

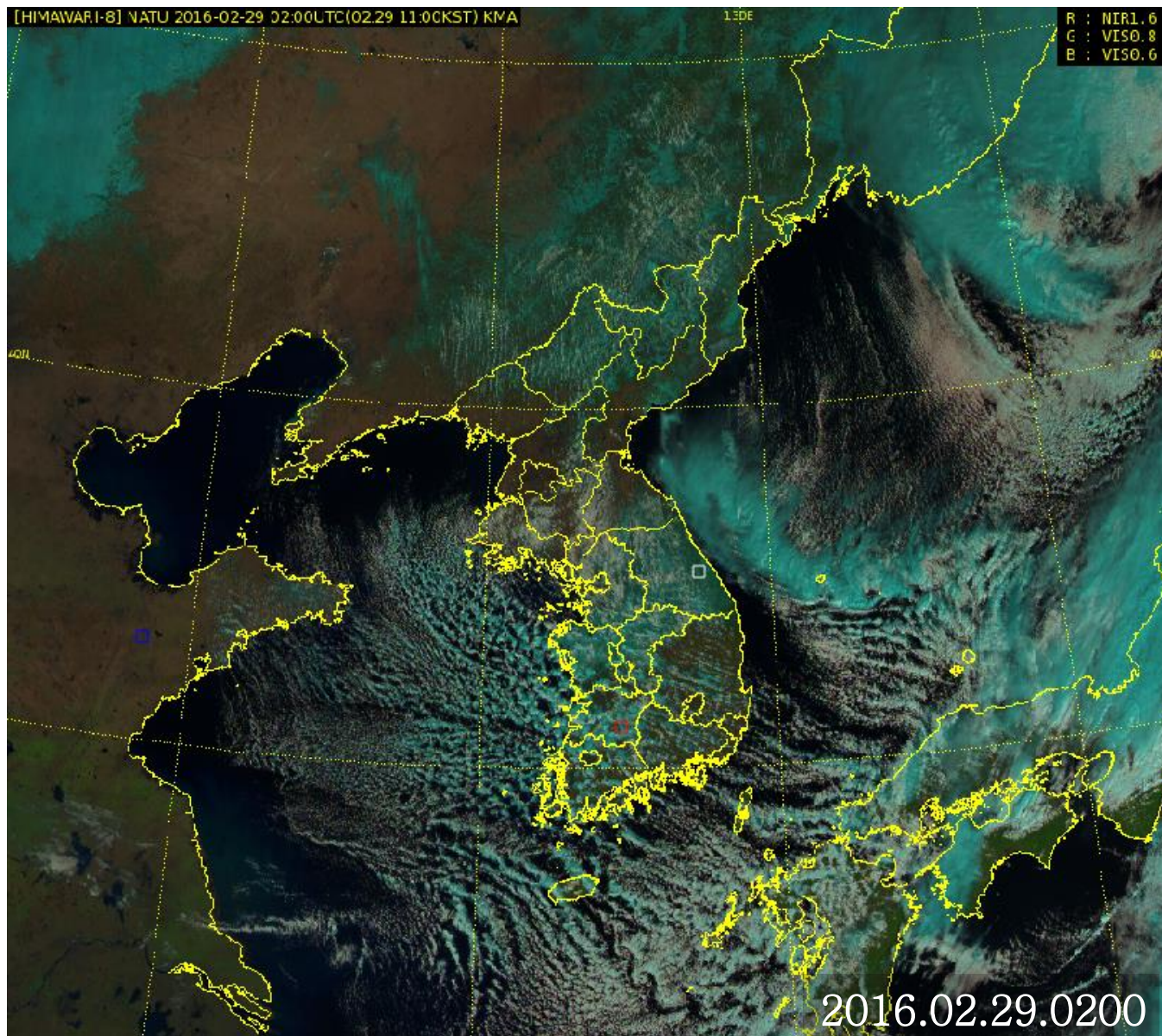





Improvement in the detection of snow-covered areas using natural color RGB image

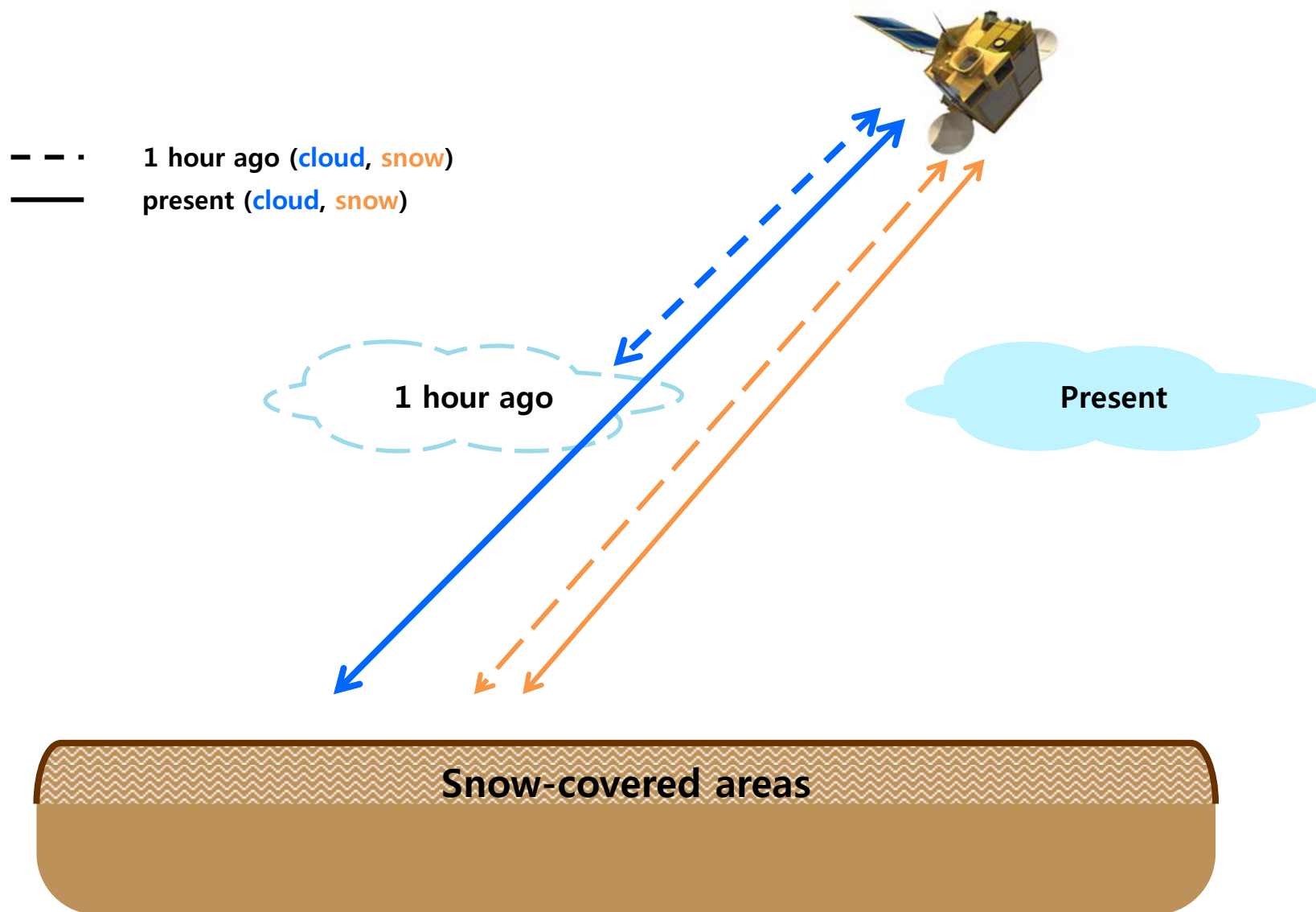


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Motivation

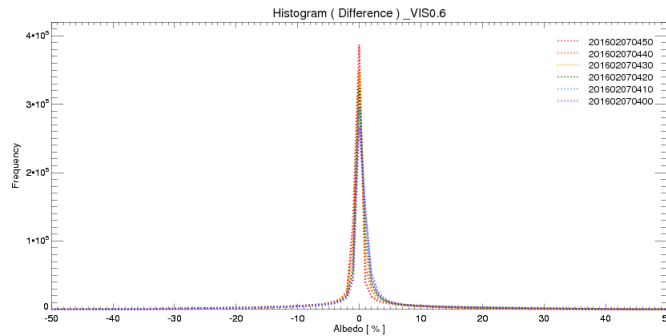


-  Cirrus
-  Snow-covered
-  Clear sky

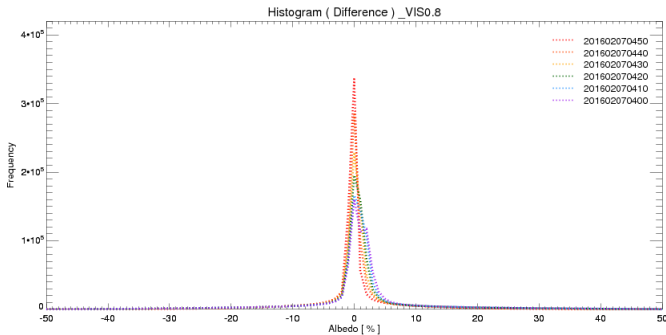


Differences of pixel values

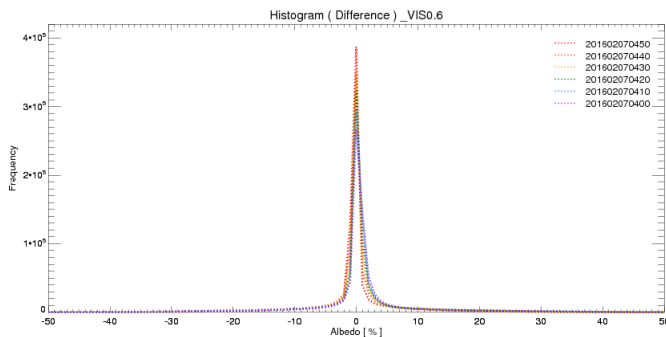
NIR 1.6 (Red)



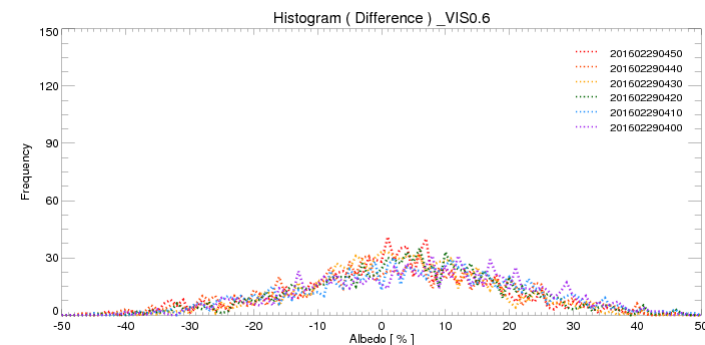
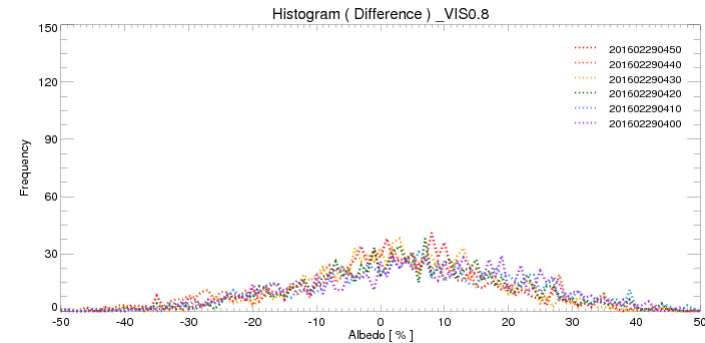
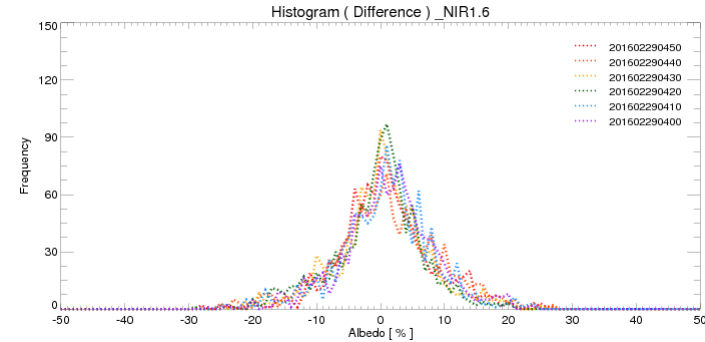
VIS 0.8 (Green)



VIS 0.6 (Blue)



Snow-covered areas



Cirrus-covered areas

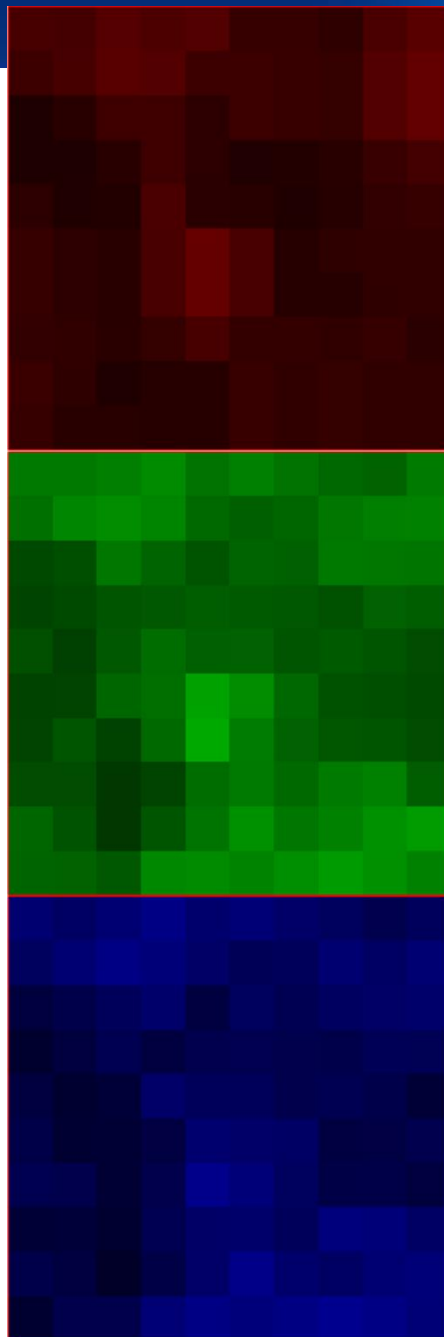
Snow

Cirrus



국가기상위성센터

| | | | | | | | | | |
|----|----|----|-----|----|----|----|----|----|----|
| 25 | 24 | 25 | 25 | 22 | 19 | 21 | 23 | 18 | 17 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 26 | 25 | 26 | 24 | 22 | 22 | 19 | 17 | 17 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 25 | 26 | 26 | 25 | 21 | 20 | 18 | 18 | 17 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 25 | 28 | 26 | 25 | 21 | 20 | 18 | 18 | 17 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 23 | 32 | 37 | 25 | 21 | 19 | 19 | 19 | 19 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | 25 | 31 | 39 | 23 | 22 | 22 | 21 | 19 | 18 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | 25 | 31 | 31 | 39 | 23 | 22 | 21 | 19 | 18 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 30 | 29 | 38 | 32 | 22 | 21 | 22 | 19 | 18 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 47 | 36 | 25 | 23 | 25 | 26 | 26 | 26 | 21 | 19 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 47 | 36 | 25 | 23 | 25 | 26 | 29 | 26 | 21 | 19 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 85 | 95 | 0 | 70 | 69 | 57 | 0 | 65 | 81 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 80 | 82 | 0 | 87 | 68 | 63 | 0 | 73 | 61 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 89 | 82 | 0 | 84 | 75 | 89 | 0 | 78 | 75 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 72 | 86 | 80 | 82 | 72 | 63 | 71 | 76 | 69 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 95 | 0 | 0 | 84 | 81 | 0 | 58 | 0 | 77 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 97 | 97 | 104 | 99 | 89 | 76 | 74 | 62 | 72 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 99 | 87 | 90 | 91 | 81 | 81 | 65 | 68 | 79 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 81 | 67 | 88 | 96 | 73 | 63 | 64 | 64 | 67 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 88 | 73 | 0 | 0 | 0 | 0 | 82 | 64 | 71 |
| 0 | 0 | 0 | 75 | 86 | 73 | 65 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 93 | 0 | 74 | 0 | 75 | 66 | 76 | 95 | 81 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 48 | 46 | 46 | 39 | 33 | 54 | 59 | 56 | 58 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 56 | 61 | 57 | 49 | 43 | 44 | 49 | 56 | 59 | 82 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 47 | 56 | 61 | 54 | 46 | 44 | 56 | 54 | 67 | 64 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 48 | 64 | 74 | 73 | 54 | 41 | 44 | 49 | 38 | 86 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 77 | 88 | 59 | 56 | 90 | 47 | 35 | 60 | 63 | 64 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 89 | 79 | 93 | 88 | 42 | 55 | 50 | 48 | 42 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 81 | 73 | 70 | 59 | 63 | 54 | 40 | 47 | 65 | 47 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 65 | 80 | 54 | 86 | 53 | 49 | 42 | 39 | 38 | 46 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 89 | 61 | 56 | 47 | 54 | 39 | 65 | 47 | 46 | 54 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 90 | 59 | 60 | 48 | 52 | 63 | 58 | 61 | 61 | 39 |



| | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 71 | 68 | 85 | 76 | 82 | 54 | 54 | 46 | 73 | 68 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 59 | 70 | 86 | 82 | 60 | 60 | 55 | 52 | 82 | 97 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 40 | 61 | 61 | 43 | 60 | 55 | 52 | 82 | 97 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 30 | 40 | 61 | 43 | 32 | 34 | 38 | 56 | 68 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 44 | 31 | 33 | 73 | 42 | 40 | 31 | 37 | 49 | 53 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 54 | 43 | 39 | 72 | 100 | 72 | 37 | 46 | 48 | 48 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 54 | 43 | 39 | 72 | 100 | 72 | 37 | 37 | 46 | 48 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 50 | 48 | 41 | 52 | 71 | 51 | 51 | 47 | 54 | 42 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 58 | 46 | 31 | 38 | 38 | 55 | 48 | 52 | 48 | 47 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 54 | 40 | 40 | 38 | 38 | 55 | 48 | 52 | 48 | 47 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 121 | 0 | 0 | 139 | 115 | 128 | 115 | 104 | 99 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 112 | 134 | 0 | 142 | 133 | 106 | 96 | 102 | 120 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 73 | 78 | 120 | 101 | 84 | 101 | 57 | 121 | 120 | 117 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 69 | 74 | 85 | 89 | 94 | 91 | 88 | 81 | 98 | 94 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80 | 64 | 0 | 0 | 109 | 97 | 96 | 85 | 90 | 85 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 96 | 88 | 102 | 111 | 162 | 141 | 104 | 82 | 79 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 88 | 65 | 68 | 105 | 125 | 98 | 87 | 85 | 76 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 76 | 76 | 56 | 68 | 109 | 122 | 105 | 123 | 129 | 94 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 102 | 83 | 56 | 86 | 116 | 145 | 119 | 130 | 145 | 156 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 101 | 0 | 89 | 136 | 140 | 132 | 143 | 155 | 144 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 112 | 98 | 113 | 132 | 108 | 117 | 103 | 94 | 78 | 91 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 94 | 113 | 132 | 119 | 101 | 86 | 89 | 112 | 98 | 114 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 82 | 74 | 90 | 106 | 64 | 93 | 82 | 95 | 101 | 105 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 45 | 61 | 81 | 64 | 77 | 79 | 76 | 74 | 86 | 84 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 64 | 47 | 56 | 103 | 89 | 90 | 76 | 82 | 74 | 54 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 72 | 50 | 52 | 86 | 110 | 103 | 98 | 65 | 67 | 78 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80 | 76 | 52 | 75 | 138 | 119 | 93 | 70 | 72 | 61 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 54 | 57 | 48 | 81 | 102 | 105 | 89 | 124 | 119 | 99 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 74 | 64 | 40 | 70 | 103 | 136 | 107 | 98 | 113 | 119 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 47 | 76 | 75 | 115 | 132 | 122 | 130 | 142 | 131 | 118 |

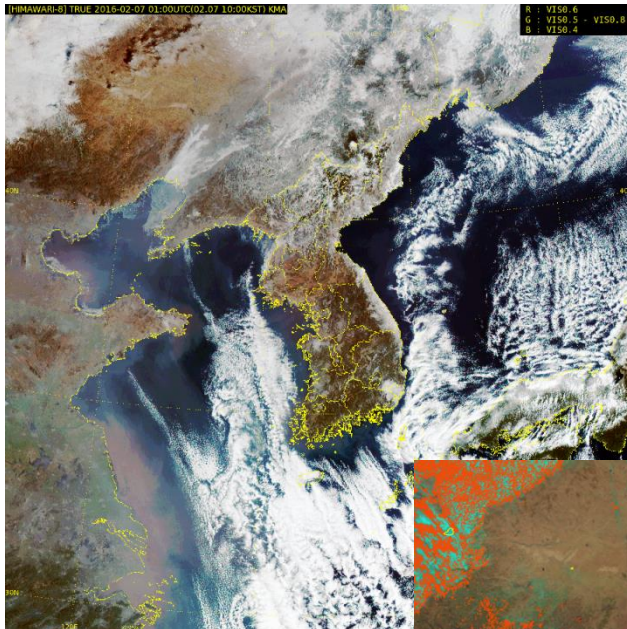
Means and Standard deviations of pixel values

| 2016.2.7. 03UTC | | | |
|-------------------------------------------|----------------------|--------|--------|
| | Snow-covered areas | | |
| | Red | Green | Blue |
| Present (mean) | 4.036 | 10.173 | 10.575 |
| 1 hour ago (mean) | 6.030 | 10.726 | 11.548 |
| Present - 1 hour ago (standard deviation) | 2.508 | 3.710 | 3.567 |
| | Cirrus-covered areas | | |
| Present (mean) | 17.153 | 17.082 | 17.902 |
| 1 hour ago (mean) | 24.953 | 25.443 | 29.208 |
| Present - 1 hour ago (standard deviation) | 35.080 | 35.383 | 40.872 |
| 2016.2.7. 04UTC | | | |
| | Snow-covered areas | | |
| | Red | Green | Blue |
| Present (mean) | 6.030 | 10.726 | 11.548 |
| 1 hour ago (mean) | 6.438 | 9.767 | 10.246 |
| Present - 1 hour ago (standard deviation) | 1.399 | 3.748 | 3.347 |
| | Cirrus-covered areas | | |
| Present (mean) | 24.953 | 25.443 | 29.208 |
| 1 hour ago (mean) | 11.126 | 18.423 | 16.821 |
| Present - 1 hour ago (standard deviation) | 23.915 | 34.375 | 36.939 |

| Cyan color (Mean) | | | | | |
|--------------------------------------------|-----|-------|-----|------|-----|
| Red | | Green | | Blue | |
| 10 | 60 | 50 | 170 | 50 | 220 |
| Snow-covered areas (Standard deviations) | | | | | |
| Red | | Green | | Blue | |
| 1.2 | 2.7 | 3.3 | 4.7 | 3.2 | 5.4 |
| Cirrus-covered areas (Standard deviations) | | | | | |
| Red | | Green | | Blue | |
| 16 | 37 | 22 | 36 | 24 | 42 |

StaSnow-covered areas

Himawari-8 True color RGB



Surface Observation for accumulated snow

