of Detection	0.36	0.15	0.85
False Alarm Rate	0.49	0.27	0.24

Overall Skill Score

Skill Score	Value
Proportion Correct	0.791
Kuiper Skill Score	0.275
Heidke Skill Score	0.198

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.90	0.75	0.07
Frequency Bias	2.92	0.71	0.93
Probability of Detection	0.29	0.18	0.87
False Alarm Rate	0.52	0.21	0.27

Overall Skill Score

Skill Score	Value
Proportion Correct	0.781
Kuiper Skill Score	0.271
Heidke Skill Score	0.224

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.92	0.77	0.07
Frequency Bias	3.59	0.76	0.92
Probability of Detection	0.27	0.17	0.86
False Alarm Rate	0.54	0.22	0.25

Overall Skill Score

Skill Score	Value
Proportion Correct	0.782
Kuiper Skill Score	0.258
Heidke Skill Score	0.199

INSAT-3D Sounder vs MODIS for July , 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	2086	2395	3215
Sounder Uncertain	606	623	2455
Sounder Cloudy	167	471	30808

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1957	2679	3060
Sounder Uncertain	538	749	2397
Sounder Cloudy	124	565	30757

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1744	2762	3190
Sounder Uncertain	464	756	2464
Sounder Cloudy	101	523	30822

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.87	5.59	7.51
Sounder Uncertain	1.42	1.45	5.73
Sounder Cloudy	0.39	1.10	71.94

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.57	6.26	7.15
Sounder Uncertain	1.26	1.75	5.60
Sounder Cloudy	0.29	1.32	71.82

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.07	6.45	7.45
Sounder Uncertain	1.08	1.77	5.75
Sounder Cloudy	0.24	1.22	71.97

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.73	0.83	0.02
Frequency Bias	2.69	1.06	0.86
Probability of Detection	0.73	0.18	0.84
False Alarm Rate	0.60	0.33	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.783
Kuiper Skill Score	0.525
Heidke Skill Score	0.389

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.75	0.80	0.02
Frequency Bias	2.94	0.92	0.87
Probability of Detection	0.75	0.19	0.85
False Alarm Rate	0.61	0.31	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.781
Kuiper Skill Score	0.519
Heidke Skill Score	0.393

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.77	0.79	0.02
Frequency Bias	3.33	0.91	0.86
Probability of Detection	0.76	0.19	0.84
False Alarm Rate	0.63	0.31	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.778
Kuiper Skill Score	0.513
Heidke Skill Score	0.378

INSAT-3D Sounder vs MODIS for July , 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	11134	7835	29693
Sounder Uncertain	2092	1418	19404
Sounder Cloudy	689	462	72504

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7958	12363	28341
Sounder Uncertain	1214	2871	18829
Sounder Cloudy	359	1178	72118

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6939	12200	29523
Sounder Uncertain	999	2670	19245
Sounder Cloudy	296	1080	72279

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7.67	5.39	20.45
Sounder Uncertain	1.44	0.98	13.36
Sounder Cloudy	0.47	0.32	49.92

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.48	8.51	19.51
Sounder Uncertain	0.84	1.98	12.96
Sounder Cloudy	0.25	0.81	49.66

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.78	8.40	20.33
Sounder Uncertain	0.69	1.84	13.25
Sounder Cloudy	0.20	0.74	49.77

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.77	0.94	0.02
Frequency Bias	3.50	2.36	0.61
Probability of Detection	0.80	0.15	0.60
False Alarm Rate	0.62	0.36	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.586
Kuiper Skill Score	0.415
Heidke Skill Score	0.222

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.84	0.87	0.02
Frequency Bias	5.11	1.40	0.62
Probability of Detection	0.83	0.17	0.60
False Alarm Rate	0.65	0.32	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.571
Kuiper Skill Score	0.372
Heidke Skill Score	0.211

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.86	0.88	0.02
Frequency Bias	5.91	1.44	0.61
Probability of Detection	0.84	0.17	0.60
False Alarm Rate	0.66	0.32	0.02

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.564
Kuiper Skill Score	0.361
Heidke Skill Score	0.194

INSAT-3D Sounder vs MODIS for July , 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	4474	7082	15527
Sounder Uncertain	709	1111	10755
Sounder Cloudy	241	287	30774

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3430	7981	15672
Sounder Uncertain	461	1401	10713
Sounder Cloudy	172	407	30723

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2881	7792	16410
Sounder Uncertain	359	1259	10957
Sounder Cloudy	139	379	30784

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6.30	9.98	21.88
Sounder Uncertain	1.00	1.57	15.16
Sounder Cloudy	0.34	0.40	43.37

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.83	11.25	22.09
Sounder Uncertain	0.65	1.97	15.10
Sounder Cloudy	0.24	0.57	43.30

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.06	10.98	23.13
Sounder Uncertain	0.51	1.77	15.44
Sounder Cloudy	0.20	0.53	43.38

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.83	0.91	0.02
Frequency Bias	4.99	1.48	0.55
Probability of Detection	0.82	0.13	0.54
False Alarm Rate	0.65	0.33	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.512
Kuiper Skill Score	0.322
Heidke Skill Score	0.180

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.87	0.89	0.02
Frequency Bias	6.67	1.28	0.55
Probability of Detection	0.84	0.14	0.54
False Alarm Rate	0.67	0.32	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.501
Kuiper Skill Score	0.302
Heidke Skill Score	0.167

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.89	0.90	0.02
Frequency Bias	8.02	1.33	0.54
Probability of Detection	0.85	0.13	0.53
False Alarm Rate	0.67	0.31	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.492
Kuiper Skill Score	0.288
Heidke Skill Score	0.149

INSAT-3D Sounder vs MODIS for July , 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	6660	753	14166
Sounder Uncertain	1383	307	8649
Sounder Cloudy	448	175	41730

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4528	4382	12669
Sounder Uncertain	753	1470	8116
Sounder Cloudy	187	771	41395

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4058	4408	13113
Sounder Uncertain	640	1411	8288
Sounder Cloudy	157	701	41495

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8.97	1.01	19.07
Sounder Uncertain	1.86	0.41	11.65
Sounder Cloudy	0.60	0.24	56.19

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6.10	5.90	17.06
Sounder Uncertain	1.01	1.98	10.93
Sounder Cloudy	0.25	1.04	55.74

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.46	5.94	17.66

Sounder Uncertain	0.86	1.90	11.16
Sounder Cloudy	0.21	0.94	55.87

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.69	0.97	0.01
Frequency Bias	2.54	8.37	0.66
Probability of Detection	0.78	0.25	0.65
False Alarm Rate	0.58	0.39	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.656
Kuiper Skill Score	0.538
Heidke Skill Score	0.266

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.79	0.86	0.02
Frequency Bias	3.95	1.56	0.68
Probability of Detection	0.83	0.22	0.67
False Alarm Rate	0.63	0.33	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.638
Kuiper Skill Score	0.444
Heidke Skill Score	0.260

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.81	0.86	0.02

Frequency Bias	4.44	1.59	0.67
Probability of Detection	0.84	0.22	0.66
False Alarm Rate	0.64	0.33	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.632
Kuiper Skill Score	0.436
Heidke Skill Score	0.243

INSAT-3D Sounder vs MODIS for July , 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	81	54	200
Sounder Uncertain	33	13	153
Sounder Cloudy	36	9	852

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	50	107	178
Sounder Uncertain	27	31	141
Sounder Cloudy	23	36	838

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37	101	197

Sounder Uncertain	22	30	147
Sounder Cloudy	17	36	844

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.66	3.77	13.98
Sounder Uncertain	2.31	0.91	10.69
Sounder Cloudy	2.52	0.63	59.54

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.49	7.48	12.44
Sounder Uncertain	1.89	2.17	9.85
Sounder Cloudy	1.61	2.52	58.56

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.59	7.06	13.77
Sounder Uncertain	1.54	2.10	10.27
Sounder Cloudy	1.19	2.52	58.98

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.76	0.93	0.05
Frequency Bias	2.23	2.62	0.74
Probability of Detection	0.54	0.17	0.71
False Alarm Rate	0.52	0.38	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.661
Kuiper Skill Score	0.366
Heidke Skill Score	0.230

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.85	0.84	0.07
Frequency Bias	3.35	1.14	0.78
Probability of Detection	0.50	0.18	0.72
False Alarm Rate	0.56	0.33	0.12

Overall Skill Score

Skill Score	Value
Proportion Correct	0.642
Kuiper Skill Score	0.313
Heidke Skill Score	0.222

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.89	0.85	0.06
Frequency Bias	4.41	1.19	0.76
Probability of Detection	0.49	0.18	0.71
False Alarm Rate	0.57	0.33	0.10

Overall Skill Score

Skill Score	Value
Proportion Correct	0.637
Kuiper Skill Score	0.297
Heidke Skill Score	0.194

INSAT-3D Sounder vs MODIS for July , 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	30	20	84
Sounder Uncertain	12	7	67
Sounder Cloudy	32	9	500

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14	46	74
Sounder Uncertain	9	15	62
Sounder Cloudy	19	35	487

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9	38	87
Sounder Uncertain	7	14	65
Sounder Cloudy	13	35	493

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.94	2.63	11.04
Sounder Uncertain	1.58	0.92	8.80
Sounder Cloudy	4.20	1.18	65.70

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1.84	6.04	9.72
Sounder Uncertain	1.18	1.97	8.15
Sounder Cloudy	2.50	4.60	63.99

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1.18	4.99	11.43
Sounder Uncertain	0.92	1.84	8.54
Sounder Cloudy	1.71	4.60	64.78

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.78	0.92	0.08
Frequency Bias	1.81	2.39	0.83
Probability of Detection	0.41	0.19	0.77
False Alarm Rate	0.46	0.35	0.18

Overall Skill Score

Skill Score	Value
Proportion Correct	0.706
Kuiper Skill Score	0.293
Heidke Skill Score	0.203

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.90	0.83	0.10
Frequency Bias	3.19	0.90	0.87
Probability of Detection	0.33	0.16	0.78
False Alarm Rate	0.49	0.29	0.22

Overall Skill Score

Skill Score	Value
Proportion Correct	0.678
Kuiper Skill Score	0.232
Heidke Skill Score	0.183

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.93	0.84	0.09
Frequency Bias	4.62	0.99	0.84
Probability of Detection	0.31	0.16	0.76
False Alarm Rate	0.51	0.29	0.20

Overall Skill Score

Skill Score	Value
Proportion Correct	0.678
Kuiper Skill Score	0.209
Heidke Skill Score	0.148

INSAT-3D Sounder vs MODIS for July , 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	51	34	116
Sounder Uncertain	21	6	86
Sounder Cloudy	4	0	352

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	36	61	104
Sounder Uncertain	18	16	79
Sounder Cloudy	4	1	351

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28	63	110
Sounder Uncertain	15	16	82
Sounder Cloudy	4	1	351

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7.61	5.07	17.31
Sounder Uncertain	3.13	0.90	12.84
Sounder Cloudy	0.60	0.00	52.54

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.37	9.10	15.52
Sounder Uncertain	2.69	2.39	11.79
Sounder Cloudy	0.60	0.15	52.39

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.18	9.40	16.42
Sounder Uncertain	2.24	2.39	12.24
Sounder Cloudy	0.60	0.15	52.39

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.75	0.95	0.01
Frequency Bias	2.64	2.83	0.64
Probability of Detection	0.67	0.15	0.64
False Alarm Rate	0.57	0.41	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.610
Kuiper Skill Score	0.424
Heidke Skill Score	0.246

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.82	0.86	0.01
Frequency Bias	3.47	1.45	0.67
Probability of Detection	0.62	0.21	0.66
False Alarm Rate	0.62	0.36	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.601
Kuiper Skill Score	0.385
Heidke Skill Score	0.249

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.86	0.86	0.01
Frequency Bias	4.28	1.41	0.66
Probability of Detection	0.60	0.20	0.65
False Alarm Rate	0.63	0.35	0.02

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.590
Kuiper Skill Score	0.363
Heidke Skill Score	0.223

INSAT-3D Sounder vs MODIS for July , 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	180	170	270
Sounder Uncertain	258	118	516
Sounder Cloudy	224	18	3886

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	144	248	228
Sounder Uncertain	164	272	456
Sounder Cloudy	95	296	3737

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	99	275	246
Sounder Uncertain	127	280	485
Sounder Cloudy	57	300	3771

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.19	3.01	4.79
Sounder Uncertain	4.57	2.09	9.15
Sounder Cloudy	3.97	0.32	68.90

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.55	4.40	4.04
Sounder Uncertain	2.91	4.82	8.09
Sounder Cloudy	1.68	5.25	66.26

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1.76	4.88	4.36
Sounder Uncertain	2.25	4.96	8.60
Sounder Cloudy	1.01	5.32	66.86

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.71	0.87	0.06
Frequency Bias	0.94	2.92	0.88
Probability of Detection	0.27	0.39	0.83
False Alarm Rate	0.30	0.53	0.17

Overall Skill Score

Skill Score	Value
Proportion Correct	0.742
Kuiper Skill Score	0.384
Heidke Skill Score	0.306

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.77	0.70	0.09
Frequency Bias	1.54	1.09	0.93
Probability of Detection	0.36	0.33	0.85
False Alarm Rate	0.32	0.42	0.26

Overall Skill Score

Skill Score	Value
Proportion Correct	0.736
Kuiper Skill Score	0.367
Heidke Skill Score	0.333

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.84	0.69	0.09
Frequency Bias	2.19	1.04	0.92
Probability of Detection	0.35	0.33	0.84
False Alarm Rate	0.35	0.41	0.24

Overall Skill Score

Skill Score	Value
Proportion Correct	0.736
Kuiper Skill Score	0.362
Heidke Skill Score	0.316

INSAT-3D Sounder vs MODIS for July , 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	106	0	65
Sounder Uncertain	219	4	215
Sounder Cloudy	209	11	1760

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	78	50	43
Sounder Uncertain	137	137	164
Sounder Cloudy	83	268	1629

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	63	61	47
Sounder Uncertain	111	151	176
Sounder Cloudy	53	271	1656

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.09	0.00	2.51
Sounder Uncertain	8.46	0.15	8.30
Sounder Cloudy	8.07	0.42	67.98

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.01	1.93	1.66
Sounder Uncertain	5.29	5.29	6.33
Sounder Cloudy	3.21	10.35	62.92

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.43	2.36	1.82

Sounder Uncertain	4.29	5.83	6.80
Sounder Cloudy	2.05	10.47	63.96

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.99	0.11
Frequency Bias	0.32	29.20	0.97
Probability of Detection	0.20	0.27	0.86
False Alarm Rate	0.09	0.60	0.31

Overall Skill Score

Skill Score	Value
Proportion Correct	0.722
Kuiper Skill Score	0.312
Heidke Skill Score	0.275

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.54	0.69	0.18
Frequency Bias	0.57	0.96	1.08
Probability of Detection	0.26	0.30	0.89
False Alarm Rate	0.12	0.40	0.47

Overall Skill Score

Skill Score	Value
Proportion Correct	0.712
Kuiper Skill Score	0.293
Heidke Skill Score	0.315

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.63	0.66	0.16

Frequency Bias	0.75	0.91	1.05
Probability of Detection	0.28	0.31	0.88
False Alarm Rate	0.15	0.40	0.45

Overall Skill Score

Skill Score	Value
Proportion Correct	0.722
Kuiper Skill Score	0.302
Heidke Skill Score	0.319

INSAT-3D Sounder vs MODIS for July , 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	74	170	205
Sounder Uncertain	39	114	301
Sounder Cloudy	15	7	2126

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	66	198	185
Sounder Uncertain	27	135	292
Sounder Cloudy	12	28	2108

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	36	214	199

Sounder Uncertain	16	129	309
Sounder Cloudy	4	29	2115

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.43	5.57	6.72
Sounder Uncertain	1.28	3.74	9.87
Sounder Cloudy	0.49	0.23	69.68

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.16	6.49	6.06
Sounder Uncertain	0.88	4.42	9.57
Sounder Cloudy	0.39	0.92	69.09

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1.18	7.01	6.52
Sounder Uncertain	0.52	4.23	10.13
Sounder Cloudy	0.13	0.95	69.32

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.84	0.75	0.01
Frequency Bias	3.51	1.56	0.82
Probability of Detection	0.58	0.39	0.81
False Alarm Rate	0.51	0.46	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.758
Kuiper Skill Score	0.534
Heidke Skill Score	0.351

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.85	0.70	0.02
Frequency Bias	4.28	1.26	0.83
Probability of Detection	0.63	0.37	0.82
False Alarm Rate	0.52	0.43	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.757
Kuiper Skill Score	0.516
Heidke Skill Score	0.361

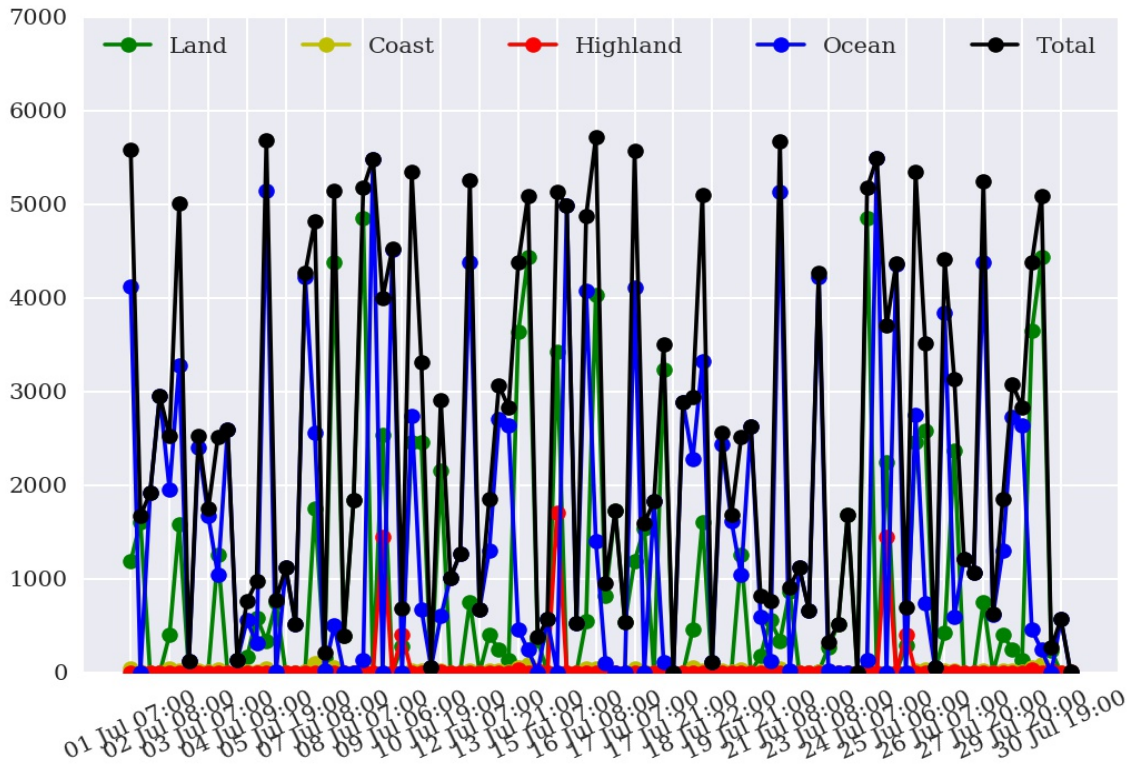
Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.92	0.72	0.02
Frequency Bias	8.02	1.22	0.82
Probability of Detection	0.64	0.35	0.81
False Alarm Rate	0.54	0.42	0.04

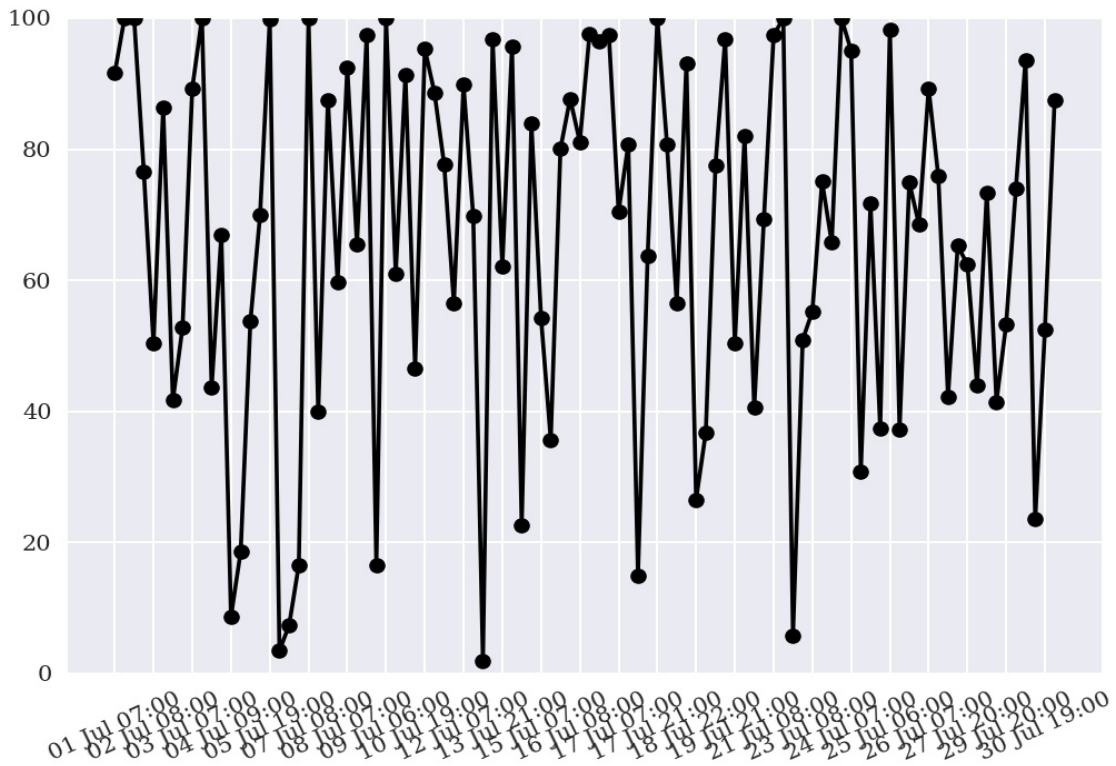
Overall Skill Score

Skill Score	Value
Proportion Correct	0.747
Kuiper Skill Score	0.493
Heidke Skill Score	0.324

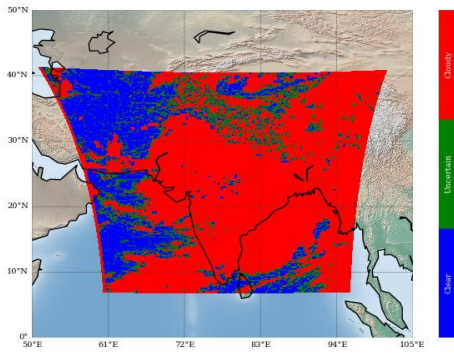
Number of Collocations for Jul-2017



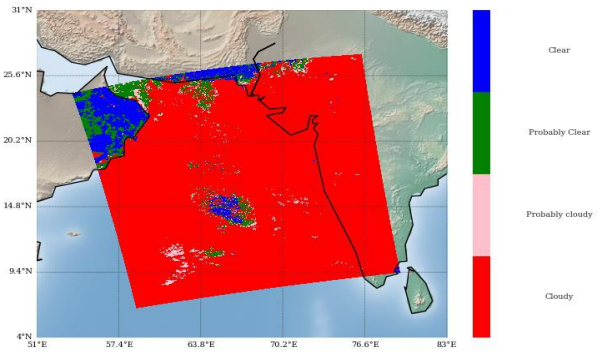
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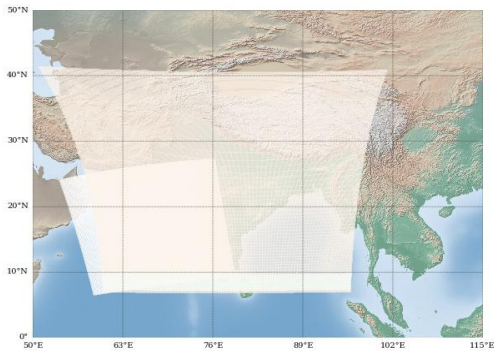
INSAT-3D Sounder Cloud Mask on
01 July, 2017 09:00 UTC



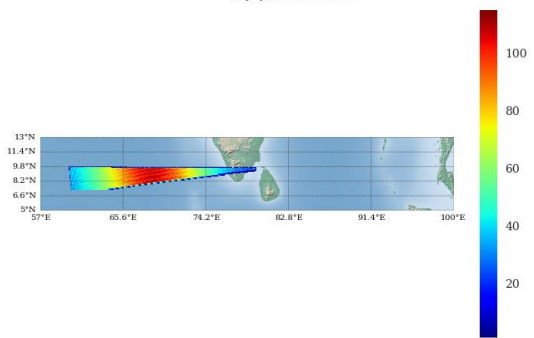
Modis Cloud Mask on
01 July, 2017 08:55 UTC



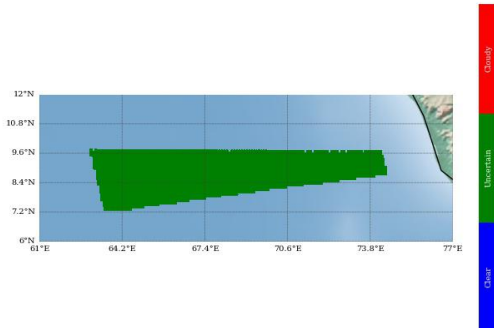
MODIS pass over INSAT-3D Sounder on
01 July, 2017 08:55 UTC



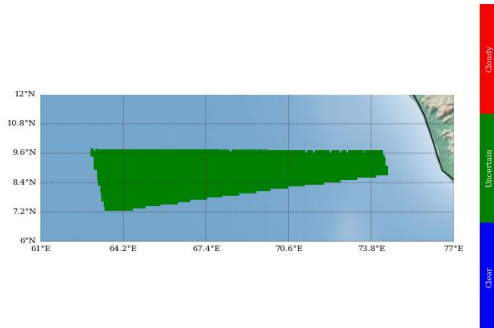
Number of Modis Pixels per Sounder Pixels on a
spatially and Temporally Collocated Domain on
01 July, 2017 08:55 UTC



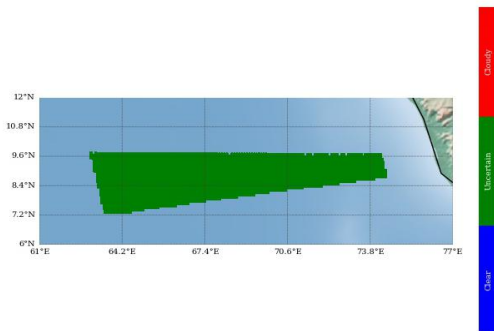
Modis Cloud Mask on Sounder Grid
Method 1 : Mode of Modis pixels



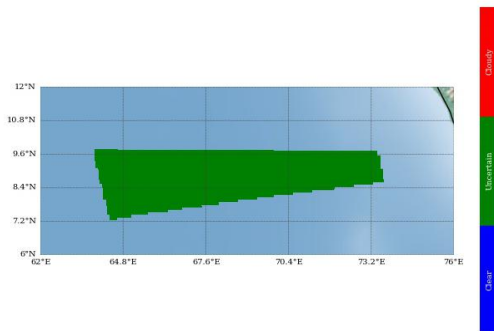
Modis Cloud Mask on Sounder Grid
Method 2 : Weighted Average



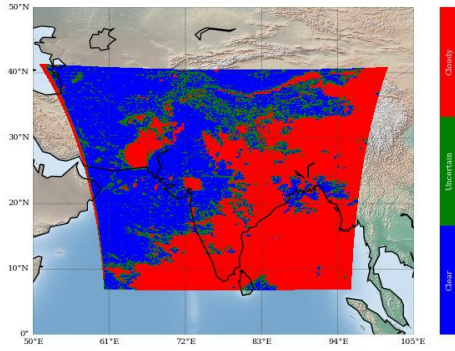
Modis Cloud Mask on Sounder Grid
Method 3 : Weighted Product Average



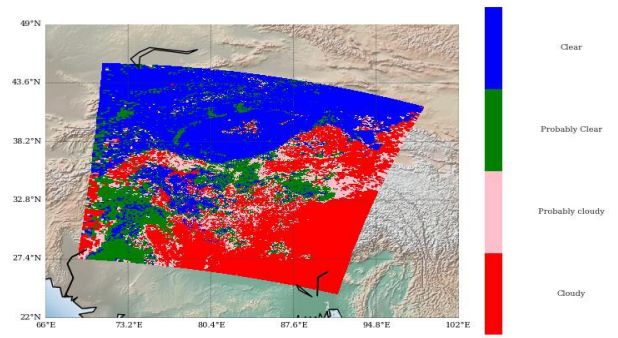
Sounder Cloud Flag on Collocated Area



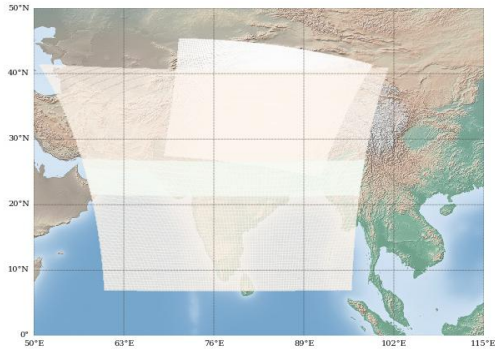
INSAT-3D Sounder Cloud Mask on
07 July, 2017 20:00 UTC



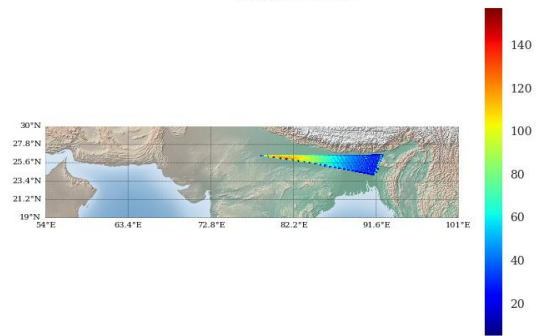
Modis Cloud Mask on
07 July, 2017 20:25 UTC



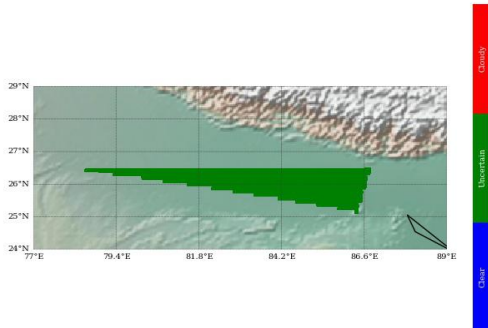
MODIS pass over INSAT-3D Sounder on
07 July, 2017 20:25 UTC



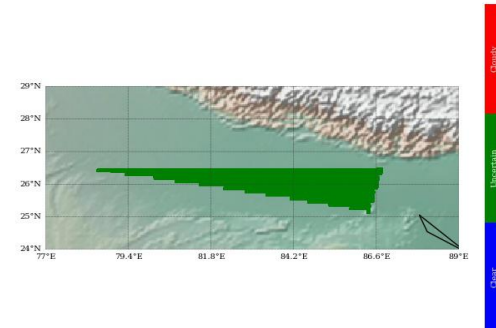
Number of Modis Pixels per Sounder Pixels on a
spatially and Temporally Collocated Domain on
07 July, 2017 20:25 UTC



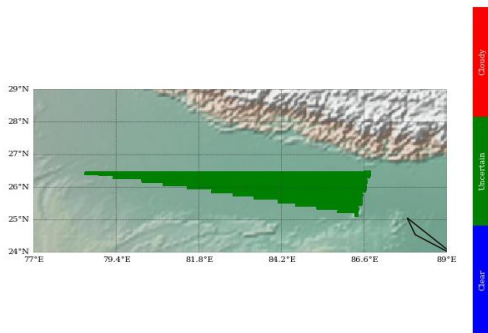
Modis Cloud Mask on Sounder Grid
Method 1 : Mode of Modis pixels



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

