**Supplementary B: Accuracy assessment with the reference of the RGB image with spatial resolution of 0.53 × 0.53 m**

The accuracy assessment is conducted based on the reference of the RGB image acquired in 2014-12-23, paired with treeline extraction results from Landsat OLI image acquired in 2014-01-02, 2014-10-17 and 2014-12-20. 150 points were selected randomly within the alpine meadow and surrounding region. The distribution of the points for accuracy assessments is presented in Figure D1.



**Figure D1**. The distribution of 150 points for the accuracy assessment.

For conducting the accuracy assessment, the points located in the elevation higher than extracted treeline was treated as meadow and those located in the lower elevation the extracted treeline from Landsat imagery were treated as tree. From the reference RGB image, the points located in the tree pixels were counted as tree and the points located in the meadow pixel were counted as meadow. The overall accuracy for treeline extracted from Landsat OLI image acquired in 2014-01-02, 2014-10-17 and 2014-12-20 were 98%. 88.67% and 96%, respectively (Table D1, D2 and D3).

**Table D1.** Error matrix for the accuracy assessment of treeline extraction results from Landsat image acquired in 2014-01-02

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Reference from the RGB image | | |  |
| Treeline extraction from Landsat OLI image (2014-01-02) | **Class** | tree | meadow | Row total |
| tree | **91** | 3 | 94 |
| meadow | 0 | **56** | 56 |
|  | Column total | 91 | 59 | 150 |
| **Overall accuracy** = (91+56)/150=98%  **Producer’s accuracy (omission error)**  tree = 91/91=100% 0% omission error  meadow = 56/59=94.9% 5.1% omission error  **User’s accuracy (omission error)**  tree = 91/94=96.8% 3.2% commission error  meadow = 56/56=100% 0% commission error  **Kappa coefficient = 95.77%** | | | |

**Table D2.** Error matrix for the accuracy assessment of treeline extraction results from Landsat image acquired in 2014-10-17

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Reference from the RGB image | | |  |
| Treeline extraction from Landsat OLI image (2014-10-17) | **Class** | tree | meadow | Row total |
| tree | **89** | 15 | 104 |
| meadow | 2 | **44** | 46 |
|  | Column total | 91 | 59 | 150 |
| **Overall accuracy** = (89+44)/150=88.67%  **Producer’s accuracy (omission error)**  tree = 89/91=97.8% 2.2% omission error  meadow = 44/59=74.58% 25.42% omission error  **User’s accuracy (omission error)**  tree = 89/104=85.58% 14.42% commission error  meadow = 44/46=95.65% 4.35% commission error  **Kappa coefficient = 75.3%** | | | |

**Table D3.** Error matrix for the accuracy assessment of treeline extraction results from Landsat image acquired in 2014-12-20

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Reference from the RGB image | | |  |
| Treeline extraction from Landsat OLI image (2014-12-20) | **Class** | tree | meadow | Row total |
| tree | **90** | 2 | 92 |
| meadow | 1 | **57** | 58 |
|  | Column total | 91 | 59 | 150 |
| **Overall accuracy** = (90+57)/150=98%  **Producer’s accuracy (omission error)**  tree = 90/91=98.90% 1.1% omission error  meadow = 57/59=96.61% 3.39% omission error  **User’s accuracy (omission error)**  tree = 90/92=97.83% 2.17% commission error  meadow = 57/58=98.28% 1.72% commission error  **Kappa coefficient = 95.80%** | | | |