

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 , 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	99685	33901	13626
Sounder Uncertain	14716	4143	8473
Sounder Cloudy	3386	546	4897

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	94604	42732	9876
Sounder Uncertain	12683	7998	6651
Sounder Cloudy	2643	2037	4149

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	87084	48431	11697
Sounder Uncertain	11099	8715	7518
Sounder Cloudy	2235	2176	4418

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	54.36	18.49	7.43
Sounder Uncertain	8.03	2.26	4.62
Sounder Cloudy	1.85	0.30	2.67

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51.59	23.30	5.39
Sounder Uncertain	6.92	4.36	3.63
Sounder Cloudy	1.44	1.11	2.26

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	47.49	26.41	6.38
Sounder Uncertain	6.05	4.75	4.10
Sounder Cloudy	1.22	1.19	2.41

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.32	0.85	0.45
Frequency Bias	1.25	0.71	0.33
Probability of Detection	0.85	0.11	0.18
False Alarm Rate	0.64	0.31	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.593
Kuiper Skill Score	0.074
Heidke Skill Score	0.087

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.36	0.71	0.53
Frequency Bias	1.34	0.52	0.43
Probability of Detection	0.86	0.15	0.20
False Alarm Rate	0.69	0.25	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.582
Kuiper Skill Score	0.096
Heidke Skill Score	0.112

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.41	0.68	0.50
Frequency Bias	1.47	0.46	0.37
Probability of Detection	0.87	0.15	0.19
False Alarm Rate	0.72	0.22	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.547
Kuiper Skill Score	0.091
Heidke Skill Score	0.104

INSAT-3D Sounder vs MODIS for November , 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	45412	18303	6657
Sounder Uncertain	6843	1630	2686
Sounder Cloudy	1464	128	2927

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	43413	21437	5522
Sounder Uncertain	5975	2986	2198
Sounder Cloudy	1087	790	2642

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	38176	25906	6290
Sounder Uncertain	5204	3538	2417
Sounder Cloudy	913	859	2747

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	52.77	21.27	7.74
Sounder Uncertain	7.95	1.89	3.12
Sounder Cloudy	1.70	0.15	3.40

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	50.45	24.91	6.42
Sounder Uncertain	6.94	3.47	2.55
Sounder Cloudy	1.26	0.92	3.07

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	44.36	30.11	7.31
Sounder Uncertain	6.05	4.11	2.81
Sounder Cloudy	1.06	1.00	3.19

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.35	0.85	0.35
Frequency Bias	1.31	0.56	0.37
Probability of Detection	0.85	0.08	0.24
False Alarm Rate	0.69	0.26	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.581
Kuiper Skill Score	0.061
Heidke Skill Score	0.072

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.73	0.42
Frequency Bias	1.39	0.44	0.44
Probability of Detection	0.86	0.12	0.25
False Alarm Rate	0.73	0.22	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.570
Kuiper Skill Score	0.083
Heidke Skill Score	0.096

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.46	0.68	0.39
Frequency Bias	1.59	0.37	0.39
Probability of Detection	0.86	0.12	0.24
False Alarm Rate	0.77	0.18	0.04

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.517
Kuiper Skill Score	0.073
Heidke Skill Score	0.082

INSAT-3D Sounder vs MODIS for November , 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	54273	15598	6969
Sounder Uncertain	7873	2513	5787
Sounder Cloudy	1922	418	1970

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51191	21295	4354
Sounder Uncertain	6708	5012	4453
Sounder Cloudy	1556	1247	1507

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48908	22525	5407
Sounder Uncertain	5895	5177	5101
Sounder Cloudy	1322	1317	1671

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	55.77	16.03	7.16
Sounder Uncertain	8.09	2.58	5.95
Sounder Cloudy	1.97	0.43	2.02

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	52.60	21.88	4.47
Sounder Uncertain	6.89	5.15	4.58
Sounder Cloudy	1.60	1.28	1.55

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	50.25	23.14	5.56
Sounder Uncertain	6.06	5.32	5.24
Sounder Cloudy	1.36	1.35	1.72

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.29	0.84	0.54
Frequency Bias	1.20	0.87	0.29
Probability of Detection	0.85	0.14	0.13
False Alarm Rate	0.59	0.35	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.604
Kuiper Skill Score	0.090
Heidke Skill Score	0.103

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.33	0.69	0.65
Frequency Bias	1.29	0.59	0.42
Probability of Detection	0.86	0.18	0.15
False Alarm Rate	0.65	0.28	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.593
Kuiper Skill Score	0.110
Heidke Skill Score	0.126

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.36	0.68	0.61
Frequency Bias	1.37	0.56	0.35
Probability of Detection	0.87	0.18	0.14
False Alarm Rate	0.67	0.26	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.573
Kuiper Skill Score	0.111
Heidke Skill Score	0.128

INSAT-3D Sounder vs MODIS for November , 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	77228	11858	6096
Sounder Uncertain	8083	1203	2929
Sounder Cloudy	1300	167	1301

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	74862	16354	3966
Sounder Uncertain	7433	2359	2423
Sounder Cloudy	1119	520	1129

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	69188	21368	4626
Sounder Uncertain	6728	2903	2584
Sounder Cloudy	978	619	1171

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	70.10	10.76	5.53
Sounder Uncertain	7.34	1.09	2.66
Sounder Cloudy	1.18	0.15	1.18

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	67.95	14.85	3.60
Sounder Uncertain	6.75	2.14	2.20
Sounder Cloudy	1.02	0.47	1.02

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	62.80	19.40	4.20

Sounder Uncertain	6.11	2.64	2.35
Sounder Cloudy	0.89	0.56	1.06

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.19	0.90	0.53
Frequency Bias	1.10	0.92	0.27
Probability of Detection	0.89	0.09	0.13
False Alarm Rate	0.59	0.36	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.724
Kuiper Skill Score	0.080
Heidke Skill Score	0.094

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.21	0.81	0.59
Frequency Bias	1.14	0.64	0.37
Probability of Detection	0.90	0.12	0.15
False Alarm Rate	0.64	0.31	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.711
Kuiper Skill Score	0.092
Heidke Skill Score	0.111

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.27	0.76	0.58

Frequency Bias	1.24	0.49	0.33
Probability of Detection	0.90	0.12	0.14
False Alarm Rate	0.70	0.25	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.665
Kuiper Skill Score	0.077
Heidke Skill Score	0.095

INSAT-3D Sounder vs MODIS for November , 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	28537	11507	2721
Sounder Uncertain	3233	1110	435
Sounder Cloudy	146	52	464

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	27966	12652	2147
Sounder Uncertain	3058	1380	340
Sounder Cloudy	117	112	433

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23637	16620	2508

Sounder Uncertain	2590	1806	382
Sounder Cloudy	107	112	443

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	59.20	23.87	5.64
Sounder Uncertain	6.71	2.30	0.90
Sounder Cloudy	0.30	0.11	0.96

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	58.01	26.25	4.45
Sounder Uncertain	6.34	2.86	0.71
Sounder Cloudy	0.24	0.23	0.90

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	49.03	34.48	5.20
Sounder Uncertain	5.37	3.75	0.79
Sounder Cloudy	0.22	0.23	0.92

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.33	0.77	0.30
Frequency Bias	1.34	0.38	0.18
Probability of Detection	0.89	0.09	0.13
False Alarm Rate	0.79	0.20	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.625
Kuiper Skill Score	0.021
Heidke Skill Score	0.026

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.35	0.71	0.35
Frequency Bias	1.37	0.34	0.23
Probability of Detection	0.90	0.10	0.15
False Alarm Rate	0.80	0.18	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.618
Kuiper Skill Score	0.030
Heidke Skill Score	0.037

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.45	0.62	0.33
Frequency Bias	1.62	0.26	0.20
Probability of Detection	0.90	0.10	0.13
False Alarm Rate	0.86	0.13	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.537
Kuiper Skill Score	0.024
Heidke Skill Score	0.028

INSAT-3D Sounder vs MODIS for November , 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	48691	351	3375
Sounder Uncertain	4850	93	2494
Sounder Cloudy	1154	115	837

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	46896	3702	1819
Sounder Uncertain	4375	979	2083
Sounder Cloudy	1002	408	696

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	45551	4748	2118
Sounder Uncertain	4138	1097	2202
Sounder Cloudy	871	507	728

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	78.58	0.57	5.45
Sounder Uncertain	7.83	0.15	4.03
Sounder Cloudy	1.86	0.19	1.35

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	75.69	5.97	2.94
Sounder Uncertain	7.06	1.58	3.36
Sounder Cloudy	1.62	0.66	1.12

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	73.52	7.66	3.42
Sounder Uncertain	6.68	1.77	3.55
Sounder Cloudy	1.41	0.82	1.17

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.07	0.99	0.60
Frequency Bias	0.96	13.30	0.31
Probability of Detection	0.89	0.17	0.12
False Alarm Rate	0.30	0.60	0.10

Overall Skill Score

Skill Score	Value
Proportion Correct	0.801
Kuiper Skill Score	0.236
Heidke Skill Score	0.198

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.11	0.87	0.67
Frequency Bias	1.00	1.46	0.46
Probability of Detection	0.90	0.19	0.15
False Alarm Rate	0.41	0.48	0.11

Overall Skill Score

Skill Score	Value
Proportion Correct	0.784
Kuiper Skill Score	0.209
Heidke Skill Score	0.211

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.13	0.85	0.65
Frequency Bias	1.04	1.17	0.42
Probability of Detection	0.90	0.17	0.14
False Alarm Rate	0.47	0.43	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.765
Kuiper Skill Score	0.187
Heidke Skill Score	0.201

INSAT-3D Sounder vs MODIS for November , 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	15490	19097	4960
Sounder Uncertain	1301	1066	2119
Sounder Cloudy	111	10	1064

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13667	21681	4199
Sounder Uncertain	940	1638	1908
Sounder Cloudy	99	29	1057

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	12819	21880	4848
Sounder Uncertain	823	1568	2095
Sounder Cloudy	94	29	1062

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34.26	42.23	10.97
Sounder Uncertain	2.88	2.36	4.69
Sounder Cloudy	0.25	0.02	2.35

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30.22	47.95	9.29
Sounder Uncertain	2.08	3.62	4.22
Sounder Cloudy	0.22	0.06	2.34

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28.35	48.39	10.72
Sounder Uncertain	1.82	3.47	4.63
Sounder Cloudy	0.21	0.06	2.35

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.61	0.76	0.10
Frequency Bias	2.34	0.22	0.15
Probability of Detection	0.92	0.05	0.13
False Alarm Rate	0.87	0.12	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.390
Kuiper Skill Score	0.022
Heidke Skill Score	0.022

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.65	0.63	0.11
Frequency Bias	2.69	0.19	0.17
Probability of Detection	0.93	0.07	0.15
False Alarm Rate	0.90	0.10	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.362
Kuiper Skill Score	0.037
Heidke Skill Score	0.033

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.68	0.65	0.10
Frequency Bias	2.88	0.19	0.15
Probability of Detection	0.93	0.07	0.13
False Alarm Rate	0.90	0.10	0.00

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.342
Kuiper Skill Score	0.033
Heidke Skill Score	0.029

INSAT-3D Sounder vs MODIS for November , 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	13780	6524	3714
Sounder Uncertain	1059	398	1384
Sounder Cloudy	64	4	1039

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	12547	8219	3252
Sounder Uncertain	819	757	1265
Sounder Cloudy	56	19	1032

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	11866	8522	3630
Sounder Uncertain	724	758	1359
Sounder Cloudy	54	17	1036

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	49.27	23.33	13.28
Sounder Uncertain	3.79	1.42	4.95
Sounder Cloudy	0.23	0.01	3.72

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	44.87	29.39	11.63
Sounder Uncertain	2.93	2.71	4.52
Sounder Cloudy	0.20	0.07	3.69

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	42.43	30.47	12.98
Sounder Uncertain	2.59	2.71	4.86
Sounder Cloudy	0.19	0.06	3.70

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.43	0.86	0.06
Frequency Bias	1.61	0.41	0.18
Probability of Detection	0.92	0.06	0.17
False Alarm Rate	0.80	0.19	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.544
Kuiper Skill Score	0.087
Heidke Skill Score	0.103

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.48	0.73	0.07
Frequency Bias	1.79	0.32	0.20
Probability of Detection	0.93	0.08	0.19
False Alarm Rate	0.84	0.15	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.513
Kuiper Skill Score	0.096
Heidke Skill Score	0.109

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.51	0.73	0.06
Frequency Bias	1.90	0.31	0.18
Probability of Detection	0.94	0.08	0.17
False Alarm Rate	0.85	0.15	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.488
Kuiper Skill Score	0.091
Heidke Skill Score	0.102

INSAT-3D Sounder vs MODIS for November , 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	1710	12573	1246
Sounder Uncertain	242	668	735
Sounder Cloudy	47	6	25

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1120	13462	947
Sounder Uncertain	121	881	643
Sounder Cloudy	43	10	25

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	953	13358	1218
Sounder Uncertain	99	810	736
Sounder Cloudy	40	12	26

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9.91	72.88	7.22
Sounder Uncertain	1.40	3.87	4.26
Sounder Cloudy	0.27	0.03	0.14

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6.49	78.03	5.49
Sounder Uncertain	0.70	5.11	3.73
Sounder Cloudy	0.25	0.06	0.14

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.52	77.43	7.06

Souder Uncertain	0.57	4.70	4.27
Souder Cloudy	0.23	0.07	0.15

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.89	0.59	0.68
Frequency Bias	7.77	0.12	0.04
Probability of Detection	0.86	0.05	0.01
False Alarm Rate	0.93	0.07	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.139
Kuiper Skill Score	-0.101
Heidke Skill Score	-0.047

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.93	0.46	0.68
Frequency Bias	12.09	0.11	0.05
Probability of Detection	0.87	0.06	0.02
False Alarm Rate	0.95	0.05	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.117
Kuiper Skill Score	-0.100
Heidke Skill Score	-0.034

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.94	0.51	0.67

Frequency Bias	14.22	0.12	0.04
Probability of Detection	0.87	0.06	0.01
False Alarm Rate	0.94	0.05	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.104
Kuiper Skill Score	-0.105
Heidke Skill Score	-0.037

INSAT-3D Sounder vs MODIS for November , 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	435	116	50
Sounder Uncertain	129	31	21
Sounder Cloudy	21	2	7

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	388	193	20
Sounder Uncertain	119	46	16
Sounder Cloudy	18	6	6

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	345	233	23

Sounder Uncertain	111	52	18
Sounder Cloudy	18	6	6

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	53.57	14.29	6.16
Sounder Uncertain	15.89	3.82	2.59
Sounder Cloudy	2.59	0.25	0.86

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	47.78	23.77	2.46
Sounder Uncertain	14.66	5.67	1.97
Sounder Cloudy	2.22	0.74	0.74

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	42.49	28.69	2.83
Sounder Uncertain	13.67	6.40	2.22
Sounder Cloudy	2.22	0.74	0.74

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.28	0.83	0.77
Frequency Bias	1.03	1.21	0.38
Probability of Detection	0.74	0.21	0.09
False Alarm Rate	0.49	0.44	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.583
Kuiper Skill Score	0.011
Heidke Skill Score	0.011

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.35	0.75	0.80
Frequency Bias	1.14	0.74	0.71
Probability of Detection	0.74	0.19	0.14
False Alarm Rate	0.57	0.36	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.542
Kuiper Skill Score	-0.012
Heidke Skill Score	-0.013

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.43	0.71	0.80
Frequency Bias	1.27	0.62	0.64
Probability of Detection	0.73	0.18	0.13
False Alarm Rate	0.63	0.32	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.496
Kuiper Skill Score	-0.034
Heidke Skill Score	-0.037

INSAT-3D Sounder vs MODIS for November , 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	254	31	21
Sounder Uncertain	106	14	10
Sounder Cloudy	16	1	6

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	239	59	8
Sounder Uncertain	99	22	9
Sounder Cloudy	15	2	6

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	216	81	9
Sounder Uncertain	94	27	9
Sounder Cloudy	15	2	6

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	55.34	6.75	4.58
Sounder Uncertain	23.09	3.05	2.18
Sounder Cloudy	3.49	0.22	1.31

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	52.07	12.85	1.74
Sounder Uncertain	21.57	4.79	1.96
Sounder Cloudy	3.27	0.44	1.31

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	47.06	17.65	1.96
Sounder Uncertain	20.48	5.88	1.96
Sounder Cloudy	3.27	0.44	1.31

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.17	0.89	0.74
Frequency Bias	0.81	2.83	0.62
Probability of Detection	0.68	0.30	0.16
False Alarm Rate	0.28	0.63	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.597
Kuiper Skill Score	0.059
Heidke Skill Score	0.044

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.22	0.83	0.74
Frequency Bias	0.87	1.57	1.00
Probability of Detection	0.68	0.27	0.26
False Alarm Rate	0.35	0.56	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.582
Kuiper Skill Score	0.041
Heidke Skill Score	0.035

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.29	0.79	0.74
Frequency Bias	0.94	1.18	0.96
Probability of Detection	0.66	0.25	0.25
False Alarm Rate	0.43	0.49	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.542
Kuiper Skill Score	-0.000
Heidke Skill Score	-0.000

INSAT-3D Sounder vs MODIS for November , 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	181	85	29
Sounder Uncertain	23	17	11
Sounder Cloudy	5	1	1

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	149	134	12
Sounder Uncertain	20	24	7
Sounder Cloudy	3	4	0

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	129	152	14
Sounder Uncertain	17	25	9
Sounder Cloudy	3	4	0

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51.27	24.08	8.22
Sounder Uncertain	6.52	4.82	3.12
Sounder Cloudy	1.42	0.28	0.28

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	42.21	37.96	3.40
Sounder Uncertain	5.67	6.80	1.98
Sounder Cloudy	0.85	1.13	0.00

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	36.54	43.06	3.97
Sounder Uncertain	4.82	7.08	2.55
Sounder Cloudy	0.85	1.13	0.00

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.39	0.67	0.86
Frequency Bias	1.41	0.50	0.17
Probability of Detection	0.87	0.17	0.02
False Alarm Rate	0.74	0.22	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.564
Kuiper Skill Score	0.044
Heidke Skill Score	0.053

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.49	0.53	1.00
Frequency Bias	1.72	0.31	0.37
Probability of Detection	0.87	0.15	0.00
False Alarm Rate	0.81	0.15	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.490
Kuiper Skill Score	0.028
Heidke Skill Score	0.030

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.56	0.51	1.00
Frequency Bias	1.98	0.28	0.30
Probability of Detection	0.87	0.14	0.00
False Alarm Rate	0.83	0.13	0.04

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.436
Kuiper Skill Score	0.015
Heidke Skill Score	0.014

INSAT-3D Sounder vs MODIS for November , 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	4464	2288	2324
Sounder Uncertain	4576	1750	3294
Sounder Cloudy	1805	344	2486

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3807	3692	1577
Sounder Uncertain	3618	3771	2231
Sounder Cloudy	1278	1429	1928

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3061	3956	2059
Sounder Uncertain	2913	3975	2732
Sounder Cloudy	1026	1463	2146

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	19.13	9.81	9.96
Sounder Uncertain	19.61	7.50	14.12
Sounder Cloudy	7.74	1.47	10.66

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	16.32	15.82	6.76
Sounder Uncertain	15.51	16.16	9.56
Sounder Cloudy	5.48	6.12	8.26

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13.12	16.96	8.83
Sounder Uncertain	12.49	17.04	11.71
Sounder Cloudy	4.40	6.27	9.20

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.51	0.82	0.46
Frequency Bias	0.84	2.20	0.57
Probability of Detection	0.41	0.40	0.31
False Alarm Rate	0.32	0.54	0.15

Overall Skill Score

Skill Score	Value
Proportion Correct	0.373
Kuiper Skill Score	0.073
Heidke Skill Score	0.068

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.58	0.61	0.58
Frequency Bias	1.04	1.08	0.81
Probability of Detection	0.44	0.42	0.34
False Alarm Rate	0.38	0.42	0.20

Overall Skill Score

Skill Score	Value
Proportion Correct	0.407
Kuiper Skill Score	0.086
Heidke Skill Score	0.087

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.66	0.59	0.54
Frequency Bias	1.30	1.02	0.67
Probability of Detection	0.44	0.42	0.31
False Alarm Rate	0.43	0.40	0.18

Overall Skill Score

Skill Score	Value
Proportion Correct	0.394
Kuiper Skill Score	0.078
Heidke Skill Score	0.079

INSAT-3D Sounder vs MODIS for November , 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	1708	37	105
Sounder Uncertain	1974	70	812
Sounder Cloudy	1140	59	1393

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1591	197	62
Sounder Uncertain	1556	747	553
Sounder Cloudy	803	639	1150

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1507	270	73
Sounder Uncertain	1385	838	633
Sounder Cloudy	646	708	1238

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23.40	0.51	1.44
Sounder Uncertain	27.05	0.96	11.13
Sounder Cloudy	15.62	0.81	19.09

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	21.80	2.70	0.85
Sounder Uncertain	21.32	10.24	7.58
Sounder Cloudy	11.00	8.76	15.76

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20.65	3.70	1.00

Sounder Uncertain	18.98	11.48	8.67
Sounder Cloudy	8.85	9.70	16.96

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.08	0.98	0.46
Frequency Bias	0.38	17.20	1.12
Probability of Detection	0.35	0.42	0.60
False Alarm Rate	0.03	0.68	0.29

Overall Skill Score

Skill Score	Value
Proportion Correct	0.435
Kuiper Skill Score	0.315
Heidke Skill Score	0.205

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.14	0.74	0.56
Frequency Bias	0.47	1.80	1.47
Probability of Detection	0.40	0.47	0.65
False Alarm Rate	0.07	0.55	0.38

Overall Skill Score

Skill Score	Value
Proportion Correct	0.478
Kuiper Skill Score	0.283
Heidke Skill Score	0.246

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.19	0.71	0.52

Frequency Bias	0.52	1.57	1.33
Probability of Detection	0.43	0.46	0.64
False Alarm Rate	0.09	0.54	0.36

Overall Skill Score

Skill Score	Value
Proportion Correct	0.491
Kuiper Skill Score	0.279
Heidke Skill Score	0.257

INSAT-3D Sounder vs MODIS for November , 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	2756	2251	2219
Sounder Uncertain	2602	1680	2482
Sounder Cloudy	665	285	1093

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2216	3495	1515
Sounder Uncertain	2062	3024	1678
Sounder Cloudy	475	790	778

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1554	3686	1986

Sounder Uncertain	1528	3137	2099
Sounder Cloudy	380	755	908

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17.19	14.04	13.84
Sounder Uncertain	16.23	10.48	15.48
Sounder Cloudy	4.15	1.78	6.82

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13.82	21.80	9.45
Sounder Uncertain	12.86	18.86	10.47
Sounder Cloudy	2.96	4.93	4.85

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9.69	22.99	12.39
Sounder Uncertain	9.53	19.57	13.09
Sounder Cloudy	2.37	4.71	5.66

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.62	0.75	0.47
Frequency Bias	1.20	1.60	0.35
Probability of Detection	0.46	0.40	0.19
False Alarm Rate	0.43	0.48	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.345
Kuiper Skill Score	0.028
Heidke Skill Score	0.028

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.69	0.55	0.62
Frequency Bias	1.52	0.93	0.51
Probability of Detection	0.47	0.41	0.20
False Alarm Rate	0.50	0.37	0.13

Overall Skill Score

Skill Score	Value
Proportion Correct	0.375
Kuiper Skill Score	0.028
Heidke Skill Score	0.028

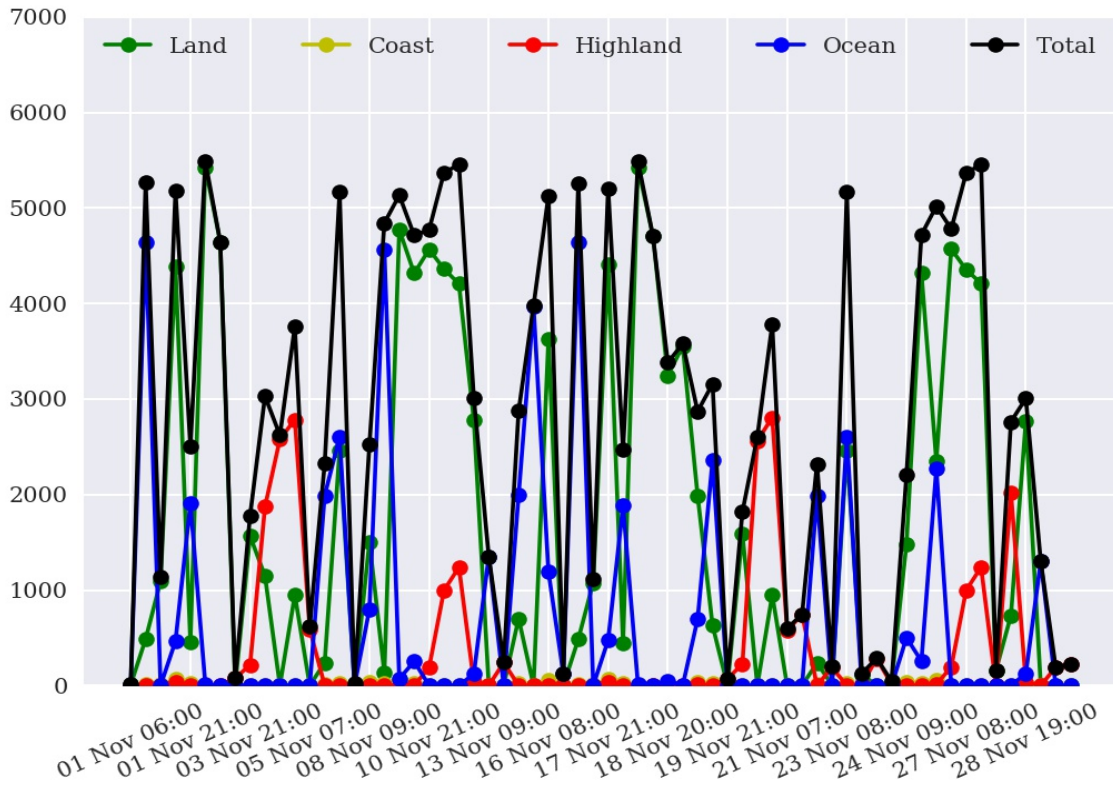
Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.78	0.54	0.56
Frequency Bias	2.09	0.89	0.41
Probability of Detection	0.45	0.41	0.18
False Alarm Rate	0.54	0.35	0.11

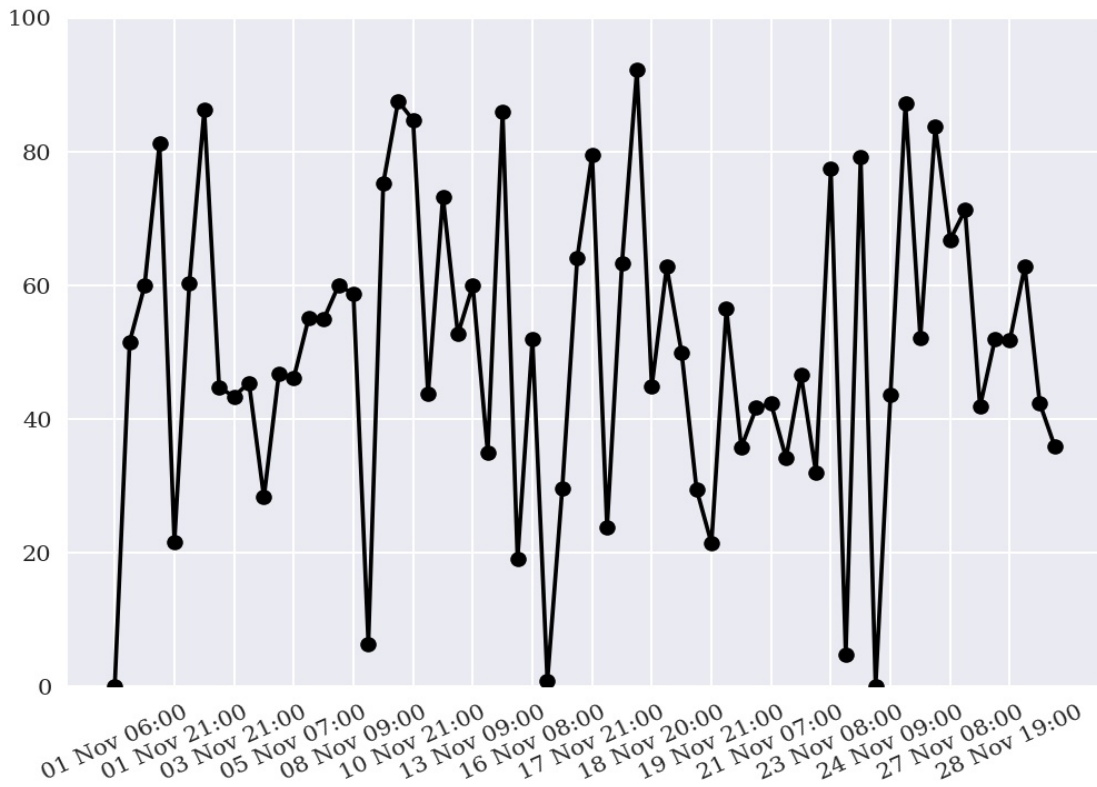
Overall Skill Score

Skill Score	Value
Proportion Correct	0.349
Kuiper Skill Score	0.020
Heidke Skill Score	0.019

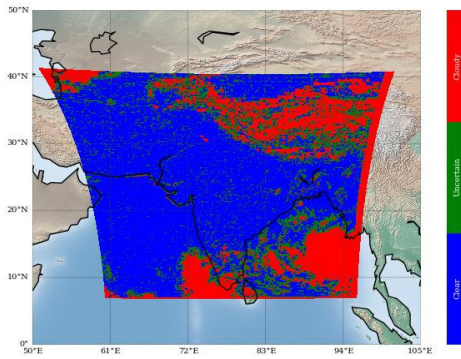
Number of Collocations for Nov-2016



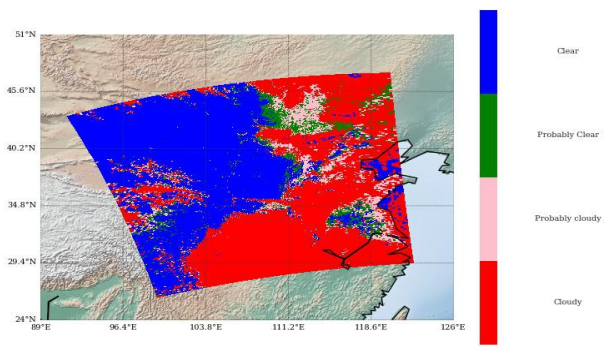
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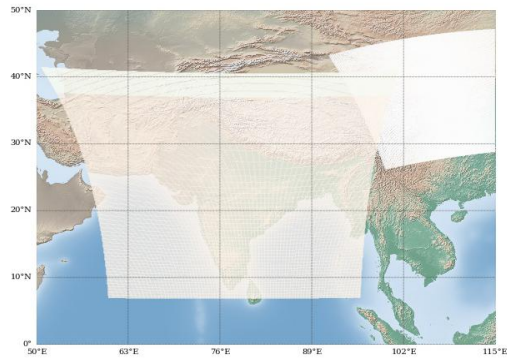
INSAT-3D Sounder Cloud Mask on 01 November, 2016 06:00 UTC



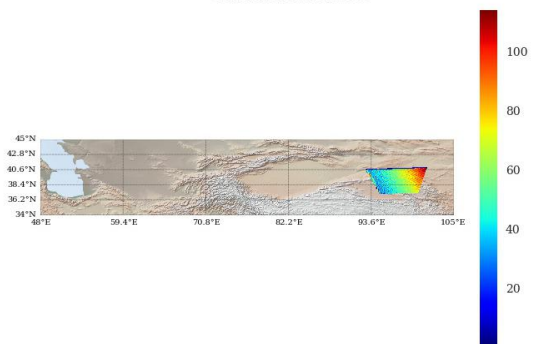
Modis Cloud Mask on 01 November, 2016 05:55 UTC



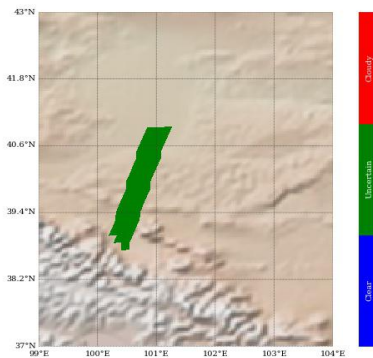
MODIS pass over INSAT-3D Sounder on 01 November, 2016 05:55 UTC



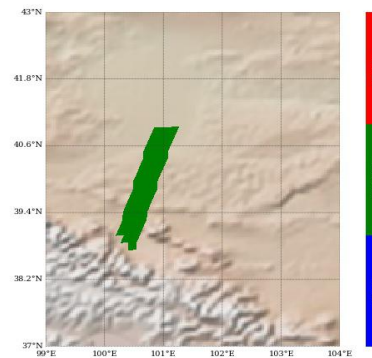
Number of Modis Pixels per Sounder Pixels on a spatially and Temporally Collocated Domain on 01 November, 2016 05:55 UTC



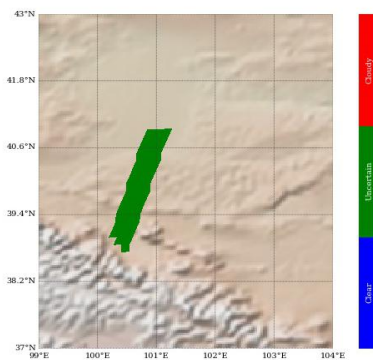
Modis Cloud Mask on Sounder Grid Method 1 : Mode of Modis pixels



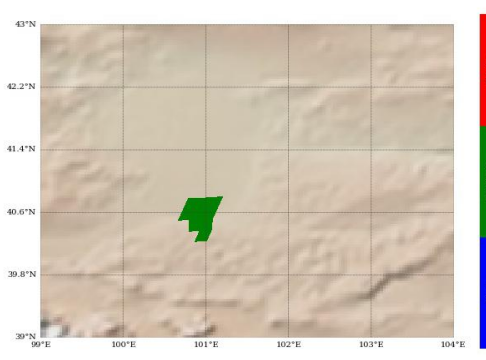
Modis Cloud Mask on Sounder Grid Method 2 : Weighted Average



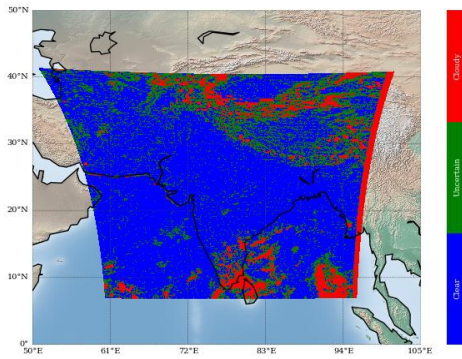
Modis Cloud Mask on Sounder Grid Method 3 : Weighted Product Average



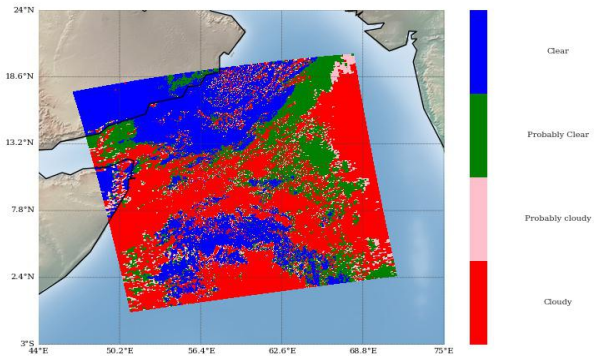
Sounder Cloud Flag on Collocated Area



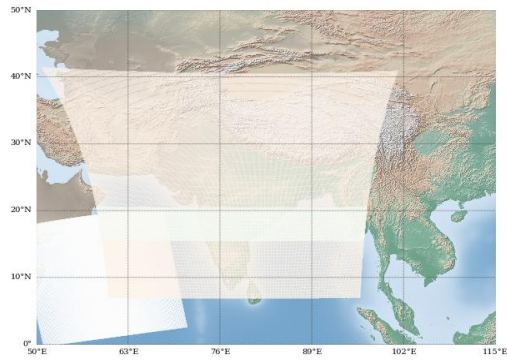
INSAT-3D Sounder Cloud Mask on 13 November, 2016 09:00 UTC



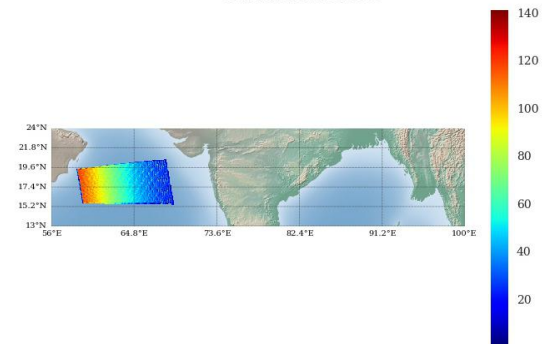
Modis Cloud Mask on 13 November, 2016 09:30 UTC



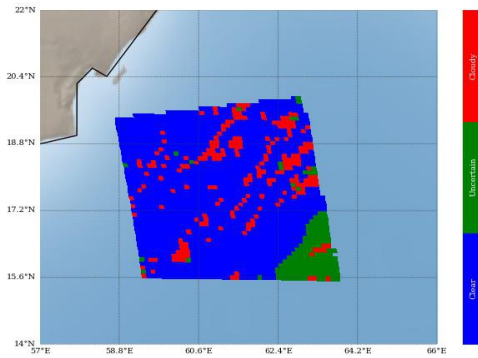
MODIS pass over INSAT-3D Sounder on 13 November, 2016 09:30 UTC



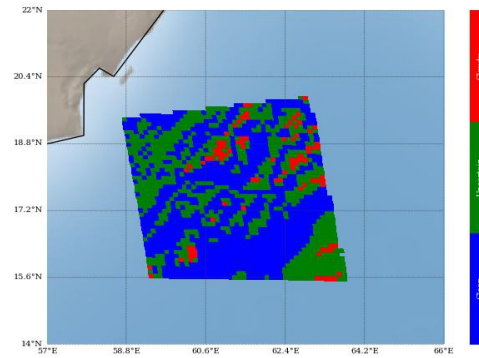
Number of Modis Pixels per Sounder Pixels on a spatially and Temporally Collocated Domain on 13 November, 2016 09:30 UTC



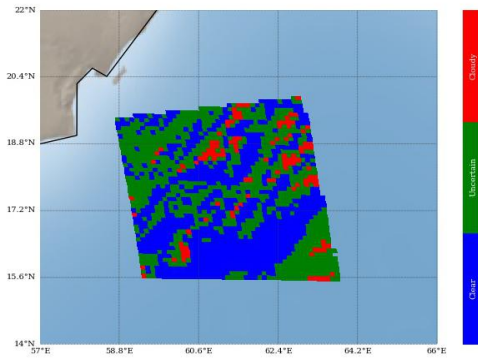
Modis Cloud Mask on Sounder Grid Method 1 : Mode of Modis pixels



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

