

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 January , 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	87868	27392	24182
Sounder Uncertain	14098	3631	18956
Sounder Cloudy	7933	921	18891

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	81217	38351	19874
Sounder Uncertain	11007	9666	16012
Sounder Cloudy	6176	4270	17299

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	74115	43518	21809
Sounder Uncertain	9324	10142	17219
Sounder Cloudy	5554	4317	17874

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	43.10	13.44	11.86
Sounder Uncertain	6.92	1.78	9.30
Sounder Cloudy	3.89	0.45	9.27

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39.84	18.81	9.75
Sounder Uncertain	5.40	4.74	7.85
Sounder Cloudy	3.03	2.09	8.49

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	36.35	21.35	10.70
Sounder Uncertain	4.57	4.97	8.45
Sounder Cloudy	2.72	2.12	8.77

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.37	0.90	0.32
Frequency Bias	1.27	1.15	0.45
Probability of Detection	0.80	0.11	0.30
False Alarm Rate	0.55	0.35	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.541
Kuiper Skill Score	0.174
Heidke Skill Score	0.184

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.42	0.74	0.38
Frequency Bias	1.42	0.70	0.52
Probability of Detection	0.83	0.18	0.33
False Alarm Rate	0.61	0.28	0.11

Overall Skill Score

Skill Score	Value
Proportion Correct	0.531
Kuiper Skill Score	0.188
Heidke Skill Score	0.202

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.47	0.72	0.36
Frequency Bias	1.57	0.63	0.49
Probability of Detection	0.83	0.17	0.31
False Alarm Rate	0.64	0.26	0.10

Overall Skill Score

Skill Score	Value
Proportion Correct	0.501
Kuiper Skill Score	0.174
Heidke Skill Score	0.185

INSAT-3D Sounder vs MODIS for January , 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	41139	14515	12282
Sounder Uncertain	7981	2172	8311
Sounder Cloudy	4794	345	13536

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37805	19913	10218
Sounder Uncertain	6039	5778	6647
Sounder Cloudy	3386	2965	12324

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32671	23935	11330
Sounder Uncertain	4916	6206	7342
Sounder Cloudy	3016	2894	12765

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39.15	13.81	11.69
Sounder Uncertain	7.60	2.07	7.91
Sounder Cloudy	4.56	0.33	12.88

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	35.98	18.95	9.72
Sounder Uncertain	5.75	5.50	6.33
Sounder Cloudy	3.22	2.82	11.73

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	31.09	22.78	10.78
Sounder Uncertain	4.68	5.91	6.99
Sounder Cloudy	2.87	2.75	12.15

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.39	0.88	0.28
Frequency Bias	1.26	1.08	0.55
Probability of Detection	0.76	0.13	0.40
False Alarm Rate	0.56	0.34	0.11

Overall Skill Score

Skill Score	Value
Proportion Correct	0.541
Kuiper Skill Score	0.203
Heidke Skill Score	0.211

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.44	0.69	0.34
Frequency Bias	1.44	0.64	0.64
Probability of Detection	0.80	0.20	0.42
False Alarm Rate	0.61	0.26	0.13

Overall Skill Score

Skill Score	Value
Proportion Correct	0.532
Kuiper Skill Score	0.223
Heidke Skill Score	0.236

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.52	0.66	0.32
Frequency Bias	1.67	0.56	0.59
Probability of Detection	0.80	0.19	0.41
False Alarm Rate	0.66	0.23	0.11

Overall Skill Score

Skill Score	Value
-------------	-------

Proportion Correct	0.491
Kuiper Skill Score	0.201
Heidke Skill Score	0.208

INSAT-3D Sounder vs MODIS for January , 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	46729	12877	11900
Sounder Uncertain	6117	1459	10645
Sounder Cloudy	3139	576	5355

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	43412	18438	9656
Sounder Uncertain	4968	3888	9365
Sounder Cloudy	2790	1305	4975

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	41444	19583	10479
Sounder Uncertain	4408	3936	9877
Sounder Cloudy	2538	1423	5109

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	47.30	13.03	12.04
Sounder Uncertain	6.19	1.48	10.77
Sounder Cloudy	3.18	0.58	5.42

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	43.94	18.66	9.77
Sounder Uncertain	5.03	3.94	9.48
Sounder Cloudy	2.82	1.32	5.04

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	41.95	19.82	10.61
Sounder Uncertain	4.46	3.98	10.00
Sounder Cloudy	2.57	1.44	5.17

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.35	0.92	0.41
Frequency Bias	1.28	1.22	0.33
Probability of Detection	0.83	0.10	0.19
False Alarm Rate	0.55	0.37	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.542
Kuiper Skill Score	0.135
Heidke Skill Score	0.146

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
-------------	-------	-----------	--------

False Alarm Ratio	0.39	0.79	0.45
Frequency Bias	1.40	0.77	0.38
Probability of Detection	0.85	0.16	0.21
False Alarm Rate	0.60	0.31	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.529
Kuiper Skill Score	0.143
Heidke Skill Score	0.157

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.42	0.78	0.44
Frequency Bias	1.48	0.73	0.36
Probability of Detection	0.86	0.16	0.20
False Alarm Rate	0.62	0.30	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.511
Kuiper Skill Score	0.137
Heidke Skill Score	0.150

INSAT-3D Sounder vs MODIS for January , 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	63255	8802	15152
Sounder Uncertain	8787	1941	10551
Sounder Cloudy	2153	364	12104

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	59511	15467	12231
Sounder Uncertain	7205	4889	9185
Sounder Cloudy	1890	976	11755

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	54000	19962	13247
Sounder Uncertain	6066	5473	9740
Sounder Cloudy	1729	990	11902

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51.38	7.15	12.31
Sounder Uncertain	7.14	1.58	8.57
Sounder Cloudy	1.75	0.30	9.83

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48.34	12.56	9.94
Sounder Uncertain	5.85	3.97	7.46
Sounder Cloudy	1.54	0.79	9.55

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	43.86	16.21	10.76

Sounder Uncertain	4.93	4.45	7.91
Sounder Cloudy	1.40	0.80	9.67

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.27	0.91	0.17
Frequency Bias	1.18	1.92	0.39
Probability of Detection	0.85	0.17	0.32
False Alarm Rate	0.52	0.42	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.628
Kuiper Skill Score	0.279
Heidke Skill Score	0.286

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.32	0.77	0.20
Frequency Bias	1.27	1.00	0.44
Probability of Detection	0.87	0.23	0.35
False Alarm Rate	0.59	0.35	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.619
Kuiper Skill Score	0.276
Heidke Skill Score	0.298

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.74	0.19

Frequency Bias	1.41	0.81	0.42
Probability of Detection	0.87	0.21	0.34
False Alarm Rate	0.64	0.31	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.580
Kuiper Skill Score	0.247
Heidke Skill Score	0.267

INSAT-3D Sounder vs MODIS for January , 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	23636	8080	6982
Sounder Uncertain	4459	1716	4058
Sounder Cloudy	313	174	8916

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	21841	11237	5620
Sounder Uncertain	3555	3338	3340
Sounder Cloudy	188	530	8685

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17533	14881	6284

Sounder Uncertain	2720	3830	3683
Sounder Cloudy	165	445	8793

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	40.52	13.85	11.97
Sounder Uncertain	7.64	2.94	6.96
Sounder Cloudy	0.54	0.30	15.28

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37.44	19.26	9.63
Sounder Uncertain	6.09	5.72	5.73
Sounder Cloudy	0.32	0.91	14.89

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30.06	25.51	10.77
Sounder Uncertain	4.66	6.57	6.31
Sounder Cloudy	0.28	0.76	15.07

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.39	0.83	0.05
Frequency Bias	1.36	1.03	0.47
Probability of Detection	0.83	0.17	0.45
False Alarm Rate	0.63	0.35	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.587
Kuiper Skill Score	0.291
Heidke Skill Score	0.303

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.44	0.67	0.08
Frequency Bias	1.51	0.68	0.53
Probability of Detection	0.85	0.22	0.49
False Alarm Rate	0.69	0.28	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.581
Kuiper Skill Score	0.301
Heidke Skill Score	0.318

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.55	0.63	0.06
Frequency Bias	1.90	0.53	0.50
Probability of Detection	0.86	0.20	0.47
False Alarm Rate	0.75	0.23	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.517
Kuiper Skill Score	0.263
Heidke Skill Score	0.266

INSAT-3D Sounder vs MODIS for January , 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	39619	722	8170
Sounder Uncertain	4328	225	6493
Sounder Cloudy	1840	190	3188

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37670	4230	6611
Sounder Uncertain	3650	1551	5845
Sounder Cloudy	1702	446	3070

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	36467	5081	6963
Sounder Uncertain	3346	1643	6057
Sounder Cloudy	1564	545	3109

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	61.16	1.11	12.61
Sounder Uncertain	6.68	0.35	10.02
Sounder Cloudy	2.84	0.29	4.92

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	58.16	6.53	10.21
Sounder Uncertain	5.63	2.39	9.02
Sounder Cloudy	2.63	0.69	4.74

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	56.30	7.84	10.75
Sounder Uncertain	5.17	2.54	9.35
Sounder Cloudy	2.41	0.84	4.80

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.18	0.98	0.39
Frequency Bias	1.06	9.72	0.29
Probability of Detection	0.87	0.20	0.18
False Alarm Rate	0.41	0.50	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.664
Kuiper Skill Score	0.259
Heidke Skill Score	0.246

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.22	0.86	0.41
Frequency Bias	1.13	1.77	0.34
Probability of Detection	0.88	0.25	0.20
False Alarm Rate	0.48	0.42	0.10

Overall Skill Score

Skill Score	Value
Proportion Correct	0.653
Kuiper Skill Score	0.243
Heidke Skill Score	0.257

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.25	0.85	0.40
Frequency Bias	1.17	1.52	0.32
Probability of Detection	0.88	0.23	0.19
False Alarm Rate	0.51	0.40	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.636
Kuiper Skill Score	0.230
Heidke Skill Score	0.246

INSAT-3D Sounder vs MODIS for January , 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	19153	16982	6047
Sounder Uncertain	894	849	2557
Sounder Cloudy	142	53	847

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17139	19689	5354
Sounder Uncertain	655	1321	2324
Sounder Cloudy	130	76	836

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	16212	19976	5994
Sounder Uncertain	602	1212	2486
Sounder Cloudy	126	76	840

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	40.30	35.73	12.72
Sounder Uncertain	1.88	1.79	5.38
Sounder Cloudy	0.30	0.11	1.78

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	36.06	41.43	11.27
Sounder Uncertain	1.38	2.78	4.89
Sounder Cloudy	0.27	0.16	1.76

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34.11	42.03	12.61
Sounder Uncertain	1.27	2.55	5.23
Sounder Cloudy	0.27	0.16	1.77

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.55	0.80	0.19
Frequency Bias	2.09	0.24	0.11
Probability of Detection	0.95	0.05	0.09
False Alarm Rate	0.86	0.13	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.439
Kuiper Skill Score	0.036
Heidke Skill Score	0.040

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.59	0.69	0.20
Frequency Bias	2.35	0.20	0.12
Probability of Detection	0.96	0.06	0.10
False Alarm Rate	0.89	0.11	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.406
Kuiper Skill Score	0.043
Heidke Skill Score	0.044

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.62	0.72	0.19
Frequency Bias	2.49	0.20	0.11
Probability of Detection	0.96	0.06	0.09
False Alarm Rate	0.89	0.11	0.01

Overall Skill Score

Skill Score	Value
-------------	-------

Proportion Correct	0.384
Kuiper Skill Score	0.036
Heidke Skill Score	0.036

INSAT-3D Sounder vs MODIS for January , 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	14461	6158	4426
Sounder Uncertain	606	328	1468
Sounder Cloudy	80	0	133

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13335	7694	4016
Sounder Uncertain	498	493	1411
Sounder Cloudy	76	4	133

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	12791	7873	4381
Sounder Uncertain	465	456	1481
Sounder Cloudy	74	6	133

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	52.28	22.26	16.00
Sounder Uncertain	2.19	1.19	5.31
Sounder Cloudy	0.29	0.00	0.48

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48.21	27.82	14.52
Sounder Uncertain	1.80	1.78	5.10
Sounder Cloudy	0.27	0.01	0.48

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	46.24	28.46	15.84
Sounder Uncertain	1.68	1.65	5.35
Sounder Cloudy	0.27	0.02	0.48

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.42	0.86	0.38
Frequency Bias	1.65	0.37	0.04
Probability of Detection	0.95	0.05	0.02
False Alarm Rate	0.83	0.16	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.539
Kuiper Skill Score	0.036
Heidke Skill Score	0.045

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
-------------	-------	-----------	--------

False Alarm Ratio	0.47	0.79	0.38
Frequency Bias	1.80	0.29	0.04
Probability of Detection	0.96	0.06	0.02
False Alarm Rate	0.85	0.14	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.505
Kuiper Skill Score	0.036
Heidke Skill Score	0.043

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.49	0.81	0.38
Frequency Bias	1.88	0.29	0.04
Probability of Detection	0.96	0.05	0.02
False Alarm Rate	0.86	0.14	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.484
Kuiper Skill Score	0.031
Heidke Skill Score	0.036

INSAT-3D Sounder vs MODIS for January , 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	4692	10824	1621
Sounder Uncertain	288	521	1089
Sounder Cloudy	62	53	714

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3804	11995	1338
Sounder Uncertain	157	828	913
Sounder Cloudy	54	72	703

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3421	12103	1613
Sounder Uncertain	137	756	1005
Sounder Cloudy	52	70	707

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23.62	54.49	8.16
Sounder Uncertain	1.45	2.62	5.48
Sounder Cloudy	0.31	0.27	3.59

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	19.15	60.39	6.74
Sounder Uncertain	0.79	4.17	4.60
Sounder Cloudy	0.27	0.36	3.54

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	17.22	60.93	8.12

Sounder Uncertain	0.69	3.81	5.06
Sounder Cloudy	0.26	0.35	3.56

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.73	0.73	0.14
Frequency Bias	3.40	0.17	0.24
Probability of Detection	0.93	0.05	0.21
False Alarm Rate	0.89	0.10	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.298
Kuiper Skill Score	0.030
Heidke Skill Score	0.024

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.78	0.56	0.15
Frequency Bias	4.27	0.15	0.28
Probability of Detection	0.95	0.06	0.24
False Alarm Rate	0.92	0.07	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.269
Kuiper Skill Score	0.050
Heidke Skill Score	0.034

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.80	0.60	0.15

Frequency Bias	4.75	0.15	0.25
Probability of Detection	0.95	0.06	0.21
False Alarm Rate	0.92	0.08	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.246
Kuiper Skill Score	0.039
Heidke Skill Score	0.026

INSAT-3D Sounder vs MODIS for January , 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	539	102	115
Sounder Uncertain	142	20	73
Sounder Cloudy	32	5	66

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	447	240	69
Sounder Uncertain	120	64	51
Sounder Cloudy	23	17	63

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	381	293	82

Sounder Uncertain	102	77	56
Sounder Cloudy	19	21	63

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	9.32	10.51
Sounder Uncertain	12.98	1.83	6.67
Sounder Cloudy	2.93	0.46	6.03

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	40.86	21.94	6.31
Sounder Uncertain	10.97	5.85	4.66
Sounder Cloudy	2.10	1.55	5.76

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34.83	26.78	7.50
Sounder Uncertain	9.32	7.04	5.12
Sounder Cloudy	1.74	1.92	5.76

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.29	0.91	0.36
Frequency Bias	1.06	1.85	0.41
Probability of Detection	0.76	0.16	0.26
False Alarm Rate	0.46	0.46	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.571
Kuiper Skill Score	0.146
Heidke Skill Score	0.147

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.41	0.73	0.39
Frequency Bias	1.28	0.73	0.56
Probability of Detection	0.76	0.20	0.34
False Alarm Rate	0.59	0.33	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.525
Kuiper Skill Score	0.123
Heidke Skill Score	0.133

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.50	0.67	0.39
Frequency Bias	1.51	0.60	0.51
Probability of Detection	0.76	0.20	0.31
False Alarm Rate	0.65	0.28	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.476
Kuiper Skill Score	0.104
Heidke Skill Score	0.111

INSAT-3D Sounder vs MODIS for January , 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	295	29	62
Sounder Uncertain	102	6	40
Sounder Cloudy	28	1	31

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	270	77	39
Sounder Uncertain	93	29	26
Sounder Cloudy	23	7	30

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	233	109	44
Sounder Uncertain	77	41	30
Sounder Cloudy	19	11	30

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	49.66	4.88	10.44
Sounder Uncertain	17.17	1.01	6.73
Sounder Cloudy	4.71	0.17	5.22

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	45.45	12.96	6.57
Sounder Uncertain	15.66	4.88	4.38
Sounder Cloudy	3.87	1.18	5.05

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39.23	18.35	7.41
Sounder Uncertain	12.96	6.90	5.05
Sounder Cloudy	3.20	1.85	5.05

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.24	0.96	0.48
Frequency Bias	0.91	4.11	0.45
Probability of Detection	0.69	0.17	0.23
False Alarm Rate	0.35	0.54	0.11

Overall Skill Score

Skill Score	Value
Proportion Correct	0.559
Kuiper Skill Score	0.130
Heidke Skill Score	0.113

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.30	0.80	0.50
Frequency Bias	1.00	1.31	0.63
Probability of Detection	0.70	0.26	0.32
False Alarm Rate	0.44	0.45	0.11

Overall Skill Score

Skill Score	Value
Proportion Correct	0.554
Kuiper Skill Score	0.132
Heidke Skill Score	0.132

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.40	0.72	0.50
Frequency Bias	1.17	0.92	0.58
Probability of Detection	0.71	0.25	0.29
False Alarm Rate	0.53	0.37	0.10

Overall Skill Score

Skill Score	Value
Proportion Correct	0.512
Kuiper Skill Score	0.113
Heidke Skill Score	0.120

INSAT-3D Sounder vs MODIS for January , 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	244	73	53
Sounder Uncertain	40	14	33
Sounder Cloudy	4	4	35

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	177	163	30
Sounder Uncertain	27	35	25
Sounder Cloudy	0	10	33

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	148	184	38
Sounder Uncertain	25	36	26
Sounder Cloudy	0	10	33

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48.80	14.60	10.60
Sounder Uncertain	8.00	2.80	6.60
Sounder Cloudy	0.80	0.80	7.00

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	35.40	32.60	6.00
Sounder Uncertain	5.40	7.00	5.00
Sounder Cloudy	0.00	2.00	6.60

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	29.60	36.80	7.60
Sounder Uncertain	5.00	7.20	5.20
Sounder Cloudy	0.00	2.00	6.60

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.34	0.84	0.19
Frequency Bias	1.28	0.96	0.36
Probability of Detection	0.85	0.15	0.29
False Alarm Rate	0.61	0.35	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.586
Kuiper Skill Score	0.186
Heidke Skill Score	0.206

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.52	0.60	0.23
Frequency Bias	1.81	0.42	0.49
Probability of Detection	0.87	0.17	0.38
False Alarm Rate	0.76	0.20	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.490
Kuiper Skill Score	0.160
Heidke Skill Score	0.165

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.60	0.59	0.23
Frequency Bias	2.14	0.38	0.44
Probability of Detection	0.86	0.16	0.34
False Alarm Rate	0.78	0.18	0.04

Overall Skill Score

Skill Score	Value
-------------	-------

Proportion Correct	0.434
Kuiper Skill Score	0.129
Heidke Skill Score	0.126

INSAT-3D Sounder vs MODIS for January , 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	2569	990	2395
Sounder Uncertain	3586	742	5418
Sounder Cloudy	5432	467	5526

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2054	1995	1905
Sounder Uncertain	2432	3130	4184
Sounder Cloudy	3990	3119	4316

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1728	2098	2128
Sounder Uncertain	2030	3068	4648
Sounder Cloudy	3556	3134	4735

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9.47	3.65	8.83
Sounder Uncertain	13.22	2.74	19.97
Sounder Cloudy	20.03	1.72	20.37

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7.57	7.35	7.02
Sounder Uncertain	8.97	11.54	15.42
Sounder Cloudy	14.71	11.50	15.91

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6.37	7.73	7.85
Sounder Uncertain	7.48	11.31	17.14
Sounder Cloudy	13.11	11.55	17.46

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.57	0.92	0.52
Frequency Bias	0.51	4.43	0.86
Probability of Detection	0.22	0.34	0.41
False Alarm Rate	0.19	0.49	0.32

Overall Skill Score

Skill Score	Value
Proportion Correct	0.326
Kuiper Skill Score	-0.007
Heidke Skill Score	-0.006

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
-------------	-------	-----------	--------

False Alarm Ratio	0.66	0.68	0.62
Frequency Bias	0.70	1.18	1.10
Probability of Detection	0.24	0.38	0.41
False Alarm Rate	0.22	0.38	0.40

Overall Skill Score

Skill Score	Value
Proportion Correct	0.350
Kuiper Skill Score	0.016
Heidke Skill Score	0.016

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.71	0.69	0.59
Frequency Bias	0.81	1.17	0.99
Probability of Detection	0.24	0.37	0.41
False Alarm Rate	0.24	0.38	0.38

Overall Skill Score

Skill Score	Value
Proportion Correct	0.351
Kuiper Skill Score	0.005
Heidke Skill Score	0.005

INSAT-3D Sounder vs MODIS for January , 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	1476	48	541
Sounder Uncertain	2309	88	2556
Sounder Cloudy	4243	166	4265

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1195	520	350
Sounder Uncertain	1438	1784	1731
Sounder Cloudy	2990	2382	3302

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1103	554	408
Sounder Uncertain	1246	1709	1998
Sounder Cloudy	2658	2385	3631

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9.41	0.31	3.45
Sounder Uncertain	14.71	0.56	16.29
Sounder Cloudy	27.04	1.06	27.18

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7.62	3.31	2.23
Sounder Uncertain	9.16	11.37	11.03
Sounder Cloudy	19.05	15.18	21.04

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7.03	3.53	2.60

Sounder Uncertain	7.94	10.89	12.73
Sounder Cloudy	16.94	15.20	23.14

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.29	0.98	0.51
Frequency Bias	0.26	16.40	1.18
Probability of Detection	0.18	0.29	0.58
False Alarm Rate	0.06	0.49	0.45

Overall Skill Score

Skill Score	Value
Proportion Correct	0.371
Kuiper Skill Score	0.075
Heidke Skill Score	0.058

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.42	0.64	0.62
Frequency Bias	0.37	1.06	1.61
Probability of Detection	0.21	0.38	0.61
False Alarm Rate	0.09	0.34	0.57

Overall Skill Score

Skill Score	Value
Proportion Correct	0.400
Kuiper Skill Score	0.104
Heidke Skill Score	0.103

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.47	0.65	0.58

Frequency Bias	0.41	1.07	1.44
Probability of Detection	0.22	0.37	0.60
False Alarm Rate	0.10	0.35	0.55

Overall Skill Score

Skill Score	Value
Proportion Correct	0.411
Kuiper Skill Score	0.094
Heidke Skill Score	0.096

INSAT-3D Sounder vs MODIS for January , 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	1093	942	1854
Sounder Uncertain	1277	654	2862
Sounder Cloudy	1189	301	1261

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	859	1475	1555
Sounder Uncertain	994	1346	2453
Sounder Cloudy	1000	737	1014

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	625	1544	1720

Sounder Uncertain	784	1359	2650
Sounder Cloudy	898	749	1104

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9.56	8.24	16.22
Sounder Uncertain	11.17	5.72	25.03
Sounder Cloudy	10.40	2.63	11.03

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7.51	12.90	13.60
Sounder Uncertain	8.69	11.77	21.46
Sounder Cloudy	8.75	6.45	8.87

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.47	13.50	15.04
Sounder Uncertain	6.86	11.89	23.18
Sounder Cloudy	7.85	6.55	9.66

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.72	0.86	0.54
Frequency Bias	1.09	2.53	0.46
Probability of Detection	0.31	0.34	0.21
False Alarm Rate	0.33	0.49	0.18

Overall Skill Score

Skill Score	Value
Proportion Correct	0.263
Kuiper Skill Score	-0.063
Heidke Skill Score	-0.055

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.78	0.72	0.63
Frequency Bias	1.36	1.35	0.55
Probability of Detection	0.30	0.38	0.20
False Alarm Rate	0.37	0.42	0.21

Overall Skill Score

Skill Score	Value
Proportion Correct	0.282
Kuiper Skill Score	-0.061
Heidke Skill Score	-0.058

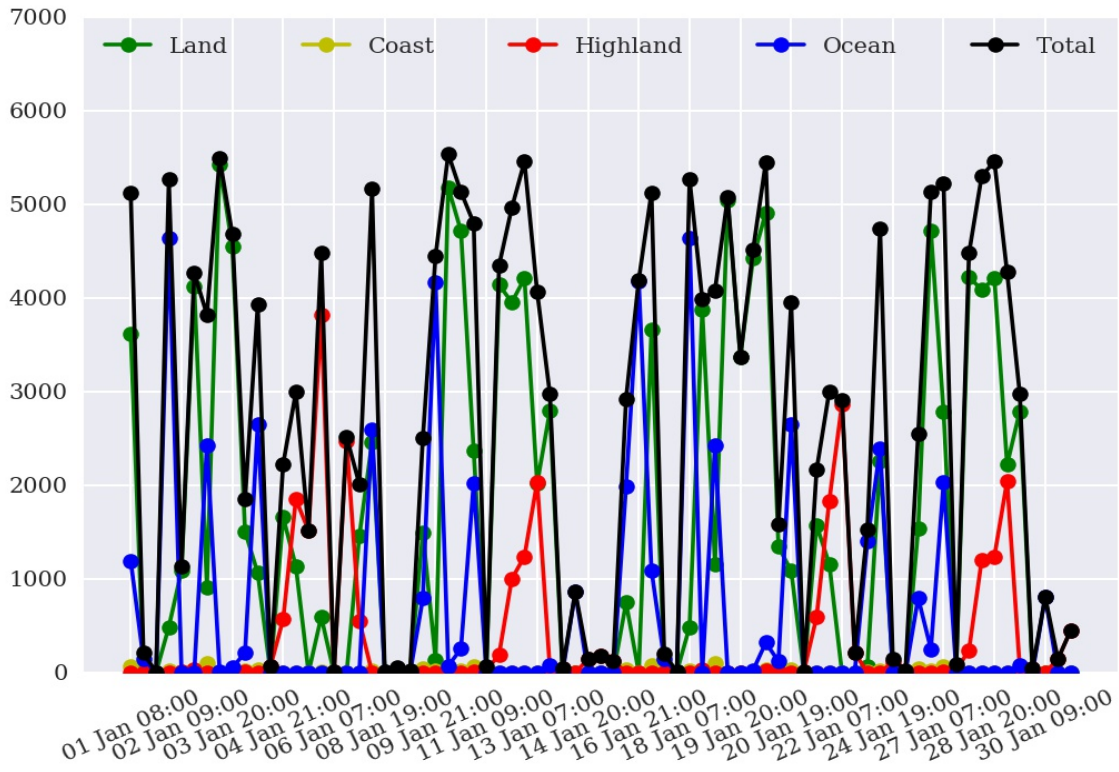
Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.84	0.72	0.60
Frequency Bias	1.69	1.31	0.50
Probability of Detection	0.27	0.37	0.20
False Alarm Rate	0.39	0.41	0.20

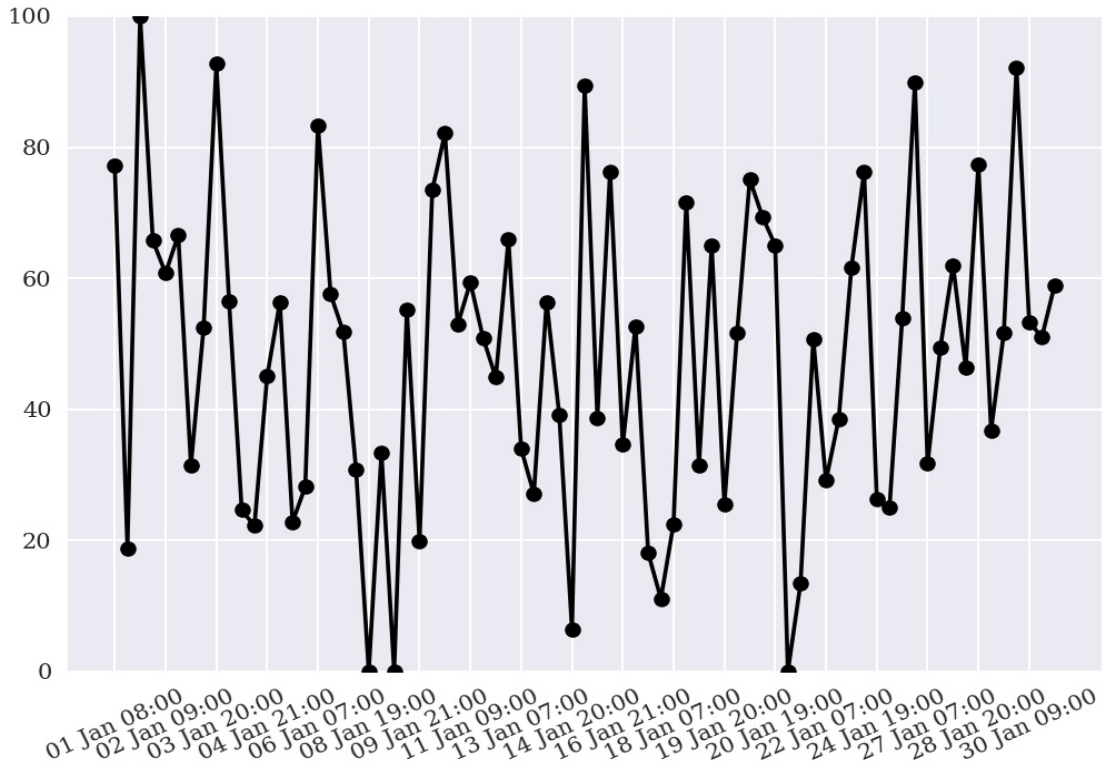
Overall Skill Score

Skill Score	Value
Proportion Correct	0.270
Kuiper Skill Score	-0.076
Heidke Skill Score	-0.070

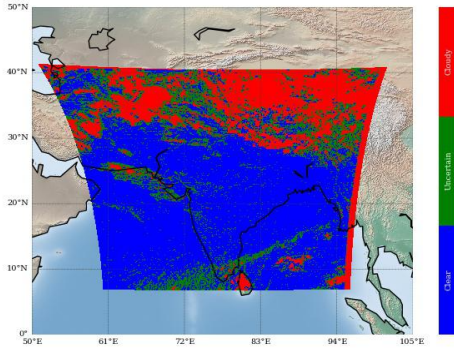
Number of Collocations for Jan-2016



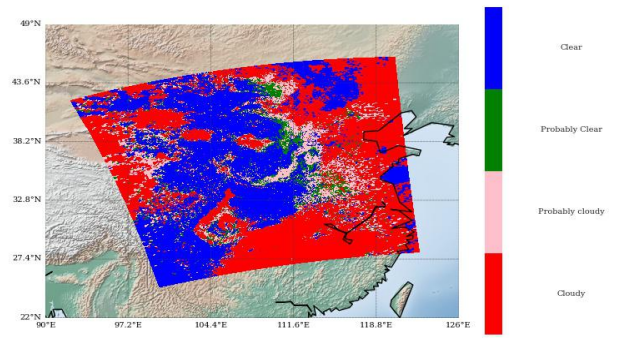
Percentage Correct for Jan-2016



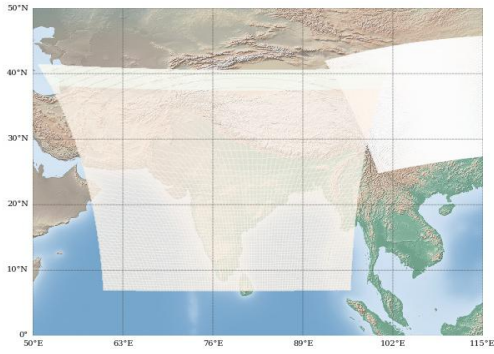
INSAT-3D Sounder Cloud Mask on
02 January, 2016 06:00 UTC



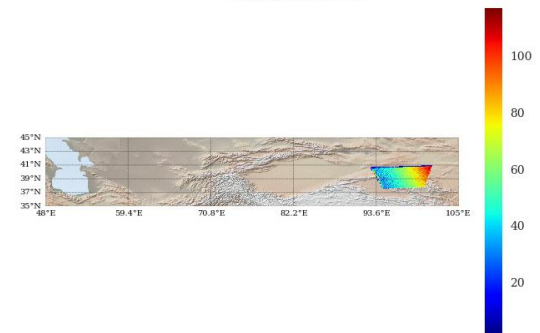
Modis Cloud Mask on
02 January, 2016 05:55 UTC



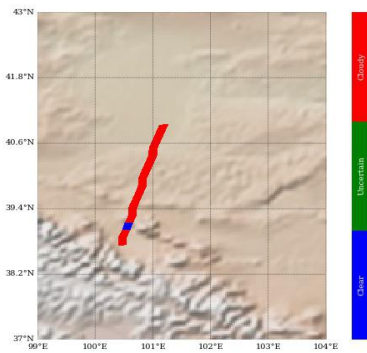
MODIS pass over INSAT-3D Sounder on
02 January, 2016 05:55 UTC



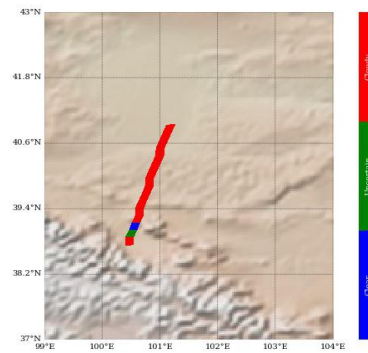
Number of Modis Pixels per Sounder Pixels on a
spatially and Temporally Collocated Domain on
02 January, 2016 05:55 UTC



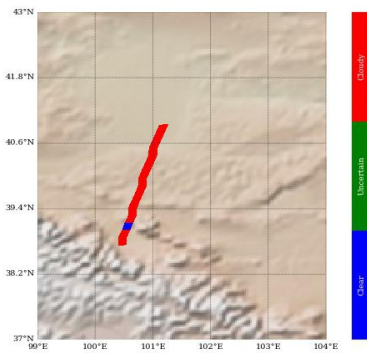
Modis Cloud Mask on Sounder Grid
Method 1 : Mode of Modis pixels



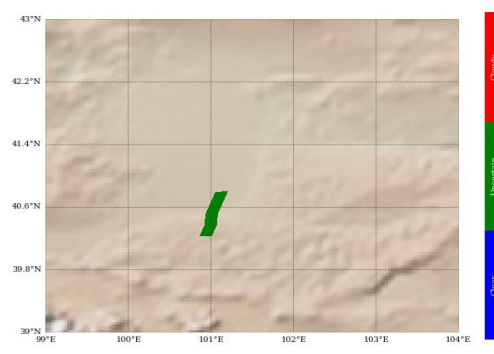
Modis Cloud Mask on Sounder Grid
Method 2 : Weighted Average



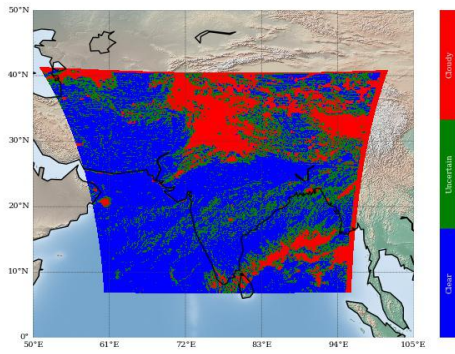
Modis Cloud Mask on Sounder Grid
Method 3 : Weighted Product Average



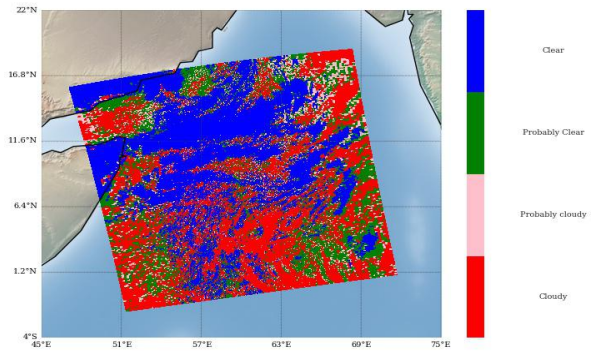
Sounder Cloud Flag on Collocated Area



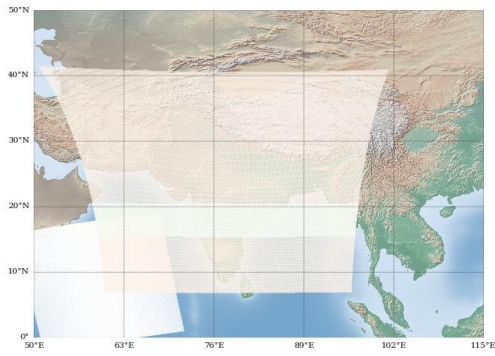
INSAT-3D Sounder Cloud Mask on
14 January, 2016 09:00 UTC



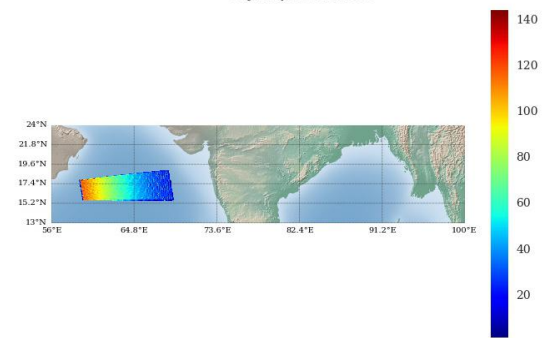
Modis Cloud Mask on
14 January, 2016 09:30 UTC



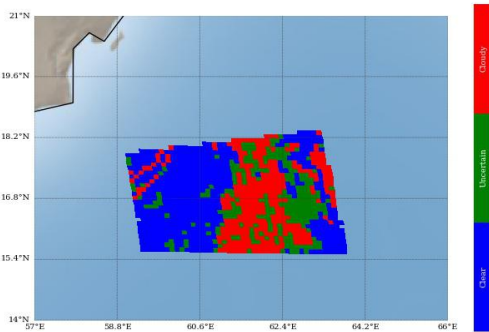
MODIS pass over INSAT-3D Sounder on
14 January, 2016 09:30 UTC



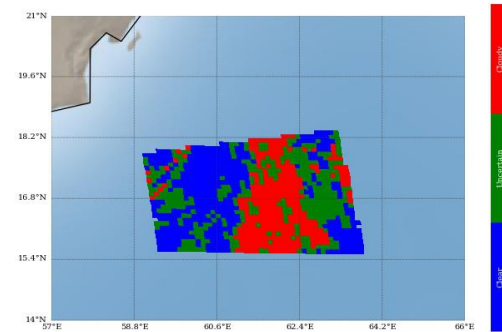
Number of Modis Pixels per Sounder Pixels on a
spatially and Temporally Collocated Domain on
14 January, 2016 09:30 UTC



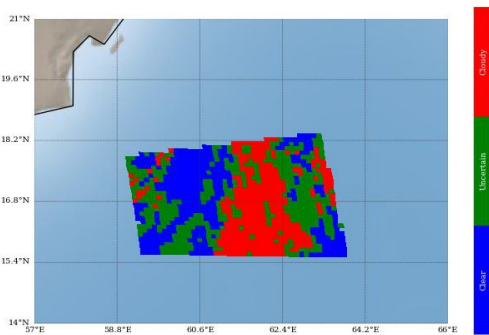
Modis Cloud Mask on Sounder Grid
Method 1 : Mode of Modis pixels



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

