Collection 6 MODIS Fire Products

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Deforestation Fires
Bolivia and Brazil, 13 Sep. 2004
## MODIS Active Fire/Thermal Anomalies Products

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOD14/MYD14</td>
<td>1-km Swath L2</td>
</tr>
<tr>
<td>MOD14A1/MYD14A1</td>
<td>1-km Daily Composite L3</td>
</tr>
<tr>
<td>MOD14A2/MYD14A2</td>
<td>1-km 8-Day Composite L3</td>
</tr>
<tr>
<td>MOD14C8H/MYD14C8H</td>
<td>0.5° 8-Day CMG</td>
</tr>
<tr>
<td>MOD14CMH/MYD14CMH</td>
<td>0.5° Monthly CMG</td>
</tr>
<tr>
<td>MCD14ML</td>
<td>Monthly fire locations + attributes</td>
</tr>
</tbody>
</table>
Collection 6 Algorithm Refinements

- Processing extended to oceans and other large water bodies
  - Detect off-shore gas flaring
- Reduce false alarms in Amazon caused by small forest clearings
- Dynamically adjust potential fire thresholds
  - Detect smaller fires
- Improved cloud mask
- Updated fire radiative power (FRP) retrieval
Collection 5
Collection 6
False color ASTER imagery superimposed with approximate edges of MODIS pixels (black grid). MODIS fire pixels are outlined in red.
C6 Dynamic Potential Fire Thresholds

Detection algorithm uses various thresholds to quickly identify obvious *non*-fire pixels. These are known as “potential fire thresholds”.

Prior to Collection 6, fixed day/night values were used for the potential fire thresholds. However, these thresholds really should vary with scan angle, location, land cover type, season, etc.

For Collection 6, the potential fire thresholds are set dynamically.
C6 Dynamic Potential Fire Threshold Examples

Terra 2005246 14:55 (Amazon)

Terra 2002204 10:05 (Sahara)
Collection 6 Higher Level Product Refinements

• 0.25° CMG product
• New CMG product layers
  – fire persistence
• Minor Level 3 product refinements
Validation

- Use swath (L2) product
- Compare Terra MODIS fire masks to 30-m ASTER fire masks
- 2500 ASTER scenes
- Largely automated
- C6 validation process can be initiated at any time
Example C5 Validation Results
Collection 6 Higher Level Product Refinements

- 0.25° CMG
- New CMG product layers
  - fire persistence
- Minor L3 product improvements
- New *type* attribute in location product
  - Distinguish between static gas flares and other industrial sources, active volcanoes, and non-static vegetation fires
## MODIS Burned Area Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCD45A1</td>
<td>500-m Monthly L3</td>
</tr>
<tr>
<td>MCD45A1-based GIS Products (SCF)</td>
<td>Shapefiles + 500-m GeoTIFF</td>
</tr>
<tr>
<td>MCD64A1 (SCF)</td>
<td>500-m Monthly L3</td>
</tr>
</tbody>
</table>

For all products burning is mapped to the nearest day.
### Algorithm/Product Characteristics

<table>
<thead>
<tr>
<th>MCD45A1</th>
<th>MCD64A1</th>
</tr>
</thead>
<tbody>
<tr>
<td>• BRDF-based approach</td>
<td>• VI time series approach</td>
</tr>
<tr>
<td>• 500-m, daily</td>
<td>• 500-m, daily</td>
</tr>
<tr>
<td>• Uses no active fire data</td>
<td>• Exploits active fire data</td>
</tr>
<tr>
<td>• Less noise-tolerant</td>
<td>• More noise-tolerant</td>
</tr>
<tr>
<td>• Poorer mapping under cloudy conditions</td>
<td>• Better mapping under cloudy conditions</td>
</tr>
<tr>
<td>• Better mapping of cropland burning</td>
<td>• Poorer mapping of cropland burning</td>
</tr>
</tbody>
</table>
Merge features of the two different approaches to produce a better C6 product, i.e., a “Koala Goat”.

Wikimedia Commons
Collection 6 Validation

- Landsat imagery
- CEOS burned area validation protocol
C6 Validation: Design Based Sampling

- Stratified random sampling
- Total population of the dataset: All Landsat pairs which respect the CEOS protocol requirements
  - Cloud free + within a set time period (~2 months)
- Stratification
  - In space: sub-continental regions
  - In time: fire seasonality based on MODIS active fire detections
C6 Validation: Design Based Sampling

• With Landsat 8 systematic acquisition sample is not merely a pair of scenes but rather the entire sequence over the year
• Number of samples guided by the results of Stage 2 validation of C5.1
Characteristics of Stage 3 Sampling

• Statistically robust sampling essential for proper characterization of presence/absence of fire
  – Current validation datasets are biased and are not suitable for detecting false positives

• Need to validate temporal and spatial aspects separately

• Image-pair interpretation widely tested and published in peer reviewed literature

• Data availability is main limiting factor
  – With Landsat 8 data we can rigorously validate burned area for the first time in over 10 years
Thanks!