

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 May , 2017 (All times (day and night)) on all surface types

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	65274	24455	17075
Sounder Uncertain	9839	3311	12754
Sounder Cloudy	9572	4667	43211

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	57567	34079	15158
Sounder Uncertain	7221	7295	11388
Sounder Cloudy	7058	8946	41446

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	50802	38680	17322
Sounder Uncertain	5796	8067	12041
Sounder Cloudy	5588	9583	42279

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34.33	12.86	8.98
Sounder Uncertain	5.17	1.74	6.71
Sounder Cloudy	5.03	2.45	22.72

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30.27	17.92	7.97
Sounder Uncertain	3.80	3.84	5.99
Sounder Cloudy	3.71	4.70	21.80

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	26.72	20.34	9.11
Sounder Uncertain	3.05	4.24	6.33
Sounder Cloudy	2.94	5.04	22.23

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.39	0.87	0.25
Frequency Bias	1.26	0.80	0.79
Probability of Detection	0.77	0.10	0.59
False Alarm Rate	0.53	0.29	0.18

Overall Skill Score

Skill Score	Value
Proportion Correct	0.588
Kuiper Skill Score	0.318
Heidke Skill Score	0.325

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.46	0.72	0.28
Frequency Bias	1.49	0.51	0.84
Probability of Detection	0.80	0.14	0.61
False Alarm Rate	0.59	0.22	0.19

Overall Skill Score

Skill Score	Value
Proportion Correct	0.559
Kuiper Skill Score	0.308
Heidke Skill Score	0.315

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.52	0.69	0.26
Frequency Bias	1.72	0.46	0.80
Probability of Detection	0.82	0.14	0.59
False Alarm Rate	0.63	0.20	0.17

Overall Skill Score

Skill Score	Value
Proportion Correct	0.532
Kuiper Skill Score	0.293
Heidke Skill Score	0.293

INSAT-3D Sounder vs MODIS for May , 2017 (Day) on all surface types

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	41810	19200	11708
Sounder Uncertain	6927	1792	7808
Sounder Cloudy	9057	4231	34225

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	36675	25332	10711
Sounder Uncertain	5031	4565	6931
Sounder Cloudy	6695	8257	32561

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	31585	28741	12392
Sounder Uncertain	3916	5280	7331
Sounder Cloudy	5277	8923	33313

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30.57	14.04	8.56
Sounder Uncertain	5.07	1.31	5.71
Sounder Cloudy	6.62	3.09	25.03

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	26.82	18.52	7.83
Sounder Uncertain	3.68	3.34	5.07
Sounder Cloudy	4.90	6.04	23.81

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23.10	21.02	9.06
Sounder Uncertain	2.86	3.86	5.36
Sounder Cloudy	3.86	6.52	24.36

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.43	0.89	0.28
Frequency Bias	1.26	0.66	0.88
Probability of Detection	0.72	0.07	0.64
False Alarm Rate	0.52	0.25	0.23

Overall Skill Score

Skill Score	Value
Proportion Correct	0.569
Kuiper Skill Score	0.293
Heidke Skill Score	0.301

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.50	0.72	0.31
Frequency Bias	1.50	0.43	0.95
Probability of Detection	0.76	0.12	0.65
False Alarm Rate	0.57	0.19	0.24

Overall Skill Score

Skill Score	Value
Proportion Correct	0.540
Kuiper Skill Score	0.287
Heidke Skill Score	0.292

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.57	0.68	0.30
Frequency Bias	1.78	0.38	0.90
Probability of Detection	0.77	0.12	0.63
False Alarm Rate	0.62	0.17	0.21

Overall Skill Score

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

Proportion Correct	0.513
Kuiper Skill Score	0.275
Heidke Skill Score	0.272

INSAT-3D Sounder vs MODIS for May , 2017 (Night) on all surface types

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23464	5255	5367
Sounder Uncertain	2912	1519	4946
Sounder Cloudy	515	436	8986

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20892	8747	4447
Sounder Uncertain	2190	2730	4457
Sounder Cloudy	363	689	8885

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	19217	9939	4930
Sounder Uncertain	1880	2787	4710
Sounder Cloudy	311	660	8966

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	43.94	9.84	10.05
Sounder Uncertain	5.45	2.84	9.26
Sounder Cloudy	0.96	0.82	16.83

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39.12	16.38	8.33
Sounder Uncertain	4.10	5.11	8.35
Sounder Cloudy	0.68	1.29	16.64

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	35.99	18.61	9.23
Sounder Uncertain	3.52	5.22	8.82
Sounder Cloudy	0.58	1.24	16.79

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.31	0.84	0.10
Frequency Bias	1.27	1.30	0.51
Probability of Detection	0.87	0.21	0.47
False Alarm Rate	0.55	0.40	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.636
Kuiper Skill Score	0.374
Heidke Skill Score	0.381

Method2 :Taking Weighted Average of MODIS pixels

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

False Alarm Ratio	0.39	0.71	0.11
Frequency Bias	1.45	0.77	0.56
Probability of Detection	0.89	0.22	0.50
False Alarm Rate	0.63	0.32	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.609
Kuiper Skill Score	0.352
Heidke Skill Score	0.367

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.44	0.70	0.10
Frequency Bias	1.59	0.70	0.53
Probability of Detection	0.90	0.21	0.48
False Alarm Rate	0.66	0.29	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.580
Kuiper Skill Score	0.329
Heidke Skill Score	0.339

INSAT-3D Sounder vs MODIS for May , 2017 (All times (day and night)) on Land

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
---------------	-------------	-----------------	--------------

Sounder Clear	31145	4140	5142
Sounder Uncertain	6621	1296	3898
Sounder Cloudy	7759	2017	17302

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28092	8856	3479
Sounder Uncertain	4989	3846	2980
Sounder Cloudy	5877	5405	15796

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	23802	12603	4022
Sounder Uncertain	3871	4691	3253
Sounder Cloudy	4605	6164	16309

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39.27	5.22	6.48
Sounder Uncertain	8.35	1.63	4.91
Sounder Cloudy	9.78	2.54	21.81

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	35.42	11.16	4.39
Sounder Uncertain	6.29	4.85	3.76
Sounder Cloudy	7.41	6.81	19.91

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30.01	15.89	5.07

Sounder Uncertain	4.88	5.91	4.10
Sounder Cloudy	5.81	7.77	20.56

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.23	0.89	0.36
Frequency Bias	0.89	1.59	1.03
Probability of Detection	0.68	0.17	0.66
False Alarm Rate	0.31	0.36	0.33

Overall Skill Score

Skill Score	Value
Proportion Correct	0.627
Kuiper Skill Score	0.376
Heidke Skill Score	0.357

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.31	0.67	0.42
Frequency Bias	1.04	0.65	1.22
Probability of Detection	0.72	0.21	0.71
False Alarm Rate	0.39	0.25	0.36

Overall Skill Score

Skill Score	Value
Proportion Correct	0.602
Kuiper Skill Score	0.353
Heidke Skill Score	0.358

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.41	0.60	0.40

Frequency Bias	1.25	0.50	1.15
Probability of Detection	0.74	0.20	0.69
False Alarm Rate	0.48	0.21	0.31

Overall Skill Score

Skill Score	Value
Proportion Correct	0.565
Kuiper Skill Score	0.322
Heidke Skill Score	0.327

INSAT-3D Sounder vs MODIS for May , 2017 (Day) on Land

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	25561	2240	3313
Sounder Uncertain	5364	465	2024
Sounder Cloudy	7458	1742	12875

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22918	6250	1946
Sounder Uncertain	3993	2517	1343
Sounder Cloudy	5655	4990	11430

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	19361	9427	2326

Sounder Uncertain	3059	3305	1489
Sounder Cloudy	4421	5761	11893

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	41.87	3.67	5.43
Sounder Uncertain	8.79	0.76	3.32
Sounder Cloudy	12.22	2.85	21.09

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	37.54	10.24	3.19
Sounder Uncertain	6.54	4.12	2.20
Sounder Cloudy	9.26	8.17	18.72

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	31.72	15.44	3.81
Sounder Uncertain	5.01	5.41	2.44
Sounder Cloudy	7.24	9.44	19.48

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.18	0.94	0.42
Frequency Bias	0.81	1.77	1.21
Probability of Detection	0.67	0.10	0.71
False Alarm Rate	0.25	0.33	0.42

Overall Skill Score

Skill Score	Value
Proportion Correct	0.637
Kuiper Skill Score	0.391
Heidke Skill Score	0.355

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.26	0.68	0.48
Frequency Bias	0.96	0.57	1.50
Probability of Detection	0.70	0.18	0.78
False Alarm Rate	0.34	0.22	0.44

Overall Skill Score

Skill Score	Value
Proportion Correct	0.604
Kuiper Skill Score	0.356
Heidke Skill Score	0.353

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.58	0.46
Frequency Bias	1.16	0.42	1.41
Probability of Detection	0.72	0.18	0.76
False Alarm Rate	0.44	0.17	0.38

Overall Skill Score

Skill Score	Value
Proportion Correct	0.566
Kuiper Skill Score	0.324
Heidke Skill Score	0.326

INSAT-3D Sounder vs MODIS for May , 2017 (Night) on Land

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5584	1900	1829
Sounder Uncertain	1257	831	1874
Sounder Cloudy	301	275	4427

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5174	2606	1533
Sounder Uncertain	996	1329	1637
Sounder Cloudy	222	415	4366

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4441	3176	1696
Sounder Uncertain	812	1386	1764
Sounder Cloudy	184	403	4416

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30.55	10.40	10.01
Sounder Uncertain	6.88	4.55	10.25
Sounder Cloudy	1.65	1.50	24.22

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28.31	14.26	8.39
Sounder Uncertain	5.45	7.27	8.96
Sounder Cloudy	1.21	2.27	23.89

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	24.30	17.38	9.28
Sounder Uncertain	4.44	7.58	9.65
Sounder Cloudy	1.01	2.20	24.16

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.40	0.79	0.12
Frequency Bias	1.30	1.32	0.62
Probability of Detection	0.78	0.28	0.54
False Alarm Rate	0.50	0.42	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.593
Kuiper Skill Score	0.380
Heidke Skill Score	0.368

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.44	0.66	0.13
Frequency Bias	1.46	0.91	0.66
Probability of Detection	0.81	0.31	0.58
False Alarm Rate	0.56	0.36	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.595
Kuiper Skill Score	0.387
Heidke Skill Score	0.383

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.52	0.65	0.12
Frequency Bias	1.71	0.80	0.64
Probability of Detection	0.82	0.28	0.56
False Alarm Rate	0.61	0.32	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.560
Kuiper Skill Score	0.356
Heidke Skill Score	0.345

INSAT-3D Sounder vs MODIS for May , 2017 (All times (day and night)) on Ocean

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32003	19660	11131
Sounder Uncertain	2274	1871	8036
Sounder Cloudy	945	2477	22122

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	27642	24049	11103
Sounder Uncertain	1553	2830	7798
Sounder Cloudy	679	2667	22198

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	25397	24751	12646
Sounder Uncertain	1353	2703	8125
Sounder Cloudy	577	2542	22425

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	31.84	19.56	11.07
Sounder Uncertain	2.26	1.86	7.99
Sounder Cloudy	0.94	2.46	22.01

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	27.50	23.92	11.05
Sounder Uncertain	1.54	2.82	7.76
Sounder Cloudy	0.68	2.65	22.08

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	25.27	24.62	12.58
Sounder Uncertain	1.35	2.69	8.08
Sounder Cloudy	0.57	2.53	22.31

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.49	0.85	0.13
Frequency Bias	1.78	0.51	0.62
Probability of Detection	0.91	0.08	0.54
False Alarm Rate	0.69	0.23	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.557
Kuiper Skill Score	0.314
Heidke Skill Score	0.316

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.56	0.77	0.13
Frequency Bias	2.10	0.41	0.62
Probability of Detection	0.93	0.10	0.54
False Alarm Rate	0.73	0.20	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.524
Kuiper Skill Score	0.302
Heidke Skill Score	0.295

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.60	0.78	0.12
Frequency Bias	2.30	0.41	0.59
Probability of Detection	0.93	0.09	0.52
False Alarm Rate	0.75	0.19	0.06

Overall Skill Score

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

Proportion Correct	0.503
Kuiper Skill Score	0.287
Heidke Skill Score	0.274

INSAT-3D Sounder vs MODIS for May , 2017 (Day) on Ocean

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14788	16573	7803
Sounder Uncertain	704	1220	5094
Sounder Cloudy	752	2320	17828

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	12521	18296	8347
Sounder Uncertain	431	1488	5099
Sounder Cloudy	554	2407	17939

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	11103	18477	9584
Sounder Uncertain	344	1371	5303
Sounder Cloudy	466	2296	18138

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22.04	24.71	11.63
Sounder Uncertain	1.05	1.82	7.59
Sounder Cloudy	1.12	3.46	26.58

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	18.67	27.27	12.44
Sounder Uncertain	0.64	2.22	7.60
Sounder Cloudy	0.83	3.59	26.74

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	16.55	27.54	14.29
Sounder Uncertain	0.51	2.04	7.91
Sounder Cloudy	0.69	3.42	27.04

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.62	0.83	0.15
Frequency Bias	2.41	0.35	0.68
Probability of Detection	0.91	0.06	0.58
False Alarm Rate	0.73	0.17	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.504
Kuiper Skill Score	0.294
Heidke Skill Score	0.276

Method2 :Taking Weighted Average of MODIS pixels

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

False Alarm Ratio	0.68	0.79	0.14
Frequency Bias	2.90	0.32	0.67
Probability of Detection	0.93	0.07	0.57
False Alarm Rate	0.76	0.16	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.476
Kuiper Skill Score	0.283
Heidke Skill Score	0.254

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.72	0.80	0.13
Frequency Bias	3.29	0.32	0.63
Probability of Detection	0.93	0.06	0.55
False Alarm Rate	0.77	0.15	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.456
Kuiper Skill Score	0.267
Heidke Skill Score	0.233

INSAT-3D Sounder vs MODIS for May , 2017 (Night) on Ocean

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
---------------	-------------	-----------------	--------------

Sounder Clear	17215	3087	3328
Sounder Uncertain	1570	651	2942
Sounder Cloudy	193	157	4294

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	15121	5753	2756
Sounder Uncertain	1122	1342	2699
Sounder Cloudy	125	260	4259

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14294	6274	3062
Sounder Uncertain	1009	1332	2822
Sounder Cloudy	111	246	4287

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51.48	9.23	9.95
Sounder Uncertain	4.70	1.95	8.80
Sounder Cloudy	0.58	0.47	12.84

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	45.22	17.21	8.24
Sounder Uncertain	3.36	4.01	8.07
Sounder Cloudy	0.37	0.78	12.74

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	42.75	18.76	9.16

Sounder Uncertain	3.02	3.98	8.44
Sounder Cloudy	0.33	0.74	12.82

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.27	0.87	0.08
Frequency Bias	1.25	1.33	0.44
Probability of Detection	0.91	0.17	0.41
False Alarm Rate	0.57	0.40	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.663
Kuiper Skill Score	0.354
Heidke Skill Score	0.372

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.36	0.74	0.08
Frequency Bias	1.44	0.70	0.48
Probability of Detection	0.92	0.18	0.44
False Alarm Rate	0.67	0.30	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.620
Kuiper Skill Score	0.318
Heidke Skill Score	0.344

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.40	0.74	0.08

Frequency Bias	1.53	0.66	0.46
Probability of Detection	0.93	0.17	0.42
False Alarm Rate	0.69	0.28	0.03

Overall Skill Score

Skill Score	Value
Proportion Correct	0.596
Kuiper Skill Score	0.299
Heidke Skill Score	0.321

INSAT-3D Sounder vs MODIS for May , 2017 (All times (day and night)) on Coast

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	330	105	137
Sounder Uncertain	49	27	73
Sounder Cloudy	64	26	213

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	287	180	105
Sounder Uncertain	45	46	58
Sounder Cloudy	45	57	201

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	259	194	119

Sounder Uncertain	35	48	66
Sounder Cloudy	34	66	203

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32.23	10.25	13.38
Sounder Uncertain	4.79	2.64	7.13
Sounder Cloudy	6.25	2.54	20.80

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28.03	17.58	10.25
Sounder Uncertain	4.39	4.49	5.66
Sounder Cloudy	4.39	5.57	19.63

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	25.29	18.95	11.62
Sounder Uncertain	3.42	4.69	6.45
Sounder Cloudy	3.32	6.45	19.82

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.42	0.82	0.30
Frequency Bias	1.29	0.94	0.72
Probability of Detection	0.74	0.17	0.50
False Alarm Rate	0.53	0.27	0.20

Overall Skill Score

Skill Score	Value
Proportion Correct	0.557
Kuiper Skill Score	0.275
Heidke Skill Score	0.278

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.50	0.69	0.34
Frequency Bias	1.52	0.53	0.83
Probability of Detection	0.76	0.16	0.55
False Alarm Rate	0.58	0.21	0.21

Overall Skill Score

Skill Score	Value
Proportion Correct	0.521
Kuiper Skill Score	0.258
Heidke Skill Score	0.263

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.55	0.68	0.33
Frequency Bias	1.74	0.48	0.78
Probability of Detection	0.79	0.16	0.52
False Alarm Rate	0.61	0.20	0.19

Overall Skill Score

Skill Score	Value
Proportion Correct	0.498
Kuiper Skill Score	0.246
Heidke Skill Score	0.245

INSAT-3D Sounder vs MODIS for May , 2017 (Day) on Coast

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	239	56	90
Sounder Uncertain	35	21	48
Sounder Cloudy	59	25	171

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	207	108	70
Sounder Uncertain	32	40	32
Sounder Cloudy	41	55	159

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	197	109	79
Sounder Uncertain	27	37	40
Sounder Cloudy	30	64	161

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32.12	7.53	12.10
Sounder Uncertain	4.70	2.82	6.45
Sounder Cloudy	7.93	3.36	22.98

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	27.82	14.52	9.41
Sounder Uncertain	4.30	5.38	4.30
Sounder Cloudy	5.51	7.39	21.37

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	26.48	14.65	10.62
Sounder Uncertain	3.63	4.97	5.38
Sounder Cloudy	4.03	8.60	21.64

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.80	0.33
Frequency Bias	1.16	1.02	0.83
Probability of Detection	0.72	0.21	0.55
False Alarm Rate	0.47	0.27	0.27

Overall Skill Score

Skill Score	Value
Proportion Correct	0.579
Kuiper Skill Score	0.306
Heidke Skill Score	0.307

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.46	0.62	0.38
Frequency Bias	1.38	0.51	0.98
Probability of Detection	0.74	0.20	0.61
False Alarm Rate	0.53	0.19	0.28

Overall Skill Score

Skill Score	Value
Proportion Correct	0.546
Kuiper Skill Score	0.291
Heidke Skill Score	0.298

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.49	0.64	0.37
Frequency Bias	1.52	0.50	0.91
Probability of Detection	0.78	0.18	0.57
False Alarm Rate	0.54	0.19	0.27

Overall Skill Score

Skill Score	Value
Proportion Correct	0.531
Kuiper Skill Score	0.281
Heidke Skill Score	0.284

INSAT-3D Sounder vs MODIS for May , 2017 (Night) on Coast

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	91	49	47
Sounder Uncertain	14	6	25
Sounder Cloudy	5	1	42

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	80	72	35
Sounder Uncertain	13	6	26
Sounder Cloudy	4	2	42

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	62	85	40
Sounder Uncertain	8	11	26
Sounder Cloudy	4	2	42

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32.50	17.50	16.79
Sounder Uncertain	5.00	2.14	8.93
Sounder Cloudy	1.79	0.36	15.00

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	28.57	25.71	12.50
Sounder Uncertain	4.64	2.14	9.29
Sounder Cloudy	1.43	0.71	15.00

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22.14	30.36	14.29
Sounder Uncertain	2.86	3.93	9.29
Sounder Cloudy	1.43	0.71	15.00

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.51	0.87	0.12
Frequency Bias	1.70	0.80	0.42
Probability of Detection	0.83	0.11	0.37
False Alarm Rate	0.68	0.28	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.496
Kuiper Skill Score	0.206
Heidke Skill Score	0.208

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.57	0.87	0.12
Frequency Bias	1.93	0.56	0.47
Probability of Detection	0.82	0.07	0.41
False Alarm Rate	0.70	0.26	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.457
Kuiper Skill Score	0.176
Heidke Skill Score	0.177

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.67	0.76	0.12
Frequency Bias	2.53	0.46	0.44
Probability of Detection	0.84	0.11	0.39
False Alarm Rate	0.76	0.21	0.04

Overall Skill Score

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

Proportion Correct	0.411
Kuiper Skill Score	0.170
Heidke Skill Score	0.160

INSAT-3D Sounder vs MODIS for May , 2017 (All times (day and night)) on Highland (>2000 m)

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	209	21	130
Sounder Uncertain	650	9	446
Sounder Cloudy	494	14	2403

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	153	132	75
Sounder Uncertain	445	371	289
Sounder Cloudy	234	556	2121

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	136	134	90
Sounder Uncertain	379	408	318
Sounder Cloudy	181	536	2194

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.78	0.48	2.97
Sounder Uncertain	14.85	0.21	10.19
Sounder Cloudy	11.29	0.32	54.91

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.50	3.02	1.71
Sounder Uncertain	10.17	8.48	6.60
Sounder Cloudy	5.35	12.71	48.47

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.11	3.06	2.06
Sounder Uncertain	8.66	9.32	7.27
Sounder Cloudy	4.14	12.25	50.14

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.42	0.99	0.17
Frequency Bias	0.27	25.11	0.98
Probability of Detection	0.15	0.20	0.81
False Alarm Rate	0.09	0.62	0.29

Overall Skill Score

Skill Score	Value
Proportion Correct	0.599
Kuiper Skill Score	0.268
Heidke Skill Score	0.228

Method2 :Taking Weighted Average of MODIS pixels

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

False Alarm Ratio	0.57	0.66	0.27
Frequency Bias	0.43	1.04	1.17
Probability of Detection	0.18	0.35	0.85
False Alarm Rate	0.12	0.42	0.46

Overall Skill Score

Skill Score	Value
Proportion Correct	0.604
Kuiper Skill Score	0.257
Heidke Skill Score	0.275

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.62	0.63	0.25
Frequency Bias	0.52	1.03	1.12
Probability of Detection	0.20	0.38	0.84
False Alarm Rate	0.14	0.43	0.44

Overall Skill Score

Skill Score	Value
Proportion Correct	0.626
Kuiper Skill Score	0.276
Heidke Skill Score	0.293

INSAT-3D Sounder vs MODIS for May , 2017 (Day) on Highland (>2000 m)

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
---------------	-------------	-----------------	--------------

Sounder Clear	188	4	115
Sounder Uncertain	639	5	440
Sounder Cloudy	494	14	2401

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	133	112	62
Sounder Uncertain	435	366	283
Sounder Cloudy	234	556	2119

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	117	115	75
Sounder Uncertain	369	403	312
Sounder Cloudy	181	536	2192

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.37	0.09	2.67
Sounder Uncertain	14.86	0.12	10.23
Sounder Cloudy	11.49	0.33	55.84

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	3.09	2.60	1.44
Sounder Uncertain	10.12	8.51	6.58
Sounder Cloudy	5.44	12.93	49.28

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2.72	2.67	1.74

Sounder Uncertain	8.58	9.37	7.26
Sounder Cloudy	4.21	12.47	50.98

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.39	1.00	0.17
Frequency Bias	0.23	47.13	0.98
Probability of Detection	0.14	0.22	0.81
False Alarm Rate	0.07	0.63	0.30

Overall Skill Score

Skill Score	Value
Proportion Correct	0.603
Kuiper Skill Score	0.265
Heidke Skill Score	0.225

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.57	0.66	0.27
Frequency Bias	0.38	1.05	1.18
Probability of Detection	0.17	0.35	0.86
False Alarm Rate	0.10	0.43	0.47

Overall Skill Score

Skill Score	Value
Proportion Correct	0.609
Kuiper Skill Score	0.254
Heidke Skill Score	0.273

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.62	0.63	0.25

Frequency Bias	0.46	1.03	1.13
Probability of Detection	0.18	0.38	0.85
False Alarm Rate	0.12	0.43	0.45

Overall Skill Score

Skill Score	Value
Proportion Correct	0.631
Kuiper Skill Score	0.273
Heidke Skill Score	0.292

INSAT-3D Sounder vs MODIS for May , 2017 (Night) on Highland (>2000 m)

1. Confusion matrix of Total number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	21	17	15
Sounder Uncertain	11	4	6
Sounder Cloudy	0	0	2

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	20	20	13
Sounder Uncertain	10	5	6
Sounder Cloudy	0	0	2

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	19	19	15

Sounder Uncertain	10	5	6
Sounder Cloudy	0	0	2

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	27.63	22.37	19.74
Sounder Uncertain	14.47	5.26	7.89
Sounder Cloudy	0.00	0.00	2.63

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	26.32	26.32	17.11
Sounder Uncertain	13.16	6.58	7.89
Sounder Cloudy	0.00	0.00	2.63

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	25.00	25.00	19.74
Sounder Uncertain	13.16	6.58	7.89
Sounder Cloudy	0.00	0.00	2.63

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.60	0.81	0.00
Frequency Bias	1.66	1.00	0.09
Probability of Detection	0.66	0.19	0.09
False Alarm Rate	0.65	0.35	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.355
Kuiper Skill Score	-0.035
Heidke Skill Score	-0.036

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.62	0.76	0.00
Frequency Bias	1.77	0.84	0.10
Probability of Detection	0.67	0.20	0.10
False Alarm Rate	0.67	0.33	0.00

Overall Skill Score

Skill Score	Value
Proportion Correct	0.355
Kuiper Skill Score	-0.028
Heidke Skill Score	-0.029

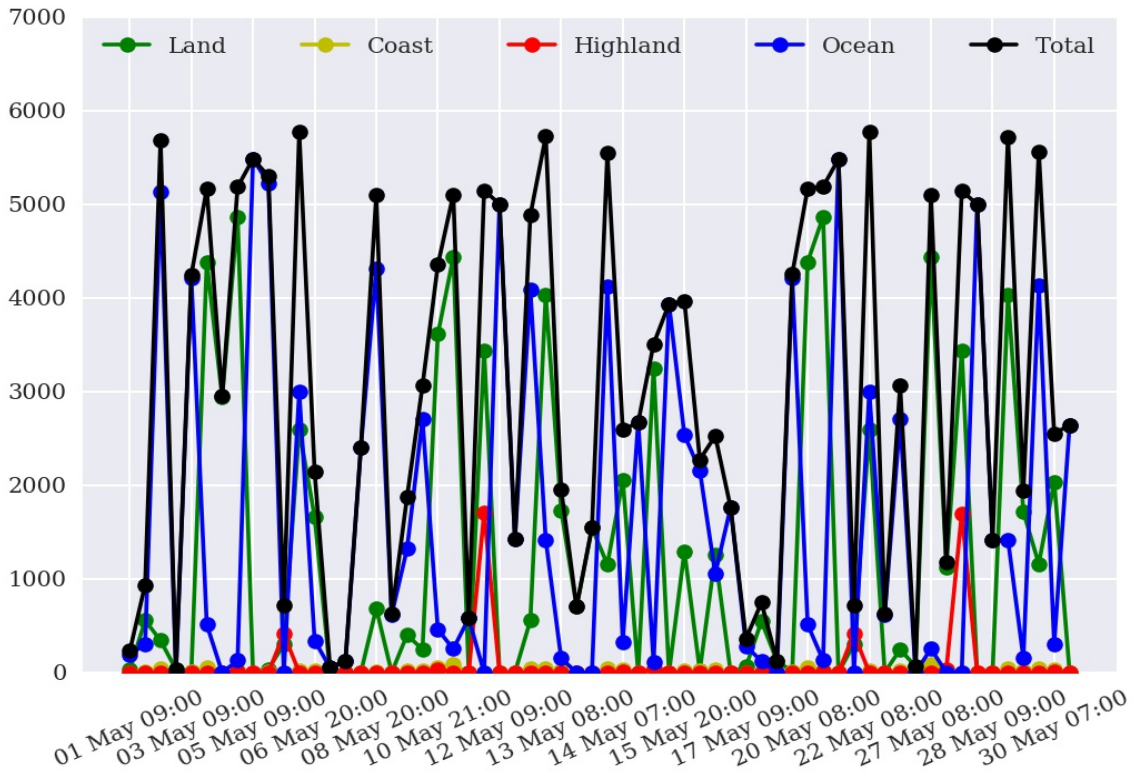
Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.64	0.76	0.00
Frequency Bias	1.83	0.88	0.09
Probability of Detection	0.66	0.21	0.09
False Alarm Rate	0.68	0.32	0.00

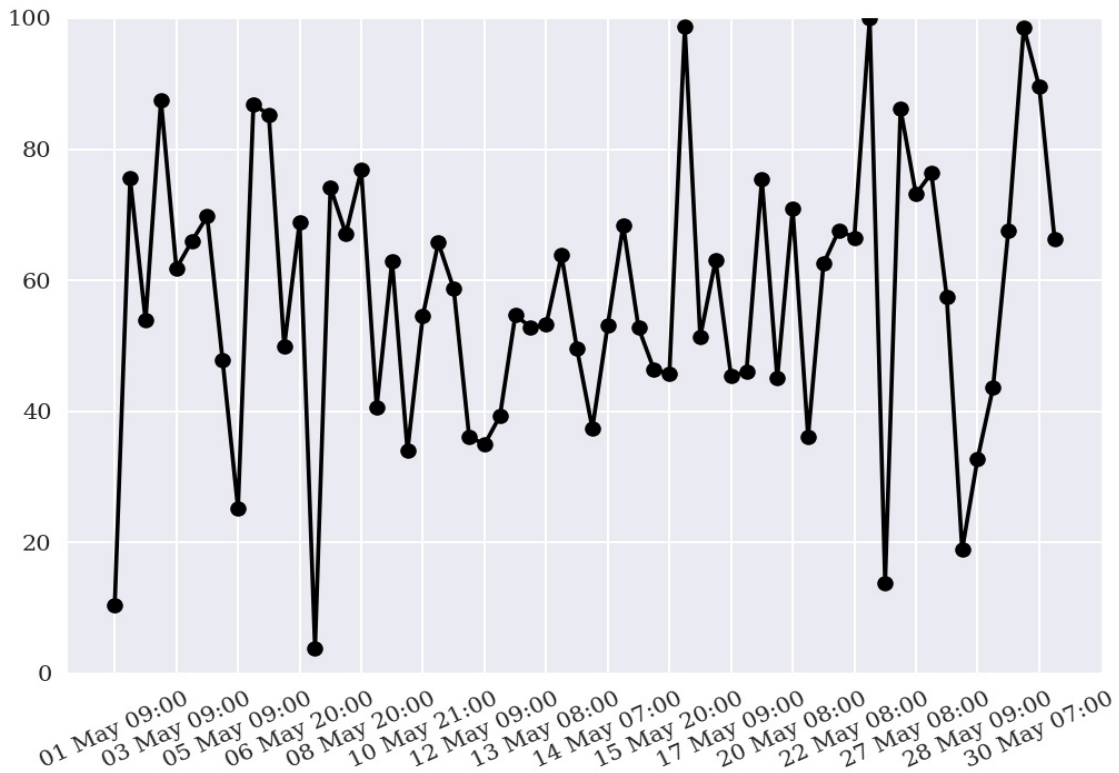
Overall Skill Score

Skill Score	Value
Proportion Correct	0.342
Kuiper Skill Score	-0.029
Heidke Skill Score	-0.030

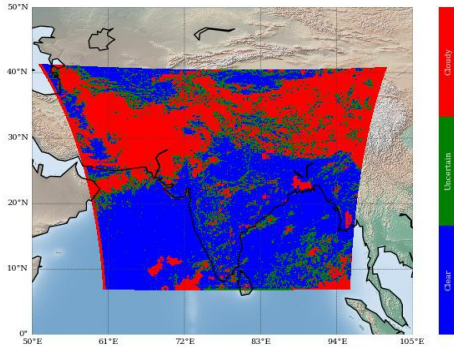
Number of Collocations for May-2017



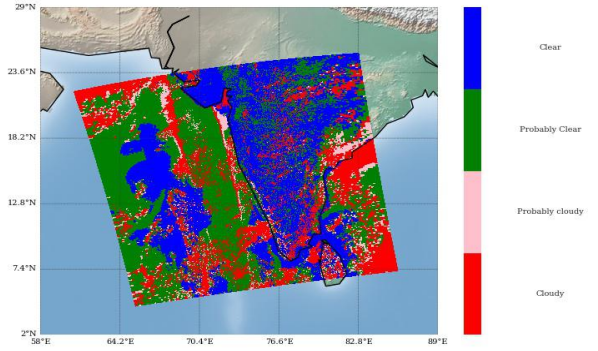
Percentage Correct for May-2017



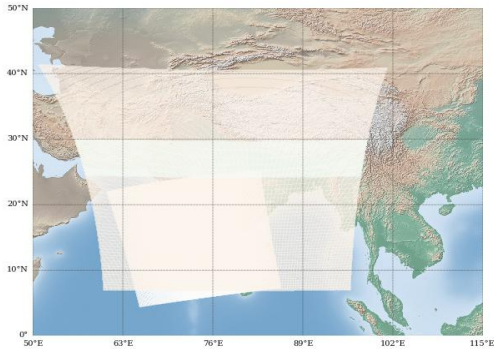
INSAT-3D Sounder Cloud Mask on
02 May, 2017 08:00 UTC



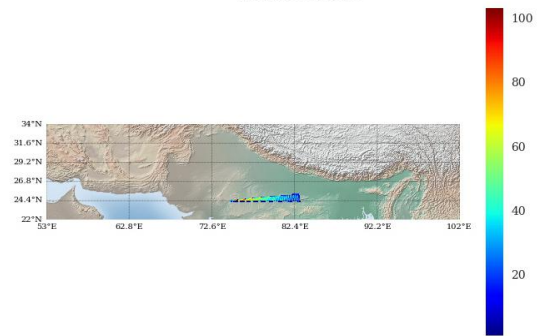
Modis Cloud Mask on
02 May, 2017 08:30 UTC



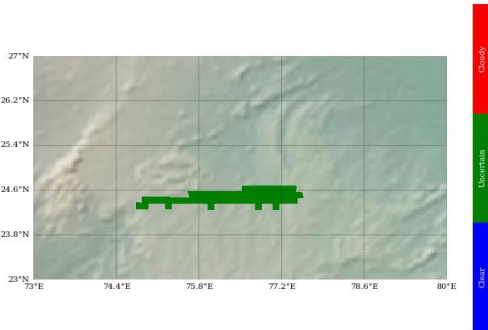
MODIS pass over INSAT-3D Sounder on
02 May, 2017 08:30 UTC



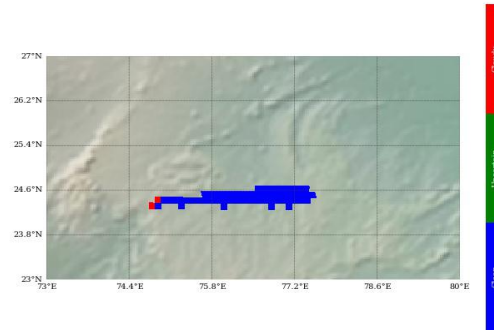
Number of Modis Pixels per Sounder Pixels on a
spatially and Temporally Collocated Domain on
02 May, 2017 08:30 UTC



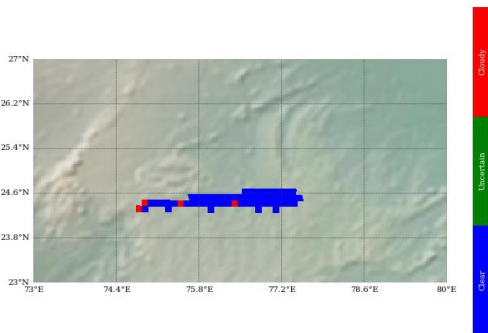
Modis Cloud Mask on Sounder Grid
Method 1 : Mode of Modis pixels



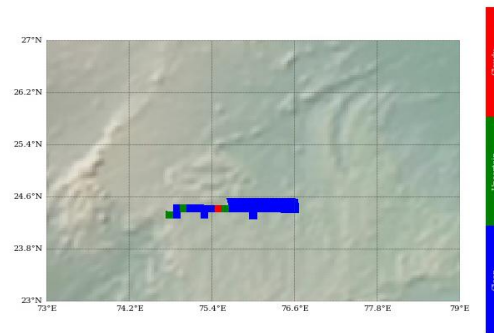
Modis Cloud Mask on Sounder Grid
Method 2 : Weighted Average



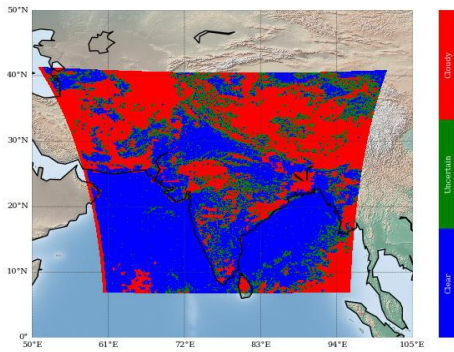
Modis Cloud Mask on Sounder Grid
Method 3 : Weighted Product Average



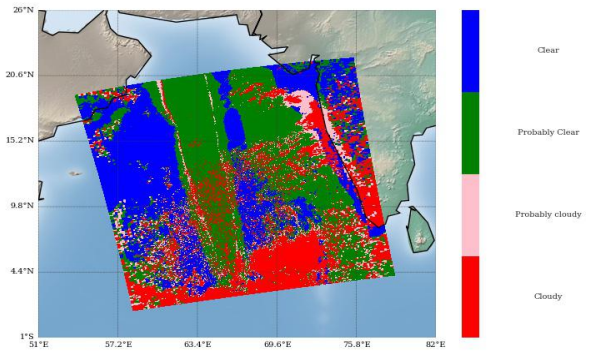
Sounder Cloud Flag on Collocated Area



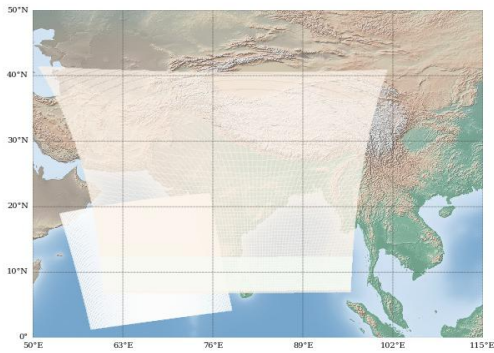
INSAT-3D Sounder Cloud Mask on 05 May, 2017 09:00 UTC



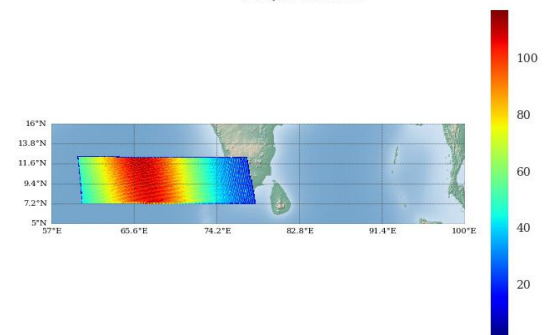
Modis Cloud Mask on 05 May, 2017 09:00 UTC



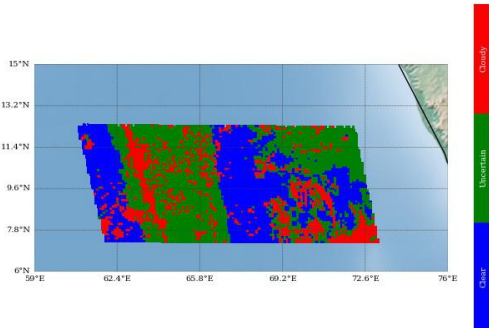
MODIS pass over INSAT-3D Sounder on 05 May, 2017 09:00 UTC



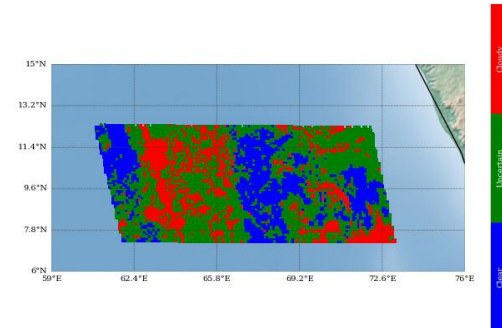
Number of Modis Pixels per Sounder Pixels on a spatially and Temporally Collocated Domain on 05 May, 2017 09:00 UTC



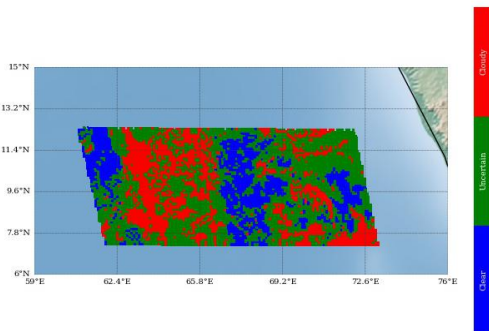
Modis Cloud Mask on Sounder Grid Method 1 : Mode of Modis pixels



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

