Climate and Land Use Change
Earth Resources Observation and Science (EROS) Center

Status of Landsat Science Products

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October 31, 2013
Science Products Under Development

- Top of Atmosphere Reflectance
- Surface Reflectance
- Surface Temperature
- Burned Area – Provisional Q1 CY14
- Surface Water - Provisional Q1 CY14
- Fractional Snow Covered Area
- Global 30m Land Cover - Provisional Q1 CY14

Landsat Science Team participation in product evaluation will be solicited.
TOA Reflectance Products

There are conceivably 3-4 methods by which the TOA reflectance product can be generated in terms of the solar zenith angle correction:

1. Assume a solar zenith angle of zero, effectively no correction (TOA r’)
2. Assume a single, scene center based solar zenith angle (TOA r)
3. Calculate and correct a pixel-based solar zenith angle
   - Provide this solar zenith angle band with the data so that users can back this out if desired.
   - Provide solar zenith angle, solar azimuth angle, sensor (view) zenith angle, and sensor (view) azimuth angle bands with the data so that users can back this out if desired.

Sample products available for evaluation at:
http://edclpdsftp.cr.usgs.gov/landsat_product_examples/
Surface Reflectance

- EROS Science Processing Architecture (ESPA)
- Released through Earth Explorer May 2013
- CFmask (cloud, shadow)
- LEDAPS 1.3.0 July 31, 2013
- Landsat 4 and 5 TM, Landsat 7 ETM+
- ESPA, LEDAPS, and Cfmask code available through Google Projects
Surface Reflectance Example
Surface Reflectance Distribution

FY 2013 ESPA Distributed Scenes

Monthly Distribution
User Characterization

FY 2013 ESPA Product Distribution User Community

- Foreign: 1%
- USFederal: 25%
- USEducation: 15%
- USCommercial: 11%
- NonProfit: 48%
Burned Area

**Classification algorithm:**
- Burned probability surfaces filtered using thresholds and region growing algorithm
  - Identifies seed locations using high probability threshold and minimum patch size
  - Region growing initiated at seed locations
  - Neighboring pixels are added using a second, lower probability threshold

**Individual layers:**
- Burned probability (0-100) and burn classification (0 or 1) layers with QA masks

**Annual summary layers:**
- Burned probability and classification layers summarized for a calendar year
  - Maximum probability, first date of observed burn, number of observed burns, number of non-cloudy observations
# Product uncertainties/validation

Path 41  Row 36 --- Year 2009

<table>
<thead>
<tr>
<th>MTBS</th>
<th>Burned</th>
<th>No Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECV</td>
<td>760,732</td>
<td>56,486</td>
</tr>
<tr>
<td>No Data</td>
<td>23,694</td>
<td>881,866</td>
</tr>
</tbody>
</table>

- **Accuracy** = 95%
- **Omission Error** = 7%
- **Commission Error** = 3%
Surface Water Extent

Comparison of Surface Water Extent Test (JWV1) Against NHD Data

Legend

- D
- 0
- 1 - 79158
- 2 - 15110
- 3 - 30256
- 10 - 213693
- 11 - 112985
- 12 - 897
- 13 - 2497

NHD vector data (Waterbodies only)

Location (Scene p21x32, NHD compare area, and detail area).

The SWE JWV1 output (0 = not water, 10 = water) and the NHD data (0-3) were added together to create an output comparing the two inputs (Values 0, 1, 2, 3, 10, 11, 12, 13).

Chart showing comparison values (JWV1 and NHD data).
ESPA

All Open Source! almost...

Inventory

Apache Solr

MongoDB

Processing

Apache Hadoop

Lustre

GeoServer & OpenLayers

Storage

Data Warehousing

VMWare Excess List

Hardware

Software

Data Access

Python GDAL