

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 December , 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	107149	31596	20379
Sounder Uncertain	14650	3211	10642
Sounder Cloudy	4026	591	6038

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	102249	39244	17631
Sounder Uncertain	12562	7216	8725
Sounder Cloudy	3352	1965	5338

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	94798	44904	19422
Sounder Uncertain	11044	7924	9535
Sounder Cloudy	2984	2093	5578

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	54.04	15.93	10.28
Sounder Uncertain	7.39	1.62	5.37
Sounder Cloudy	2.03	0.30	3.05

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51.57	19.79	8.89
Sounder Uncertain	6.34	3.64	4.40
Sounder Cloudy	1.69	0.99	2.69

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	47.81	22.65	9.80
Sounder Uncertain	5.57	4.00	4.81
Sounder Cloudy	1.50	1.06	2.81

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.33	0.89	0.43
Frequency Bias	1.26	0.81	0.29
Probability of Detection	0.85	0.09	0.16
False Alarm Rate	0.63	0.31	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.587
Kuiper Skill Score	0.079
Heidke Skill Score	0.092

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.36	0.75	0.50
Frequency Bias	1.35	0.59	0.34
Probability of Detection	0.87	0.15	0.17
False Alarm Rate	0.68	0.25	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.579
Kuiper Skill Score	0.102
Heidke Skill Score	0.119

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.40	0.72	0.48
Frequency Bias	1.46	0.52	0.31
Probability of Detection	0.87	0.14	0.16
False Alarm Rate	0.71	0.23	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.546
Kuiper Skill Score	0.096
Heidke Skill Score	0.111

INSAT-3D Sounder vs MODIS for December , 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	56900	12180	7697
Sounder Uncertain	7411	1360	3205
Sounder Cloudy	1985	139	3046

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	54986	15376	6415
Sounder Uncertain	6531	2809	2636
Sounder Cloudy	1591	764	2815

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	49183	20455	7139
Sounder Uncertain	5680	3417	2879
Sounder Cloudy	1398	884	2888

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	60.58	12.97	8.20
Sounder Uncertain	7.89	1.45	3.41
Sounder Cloudy	2.11	0.15	3.24

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	58.54	16.37	6.83
Sounder Uncertain	6.95	2.99	2.81
Sounder Cloudy	1.69	0.81	3.00

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	52.37	21.78	7.60
Sounder Uncertain	6.05	3.64	3.07
Sounder Cloudy	1.49	0.94	3.07

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.26	0.89	0.41
Frequency Bias	1.16	0.88	0.37
Probability of Detection	0.86	0.10	0.22
False Alarm Rate	0.61	0.33	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.653
Kuiper Skill Score	0.107
Heidke Skill Score	0.124

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.28	0.77	0.46
Frequency Bias	1.22	0.63	0.44
Probability of Detection	0.87	0.15	0.24
False Alarm Rate	0.65	0.28	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.645
Kuiper Skill Score	0.129
Heidke Skill Score	0.152

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.36	0.71	0.44
Frequency Bias	1.36	0.48	0.40
Probability of Detection	0.87	0.14	0.22
False Alarm Rate	0.72	0.22	0.06

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.591
Kuiper Skill Score	0.108
Heidke Skill Score	0.128

INSAT-3D Sounder vs MODIS for December , 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	50249	19416	12682
Sounder Uncertain	7239	1851	7437
Sounder Cloudy	2041	452	2992

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	47263	23868	11216
Sounder Uncertain	6031	4407	6089
Sounder Cloudy	1761	1201	2523

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	45615	24449	12283
Sounder Uncertain	5364	4507	6656
Sounder Cloudy	1586	1209	2690

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48.15	18.61	12.15
Sounder Uncertain	6.94	1.77	7.13
Sounder Cloudy	1.96	0.43	2.87

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	45.29	22.87	10.75
Sounder Uncertain	5.78	4.22	5.83
Sounder Cloudy	1.69	1.15	2.42

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	43.71	23.43	11.77
Sounder Uncertain	5.14	4.32	6.38
Sounder Cloudy	1.52	1.16	2.58

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.39	0.89	0.45
Frequency Bias	1.38	0.76	0.24
Probability of Detection	0.84	0.09	0.13
False Alarm Rate	0.65	0.30	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.528
Kuiper Skill Score	0.057
Heidke Skill Score	0.066

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.43	0.73	0.54
Frequency Bias	1.50	0.56	0.28
Probability of Detection	0.86	0.15	0.13
False Alarm Rate	0.70	0.24	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.519
Kuiper Skill Score	0.080
Heidke Skill Score	0.091

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.45	0.73	0.51
Frequency Bias	1.57	0.55	0.25
Probability of Detection	0.87	0.15	0.12
False Alarm Rate	0.71	0.23	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.506
Kuiper Skill Score	0.084
Heidke Skill Score	0.095

INSAT-3D Sounder vs MODIS for December , 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	76777	7652	11797
Sounder Uncertain	8704	1038	5686
Sounder Cloudy	1423	117	2272

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	74281	12078	9867
Sounder Uncertain	7786	2821	4821
Sounder Cloudy	1232	503	2077

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	68769	16890	10567
Sounder Uncertain	6975	3356	5097
Sounder Cloudy	1111	579	2122

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	66.49	6.63	10.22
Sounder Uncertain	7.54	0.90	4.92
Sounder Cloudy	1.23	0.10	1.97

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	64.33	10.46	8.55
Sounder Uncertain	6.74	2.44	4.18
Sounder Cloudy	1.07	0.44	1.80

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	59.56	14.63	9.15

Sounder Uncertain	6.04	2.91	4.41
Sounder Cloudy	0.96	0.50	1.84

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.20	0.93	0.40
Frequency Bias	1.11	1.75	0.19
Probability of Detection	0.88	0.12	0.12
False Alarm Rate	0.55	0.41	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.694
Kuiper Skill Score	0.127
Heidke Skill Score	0.142

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.23	0.82	0.46
Frequency Bias	1.16	1.00	0.23
Probability of Detection	0.89	0.18	0.12
False Alarm Rate	0.60	0.35	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.686
Kuiper Skill Score	0.140
Heidke Skill Score	0.165

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.29	0.78	0.44

Frequency Bias	1.25	0.74	0.21
Probability of Detection	0.89	0.16	0.12
False Alarm Rate	0.67	0.29	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.643
Kuiper Skill Score	0.118
Heidke Skill Score	0.142

INSAT-3D Sounder vs MODIS for December , 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	35407	7463	4458
Sounder Uncertain	4039	952	1291
Sounder Cloudy	155	72	769

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34485	9320	3523
Sounder Uncertain	3761	1458	1063
Sounder Cloudy	110	152	734

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	29738	13580	4010

Sounder Uncertain	3207	1893	1182
Sounder Cloudy	85	162	749

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	64.84	13.67	8.16
Sounder Uncertain	7.40	1.74	2.36
Sounder Cloudy	0.28	0.13	1.41

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	63.15	17.07	6.45
Sounder Uncertain	6.89	2.67	1.95
Sounder Cloudy	0.20	0.28	1.34

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	54.46	24.87	7.34
Sounder Uncertain	5.87	3.47	2.16
Sounder Cloudy	0.16	0.30	1.37

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.25	0.85	0.23
Frequency Bias	1.20	0.74	0.15
Probability of Detection	0.89	0.11	0.12
False Alarm Rate	0.68	0.30	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.680
Kuiper Skill Score	0.072
Heidke Skill Score	0.089

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.27	0.77	0.26
Frequency Bias	1.23	0.57	0.19
Probability of Detection	0.90	0.13	0.14
False Alarm Rate	0.72	0.27	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.672
Kuiper Skill Score	0.083
Heidke Skill Score	0.104

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.37	0.70	0.25
Frequency Bias	1.43	0.40	0.17
Probability of Detection	0.90	0.12	0.13
False Alarm Rate	0.79	0.20	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.593
Kuiper Skill Score	0.063
Heidke Skill Score	0.077

INSAT-3D Sounder vs MODIS for December , 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	41370	189	7339
Sounder Uncertain	4665	86	4395
Sounder Cloudy	1268	45	1503

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39796	2758	6344
Sounder Uncertain	4025	1363	3758
Sounder Cloudy	1122	351	1343

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39031	3310	6557
Sounder Uncertain	3768	1463	3915
Sounder Cloudy	1026	417	1373

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	67.98	0.31	12.06
Sounder Uncertain	7.67	0.14	7.22
Sounder Cloudy	2.08	0.07	2.47

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	65.39	4.53	10.42
Sounder Uncertain	6.61	2.24	6.17
Sounder Cloudy	1.84	0.58	2.21

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	64.13	5.44	10.77
Sounder Uncertain	6.19	2.40	6.43
Sounder Cloudy	1.69	0.69	2.26

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.15	0.99	0.47
Frequency Bias	1.03	28.58	0.21
Probability of Detection	0.87	0.27	0.11
False Alarm Rate	0.42	0.51	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.706
Kuiper Skill Score	0.202
Heidke Skill Score	0.193

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.19	0.85	0.52
Frequency Bias	1.09	2.05	0.25
Probability of Detection	0.89	0.30	0.12
False Alarm Rate	0.50	0.42	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.698
Kuiper Skill Score	0.206
Heidke Skill Score	0.220

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.20	0.84	0.51
Frequency Bias	1.12	1.76	0.24
Probability of Detection	0.89	0.28	0.12
False Alarm Rate	0.52	0.40	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.688
Kuiper Skill Score	0.201
Heidke Skill Score	0.219

INSAT-3D Sounder vs MODIS for December , 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	22834	20873	5265
Sounder Uncertain	1133	550	2211
Sounder Cloudy	67	19	1493

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	21353	22309	5310
Sounder Uncertain	870	1025	1999
Sounder Cloudy	49	52	1478

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20368	22697	5907
Sounder Uncertain	787	989	2118
Sounder Cloudy	46	49	1484

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	41.94	38.34	9.67
Sounder Uncertain	2.08	1.01	4.06
Sounder Cloudy	0.12	0.03	2.74

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39.22	40.98	9.75
Sounder Uncertain	1.60	1.88	3.67
Sounder Cloudy	0.09	0.10	2.71

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37.41	41.69	10.85
Sounder Uncertain	1.45	1.82	3.89
Sounder Cloudy	0.08	0.09	2.73

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.53	0.86	0.05
Frequency Bias	2.04	0.18	0.18
Probability of Detection	0.95	0.03	0.17
False Alarm Rate	0.88	0.11	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.457
Kuiper Skill Score	0.043
Heidke Skill Score	0.047

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.56	0.74	0.06
Frequency Bias	2.20	0.17	0.18
Probability of Detection	0.96	0.04	0.17
False Alarm Rate	0.90	0.09	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.438
Kuiper Skill Score	0.056
Heidke Skill Score	0.058

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.58	0.75	0.06
Frequency Bias	2.31	0.16	0.17
Probability of Detection	0.96	0.04	0.16
False Alarm Rate	0.91	0.09	0.00

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.420
Kuiper Skill Score	0.053
Heidke Skill Score	0.054

INSAT-3D Sounder vs MODIS for December , 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	18017	4415	2995
Sounder Uncertain	796	253	1243
Sounder Cloudy	60	15	1176

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17266	5411	2750
Sounder Uncertain	675	465	1152
Sounder Cloudy	49	34	1168

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	16543	5915	2969
Sounder Uncertain	618	461	1213
Sounder Cloudy	46	33	1172

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	62.19	15.24	10.34
Sounder Uncertain	2.75	0.87	4.29
Sounder Cloudy	0.21	0.05	4.06

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	59.60	18.68	9.49
Sounder Uncertain	2.33	1.61	3.98
Sounder Cloudy	0.17	0.12	4.03

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	57.10	20.42	10.25
Sounder Uncertain	2.13	1.59	4.19
Sounder Cloudy	0.16	0.11	4.05

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.29	0.89	0.06
Frequency Bias	1.35	0.49	0.23
Probability of Detection	0.95	0.05	0.22
False Alarm Rate	0.78	0.21	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.671
Kuiper Skill Score	0.153
Heidke Skill Score	0.193

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.32	0.80	0.07
Frequency Bias	1.41	0.39	0.25
Probability of Detection	0.96	0.08	0.23
False Alarm Rate	0.81	0.18	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.652
Kuiper Skill Score	0.154
Heidke Skill Score	0.194

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.35	0.80	0.06
Frequency Bias	1.48	0.36	0.23
Probability of Detection	0.96	0.07	0.22
False Alarm Rate	0.82	0.17	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.627
Kuiper Skill Score	0.143
Heidke Skill Score	0.178

INSAT-3D Sounder vs MODIS for December , 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	4817	16458	2270
Sounder Uncertain	337	297	968
Sounder Cloudy	7	4	317

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4087	16898	2560
Sounder Uncertain	195	560	847
Sounder Cloudy	0	18	310

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3825	16782	2938
Sounder Uncertain	169	528	905
Sounder Cloudy	0	16	312

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	18.91	64.60	8.91
Sounder Uncertain	1.32	1.17	3.80
Sounder Cloudy	0.03	0.02	1.24

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	16.04	66.33	10.05
Sounder Uncertain	0.77	2.20	3.32
Sounder Cloudy	0.00	0.07	1.22

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	15.01	65.88	11.53

Sounder Uncertain	0.66	2.07	3.55
Sounder Cloudy	0.00	0.06	1.22

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.80	0.81	0.03
Frequency Bias	4.56	0.10	0.09
Probability of Detection	0.93	0.02	0.09
False Alarm Rate	0.93	0.07	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.213
Kuiper Skill Score	-0.034
Heidke Skill Score	-0.022

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.83	0.65	0.05
Frequency Bias	5.50	0.09	0.09
Probability of Detection	0.95	0.03	0.08
False Alarm Rate	0.95	0.05	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.195
Kuiper Skill Score	-0.012
Heidke Skill Score	-0.007

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.84	0.67	0.05

Frequency Bias	5.90	0.09	0.08
Probability of Detection	0.96	0.03	0.08
False Alarm Rate	0.95	0.05	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.183
Kuiper Skill Score	-0.014
Heidke Skill Score	-0.008

INSAT-3D Sounder vs MODIS for December , 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	504	115	59
Sounder Uncertain	122	30	58
Sounder Cloudy	11	8	35

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	452	197	29
Sounder Uncertain	101	69	40
Sounder Cloudy	11	12	31

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	400	244	34

Sounder Uncertain	91	74	45
Sounder Cloudy	9	13	32

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	53.50	12.21	6.26
Sounder Uncertain	12.95	3.18	6.16
Sounder Cloudy	1.17	0.85	3.72

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	47.98	20.91	3.08
Sounder Uncertain	10.72	7.32	4.25
Sounder Cloudy	1.17	1.27	3.29

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	42.46	25.90	3.61
Sounder Uncertain	9.66	7.86	4.78
Sounder Cloudy	0.96	1.38	3.40

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.26	0.86	0.35
Frequency Bias	1.06	1.37	0.36
Probability of Detection	0.79	0.20	0.23
False Alarm Rate	0.47	0.48	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.604
Kuiper Skill Score	0.147
Heidke Skill Score	0.154

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.33	0.67	0.43
Frequency Bias	1.20	0.76	0.54
Probability of Detection	0.80	0.25	0.31
False Alarm Rate	0.58	0.36	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.586
Kuiper Skill Score	0.153
Heidke Skill Score	0.167

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.41	0.65	0.41
Frequency Bias	1.36	0.63	0.49
Probability of Detection	0.80	0.22	0.29
False Alarm Rate	0.64	0.31	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.537
Kuiper Skill Score	0.121
Heidke Skill Score	0.131

INSAT-3D Sounder vs MODIS for December , 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	323	47	23
Sounder Uncertain	93	18	23
Sounder Cloudy	10	3	11

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	303	77	13
Sounder Uncertain	84	36	14
Sounder Cloudy	10	3	11

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	267	113	13
Sounder Uncertain	77	42	15
Sounder Cloudy	8	5	11

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	58.62	8.53	4.17
Sounder Uncertain	16.88	3.27	4.17
Sounder Cloudy	1.81	0.54	2.00

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	54.99	13.97	2.36
Sounder Uncertain	15.25	6.53	2.54
Sounder Cloudy	1.81	0.54	2.00

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48.46	20.51	2.36
Sounder Uncertain	13.97	7.62	2.72
Sounder Cloudy	1.45	0.91	2.00

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.18	0.87	0.54
Frequency Bias	0.92	1.97	0.42
Probability of Detection	0.76	0.26	0.19
False Alarm Rate	0.35	0.58	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.639
Kuiper Skill Score	0.141
Heidke Skill Score	0.128

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.23	0.73	0.54
Frequency Bias	0.99	1.16	0.63
Probability of Detection	0.76	0.31	0.29
False Alarm Rate	0.45	0.49	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.635
Kuiper Skill Score	0.155
Heidke Skill Score	0.155

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.32	0.69	0.54
Frequency Bias	1.12	0.84	0.62
Probability of Detection	0.76	0.26	0.28
False Alarm Rate	0.55	0.40	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.581
Kuiper Skill Score	0.102
Heidke Skill Score	0.109

INSAT-3D Sounder vs MODIS for December , 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	68	36
Sounder Uncertain	29	12	35
Sounder Cloudy	1	5	24

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	149	120	16
Sounder Uncertain	17	33	26
Sounder Cloudy	1	9	20

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	133	131	21
Sounder Uncertain	14	32	30
Sounder Cloudy	1	8	21

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	46.29	17.39	9.21
Sounder Uncertain	7.42	3.07	8.95
Sounder Cloudy	0.26	1.28	6.14

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	38.11	30.69	4.09
Sounder Uncertain	4.35	8.44	6.65
Sounder Cloudy	0.26	2.30	5.12

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34.02	33.50	5.37
Sounder Uncertain	3.58	8.18	7.67
Sounder Cloudy	0.26	2.05	5.37

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.36	0.84	0.20
Frequency Bias	1.35	0.89	0.32
Probability of Detection	0.86	0.14	0.25
False Alarm Rate	0.60	0.37	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.555
Kuiper Skill Score	0.167
Heidke Skill Score	0.185

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.48	0.57	0.33
Frequency Bias	1.71	0.47	0.48
Probability of Detection	0.89	0.20	0.32
False Alarm Rate	0.72	0.23	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.517
Kuiper Skill Score	0.181
Heidke Skill Score	0.189

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.53	0.58	0.30
Frequency Bias	1.93	0.44	0.42
Probability of Detection	0.90	0.19	0.29
False Alarm Rate	0.74	0.21	0.04

Overall Skill Score

Skill Score	Value
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Proportion Correct	0.476
Kuiper Skill Score	0.159
Heidke Skill Score	0.161

INSAT-3D Sounder vs MODIS for December , 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	4726	2447	2959
Sounder Uncertain	4085	1478	2495
Sounder Cloudy	2445	412	2066

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4026	3871	2235
Sounder Uncertain	3256	3087	1715
Sounder Cloudy	1991	1336	1596

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3362	4070	2700
Sounder Uncertain	2694	3251	2113
Sounder Cloudy	1759	1387	1777

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20.45	10.59	12.80
Sounder Uncertain	17.67	6.39	10.79
Sounder Cloudy	10.58	1.78	8.94

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17.42	16.75	9.67
Sounder Uncertain	14.09	13.36	7.42
Sounder Cloudy	8.61	5.78	6.91

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14.55	17.61	11.68
Sounder Uncertain	11.66	14.07	9.14
Sounder Cloudy	7.61	6.00	7.69

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.53	0.82	0.58
Frequency Bias	0.90	1.86	0.65
Probability of Detection	0.42	0.34	0.27
False Alarm Rate	0.36	0.44	0.19

Overall Skill Score

Skill Score	Value
Proportion Correct	0.358
Kuiper Skill Score	0.015
Heidke Skill Score	0.015

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
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False Alarm Ratio	0.60	0.62	0.68
Frequency Bias	1.09	0.97	0.89
Probability of Detection	0.43	0.37	0.29
False Alarm Rate	0.42	0.35	0.23

Overall Skill Score

Skill Score	Value
Proportion Correct	0.377
Kuiper Skill Score	0.038
Heidke Skill Score	0.038

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.67	0.60	0.64
Frequency Bias	1.30	0.93	0.75
Probability of Detection	0.43	0.37	0.27
False Alarm Rate	0.46	0.33	0.21

Overall Skill Score

Skill Score	Value
Proportion Correct	0.363
Kuiper Skill Score	0.034
Heidke Skill Score	0.034

INSAT-3D Sounder vs MODIS for December , 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	1731	37	104
Sounder Uncertain	2015	63	571
Sounder Cloudy	1710	40	1042

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1563	253	56
Sounder Uncertain	1574	725	350
Sounder Cloudy	1375	558	859

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1431	373	68
Sounder Uncertain	1377	863	409
Sounder Cloudy	1217	665	910

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23.67	0.51	1.42
Sounder Uncertain	27.55	0.86	7.81
Sounder Cloudy	23.38	0.55	14.25

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	21.37	3.46	0.77
Sounder Uncertain	21.52	9.91	4.79
Sounder Cloudy	18.80	7.63	11.75

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	19.57	5.10	0.93

Sounder Uncertain	18.83	11.80	5.59
Sounder Cloudy	16.64	9.09	12.44

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.08	0.98	0.63
Frequency Bias	0.34	18.92	1.63
Probability of Detection	0.32	0.45	0.61
False Alarm Rate	0.03	0.58	0.39

Overall Skill Score

Skill Score	Value
Proportion Correct	0.388
Kuiper Skill Score	0.258
Heidke Skill Score	0.141

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.17	0.73	0.69
Frequency Bias	0.41	1.72	2.21
Probability of Detection	0.35	0.47	0.68
False Alarm Rate	0.07	0.46	0.46

Overall Skill Score

Skill Score	Value
Proportion Correct	0.430
Kuiper Skill Score	0.239
Heidke Skill Score	0.186

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.24	0.67	0.67

Frequency Bias	0.47	1.39	2.01
Probability of Detection	0.36	0.45	0.66
False Alarm Rate	0.11	0.43	0.46

Overall Skill Score

Skill Score	Value
Proportion Correct	0.438
Kuiper Skill Score	0.220
Heidke Skill Score	0.189

INSAT-3D Sounder vs MODIS for December , 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	2995	2410	2855
Sounder Uncertain	2070	1415	1924
Sounder Cloudy	735	372	1024

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2463	3618	2179
Sounder Uncertain	1682	2362	1365
Sounder Cloudy	616	778	737

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1931	3697	2632

Sounder Uncertain	1317	2388	1704
Sounder Cloudy	542	722	867

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	18.96	15.25	18.07
Sounder Uncertain	13.10	8.96	12.18
Sounder Cloudy	4.65	2.35	6.48

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	15.59	22.90	13.79
Sounder Uncertain	10.65	14.95	8.64
Sounder Cloudy	3.90	4.92	4.66

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	12.22	23.40	16.66
Sounder Uncertain	8.34	15.11	10.78
Sounder Cloudy	3.43	4.57	5.49

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.64	0.74	0.52
Frequency Bias	1.42	1.29	0.37
Probability of Detection	0.52	0.34	0.18
False Alarm Rate	0.51	0.39	0.11

Overall Skill Score

Skill Score	Value
Proportion Correct	0.344
Kuiper Skill Score	0.017
Heidke Skill Score	0.017

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.70	0.56	0.65
Frequency Bias	1.73	0.80	0.50
Probability of Detection	0.52	0.35	0.17
False Alarm Rate	0.57	0.30	0.14

Overall Skill Score

Skill Score	Value
Proportion Correct	0.352
Kuiper Skill Score	0.018
Heidke Skill Score	0.017

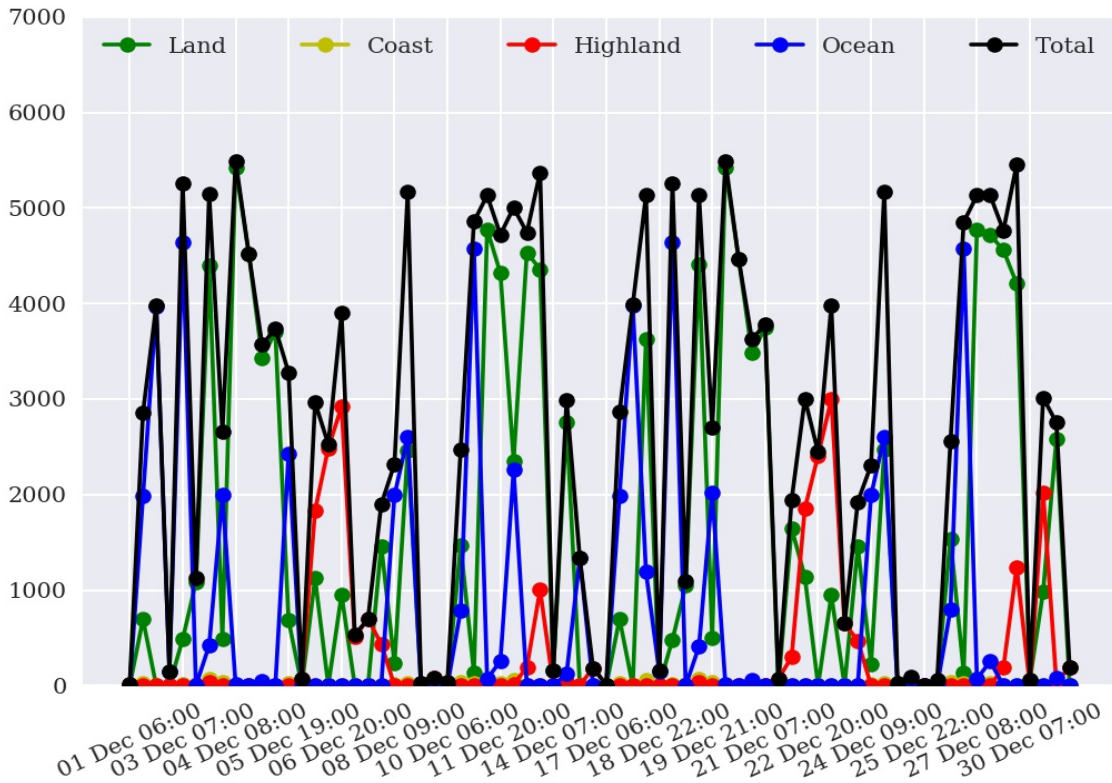
Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.77	0.56	0.59
Frequency Bias	2.18	0.79	0.41
Probability of Detection	0.51	0.35	0.17
False Alarm Rate	0.60	0.28	0.12

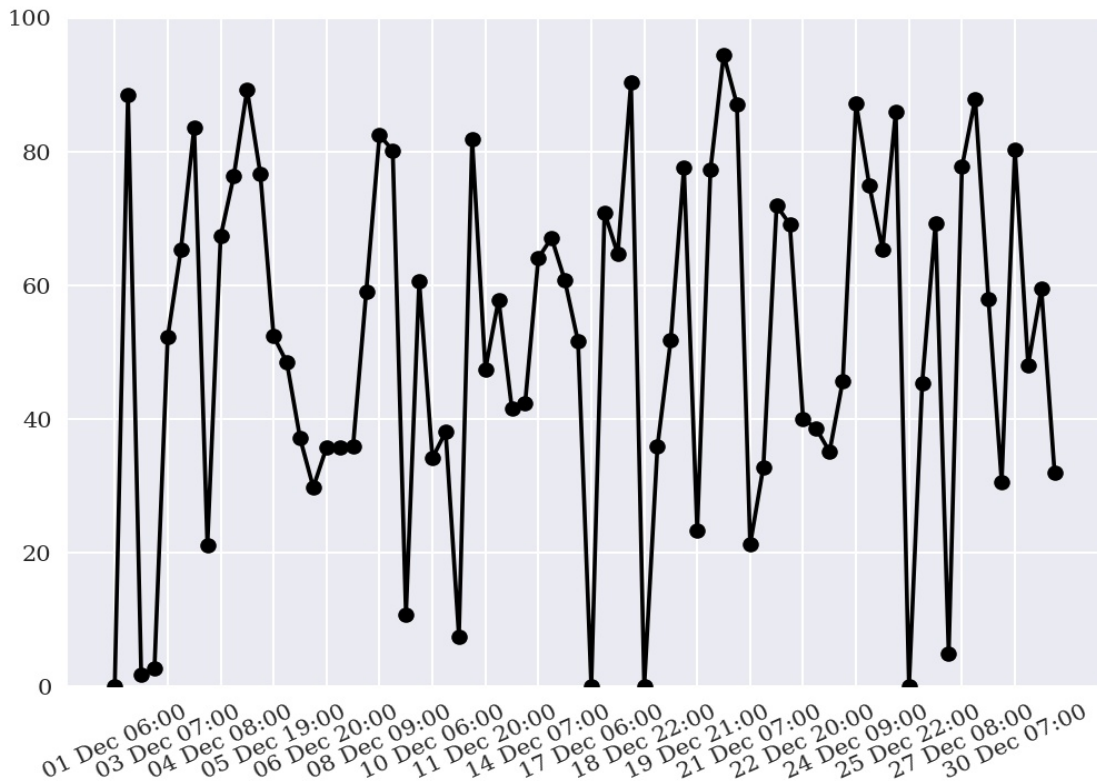
Overall Skill Score

Skill Score	Value
Proportion Correct	0.328
Kuiper Skill Score	0.017
Heidke Skill Score	0.016

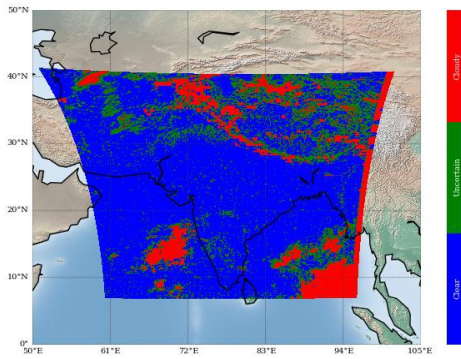
Number of Collocations for Dec-2016



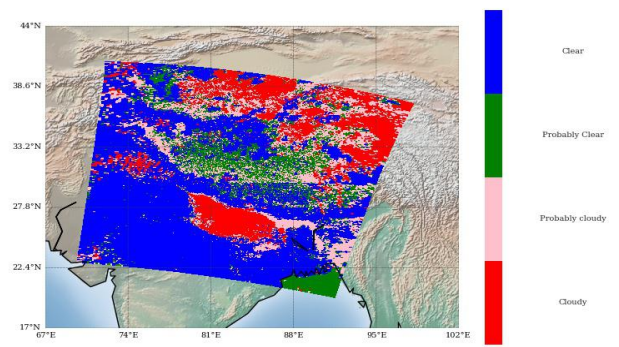
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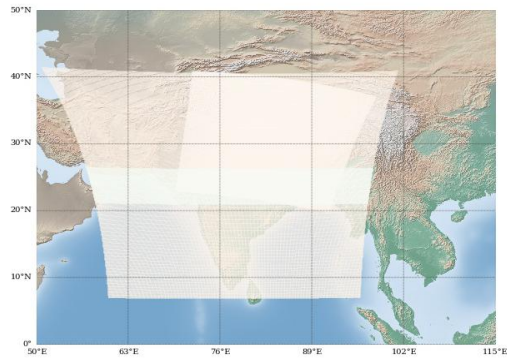
INSAT-3D Sounder Cloud Mask on
04 December, 2016 20:00 UTC



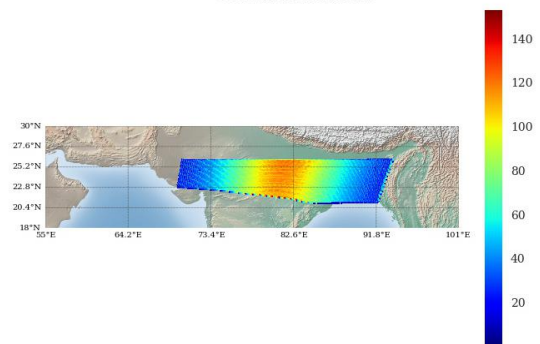
Modis Cloud Mask on
04 December, 2016 20:20 UTC



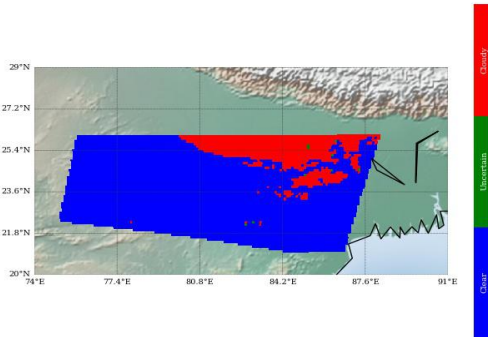
MODIS pass over INSAT-3D Sounder on
04 December, 2016 20:20 UTC



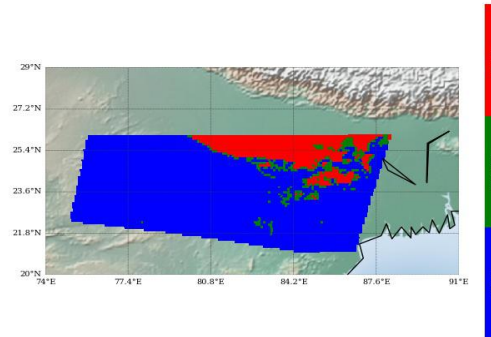
Number of Modis Pixels per Sounder Pixels on a
spatially and Temporally Collocated Domain on
04 December, 2016 20:20 UTC



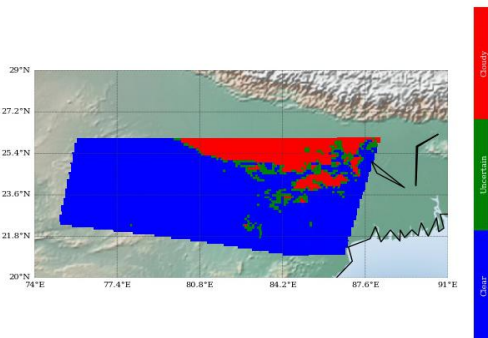
Modis Cloud Mask on Sounder Grid
Method 1 : Mode of Modis pixels



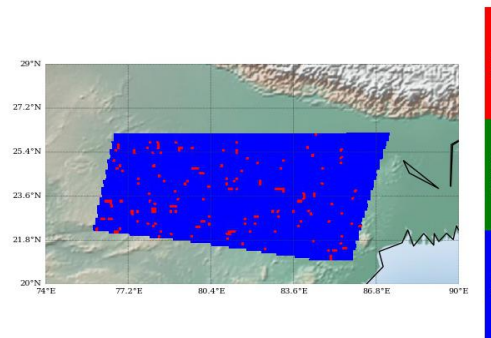
Modis Cloud Mask on Sounder Grid
Method 2 : Weighted Average



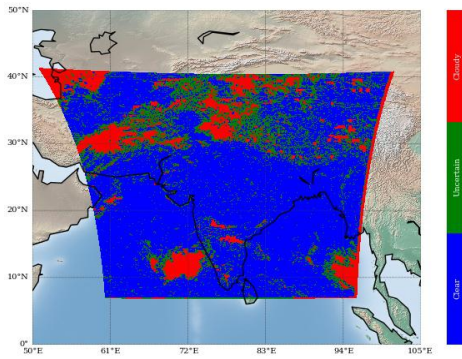
Modis Cloud Mask on Sounder Grid
Method 3 : Weighted Product Average



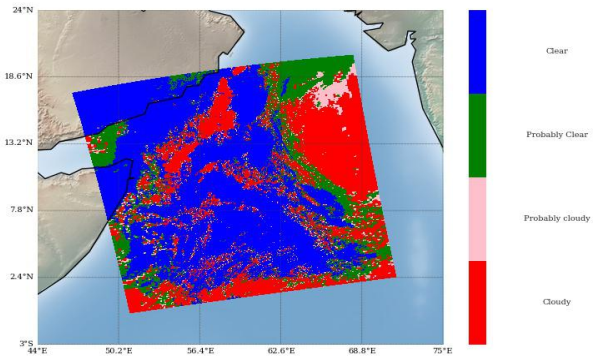
Sounder Cloud Flag on Collocated Area



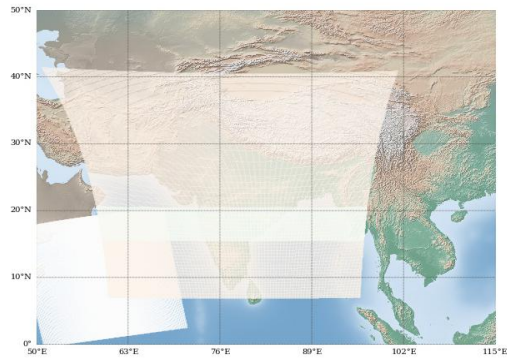
INSAT-3D Sounder Cloud Mask on 15 December, 2016 09:00 UTC



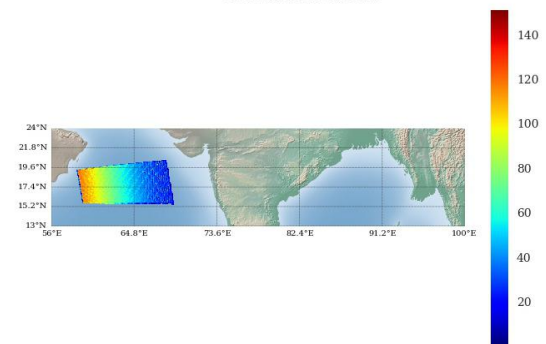
Modis Cloud Mask on 15 December, 2016 09:30 UTC



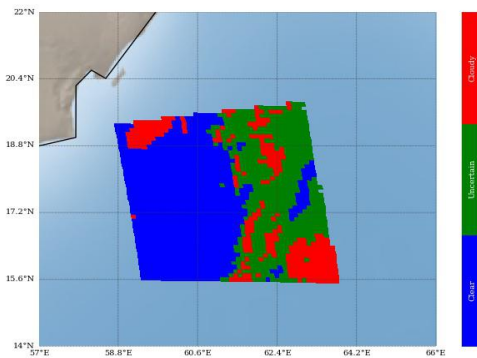
MODIS pass over INSAT-3D Sounder on 15 December, 2016 09:30 UTC



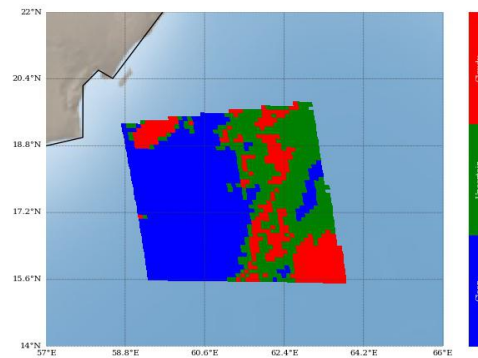
Number of Modis Pixels per Sounder Pixels on a spatially and Temporally Collocated Domain on 15 December, 2016 09:30 UTC



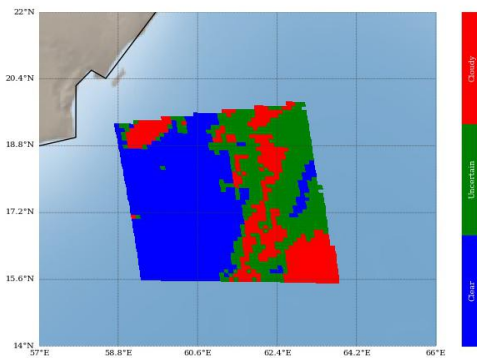
Modis Cloud Mask on Sounder Grid Method 1 : Mode of Modis pixels



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

