

# Quantifying the Actual Impacts of Forest Cover Change on Surface Temperature in Guangdong, China

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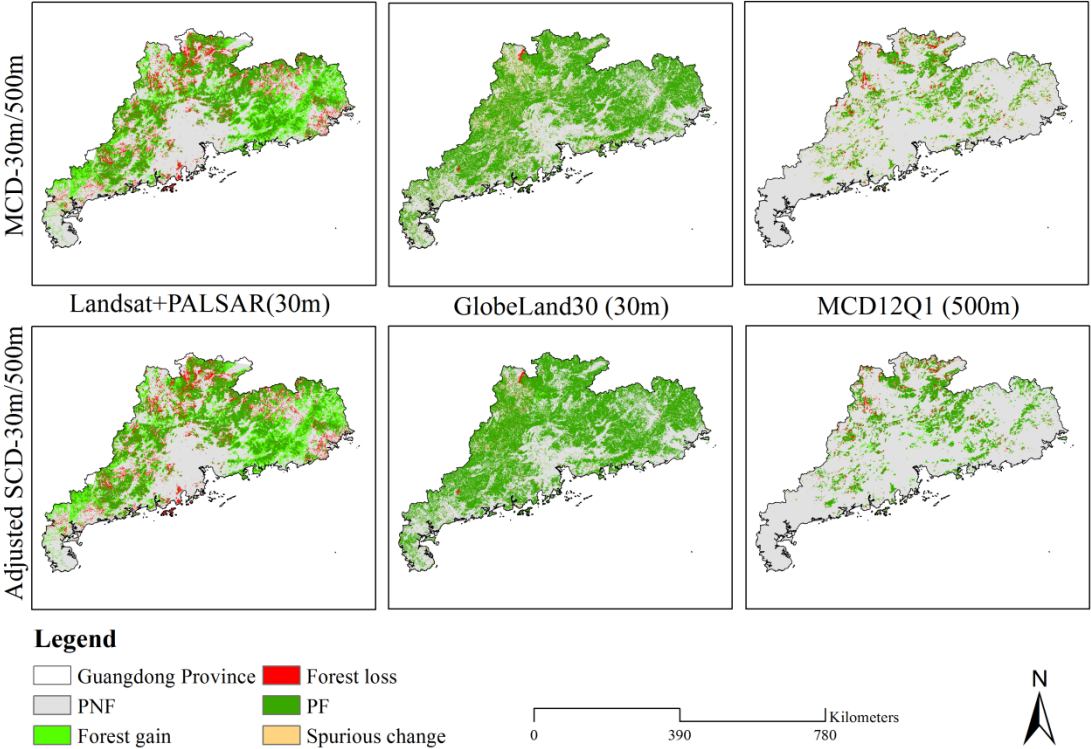
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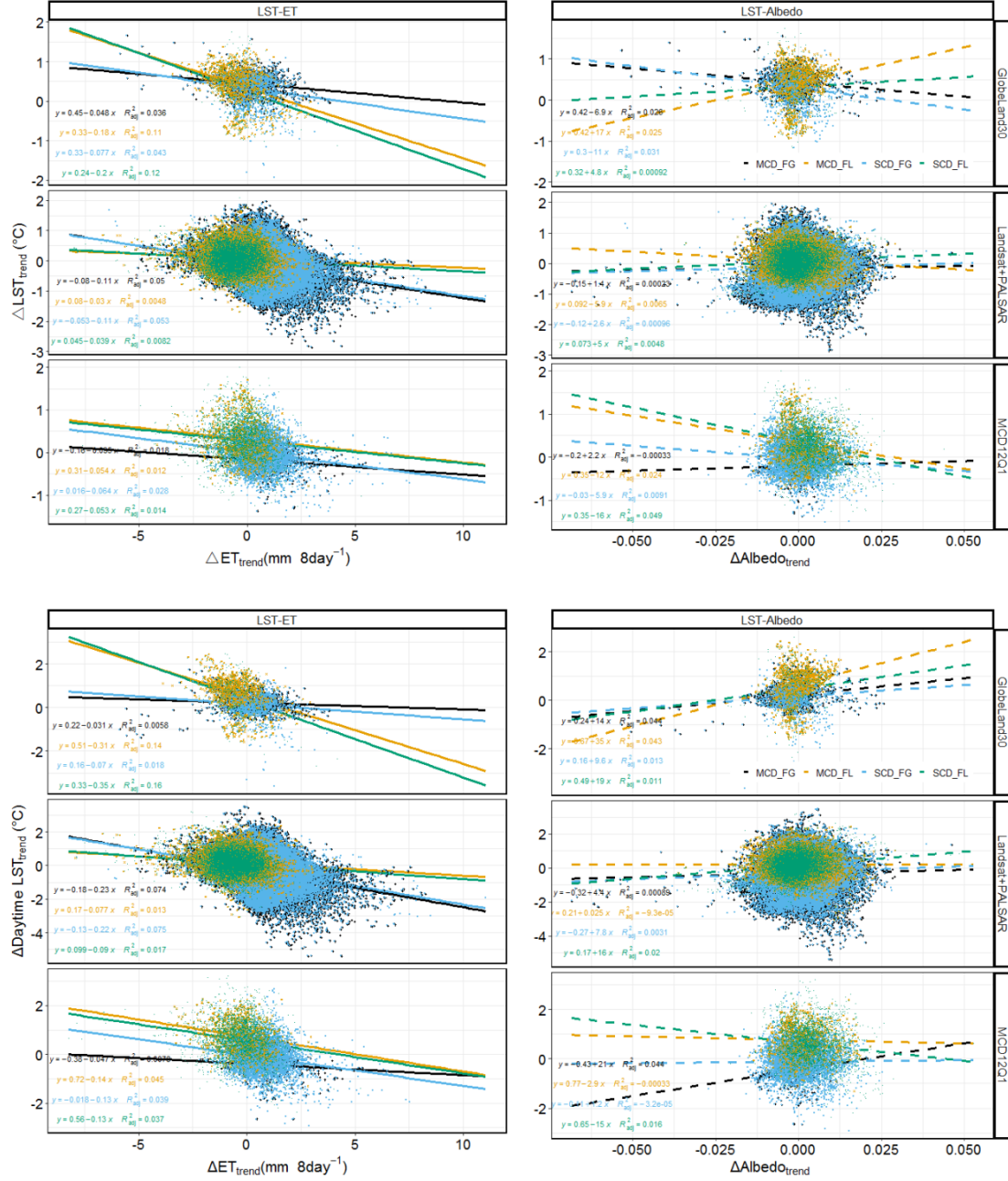
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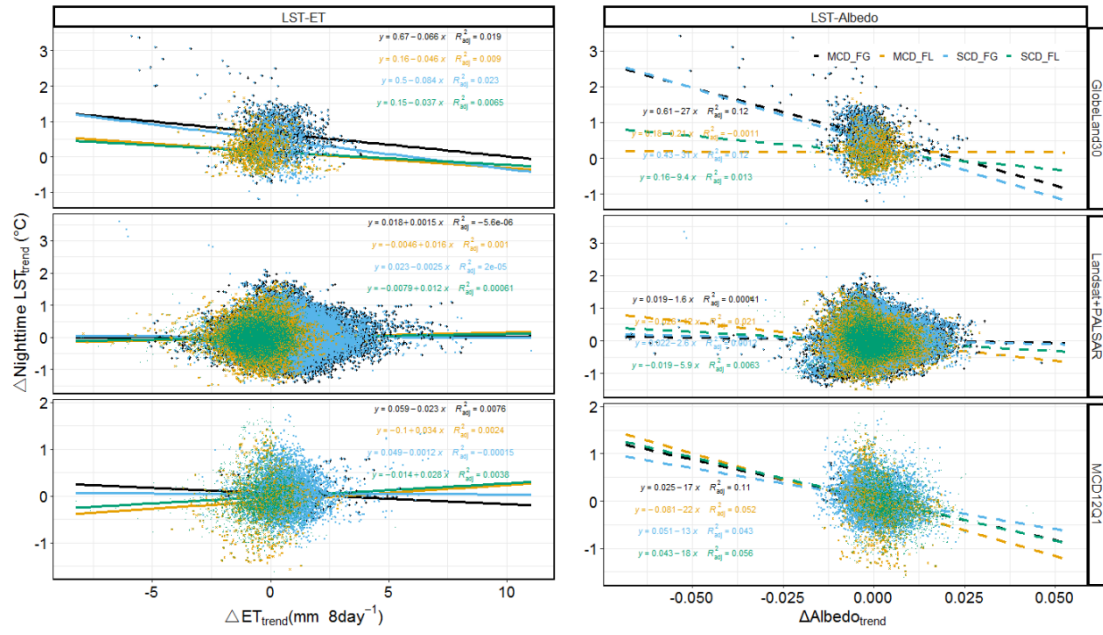
Supplemental material includes 5 Figures and 3 Tables. They all have been listed in the main text as Fig. S1, S2, S3, S4, S5, Table S1, S2, S3.

**Figure S1.** Change in forest cover estimated by the MCD and adjusted SCD methods based on the 3 datasets for 30-m, 500-m, and 1-km resolution between 2000 and 2010 showing the spatial and temporal pattern of unchanged non-forest, unchanged forest, forest gain, and forest loss in the Guangdong Province, China.

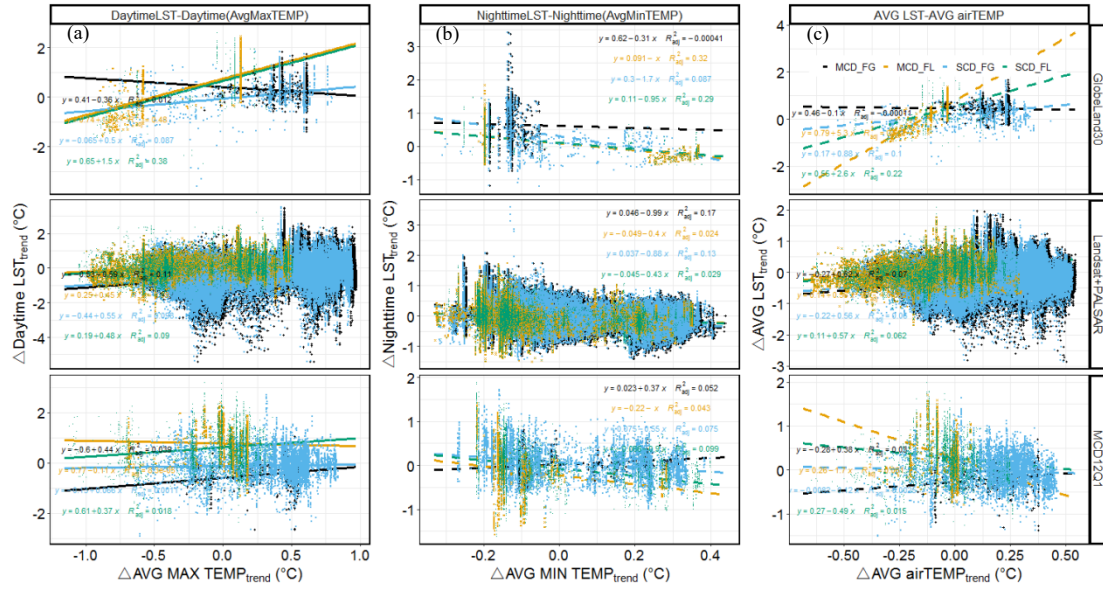


**Figure S2.** The relationships between yearly  $\Delta LST_{trend}$ ,  $\Delta daytime LST_{trend}$ ,  $\Delta nighttime LST_{trend}$ , and  $\Delta ET_{trend}$  ( $\Delta Albedo_{trend}$ ) during 2000–2010 caused by the 3 dataset-based forest losses and gains estimated by the MCD and adjusted SCD in Guangdong Province, China. The colored lines are the linear regressed lines.

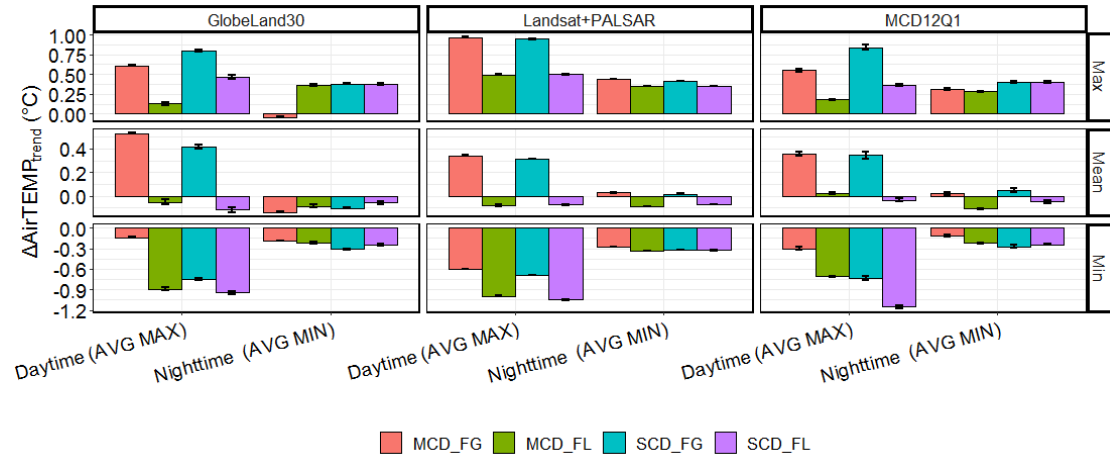




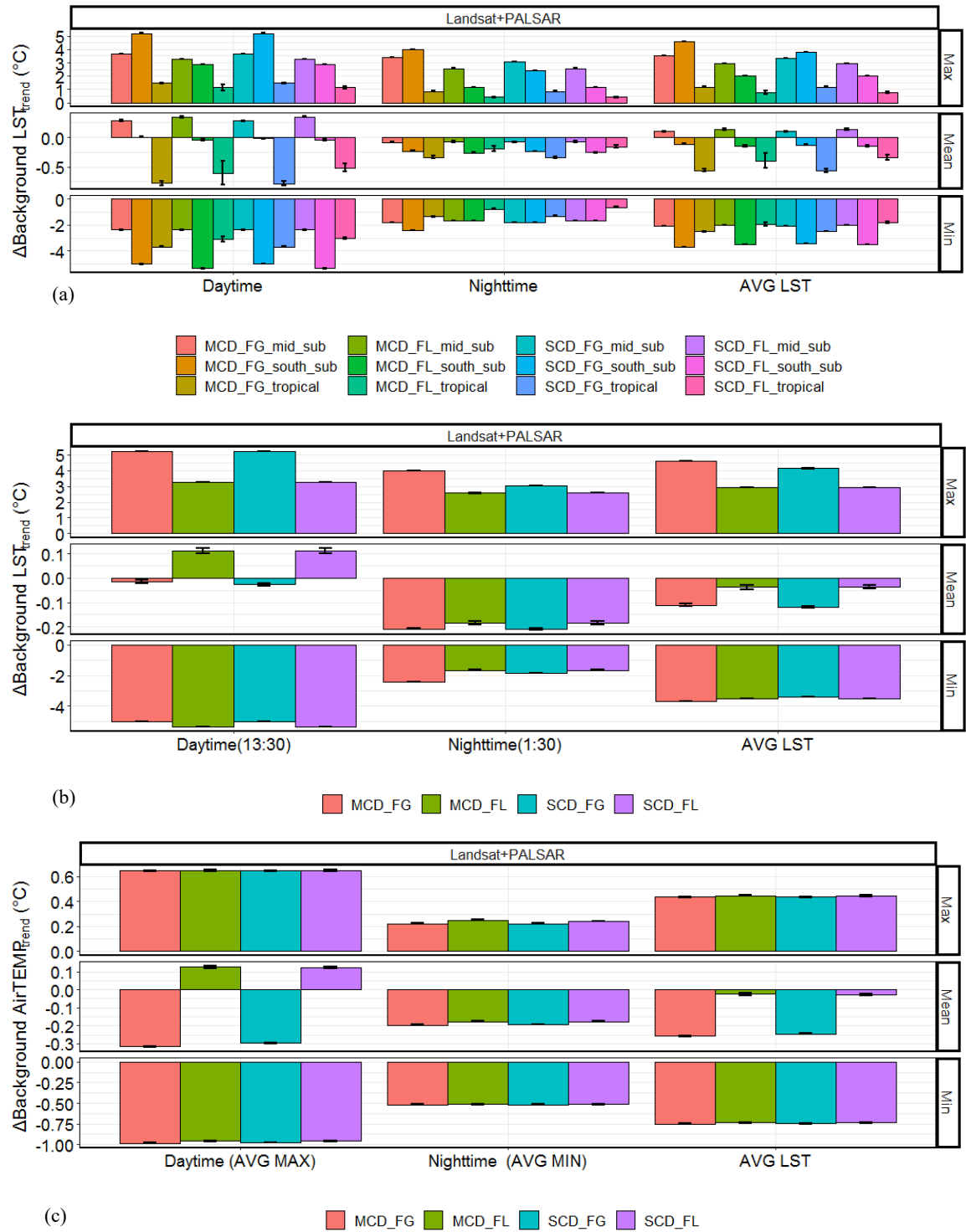
**Figure S3.** The relationships between annual (a)  $\Delta$ average maximum temperature<sub>trend</sub> (AVG MAX TEMP) and  $\Delta$ daytime LST<sub>trend</sub>, (b)  $\Delta$ average minimum temperature<sub>trend</sub> (AVG MIN TEMP) and  $\Delta$ nighttime LST<sub>trend</sub>, and (c)  $\Delta$ average temperature<sub>trend</sub> (AVG airTEMP) and  $\Delta$ average LST<sub>trend</sub> ( $\Delta$ AVG LST<sub>trend</sub>) during 2000–2010 caused by the 3 dataset-based forest losses and gains estimated by the MCD and adjusted SCD in Guangdong Province, China. The colored lines are the linear regressed lines ( $P < 0.001$ ).



**Figure S4.** Annual daytime ( $\Delta\text{daytime (AVG MAX)}$ ) airTEMP<sub>trend</sub> and nighttime ( $\Delta\text{nighttime (AVG MIN)}$ ) airTEMP<sub>trend</sub> caused by 3 dataset-based forest losses and gains estimated by the MCD and adjusted SCD in Guangdong Province, China, from 2000–2010. The vertical lines on each bar represent the confidence interval at 95% estimated by *t* test.



**Figure S5.** Annual daytime, nighttime, and (a) average background LST over the 3 climate zone-based forest zone, and annual daytime, nighttime, and (b) average background LST ( $\Delta$ background LST<sub>trend</sub>), as well as annual daytime, nighttime, and (c) average background airTEMP<sub>trend</sub> ( $\Delta$ background AirTEMP<sub>trend</sub>) caused by the Landsat/PALSAR-based forest loss and gain estimated by the MCD and adjusted SCD, in Guangdong Province, China, from 2000–2010. The vertical lines on each bar represent the confidence interval at 95% estimated by *t* test.



**Table S1.** Comparison of the area of forest loss and gain of different resolution-based satellite datasets from 2000–2010 in northern Guangdong Province (p122r043) and VCT-based forest cover change acts as a reference dataset.

| 2000–<br>2010  | Algorithm | VCT<br>(30-m/1-km,<br>10 <sup>5</sup> ha) | GlobeLand30<br>(30-m/1-km,<br>10 <sup>5</sup> ha) | MCD12Q1<br>(500-m/1-km,10 <sup>5</sup> ha) | Landsat/PALSAR<br>(30-m/1-km,<br>10 <sup>5</sup> ha) |
|----------------|-----------|-------------------------------------------|---------------------------------------------------|--------------------------------------------|------------------------------------------------------|
| Forest<br>loss | MCD       | 1.27/0.05                                 | 0.01/0                                            | 0.81/0.04                                  | 2.97/1.61                                            |
|                | SCD       | 1.35/0.2                                  | 0.04/0                                            | 1.02/0.68                                  | 2.94/1.79                                            |
| Forest<br>gain | MCD       | 0.15/0                                    | 0.15/0.39                                         | 0.15/0.02                                  | 3.37/2.14                                            |
|                | SCD       | 0.36/0.01                                 | 0.59/0.4                                          | 0.55/0.3                                   | 3.38/2.79                                            |

**Table S2.** Comparison of the accuracy of forest cover change (the MCD-based and adjusted SCD-based) of different resolution-based satellite datasets from 2000–2010 in northern Guangdong Province (p122r043) by stratified random sampling and ground truth ROIs (forest loss (FL) ROIs, forest gain (FG) ROIs, no-change forest (PF) ROIs, no-change non-forest (PNF) ROIs, and spurious change (SPC) ROIs) selected from VCT-based forest cover change datasets.

| MCD          | Product<br>(30-m/500-m/1-km)  | Class                   | Producer<br>Accuracy<br>(%) | User<br>Accuracy<br>(%) | Overall Accuracy (95% CI)/<br>Kappa Coefficient |                |
|--------------|-------------------------------|-------------------------|-----------------------------|-------------------------|-------------------------------------------------|----------------|
|              | GlobeLand30<br>(30-m/1-km)    | FG                      | 1%/2%                       | 100%/100%               | 30-m:                                           |                |
|              |                               | FL                      | 0/0                         | 0/0                     | [28% (95%CI: 24-33%)/0.16]                      |                |
|              |                               | PF                      | 98%/84%                     | 20%/31%                 | 1-km:                                           |                |
|              |                               | PNF                     | 96%/90%                     | 54%/23%                 | [26% (95%CI: 22-31%)/0.14]                      |                |
|              |                               | SPC                     | 2%/4%                       | 6%/11%                  |                                                 |                |
|              | MCD12Q1<br>(500-m/1-km)       | FG                      | 11%/0                       | 100%/0                  | 500-m:                                          |                |
|              |                               | FL                      | 20%/1%                      | 80%/100%                | [35% (95%CI: 30-40%)/0.23]                      |                |
|              |                               | PF                      | 80%/74%                     | 47%/41%                 | 1-km:                                           |                |
|              |                               | PNF                     | 92%/88%                     | 28%/27%                 | [26% (95%CI: 21-30%)/0.13]                      |                |
|              |                               | SPC                     | 10%/14%                     | 8%/8%                   |                                                 |                |
|              | Landsat/PALSAR<br>(30-m/1-km) | FG                      | 57%/12%                     | 75%/52%                 | 30-m:                                           |                |
|              |                               | FL                      | 50%/12%                     | 76%/60%                 | [55% (95%CI: 50-60%)/0.44]                      |                |
|              |                               | PF                      | 78%/80%                     | 38%/30%                 | 1-km:                                           |                |
|              |                               | PNF                     | 94%/78%                     | 45%/38%                 | [31% (95%CI: 27-37%)/0.18]                      |                |
| SPC          |                               | 0/14%                   | 0/10%                       |                         |                                                 |                |
|              |                               |                         |                             |                         |                                                 |                |
| Adjusted SCD | Product<br>(30-m/500-m/1-km)  | Class                   | Producer<br>Accuracy<br>(%) | User Accuracy<br>(%)    | Overall<br>Coefficient                          | Accuracy/Kappa |
|              | GlobeLand30<br>(30-m/1-km)    | FG                      | 2%/0                        | 66.67%/0                | 30-m:                                           |                |
|              |                               | FL                      | 0/0                         | 0/0                     | [34% (95%CI: 29-40%)/0.21]                      |                |
|              |                               | PF                      | 100%/84%                    | 24%/37%                 | 1-km:                                           |                |
|              |                               | PNF                     | 100%/98%                    | 59%/27%                 | [30% (95%CI: 25-36%)/0.16]                      |                |
|              |                               | MCD12Q1<br>(500-m/1-km) | FG                          | 21%/11%                 | 100%/92%                                        | 500-m:         |
|              | FL                            |                         | 36%/15%                     | 95%/79%                 | [50% (95%CI: 44-56%)/0.38]                      |                |
|              | PF                            |                         | 86%/84%                     | 51%/38%                 | 1-km:                                           |                |
|              | PNF                           |                         | 100%/98%                    | 32%/31%                 | [39% (95%CI: 34-45%)/0.25]                      |                |
|              | Landsat/PALSAR<br>(30-m/1-km) |                         | FG                          | 49%/19%                 | 88%/61%                                         | 30-m:          |
|              |                               | FL                      | 57%/16%                     | 93%/67%                 | [66% (95%CI: 60-71%)/0.55]                      |                |
|              |                               | PF                      | 82%/86%                     | 51%/31%                 | 1-km:                                           |                |
|              |                               | PNF                     | 100%/92%                    | 49%/43%                 | [41% (95%CI: 36-47%)/0.27]                      |                |
|              |                               |                         |                             |                         |                                                 |                |

**Table S3.** The statistical summaries for the forest cover change spatial agreement (SA) and disagreement (SD) maps. OA\_FG: overall accuracy of spatial agreement of forest gain, OA\_FL: overall accuracy of spatial agreement of forest loss, OA\_PF: overall accuracy of spatial agreement of no-change forest, OA\_PNF: overall accuracy of spatial agreement of no-change non-forest, SA\_Area: the area of spatial agreement, SD\_Area: the area of spatial disagreement.

| Algorithm    | Product pairs (30-m/<br>1-km)      | OA (%) | OA_F<br>G<br>(%) | OA_FL<br>(%) | OA_PF<br>(%) | OA_PNF<br>(%) | SA_Area<br>(10 <sup>6</sup> ha) | SD_Area<br>(10 <sup>6</sup> ha) |
|--------------|------------------------------------|--------|------------------|--------------|--------------|---------------|---------------------------------|---------------------------------|
| MCD          | VCT-Landsat/PALSA<br>R (30-m/1-km) | 58/60  | 0.3/0            | 2/0.01       | 38/42        | 19/18         | 1.49/1.54                       | 1.07/1.02                       |
|              | VCT-GlobeLand30<br>(30-m/1-km)     | 75/52  | 0.01/0           | 0/0          | 54/32        | 20/20         | 1.92/1.34                       | 0.64/1.23                       |
|              | VCT-MCD12Q1<br>(1-km)              | ~/55   | ~/0              | ~/0          | ~/33         | ~/21          | /~1.40                          | ~/1.16                          |
| Adjusted SCD | VCT-Landsat/PALSA<br>R(30-m/1-km)  | 62/67  | 0.4/0            | 1/0.04       | 40/47        | 20/20         | 1.58/1.68                       | 0.99/0.84                       |
|              | VCT-GlobeLand30<br>(30-m/1-km)     | 80/46  | 0.1/0            | 0.01/0       | 58/23        | 22/23         | 2.07/1.16                       | 0.50/1.36                       |
|              | VCT-MCD12Q1<br>(1-km)              | ~/55   | ~/0.01           | ~/0          | ~/32         | ~/23          | ~/1.38                          | ~/1.13                          |