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 arround 40-60 pixles 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 clouly 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 probabilty value (p) obtained from above mentioned methods, the cloud mask flag for modis is decided for each method as follows :

$p < 0.35$: Cloudy

$p = 0.35\text{-}0.75$: Uncertain

$p > 0.75$: Clear

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

The validation satatistics are presented in follwing 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 April , 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	106558	54115	21979
Sounder Uncertain	15813	4965	13533
Sounder Cloudy	10950	3749	16382

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	94195	68145	20312
Sounder Uncertain	12553	9903	11855
Sounder Cloudy	8750	7506	14825

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	83777	75646	23229
Sounder Uncertain	10559	11097	12655
Sounder Cloudy	6657	8987	15437

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	42.96	21.82	8.86
Sounder Uncertain	6.38	2.00	5.46
Sounder Cloudy	4.41	1.51	6.60

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37.98	27.47	8.19
Sounder Uncertain	5.06	3.99	4.78
Sounder Cloudy	3.53	3.03	5.98

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	33.78	30.50	9.36
Sounder Uncertain	4.26	4.47	5.10
Sounder Cloudy	2.68	3.62	6.22

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.42	0.86	0.47
Frequency Bias	1.37	0.55	0.60
Probability of Detection	0.80	0.08	0.32
False Alarm Rate	0.63	0.24	0.12

Overall Skill Score

Skill Score	Value
Proportion Correct	0.516
Kuiper Skill Score	0.097
Heidke Skill Score	0.108

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.48	0.71	0.52
Frequency Bias	1.58	0.40	0.66
Probability of Detection	0.82	0.12	0.32
False Alarm Rate	0.69	0.19	0.13

Overall Skill Score

Skill Score	Value
Proportion Correct	0.479
Kuiper Skill Score	0.104
Heidke Skill Score	0.111

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.54	0.68	0.50
Frequency Bias	1.81	0.36	0.61
Probability of Detection	0.83	0.12	0.30
False Alarm Rate	0.72	0.17	0.11

Overall Skill Score

Skill Score	Value
Proportion Correct	0.445
Kuiper Skill Score	0.102
Heidke Skill Score	0.106

INSAT-3D Sounder vs MODIS for April , 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	58491	34062	12963
Sounder Uncertain	9000	2519	5809
Sounder Cloudy	9063	3206	11253

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	54615	37634	13267
Sounder Uncertain	7467	4806	5055
Sounder Cloudy	7332	6264	9926

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48523	41861	15132
Sounder Uncertain	6237	5640	5451
Sounder Cloudy	5388	7702	10432

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39.96	23.27	8.86
Sounder Uncertain	6.15	1.72	3.97
Sounder Cloudy	6.19	2.19	7.69

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37.31	25.71	9.06
Sounder Uncertain	5.10	3.28	3.45
Sounder Cloudy	5.01	4.28	6.78

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	33.15	28.60	10.34
Sounder Uncertain	4.26	3.85	3.72
Sounder Cloudy	3.68	5.26	7.13

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.45	0.85	0.52
Frequency Bias	1.38	0.44	0.78
Probability of Detection	0.76	0.06	0.37
False Alarm Rate	0.63	0.20	0.17

Overall Skill Score

Skill Score	Value
Proportion Correct	0.494
Kuiper Skill Score	0.084
Heidke Skill Score	0.092

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.48	0.72	0.58
Frequency Bias	1.52	0.36	0.83
Probability of Detection	0.79	0.10	0.35
False Alarm Rate	0.66	0.16	0.18

Overall Skill Score

Skill Score	Value
Proportion Correct	0.474
Kuiper Skill Score	0.098
Heidke Skill Score	0.105

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.54	0.67	0.56
Frequency Bias	1.75	0.31	0.76
Probability of Detection	0.81	0.10	0.34
False Alarm Rate	0.70	0.14	0.16

Overall Skill Score

Skill Score	Value

Proportion Correct	0.441
Kuiper Skill Score	0.103
Heidke Skill Score	0.106

INSAT-3D Sounder vs MODIS for April , 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	48067	20053	9016
Sounder Uncertain	6813	2446	7724
Sounder Cloudy	1887	543	5129

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39580	30511	7045
Sounder Uncertain	5086	5097	6800
Sounder Cloudy	1418	1242	4899

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	35254	33785	8097
Sounder Uncertain	4322	5457	7204
Sounder Cloudy	1269	1285	5005

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	47.27	19.72	8.87
Sounder Uncertain	6.70	2.41	7.60
Sounder Cloudy	1.86	0.53	5.04

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	38.93	30.01	6.93
Sounder Uncertain	5.00	5.01	6.69
Sounder Cloudy	1.39	1.22	4.82

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34.67	33.23	7.96
Sounder Uncertain	4.25	5.37	7.09
Sounder Cloudy	1.25	1.26	4.92

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.86	0.32
Frequency Bias	1.36	0.74	0.35
Probability of Detection	0.85	0.11	0.23
False Alarm Rate	0.63	0.32	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.547
Kuiper Skill Score	0.118
Heidke Skill Score	0.134

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy

False Alarm Ratio	0.49	0.70	0.35
Frequency Bias	1.67	0.46	0.40
Probability of Detection	0.86	0.14	0.26
False Alarm Rate	0.72	0.23	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.488
Kuiper Skill Score	0.110
Heidke Skill Score	0.119

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.54	0.68	0.34
Frequency Bias	1.89	0.42	0.37
Probability of Detection	0.86	0.13	0.25
False Alarm Rate	0.75	0.21	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.450
Kuiper Skill Score	0.099
Heidke Skill Score	0.103

INSAT-3D Sounder vs MODIS for April , 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

Sounder Clear	48421	7460	3903
Sounder Uncertain	9308	1819	4354
Sounder Cloudy	8033	2026	10153

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	46676	10260	2848
Sounder Uncertain	7827	4218	3436
Sounder Cloudy	6434	4957	8821

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	40218	16382	3184
Sounder Uncertain	6334	5414	3733
Sounder Cloudy	4583	6349	9280

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	50.71	7.81	4.09
Sounder Uncertain	9.75	1.91	4.56
Sounder Cloudy	8.41	2.12	10.63

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48.89	10.75	2.98
Sounder Uncertain	8.20	4.42	3.60
Sounder Cloudy	6.74	5.19	9.24

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	42.12	17.16	3.33

Sounder Uncertain	6.63	5.67	3.91
Sounder Cloudy	4.80	6.65	9.72

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.19	0.88	0.50
Frequency Bias	0.91	1.37	1.10
Probability of Detection	0.74	0.16	0.55
False Alarm Rate	0.32	0.39	0.29

Overall Skill Score

Skill Score	Value
Proportion Correct	0.633
Kuiper Skill Score	0.298
Heidke Skill Score	0.278

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.22	0.73	0.56
Frequency Bias	0.98	0.80	1.34
Probability of Detection	0.77	0.22	0.58
False Alarm Rate	0.37	0.31	0.32

Overall Skill Score

Skill Score	Value
Proportion Correct	0.625
Kuiper Skill Score	0.303
Heidke Skill Score	0.298

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.33	0.65	0.54

Frequency Bias	1.17	0.55	1.25
Probability of Detection	0.79	0.19	0.57
False Alarm Rate	0.48	0.25	0.27

Overall Skill Score

Skill Score	Value
Proportion Correct	0.575
Kuiper Skill Score	0.261
Heidke Skill Score	0.269

INSAT-3D Sounder vs MODIS for April , 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	29713	3317	1917
Sounder Uncertain	6344	689	1590
Sounder Cloudy	7492	1778	7361

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28624	4975	1348
Sounder Uncertain	5369	2208	1046
Sounder Cloudy	5995	4498	6138

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	24421	8991	1535

Sounder Uncertain	4382	3054	1187
Sounder Cloudy	4200	5893	6538

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	49.36	5.51	3.18
Sounder Uncertain	10.54	1.14	2.64
Sounder Cloudy	12.44	2.95	12.23

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	47.55	8.26	2.24
Sounder Uncertain	8.92	3.67	1.74
Sounder Cloudy	9.96	7.47	10.20

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	40.57	14.93	2.55
Sounder Uncertain	7.28	5.07	1.97
Sounder Cloudy	6.98	9.79	10.86

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.15	0.92	0.56
Frequency Bias	0.80	1.49	1.53
Probability of Detection	0.68	0.12	0.68
False Alarm Rate	0.23	0.35	0.41

Overall Skill Score

Skill Score	Value
Proportion Correct	0.627
Kuiper Skill Score	0.330
Heidke Skill Score	0.278

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.18	0.74	0.63
Frequency Bias	0.87	0.74	1.95
Probability of Detection	0.72	0.19	0.72
False Alarm Rate	0.27	0.28	0.45

Overall Skill Score

Skill Score	Value
Proportion Correct	0.614
Kuiper Skill Score	0.322
Heidke Skill Score	0.295

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.30	0.65	0.61
Frequency Bias	1.06	0.48	1.80
Probability of Detection	0.74	0.17	0.71
False Alarm Rate	0.40	0.21	0.39

Overall Skill Score

Skill Score	Value
Proportion Correct	0.565
Kuiper Skill Score	0.275
Heidke Skill Score	0.271

INSAT-3D Sounder vs MODIS for April , 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	18708	4143	1986
Sounder Uncertain	2964	1130	2764
Sounder Cloudy	541	248	2792

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	18052	5285	1500
Sounder Uncertain	2458	2010	2390
Sounder Cloudy	439	459	2683

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	15797	7391	1649
Sounder Uncertain	1952	2360	2546
Sounder Cloudy	383	456	2742

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	53.03	11.74	5.63
Sounder Uncertain	8.40	3.20	7.84
Sounder Cloudy	1.53	0.70	7.91

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51.17	14.98	4.25
Sounder Uncertain	6.97	5.70	6.78
Sounder Cloudy	1.24	1.30	7.61

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	44.78	20.95	4.67
Sounder Uncertain	5.53	6.69	7.22
Sounder Cloudy	1.09	1.29	7.77

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.25	0.84	0.22
Frequency Bias	1.12	1.24	0.47
Probability of Detection	0.84	0.20	0.37
False Alarm Rate	0.48	0.45	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.642
Kuiper Skill Score	0.274
Heidke Skill Score	0.289

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.27	0.71	0.25
Frequency Bias	1.19	0.88	0.54
Probability of Detection	0.86	0.26	0.41
False Alarm Rate	0.54	0.39	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.645
Kuiper Skill Score	0.292
Heidke Skill Score	0.317

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.36	0.66	0.23
Frequency Bias	1.37	0.67	0.52
Probability of Detection	0.87	0.23	0.40
False Alarm Rate	0.63	0.31	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.592
Kuiper Skill Score	0.252
Heidke Skill Score	0.275

INSAT-3D Sounder vs MODIS for April , 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	55102	45070	17059
Sounder Uncertain	5599	2832	8319
Sounder Cloudy	2060	1556	4769

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	44957	55649	16625
Sounder Uncertain	4022	5026	7702
Sounder Cloudy	1604	2087	4694

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	41448	56670	19113
Sounder Uncertain	3645	4963	8142
Sounder Cloudy	1451	2130	4804

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	38.70	31.66	11.98
Sounder Uncertain	3.93	1.99	5.84
Sounder Cloudy	1.45	1.09	3.35

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	31.58	39.09	11.68
Sounder Uncertain	2.83	3.53	5.41
Sounder Cloudy	1.13	1.47	3.30

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	29.11	39.81	13.43
Sounder Uncertain	2.56	3.49	5.72
Sounder Cloudy	1.02	1.50	3.37

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.53	0.83	0.43
Frequency Bias	1.87	0.34	0.28
Probability of Detection	0.88	0.06	0.16
False Alarm Rate	0.78	0.17	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.440
Kuiper Skill Score	0.038
Heidke Skill Score	0.041

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.62	0.70	0.44
Frequency Bias	2.32	0.27	0.29
Probability of Detection	0.89	0.08	0.16
False Alarm Rate	0.82	0.13	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.384
Kuiper Skill Score	0.043
Heidke Skill Score	0.043

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.65	0.70	0.43
Frequency Bias	2.52	0.26	0.26
Probability of Detection	0.89	0.08	0.15
False Alarm Rate	0.83	0.13	0.04

Overall Skill Score

Skill Score	Value

Proportion Correct	0.360
Kuiper Skill Score	0.038
Heidke Skill Score	0.037

INSAT-3D Sounder vs MODIS for April , 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	27137	30085	10309
Sounder Uncertain	1993	1653	3811
Sounder Cloudy	843	1269	2582

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	24620	31610	11301
Sounder Uncertain	1576	2188	3693
Sounder Cloudy	748	1325	2621

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22909	31708	12914
Sounder Uncertain	1413	2131	3913
Sounder Cloudy	680	1328	2686

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34.06	37.76	12.94
Sounder Uncertain	2.50	2.07	4.78
Sounder Cloudy	1.06	1.59	3.24

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30.90	39.67	14.18
Sounder Uncertain	1.98	2.75	4.63
Sounder Cloudy	0.94	1.66	3.29

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28.75	39.79	16.21
Sounder Uncertain	1.77	2.67	4.91
Sounder Cloudy	0.85	1.67	3.37

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.60	0.78	0.45
Frequency Bias	2.25	0.23	0.28
Probability of Detection	0.91	0.05	0.15
False Alarm Rate	0.84	0.12	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.394
Kuiper Skill Score	0.037
Heidke Skill Score	0.038

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy

False Alarm Ratio	0.64	0.71	0.44
Frequency Bias	2.51	0.21	0.27
Probability of Detection	0.91	0.06	0.15
False Alarm Rate	0.85	0.10	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.369
Kuiper Skill Score	0.044
Heidke Skill Score	0.043

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.66	0.71	0.43
Frequency Bias	2.70	0.21	0.24
Probability of Detection	0.92	0.06	0.14
False Alarm Rate	0.86	0.10	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.348
Kuiper Skill Score	0.041
Heidke Skill Score	0.039

INSAT-3D Sounder vs MODIS for April , 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

Sounder Clear	27965	14985	6750
Sounder Uncertain	3606	1179	4508
Sounder Cloudy	1217	287	2187

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20337	24039	5324
Sounder Uncertain	2446	2838	4009
Sounder Cloudy	856	762	2073

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	18539	24962	6199
Sounder Uncertain	2232	2832	4229
Sounder Cloudy	771	802	2118

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	44.61	23.91	10.77
Sounder Uncertain	5.75	1.88	7.19
Sounder Cloudy	1.94	0.46	3.49

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32.44	38.35	8.49
Sounder Uncertain	3.90	4.53	6.40
Sounder Cloudy	1.37	1.22	3.31

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	29.58	39.82	9.89

Sounder Uncertain	3.56	4.52	6.75
Sounder Cloudy	1.23	1.28	3.38

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.44	0.87	0.41
Frequency Bias	1.52	0.56	0.27
Probability of Detection	0.85	0.07	0.16
False Alarm Rate	0.69	0.26	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.500
Kuiper Skill Score	0.055
Heidke Skill Score	0.063

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.59	0.69	0.44
Frequency Bias	2.10	0.34	0.32
Probability of Detection	0.86	0.10	0.18
False Alarm Rate	0.78	0.17	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.403
Kuiper Skill Score	0.044
Heidke Skill Score	0.044

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.63	0.70	0.43

Frequency Bias	2.31	0.32	0.29
Probability of Detection	0.86	0.10	0.17
False Alarm Rate	0.80	0.16	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.375
Kuiper Skill Score	0.036
Heidke Skill Score	0.035

INSAT-3D Sounder vs MODIS for April , 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	485	312	170
Sounder Uncertain	103	40	94
Sounder Cloudy	87	21	114

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	400	428	139
Sounder Uncertain	77	89	71
Sounder Cloudy	73	52	97

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	320	493	154

Sounder Uncertain	62	95	80
Sounder Cloudy	63	57	102

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34.01	21.88	11.92
Sounder Uncertain	7.22	2.81	6.59
Sounder Cloudy	6.10	1.47	7.99

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28.05	30.01	9.75
Sounder Uncertain	5.40	6.24	4.98
Sounder Cloudy	5.12	3.65	6.80

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22.44	34.57	10.80
Sounder Uncertain	4.35	6.66	5.61
Sounder Cloudy	4.42	4.00	7.15

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.50	0.83	0.49
Frequency Bias	1.43	0.64	0.59
Probability of Detection	0.72	0.11	0.30
False Alarm Rate	0.61	0.25	0.14

Overall Skill Score

Skill Score	Value
Proportion Correct	0.448
Kuiper Skill Score	0.066
Heidke Skill Score	0.071

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.59	0.62	0.56
Frequency Bias	1.76	0.42	0.72
Probability of Detection	0.73	0.16	0.32
False Alarm Rate	0.68	0.18	0.15

Overall Skill Score

Skill Score	Value
Proportion Correct	0.411
Kuiper Skill Score	0.077
Heidke Skill Score	0.078

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.67	0.60	0.54
Frequency Bias	2.17	0.37	0.66
Probability of Detection	0.72	0.15	0.30
False Alarm Rate	0.71	0.16	0.13

Overall Skill Score

Skill Score	Value
Proportion Correct	0.363
Kuiper Skill Score	0.061
Heidke Skill Score	0.058

INSAT-3D Sounder vs MODIS for April , 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	262	125	124
Sounder Uncertain	76	27	57
Sounder Cloudy	75	21	95

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	216	189	106
Sounder Uncertain	59	62	39
Sounder Cloudy	62	51	78

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	192	201	118
Sounder Uncertain	47	67	46
Sounder Cloudy	53	55	83

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30.39	14.50	14.39
Sounder Uncertain	8.82	3.13	6.61
Sounder Cloudy	8.70	2.44	11.02

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	25.06	21.93	12.30
Sounder Uncertain	6.84	7.19	4.52
Sounder Cloudy	7.19	5.92	9.05

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22.27	23.32	13.69
Sounder Uncertain	5.45	7.77	5.34
Sounder Cloudy	6.15	6.38	9.63

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.49	0.83	0.50
Frequency Bias	1.24	0.92	0.69
Probability of Detection	0.63	0.16	0.34
False Alarm Rate	0.52	0.28	0.20

Overall Skill Score

Skill Score	Value
Proportion Correct	0.445
Kuiper Skill Score	0.085
Heidke Skill Score	0.088

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.58	0.61	0.59
Frequency Bias	1.52	0.53	0.86
Probability of Detection	0.64	0.21	0.35
False Alarm Rate	0.58	0.19	0.22

Overall Skill Score

Skill Score	Value
Proportion Correct	0.413
Kuiper Skill Score	0.090
Heidke Skill Score	0.091

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.62	0.58	0.57
Frequency Bias	1.75	0.50	0.77
Probability of Detection	0.66	0.21	0.34
False Alarm Rate	0.61	0.18	0.21

Overall Skill Score

Skill Score	Value
Proportion Correct	0.397
Kuiper Skill Score	0.095
Heidke Skill Score	0.094

INSAT-3D Sounder vs MODIS for April , 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	223	187	46
Sounder Uncertain	27	13	37
Sounder Cloudy	12	0	19

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	184	239	33
Sounder Uncertain	18	27	32
Sounder Cloudy	11	1	19

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	128	292	36
Sounder Uncertain	15	28	34
Sounder Cloudy	10	2	19

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39.54	33.16	8.16
Sounder Uncertain	4.79	2.30	6.56
Sounder Cloudy	2.13	0.00	3.37

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32.62	42.38	5.85
Sounder Uncertain	3.19	4.79	5.67
Sounder Cloudy	1.95	0.18	3.37

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22.70	51.77	6.38
Sounder Uncertain	2.66	4.96	6.03
Sounder Cloudy	1.77	0.35	3.37

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.51	0.83	0.39
Frequency Bias	1.74	0.39	0.30
Probability of Detection	0.85	0.07	0.19
False Alarm Rate	0.75	0.21	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.452
Kuiper Skill Score	0.029
Heidke Skill Score	0.032

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.60	0.65	0.39
Frequency Bias	2.14	0.29	0.37
Probability of Detection	0.86	0.10	0.23
False Alarm Rate	0.81	0.15	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.408
Kuiper Skill Score	0.049
Heidke Skill Score	0.048

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.72	0.64	0.39
Frequency Bias	2.98	0.24	0.35
Probability of Detection	0.84	0.09	0.21
False Alarm Rate	0.84	0.13	0.03

Overall Skill Score

Skill Score	Value

Proportion Correct	0.310
Kuiper Skill Score	0.008
Heidke Skill Score	0.006

INSAT-3D Sounder vs MODIS for April , 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	218	13	105
Sounder Uncertain	352	20	390
Sounder Cloudy	132	8	800

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	192	54	90
Sounder Uncertain	260	196	306
Sounder Cloudy	67	140	733

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	172	72	92
Sounder Uncertain	213	216	333
Sounder Cloudy	52	135	753

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	10.70	0.64	5.15
Sounder Uncertain	17.27	0.98	19.14
Sounder Cloudy	6.48	0.39	39.25

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9.42	2.65	4.42
Sounder Uncertain	12.76	9.62	15.01
Sounder Cloudy	3.29	6.87	35.97

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8.44	3.53	4.51
Sounder Uncertain	10.45	10.60	16.34
Sounder Cloudy	2.55	6.62	36.95

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.35	0.97	0.15
Frequency Bias	0.48	18.59	0.73
Probability of Detection	0.31	0.49	0.62
False Alarm Rate	0.12	0.74	0.14

Overall Skill Score

Skill Score	Value
Proportion Correct	0.509
Kuiper Skill Score	0.318
Heidke Skill Score	0.236

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy

False Alarm Ratio	0.43	0.74	0.22
Frequency Bias	0.65	1.95	0.83
Probability of Detection	0.37	0.50	0.65
False Alarm Rate	0.16	0.62	0.23

Overall Skill Score

Skill Score	Value
Proportion Correct	0.550
Kuiper Skill Score	0.306
Heidke Skill Score	0.287

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.49	0.72	0.20
Frequency Bias	0.77	1.80	0.80
Probability of Detection	0.39	0.51	0.64
False Alarm Rate	0.18	0.61	0.21

Overall Skill Score

Skill Score	Value
Proportion Correct	0.560
Kuiper Skill Score	0.313
Heidke Skill Score	0.291

INSAT-3D Sounder vs MODIS for April , 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

Sounder Clear	105	1	33
Sounder Uncertain	260	3	107
Sounder Cloudy	122	7	743

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	88	31	20
Sounder Uncertain	191	122	57
Sounder Cloudy	61	131	680

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	78	39	22
Sounder Uncertain	157	147	66
Sounder Cloudy	46	127	699

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7.60	0.07	2.39
Sounder Uncertain	18.83	0.22	7.75
Sounder Cloudy	8.83	0.51	53.80

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6.37	2.24	1.45
Sounder Uncertain	13.83	8.83	4.13
Sounder Cloudy	4.42	9.49	49.24

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.65	2.82	1.59

Sounder Uncertain	11.37	10.64	4.78
Sounder Cloudy	3.33	9.20	50.62

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.24	0.99	0.15
Frequency Bias	0.29	33.64	0.99
Probability of Detection	0.22	0.27	0.84
False Alarm Rate	0.06	0.69	0.24

Overall Skill Score

Skill Score	Value
Proportion Correct	0.616
Kuiper Skill Score	0.375
Heidke Skill Score	0.313

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.37	0.67	0.22
Frequency Bias	0.41	1.30	1.15
Probability of Detection	0.26	0.43	0.90
False Alarm Rate	0.10	0.51	0.39

Overall Skill Score

Skill Score	Value
Proportion Correct	0.644
Kuiper Skill Score	0.366
Heidke Skill Score	0.381

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.44	0.60	0.20

Frequency Bias	0.49	1.18	1.11
Probability of Detection	0.28	0.47	0.89
False Alarm Rate	0.13	0.49	0.38

Overall Skill Score

Skill Score	Value
Proportion Correct	0.669
Kuiper Skill Score	0.392
Heidke Skill Score	0.408

INSAT-3D Sounder vs MODIS for April , 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	113	12	72
Sounder Uncertain	92	17	283
Sounder Cloudy	10	1	57

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	104	23	70
Sounder Uncertain	69	74	249
Sounder Cloudy	6	9	53

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	94	33	70

Sounder Uncertain	56	69	267
Sounder Cloudy	6	8	54

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17.20	1.83	10.96
Sounder Uncertain	14.00	2.59	43.07
Sounder Cloudy	1.52	0.15	8.68

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	15.83	3.50	10.65
Sounder Uncertain	10.50	11.26	37.90
Sounder Cloudy	0.91	1.37	8.07

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14.31	5.02	10.65
Sounder Uncertain	8.52	10.50	40.64
Sounder Cloudy	0.91	1.22	8.22

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.43	0.96	0.16
Frequency Bias	0.92	13.07	0.17
Probability of Detection	0.53	0.57	0.14
False Alarm Rate	0.18	0.80	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.285
Kuiper Skill Score	0.190
Heidke Skill Score	0.117

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.47	0.81	0.22
Frequency Bias	1.10	3.70	0.18
Probability of Detection	0.58	0.70	0.14
False Alarm Rate	0.22	0.75	0.04

Overall Skill Score

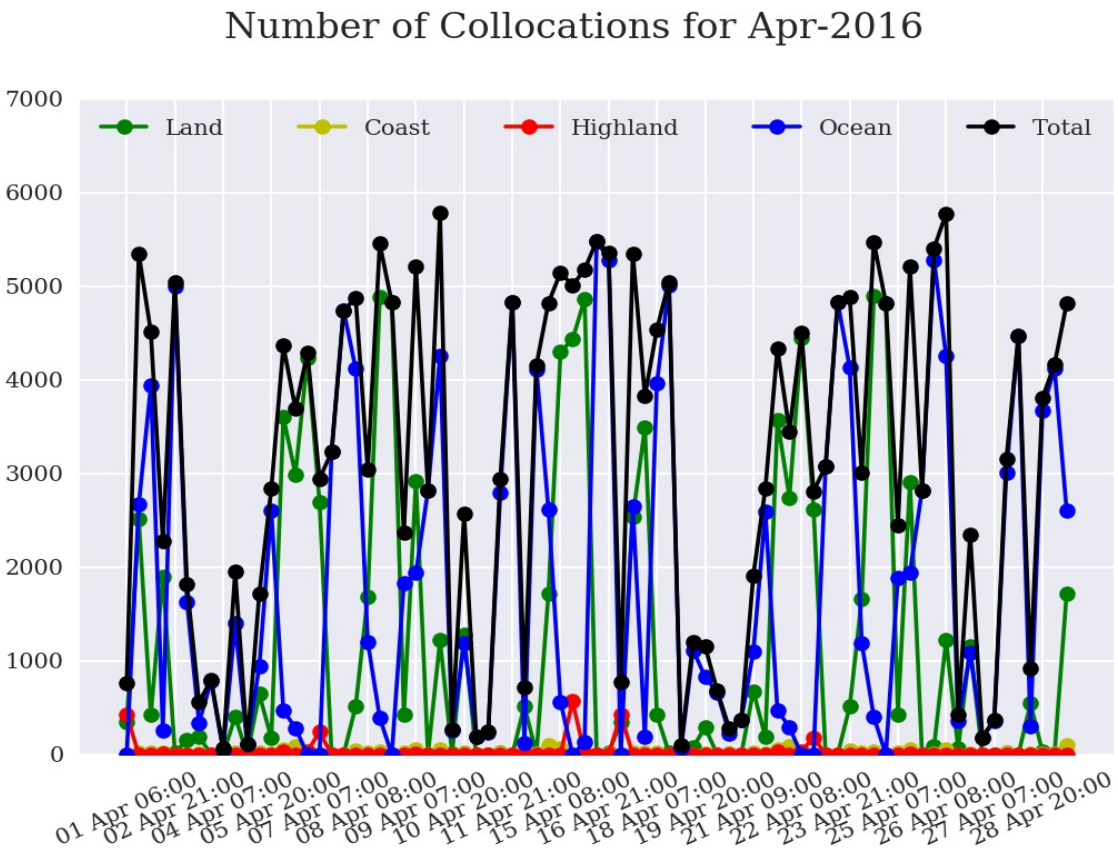
Skill Score	Value
Proportion Correct	0.352
Kuiper Skill Score	0.199
Heidke Skill Score	0.151

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.52	0.82	0.21
Frequency Bias	1.26	3.56	0.17
Probability of Detection	0.60	0.63	0.14
False Alarm Rate	0.23	0.73	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.330
Kuiper Skill Score	0.174
Heidke Skill Score	0.127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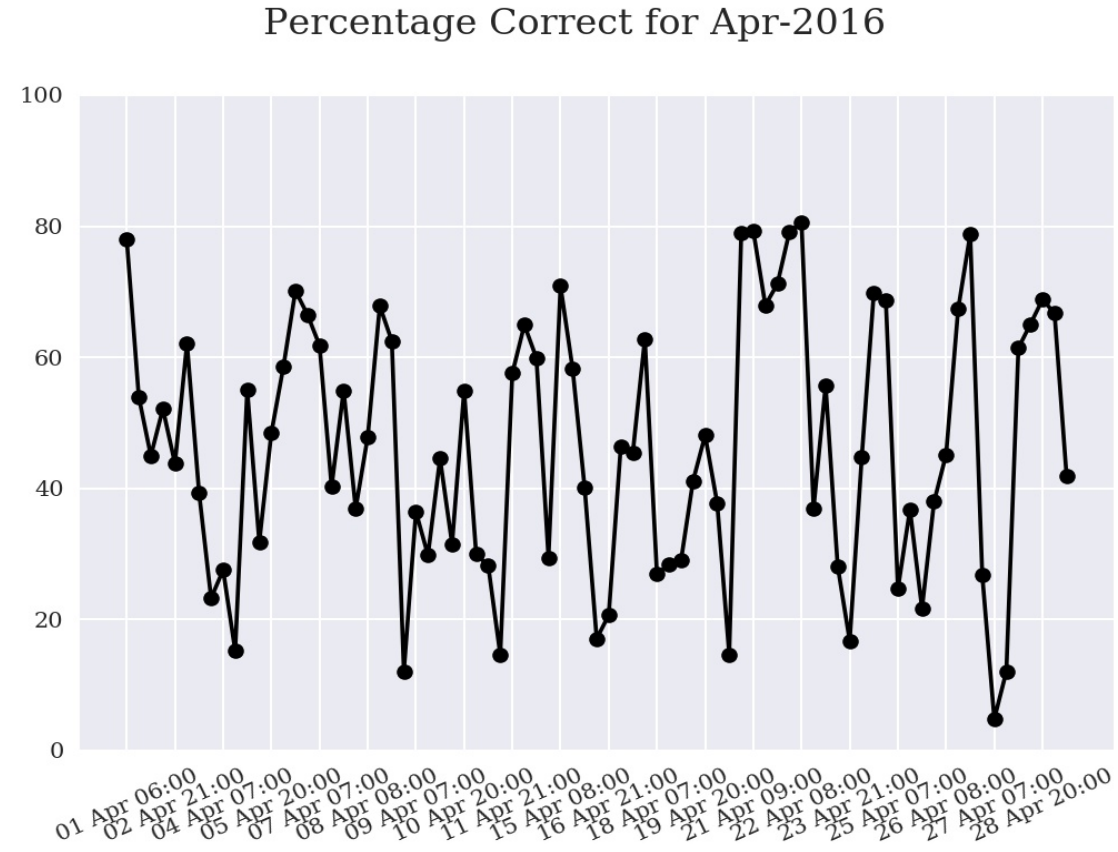
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21 Apr 09:00
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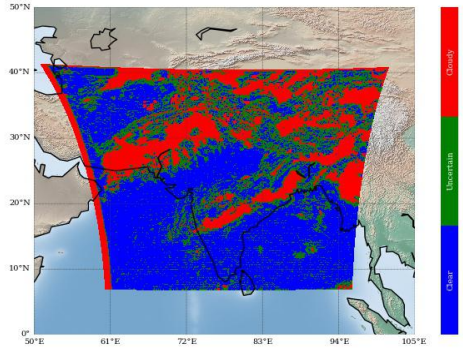
28 Apr 20:00

INSAT-3D Sounder Cloud Mask on
04 April, 2016 21:00 UTC



Modis Cloud Mask on
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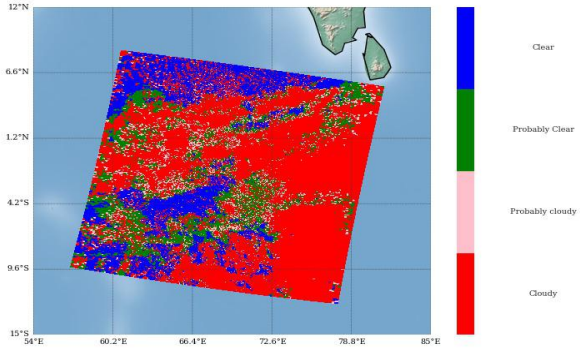
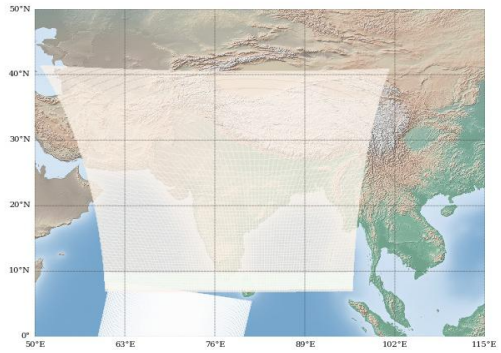
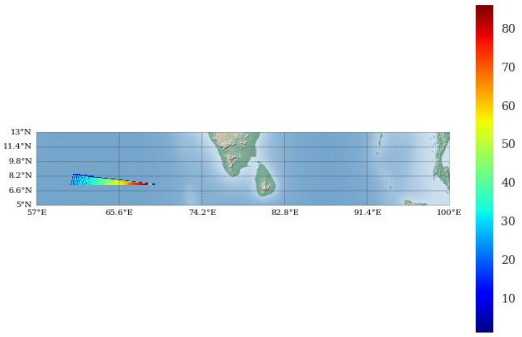


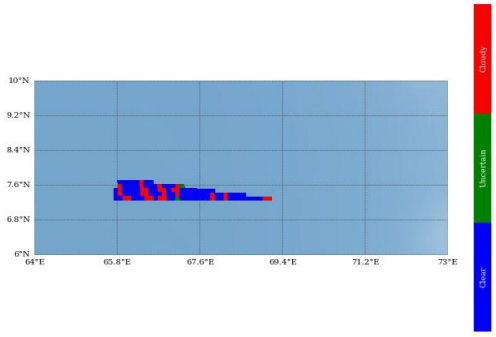
MODIS pass over INSAT-3D Sounder on
04 April, 2016 20:55 UTC



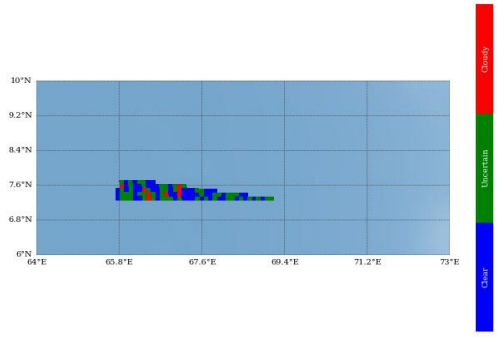
Number of Modis Pixels per Sounder Pixels on a
spatially and Temporally Collocated Domain on
04 April, 2016 20:55 UTC



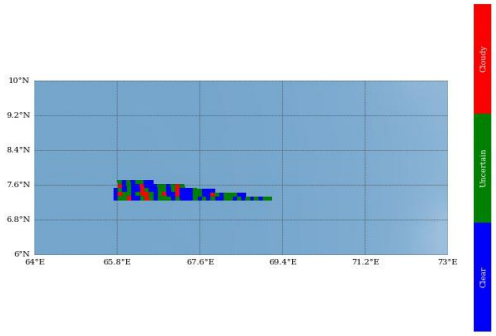
Modis Cloud Mask on Sounder Grid
Method 1 : Mode of Modis pixels



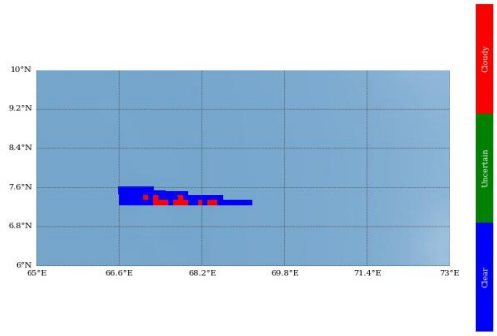
Modis Cloud Mask on Sounder Grid
Method 2 : Weighted Average



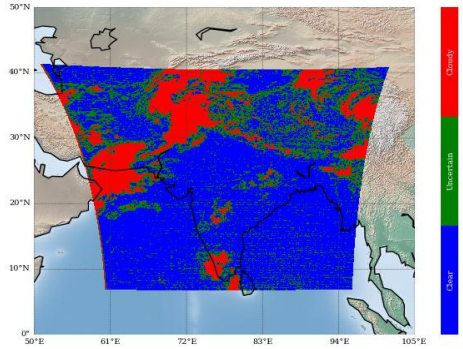
Modis Cloud Mask on Sounder Grid
Method 3 : Weighted Product Average



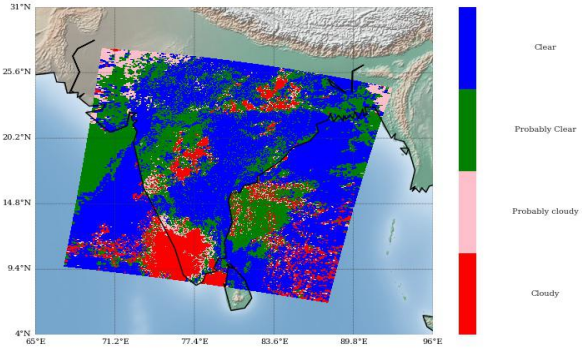
Sounder Cloud Flag on Collocated Area



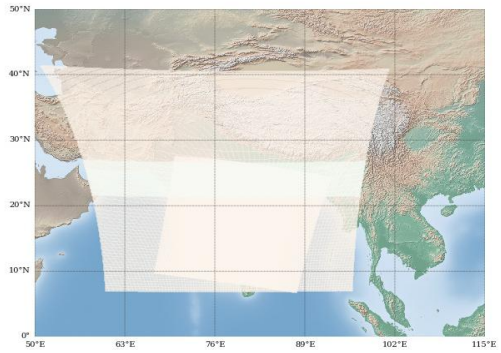
INSAT-3D Sounder Cloud Mask on
08 April, 2016 20:00 UTC



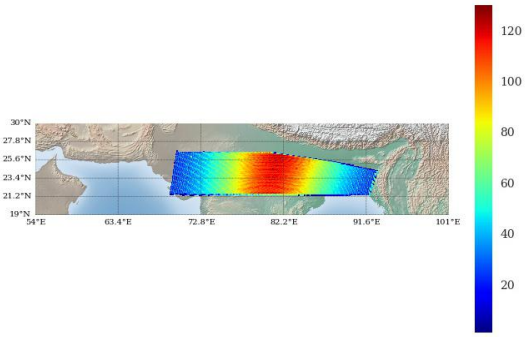
Modis Cloud Mask on
08 April, 2016 20:25 UTC



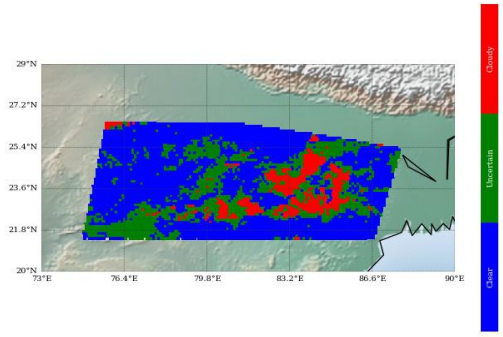
MODIS pass over INSAT-3D Sounder on
08 April, 2016 20:25 UTC



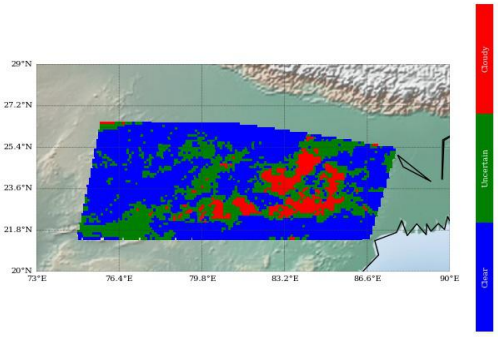
Number of Modis Pixels per Sounder Pixels on a
spatially and Temporally Collocated Domain on
08 April, 2016 20:25 UTC



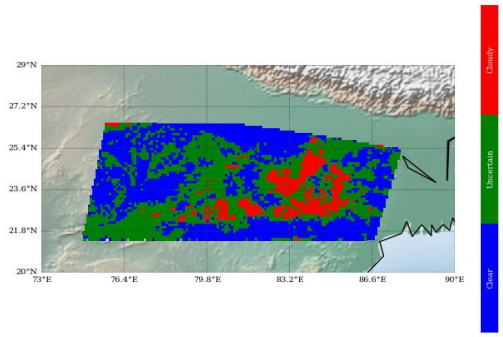
Modis Cloud Mask on Sounder Grid
Method 1 : Mode of Modis pixels



Modis Cloud Mask on Sounder Grid
Method 2 : Weighted Average



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



Sounder Cloud Flag on Collocated Area