

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 February , 2018 (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	52537	11106	9325
Sounder Uncertain	10196	1877	11360
Sounder Cloudy	6339	949	23390

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	49712	15868	7388
Sounder Uncertain	8052	5810	9571
Sounder Cloudy	4511	4421	21746

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	45282	19443	8243
Sounder Uncertain	6940	6269	10224
Sounder Cloudy	3706	4674	22298

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	41.34	8.74	7.34
Sounder Uncertain	8.02	1.48	8.94
Sounder Cloudy	4.99	0.75	18.41

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39.12	12.49	5.81
Sounder Uncertain	6.34	4.57	7.53
Sounder Cloudy	3.55	3.48	17.11

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	35.63	15.30	6.49
Sounder Uncertain	5.46	4.93	8.05
Sounder Cloudy	2.92	3.68	17.55

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.28	0.92	0.24
Frequency Bias	1.06	1.68	0.70
Probability of Detection	0.76	0.13	0.53
False Alarm Rate	0.41	0.44	0.15

Overall Skill Score

Skill Score	Value
Proportion Correct	0.612
Kuiper Skill Score	0.343
Heidke Skill Score	0.336

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.32	0.75	0.29
Frequency Bias	1.17	0.90	0.79
Probability of Detection	0.80	0.22	0.56
False Alarm Rate	0.47	0.35	0.18

Overall Skill Score

Skill Score	Value
Proportion Correct	0.608
Kuiper Skill Score	0.344
Heidke Skill Score	0.354

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.38	0.73	0.27
Frequency Bias	1.30	0.77	0.75
Probability of Detection	0.81	0.21	0.55
False Alarm Rate	0.52	0.32	0.16

Overall Skill Score

Skill Score	Value
Proportion Correct	0.581
Kuiper Skill Score	0.320
Heidke Skill Score	0.331

INSAT-3D Sounder vs MODIS for February , 2018 (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	36187	7228	4112
Sounder Uncertain	7536	1084	4615
Sounder Cloudy	5504	857	17829

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34907	9180	3440
Sounder Uncertain	6139	3365	3731
Sounder Cloudy	3815	4014	16361

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	31421	12344	3762
Sounder Uncertain	5360	3813	4062
Sounder Cloudy	3095	4247	16848

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	42.60	8.51	4.84
Sounder Uncertain	8.87	1.28	5.43
Sounder Cloudy	6.48	1.01	20.99

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	41.09	10.81	4.05
Sounder Uncertain	7.23	3.96	4.39
Sounder Cloudy	4.49	4.73	19.26

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	36.99	14.53	4.43
Sounder Uncertain	6.31	4.49	4.78
Sounder Cloudy	3.64	5.00	19.83

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.24	0.92	0.26
Frequency Bias	0.97	1.44	0.91
Probability of Detection	0.74	0.12	0.67
False Alarm Rate	0.38	0.41	0.21

Overall Skill Score

Skill Score	Value
Proportion Correct	0.649
Kuiper Skill Score	0.394
Heidke Skill Score	0.383

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.27	0.75	0.32
Frequency Bias	1.06	0.80	1.03
Probability of Detection	0.78	0.20	0.70
False Alarm Rate	0.42	0.33	0.26

Overall Skill Score

Skill Score	Value
Proportion Correct	0.643
Kuiper Skill Score	0.393
Heidke Skill Score	0.400

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.34	0.71	0.30
Frequency Bias	1.19	0.65	0.98
Probability of Detection	0.79	0.19	0.68
False Alarm Rate	0.49	0.29	0.22

Overall Skill Score

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

Proportion Correct	0.613
Kuiper Skill Score	0.361
Heidke Skill Score	0.373

INSAT-3D Sounder vs MODIS for February , 2018 (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	16350	3878	5213
Sounder Uncertain	2660	793	6745
Sounder Cloudy	835	92	5561

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14805	6688	3948
Sounder Uncertain	1913	2445	5840
Sounder Cloudy	696	407	5385

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13861	7099	4481
Sounder Uncertain	1580	2456	6162
Sounder Cloudy	611	427	5450

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	38.81	9.21	12.37
Sounder Uncertain	6.31	1.88	16.01
Sounder Cloudy	1.98	0.22	13.20

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	35.14	15.88	9.37
Sounder Uncertain	4.54	5.80	13.86
Sounder Cloudy	1.65	0.97	12.78

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	32.90	16.85	10.64
Sounder Uncertain	3.75	5.83	14.63
Sounder Cloudy	1.45	1.01	12.94

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.36	0.92	0.14
Frequency Bias	1.28	2.14	0.37
Probability of Detection	0.82	0.17	0.32
False Alarm Rate	0.47	0.48	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.539
Kuiper Skill Score	0.275
Heidke Skill Score	0.261

Method2 :Taking Weighted Average of MODIS pixels

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

False Alarm Ratio	0.42	0.76	0.17
Frequency Bias	1.46	1.07	0.43
Probability of Detection	0.85	0.26	0.35
False Alarm Rate	0.55	0.40	0.06

Overall Skill Score

Skill Score	Value
Proportion Correct	0.537
Kuiper Skill Score	0.274
Heidke Skill Score	0.277

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.46	0.76	0.16
Frequency Bias	1.58	1.02	0.40
Probability of Detection	0.86	0.25	0.34
False Alarm Rate	0.57	0.38	0.05

Overall Skill Score

Skill Score	Value
Proportion Correct	0.517
Kuiper Skill Score	0.261
Heidke Skill Score	0.261

INSAT-3D Sounder vs MODIS for February , 2018 (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	40049	3719	5296
Sounder Uncertain	5310	720	5308
Sounder Cloudy	2419	578	13858

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	38138	6853	4073
Sounder Uncertain	4454	2269	4615
Sounder Cloudy	1992	1432	13431

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34497	10112	4455
Sounder Uncertain	3868	2625	4845
Sounder Cloudy	1626	1619	13610

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51.84	4.81	6.86
Sounder Uncertain	6.87	0.93	6.87
Sounder Cloudy	3.13	0.75	17.94

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	49.37	8.87	5.27
Sounder Uncertain	5.77	2.94	5.97
Sounder Cloudy	2.58	1.85	17.38

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	44.65	13.09	5.77

Sounder Uncertain	5.01	3.40	6.27
Sounder Cloudy	2.10	2.10	17.62

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.18	0.94	0.18
Frequency Bias	1.03	2.26	0.69
Probability of Detection	0.84	0.14	0.57
False Alarm Rate	0.40	0.47	0.13

Overall Skill Score

Skill Score	Value
Proportion Correct	0.707
Kuiper Skill Score	0.459
Heidke Skill Score	0.446

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.22	0.80	0.20
Frequency Bias	1.10	1.07	0.76
Probability of Detection	0.86	0.21	0.61
False Alarm Rate	0.47	0.39	0.15

Overall Skill Score

Skill Score	Value
Proportion Correct	0.697
Kuiper Skill Score	0.438
Heidke Skill Score	0.450

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.30	0.77	0.19

Frequency Bias	1.23	0.79	0.74
Probability of Detection	0.86	0.18	0.59
False Alarm Rate	0.55	0.33	0.12

Overall Skill Score

Skill Score	Value
Proportion Correct	0.657
Kuiper Skill Score	0.387
Heidke Skill Score	0.407

INSAT-3D Sounder vs MODIS for February , 2018 (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	25898	3237	2926
Sounder Uncertain	3913	665	1673
Sounder Cloudy	2086	564	9305

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	25046	4599	2416
Sounder Uncertain	3462	1434	1355
Sounder Cloudy	1689	1358	8908

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	22000	7426	2635

Sounder Uncertain	2989	1766	1496
Sounder Cloudy	1353	1523	9079

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51.52	6.44	5.82
Sounder Uncertain	7.78	1.32	3.33
Sounder Cloudy	4.15	1.12	18.51

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	49.83	9.15	4.81
Sounder Uncertain	6.89	2.85	2.70
Sounder Cloudy	3.36	2.70	17.72

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	43.77	14.77	5.24
Sounder Uncertain	5.95	3.51	2.98
Sounder Cloudy	2.69	3.03	18.06

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.19	0.89	0.22
Frequency Bias	1.01	1.40	0.86
Probability of Detection	0.81	0.15	0.67
False Alarm Rate	0.43	0.39	0.18

Overall Skill Score

Skill Score	Value
Proportion Correct	0.714
Kuiper Skill Score	0.452
Heidke Skill Score	0.447

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.22	0.77	0.25
Frequency Bias	1.06	0.85	0.94
Probability of Detection	0.83	0.19	0.70
False Alarm Rate	0.47	0.32	0.20

Overall Skill Score

Skill Score	Value
Proportion Correct	0.704
Kuiper Skill Score	0.438
Heidke Skill Score	0.450

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.31	0.72	0.24
Frequency Bias	1.22	0.58	0.90
Probability of Detection	0.84	0.16	0.69
False Alarm Rate	0.58	0.26	0.17

Overall Skill Score

Skill Score	Value
Proportion Correct	0.653
Kuiper Skill Score	0.377
Heidke Skill Score	0.399

INSAT-3D Sounder vs MODIS for February , 2018 (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	14151	482	2370
Sounder Uncertain	1397	55	3635
Sounder Cloudy	333	14	4553

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13092	2254	1657
Sounder Uncertain	992	835	3260
Sounder Cloudy	303	74	4523

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	12497	2686	1820
Sounder Uncertain	879	859	3349
Sounder Cloudy	273	96	4531

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	52.43	1.79	8.78
Sounder Uncertain	5.18	0.20	13.47
Sounder Cloudy	1.23	0.05	16.87

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	48.51	8.35	6.14
Sounder Uncertain	3.68	3.09	12.08
Sounder Cloudy	1.12	0.27	16.76

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	46.30	9.95	6.74
Sounder Uncertain	3.26	3.18	12.41
Sounder Cloudy	1.01	0.36	16.79

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.17	0.99	0.07
Frequency Bias	1.07	9.23	0.46
Probability of Detection	0.89	0.10	0.43
False Alarm Rate	0.35	0.61	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.695
Kuiper Skill Score	0.499
Heidke Skill Score	0.450

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.23	0.84	0.08
Frequency Bias	1.18	1.61	0.52
Probability of Detection	0.91	0.26	0.48
False Alarm Rate	0.46	0.50	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.684
Kuiper Skill Score	0.452
Heidke Skill Score	0.453

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.27	0.83	0.08
Frequency Bias	1.25	1.40	0.51
Probability of Detection	0.92	0.24	0.47
False Alarm Rate	0.50	0.46	0.04

Overall Skill Score

Skill Score	Value
Proportion Correct	0.663
Kuiper Skill Score	0.425
Heidke Skill Score	0.429

INSAT-3D Sounder vs MODIS for February , 2018 (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	7215	5920	1168
Sounder Uncertain	781	388	2027
Sounder Cloudy	116	56	1899

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6982	6246	1075
Sounder Uncertain	637	661	1898
Sounder Cloudy	90	87	1894

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6709	6389	1205
Sounder Uncertain	591	624	1981
Sounder Cloudy	83	85	1903

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	36.87	30.25	5.97
Sounder Uncertain	3.99	1.98	10.36
Sounder Cloudy	0.59	0.29	9.70

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	35.68	31.92	5.49
Sounder Uncertain	3.25	3.38	9.70
Sounder Cloudy	0.46	0.44	9.68

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	34.28	32.65	6.16
Sounder Uncertain	3.02	3.19	10.12
Sounder Cloudy	0.42	0.43	9.72

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.50	0.88	0.08
Frequency Bias	1.76	0.50	0.41
Probability of Detection	0.89	0.06	0.37
False Alarm Rate	0.70	0.28	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.486
Kuiper Skill Score	0.156
Heidke Skill Score	0.165

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.51	0.79	0.09
Frequency Bias	1.86	0.46	0.43
Probability of Detection	0.91	0.09	0.39
False Alarm Rate	0.73	0.25	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.487
Kuiper Skill Score	0.175
Heidke Skill Score	0.183

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.53	0.80	0.08
Frequency Bias	1.94	0.45	0.41
Probability of Detection	0.91	0.09	0.37
False Alarm Rate	0.73	0.25	0.02

Overall Skill Score

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

Proportion Correct	0.472
Kuiper Skill Score	0.166
Heidke Skill Score	0.172

INSAT-3D Sounder vs MODIS for February , 2018 (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	6995	3832	968
Sounder Uncertain	736	322	1767
Sounder Cloudy	92	47	1879

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6825	4061	909
Sounder Uncertain	609	529	1687
Sounder Cloudy	67	77	1874

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	6576	4230	989
Sounder Uncertain	572	499	1754
Sounder Cloudy	60	75	1883

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	42.04	23.03	5.82
Sounder Uncertain	4.42	1.94	10.62
Sounder Cloudy	0.55	0.28	11.29

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	41.02	24.41	5.46
Sounder Uncertain	3.66	3.18	10.14
Sounder Cloudy	0.40	0.46	11.26

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	39.52	25.42	5.94
Sounder Uncertain	3.44	3.00	10.54
Sounder Cloudy	0.36	0.45	11.32

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.41	0.89	0.07
Frequency Bias	1.51	0.67	0.44
Probability of Detection	0.89	0.08	0.41
False Alarm Rate	0.64	0.34	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.553
Kuiper Skill Score	0.224
Heidke Skill Score	0.242

Method2 :Taking Weighted Average of MODIS pixels

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

False Alarm Ratio	0.42	0.81	0.07
Frequency Bias	1.57	0.61	0.45
Probability of Detection	0.91	0.11	0.42
False Alarm Rate	0.67	0.31	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.555
Kuiper Skill Score	0.240
Heidke Skill Score	0.258

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.44	0.82	0.07
Frequency Bias	1.64	0.59	0.44
Probability of Detection	0.91	0.10	0.41
False Alarm Rate	0.68	0.30	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.538
Kuiper Skill Score	0.228
Heidke Skill Score	0.243

INSAT-3D Sounder vs MODIS for February , 2018 (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	220	2088	200
Sounder Uncertain	45	66	260
Sounder Cloudy	24	9	20

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	157	2185	166
Sounder Uncertain	28	132	211
Sounder Cloudy	23	10	20

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	133	2159	216
Sounder Uncertain	19	125	227
Sounder Cloudy	23	10	20

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	7.50	71.21	6.82
Sounder Uncertain	1.53	2.25	8.87
Sounder Cloudy	0.82	0.31	0.68

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	5.35	74.52	5.66
Sounder Uncertain	0.95	4.50	7.20
Sounder Cloudy	0.78	0.34	0.68

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	4.54	73.64	7.37

Sounder Uncertain	0.65	4.26	7.74
Sounder Cloudy	0.78	0.34	0.68

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.91	0.82	0.62
Frequency Bias	8.68	0.17	0.11
Probability of Detection	0.76	0.03	0.04
False Alarm Rate	0.87	0.12	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.104
Kuiper Skill Score	-0.182
Heidke Skill Score	-0.093

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.94	0.64	0.62
Frequency Bias	12.06	0.16	0.13
Probability of Detection	0.75	0.06	0.05
False Alarm Rate	0.90	0.09	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.105
Kuiper Skill Score	-0.168
Heidke Skill Score	-0.070

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.95	0.66	0.62

Frequency Bias	14.33	0.16	0.11
Probability of Detection	0.76	0.05	0.04
False Alarm Rate	0.89	0.09	0.01

Overall Skill Score

Skill Score	Value
Proportion Correct	0.095
Kuiper Skill Score	-0.162
Heidke Skill Score	-0.069

INSAT-3D Sounder vs MODIS for February , 2018 (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	277	54	17
Sounder Uncertain	51	7	28
Sounder Cloudy	22	1	66

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	268	66	14
Sounder Uncertain	46	19	21
Sounder Cloudy	21	9	59

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	247	86	15

Sounder Uncertain	45	19	22
Sounder Cloudy	20	7	62

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	52.96	10.33	3.25
Sounder Uncertain	9.75	1.34	5.35
Sounder Cloudy	4.21	0.19	12.62

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51.24	12.62	2.68
Sounder Uncertain	8.80	3.63	4.02
Sounder Cloudy	4.02	1.72	11.28

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	47.23	16.44	2.87
Sounder Uncertain	8.60	3.63	4.21
Sounder Cloudy	3.82	1.34	11.85

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.20	0.92	0.26
Frequency Bias	0.99	1.39	0.80
Probability of Detection	0.79	0.11	0.59
False Alarm Rate	0.41	0.46	0.13

Overall Skill Score

Skill Score	Value
Proportion Correct	0.669
Kuiper Skill Score	0.341
Heidke Skill Score	0.337

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.23	0.78	0.34
Frequency Bias	1.04	0.91	0.95
Probability of Detection	0.80	0.20	0.63
False Alarm Rate	0.45	0.38	0.17

Overall Skill Score

Skill Score	Value
Proportion Correct	0.662
Kuiper Skill Score	0.334
Heidke Skill Score	0.341

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.29	0.78	0.30
Frequency Bias	1.12	0.77	0.90
Probability of Detection	0.79	0.17	0.63
False Alarm Rate	0.52	0.34	0.14

Overall Skill Score

Skill Score	Value
Proportion Correct	0.627
Kuiper Skill Score	0.289
Heidke Skill Score	0.304

INSAT-3D Sounder vs MODIS for February , 2018 (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	241	28	8
Sounder Uncertain	39	2	19
Sounder Cloudy	21	1	64

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	235	34	8
Sounder Uncertain	37	8	15
Sounder Cloudy	20	9	57

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	217	51	9
Sounder Uncertain	37	8	15
Sounder Cloudy	19	7	60

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	56.97	6.62	1.89
Sounder Uncertain	9.22	0.47	4.49
Sounder Cloudy	4.96	0.24	15.13

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	55.56	8.04	1.89
Sounder Uncertain	8.75	1.89	3.55
Sounder Cloudy	4.73	2.13	13.48

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	51.30	12.06	2.13
Sounder Uncertain	8.75	1.89	3.55
Sounder Cloudy	4.49	1.65	14.18

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.13	0.97	0.26
Frequency Bias	0.92	1.94	0.95
Probability of Detection	0.80	0.06	0.70
False Alarm Rate	0.31	0.50	0.19

Overall Skill Score

Skill Score	Value
Proportion Correct	0.726
Kuiper Skill Score	0.465
Heidke Skill Score	0.429

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.15	0.87	0.34
Frequency Bias	0.95	1.18	1.07
Probability of Detection	0.80	0.16	0.71
False Alarm Rate	0.34	0.42	0.24

Overall Skill Score

Skill Score	Value
Proportion Correct	0.709
Kuiper Skill Score	0.426
Heidke Skill Score	0.409

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.22	0.87	0.30
Frequency Bias	1.01	0.91	1.02
Probability of Detection	0.79	0.12	0.71
False Alarm Rate	0.43	0.38	0.19

Overall Skill Score

Skill Score	Value
Proportion Correct	0.674
Kuiper Skill Score	0.363
Heidke Skill Score	0.366

INSAT-3D Sounder vs MODIS for February , 2018 (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	36	26	9
Sounder Uncertain	12	5	9
Sounder Cloudy	1	0	2

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	33	32	6
Sounder Uncertain	9	11	6
Sounder Cloudy	1	0	2

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30	35	6
Sounder Uncertain	8	11	7
Sounder Cloudy	1	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	36.00	26.00	9.00
Sounder Uncertain	12.00	5.00	9.00
Sounder Cloudy	1.00	0.00	2.00

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	33.00	32.00	6.00
Sounder Uncertain	9.00	11.00	6.00
Sounder Cloudy	1.00	0.00	2.00

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	30.00	35.00	6.00
Sounder Uncertain	8.00	11.00	7.00
Sounder Cloudy	1.00	0.00	2.00

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.49	0.81	0.33
Frequency Bias	1.45	0.84	0.15
Probability of Detection	0.73	0.16	0.10
False Alarm Rate	0.61	0.37	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.430
Kuiper Skill Score	-0.007
Heidke Skill Score	-0.008

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.54	0.58	0.33
Frequency Bias	1.65	0.60	0.21
Probability of Detection	0.77	0.26	0.14
False Alarm Rate	0.70	0.28	0.02

Overall Skill Score

Skill Score	Value
Proportion Correct	0.460
Kuiper Skill Score	0.063
Heidke Skill Score	0.067

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.58	0.58	0.33
Frequency Bias	1.82	0.57	0.20
Probability of Detection	0.77	0.24	0.13
False Alarm Rate	0.72	0.26	0.02

Overall Skill Score

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

Proportion Correct	0.430
Kuiper Skill Score	0.047
Heidke Skill Score	0.048

INSAT-3D Sounder vs MODIS for February , 2018 (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	3582	1133	2702
Sounder Uncertain	3798	729	3788
Sounder Cloudy	3667	288	7236

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2972	2323	2122
Sounder Uncertain	2701	2753	2861
Sounder Cloudy	2313	2827	6051

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	2557	2418	2442
Sounder Uncertain	2240	2885	3190
Sounder Cloudy	1891	2897	6403

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	13.30	4.21	10.04
Sounder Uncertain	14.11	2.71	14.07
Sounder Cloudy	13.62	1.07	26.88

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	11.04	8.63	7.88
Sounder Uncertain	10.03	10.23	10.63
Sounder Cloudy	8.59	10.50	22.48

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	9.50	8.98	9.07
Sounder Uncertain	8.32	10.72	11.85
Sounder Cloudy	7.02	10.76	23.78

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.52	0.91	0.35
Frequency Bias	0.67	3.87	0.82
Probability of Detection	0.32	0.34	0.53
False Alarm Rate	0.25	0.49	0.26

Overall Skill Score

Skill Score	Value
Proportion Correct	0.429
Kuiper Skill Score	0.140
Heidke Skill Score	0.122

Method2 :Taking Weighted Average of MODIS pixels

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

False Alarm Ratio	0.60	0.67	0.46
Frequency Bias	0.93	1.05	1.01
Probability of Detection	0.37	0.35	0.55
False Alarm Rate	0.29	0.37	0.34

Overall Skill Score

Skill Score	Value
Proportion Correct	0.437
Kuiper Skill Score	0.144
Heidke Skill Score	0.144

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.66	0.65	0.43
Frequency Bias	1.11	1.01	0.93
Probability of Detection	0.38	0.35	0.53
False Alarm Rate	0.32	0.36	0.32

Overall Skill Score

Skill Score	Value
Proportion Correct	0.440
Kuiper Skill Score	0.142
Heidke Skill Score	0.141

INSAT-3D Sounder vs MODIS for February , 2018 (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	1863	20	136
Sounder Uncertain	2636	77	1034
Sounder Cloudy	3204	221	6260

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1657	306	56
Sounder Uncertain	1847	1329	571
Sounder Cloudy	1958	2507	5220

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1549	400	70
Sounder Uncertain	1592	1464	691
Sounder Cloudy	1590	2579	5516

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	12.06	0.13	0.88
Sounder Uncertain	17.06	0.50	6.69
Sounder Cloudy	20.74	1.43	40.52

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	10.72	1.98	0.36
Sounder Uncertain	11.95	8.60	3.70
Sounder Cloudy	12.67	16.23	33.78

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	10.03	2.59	0.45

Sounder Uncertain	10.30	9.48	4.47
Sounder Cloudy	10.29	16.69	35.70

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.08	0.98	0.35
Frequency Bias	0.26	11.78	1.30
Probability of Detection	0.24	0.24	0.84
False Alarm Rate	0.02	0.51	0.47

Overall Skill Score

Skill Score	Value
Proportion Correct	0.531
Kuiper Skill Score	0.306
Heidke Skill Score	0.253

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.18	0.65	0.46
Frequency Bias	0.37	0.90	1.66
Probability of Detection	0.30	0.32	0.89
False Alarm Rate	0.05	0.33	0.62

Overall Skill Score

Skill Score	Value
Proportion Correct	0.531
Kuiper Skill Score	0.277
Heidke Skill Score	0.280

Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.23	0.61	0.43

Frequency Bias	0.43	0.84	1.54
Probability of Detection	0.33	0.33	0.88
False Alarm Rate	0.07	0.33	0.60

Overall Skill Score

Skill Score	Value
Proportion Correct	0.552
Kuiper Skill Score	0.285
Heidke Skill Score	0.295

INSAT-3D Sounder vs MODIS for February , 2018 (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	1719	1113	2566
Sounder Uncertain	1162	652	2754
Sounder Cloudy	463	67	976

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1315	2017	2066
Sounder Uncertain	854	1424	2290
Sounder Cloudy	355	320	831

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	1008	2018	2372

Sounder Uncertain	648	1421	2499
Sounder Cloudy	301	318	887

2. Confusion matrix of percentage number of collocations

Method1 :Taking Mode of MODIS Pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	14.98	9.70	22.37
Sounder Uncertain	10.13	5.68	24.01
Sounder Cloudy	4.04	0.58	8.51

Method2 :Taking Weighted Average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	11.46	17.58	18.01
Sounder Uncertain	7.44	12.41	19.96
Sounder Cloudy	3.09	2.79	7.24

Method3: Taking Weighted Product average of MODIS pixels

MODIS/Sounder	MODIS Clear	MODIS Uncertain	MODIS Cloudy
Sounder Clear	8.79	17.59	20.68
Sounder Uncertain	5.65	12.39	21.78
Sounder Cloudy	2.62	2.77	7.73

3. Skill Scores

Method1 :Taking Mode of MODIS Pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.68	0.86	0.35
Frequency Bias	1.61	2.49	0.24
Probability of Detection	0.51	0.36	0.16
False Alarm Rate	0.45	0.48	0.07

Overall Skill Score

Skill Score	Value
Proportion Correct	0.292
Kuiper Skill Score	0.032
Heidke Skill Score	0.026

Method2 :Taking Weighted Average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.76	0.69	0.45
Frequency Bias	2.14	1.21	0.29
Probability of Detection	0.52	0.38	0.16
False Alarm Rate	0.52	0.40	0.09

Overall Skill Score

Skill Score	Value
Proportion Correct	0.311
Kuiper Skill Score	0.028
Heidke Skill Score	0.025

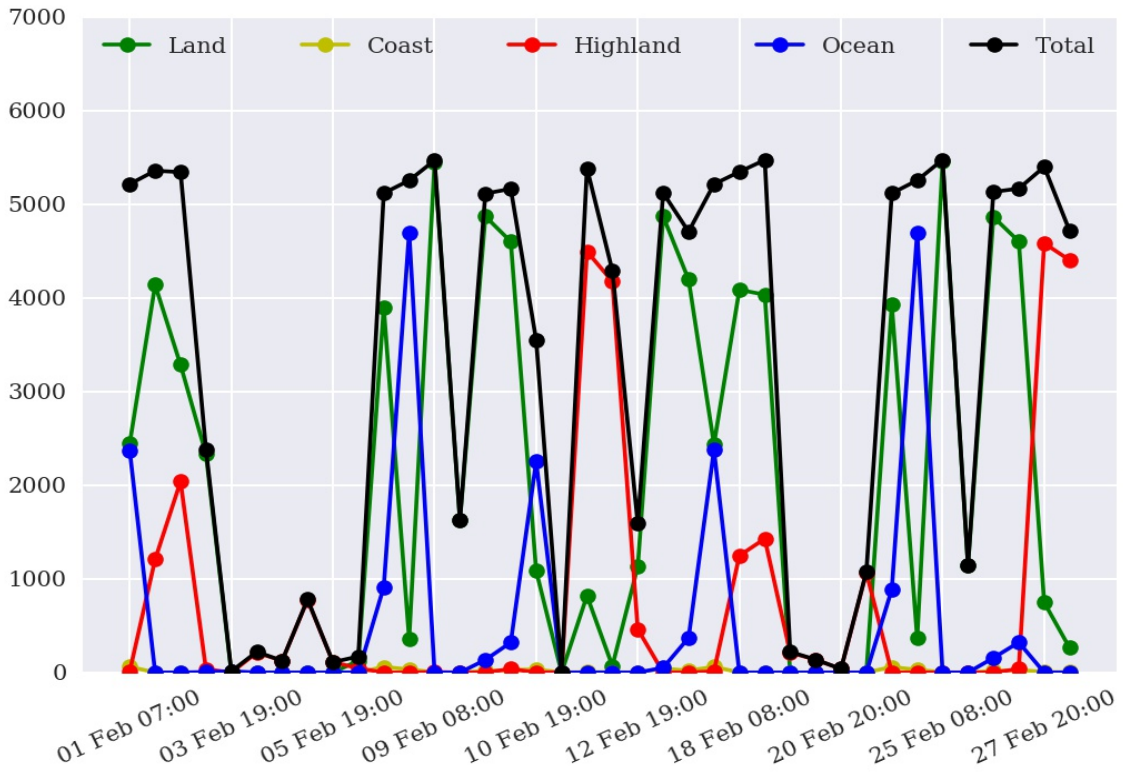
Method3: Taking Weighted Product average of MODIS pixels

Skill Score	Clear	Uncertain	Cloudy
False Alarm Ratio	0.81	0.69	0.41
Frequency Bias	2.76	1.22	0.26
Probability of Detection	0.52	0.38	0.15
False Alarm Rate	0.54	0.39	0.08

Overall Skill Score

Skill Score	Value
Proportion Correct	0.289
Kuiper Skill Score	0.020
Heidke Skill Score	0.017

Number of Collocations for Feb-2018



Percentage Correct for Feb-2018

