Assessment of the NASA-USGS Global Land Survey (GLS) Datasets

Gyanesh Chander *, Aparajithan Sampath *, Chengguan Huang, Garik Gutman

* Global Land Cover Facility, Department of Geographical Sciences, University of Maryland, 4231 Northcy, College Park, MD 20746 - NASA Headquarters, Washington, DC 20548

Introduction

Jointly produced by NASA and USGS, the Global Land Survey (GLS) datasets establish a solid baseline for monitoring land and surface changes at medium spatial resolution by providing near complete global coverage of landcover images for all land areas for epochs centered around 1975, 1990, 2000, 2005, and 2015. These datasets are available for free downloaded through many web portals, including the USGS Earth Explorer (GLS) (http://glcf.umd.edu), and the Global Land Cover Facility (GLCF). The GLS datasets are widely used in a broad range of land-cover and change studies at local, regional, and global scales, including many funded by the Land Cover Change (LCC) and other NASA and USGS programs. In spite of the wide usage of these datasets, however, there is no documented assessment of their quality. This poster provides a comprehensive assessment of the quality of these data sets (based GLS 2010), which is still being generated, including the spatial coverage, temporal consistency, geometric accuracy, image completeness, and cloud cover. Results from this study likely will benefit the users of the GLS datasets, and will provide valuable insights for future efforts to develop global datasets for land change monitoring.

Geodetic Accuracy Assessment

Geodetic accuracy of the GLS datasets was established in two steps:

1. Used Landsat 7 systematic scenes during quiescent period (May 2005 – May 2007), which had accurate pointing knowledge, to evaluate the geodetic accuracy of the GLS 2000 dataset (Figure 1).
2. Used image-to-image (OI) coregistration method to determine the coregistration accuracy of other GLS datasets with GLS 2000 as reference (Table 1, Figure 2).

Table 1. Summary of (OI) coregistration accuracy of the GLS datasets measured using the GLS 2000 dataset as the reference.

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Total RMSE (Lime)</th>
<th>Total RMSE (Sample)</th>
<th>Total RMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLS 1975</td>
<td>18.2 m</td>
<td>16.95 m</td>
<td>24.88 m</td>
</tr>
<tr>
<td>GLS 1990</td>
<td>7.75 m</td>
<td>8.06 m</td>
<td>11.19 m</td>
</tr>
<tr>
<td>GLS 2005</td>
<td>4.69 m</td>
<td>5.09 m</td>
<td>5.89 m</td>
</tr>
</tbody>
</table>

Cloud Cover and Residual Gaps

- Cloud cover was calculated using an algorithm developed by Huang et al. (2011). It does not separate snow from their cloud (clouds trapped over high latitude and high altitude regions are the snows) and may overestimate cloud cover over desert areas.
- About 70% of the GLS 2000 images are gap-filled (Landsat 7 images). Many of them have residual gaps. Because the GLS images were produced using the cubic convolution resampling method that had a 4 x 4 buffer, up to two pixels from a residual gap pixel could be contaminated by the gap. Therefore, we expanded the residual gaps by 2 pixels in our calculation.

Suitability for Land Cover Change Studies

- The year difference between pair GLS images varies across space (Figure 5). Such variations need to be normalized in calculating annual change rate.
- Many images have day of year differences > 3 months (Figure 6), suggesting significant phenology differences in mid- to high-latitude areas that may result in spurious changes.
- About 20% of the GLS 2000 and 2005 images were acquired near or during the leaf-off season and may not be suitable for forest change analysis. These images need to be replaced with leaf-on images in order to derive reliable forest change products.

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