

# Collection 6 MODIS Fire Products

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GOFC Fire Implementation Team Meeting

July 2014

# MODIS Active Fire/Thermal Anomalies Products

|                   |                                     |
|-------------------|-------------------------------------|
| MOD14/MYD14       | 1-km Swath L2                       |
| MOD14A1/MYD14A1   | 1-km Daily Composite L3             |
| MOD14A2/MYD14A2   | 1-km 8-Day Composite L3             |
| MOD14C8H/MYD14C8H | 0.5° 8-Day CMG                      |
| MOD14CMH/MYD14CMH | 0.5° Monthly CMG                    |
| MCD14ML           | Monthly fire locations + attributes |

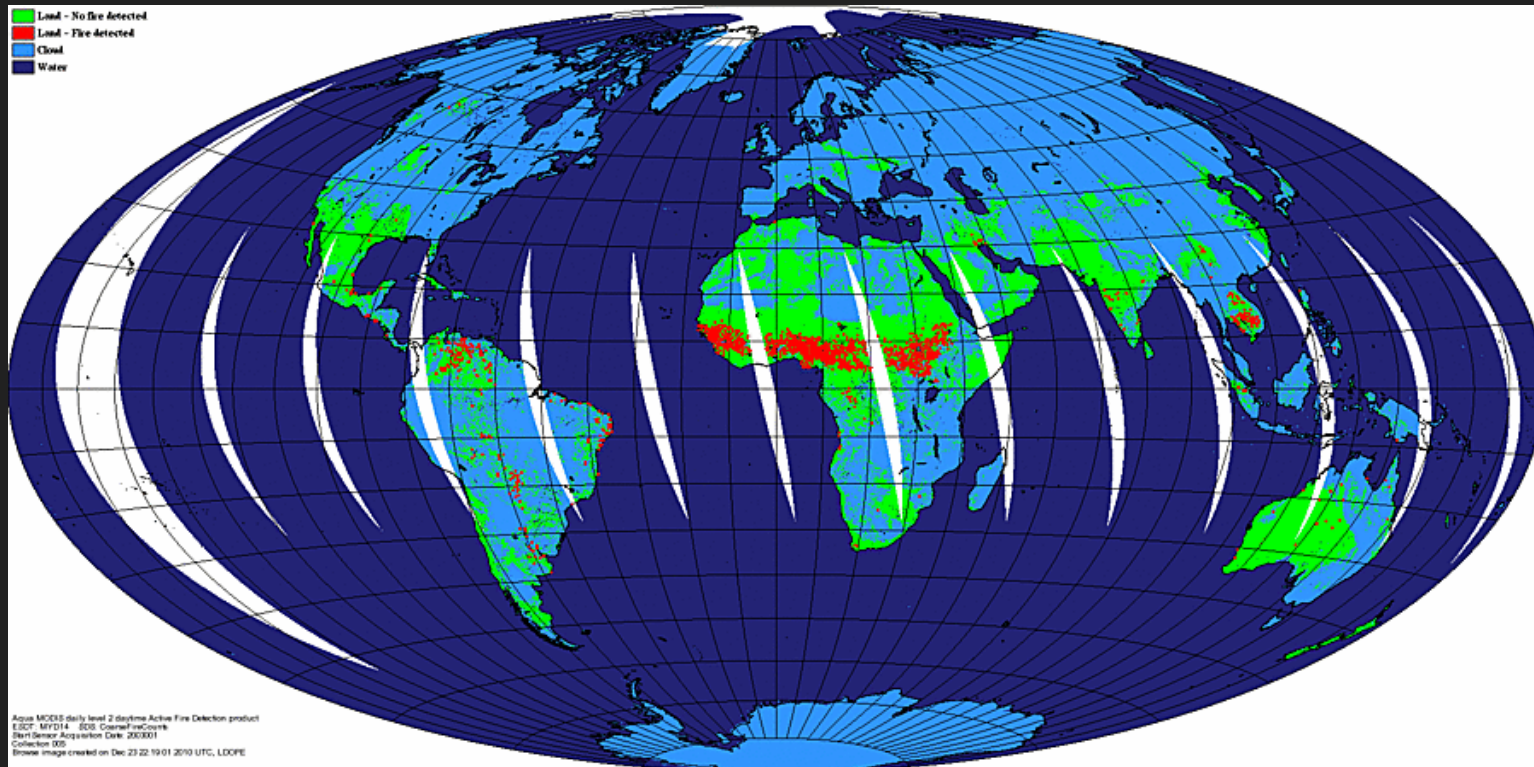
# Collection 6 Algorithm Refinements

- 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

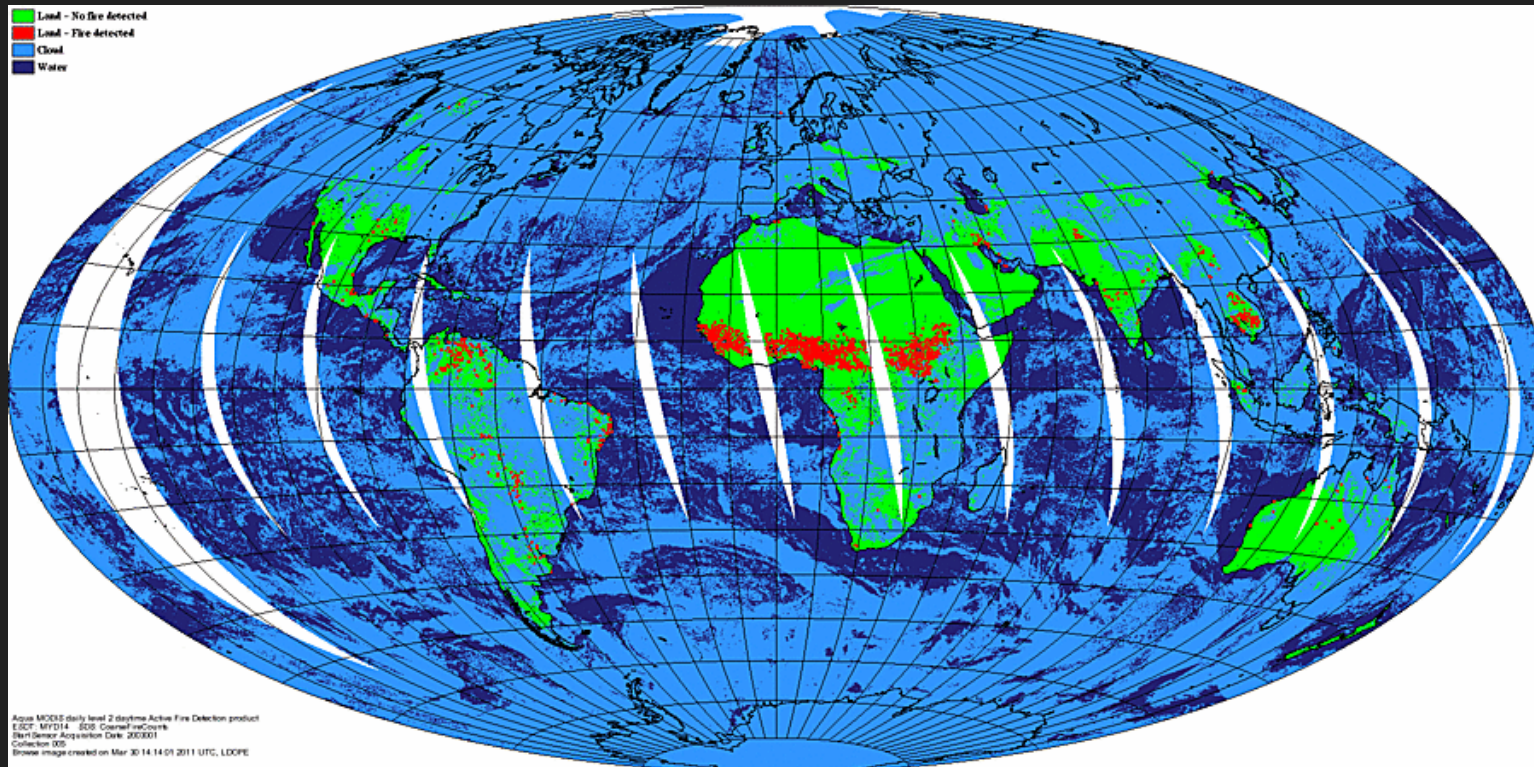
# Collection 6 Algorithm Refinements

- Assorted minor refinements

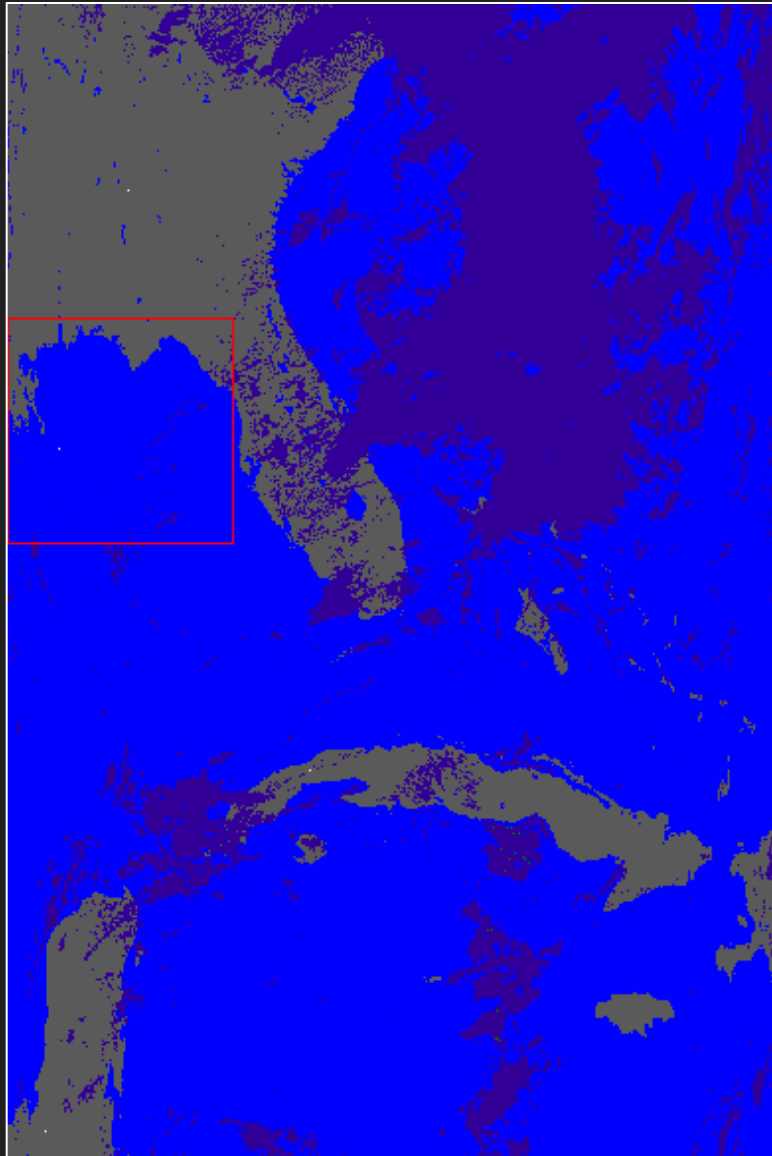
# Collection 5



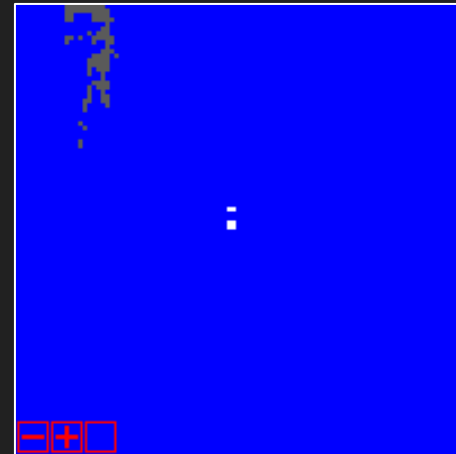
# Collection 6



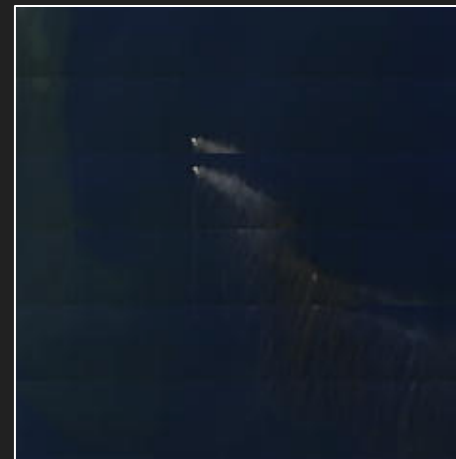
# Deepwater Horizon Offshore Drilling Rig Fire



C6 Fire Mask



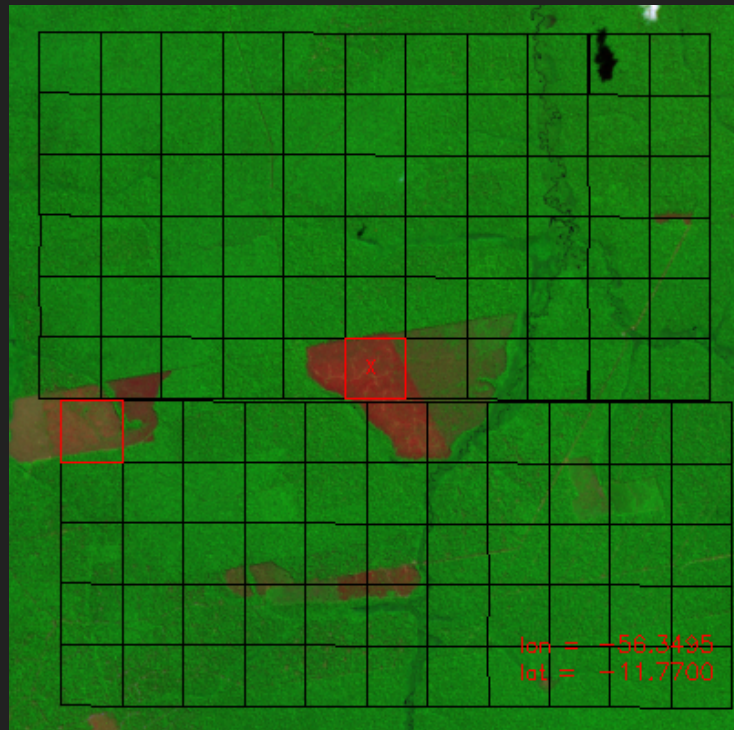
True Color



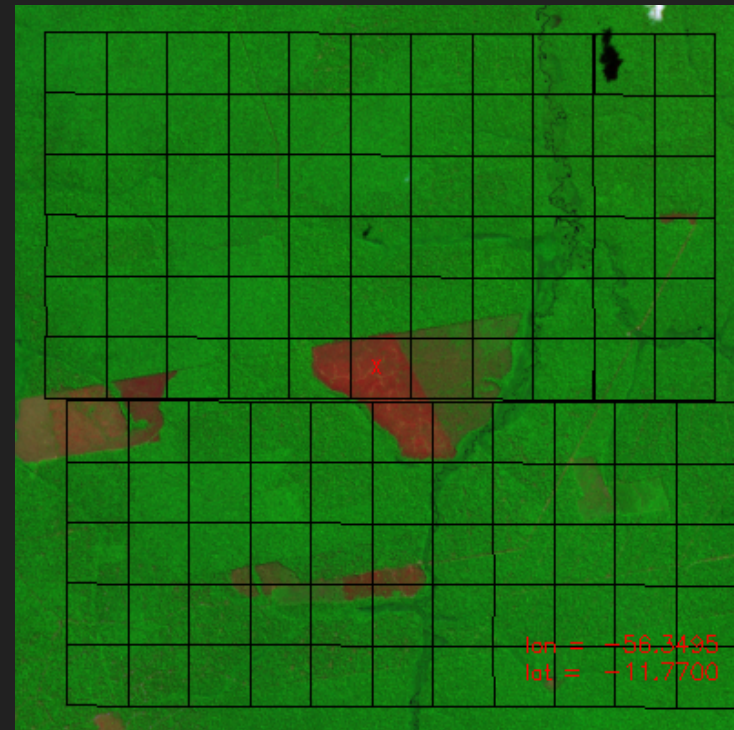
Terra MODIS 2010111 16:05 (21 April 2010)

# C6 Forest Clearing Rejection Test

C5



C6



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

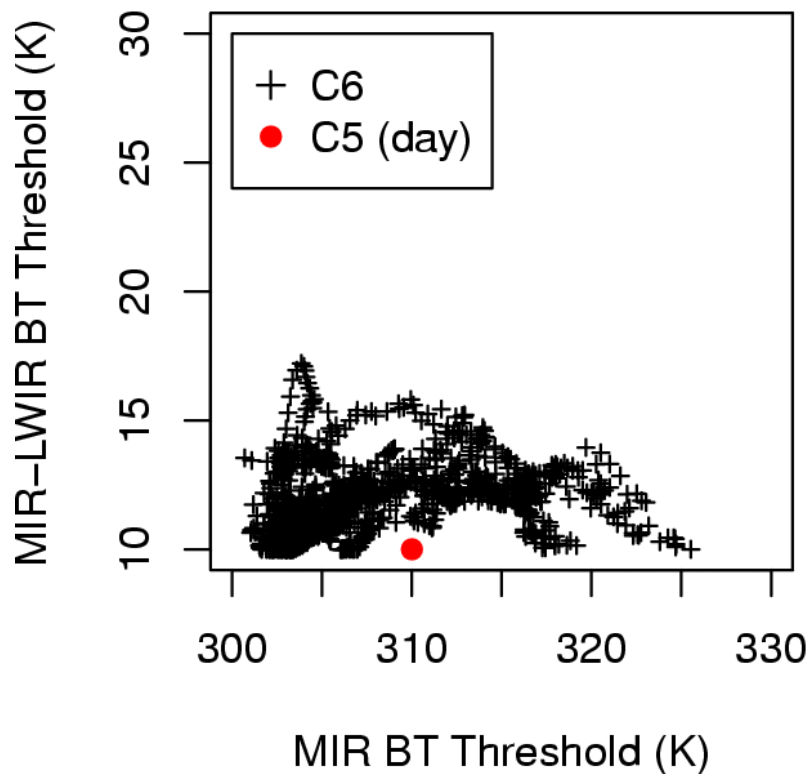
Detection algorithm uses various thresholds to quickly identify obvious *non*-fire pixels. These are known as “potential fire thresholds”.

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.

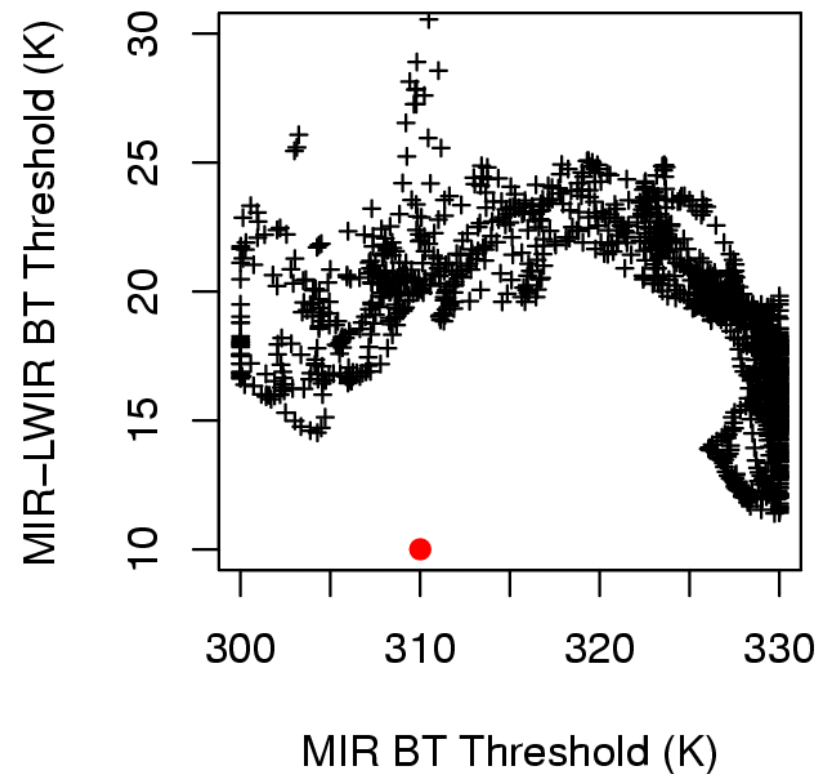
For Collection 6, the potential fire thresholds are set dynamically.

# C6 Dynamic Potential Fire Threshold Examples

Terra 2005246 14:55 (Amazon)



Terra 2002204 10:05 (Sahara)

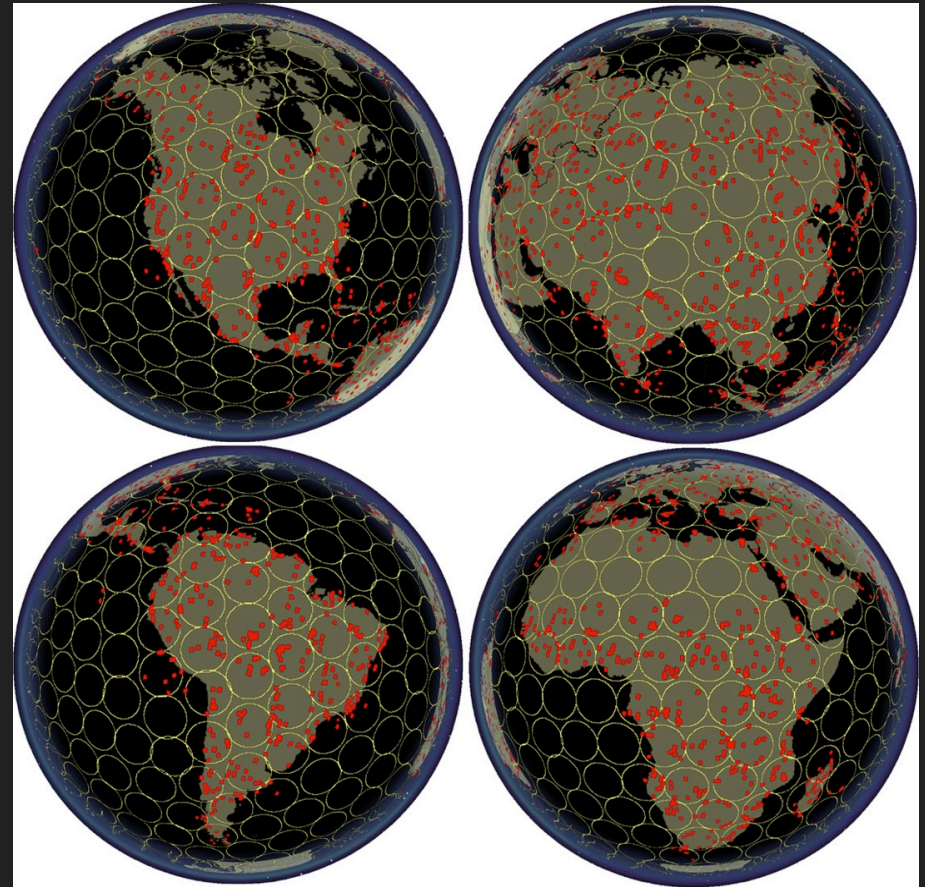


# Collection 6 Higher Level Product Refinements

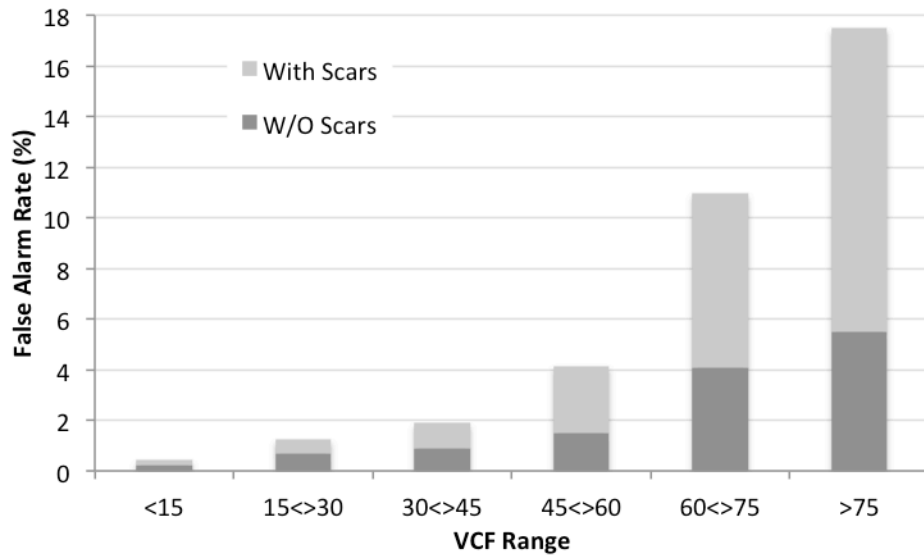
- 0.25° CMG
- New CMG product layers
  - fire persistence
- Minor L3 product improvements
- New *type* attribute in location product
  - Distinguish between static gas flares and other industrial sources, active volcanoes, and non-static vegetation fires

# Validation

- Use swath (L2) product
- Compare Terra MODIS fire masks to 30-m ASTER fire masks
- 2500 ASTER scenes
- Automated
- C6 validation now complete



# Terra MODIS Fire Product Validation

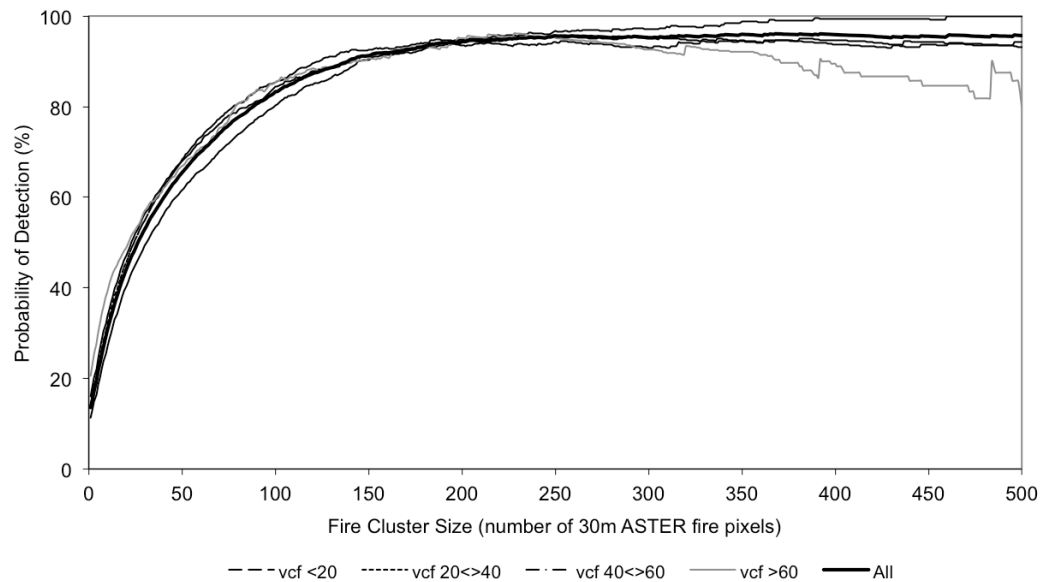


False alarm rates as a function of tree cover

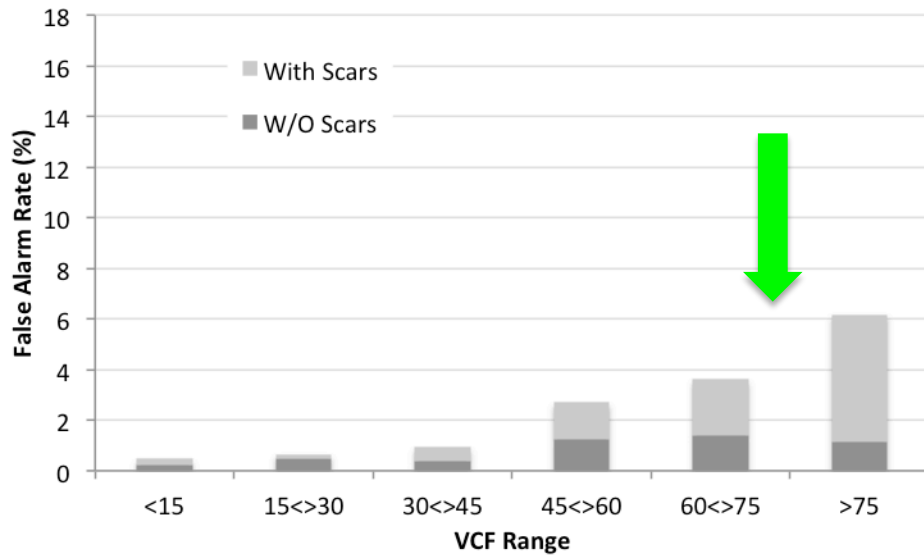
C5

*MODIS results based on +2,300 reference ASTER scenes*

Probability of detection as a function of tree cover



# Terra MODIS Fire Product Validation

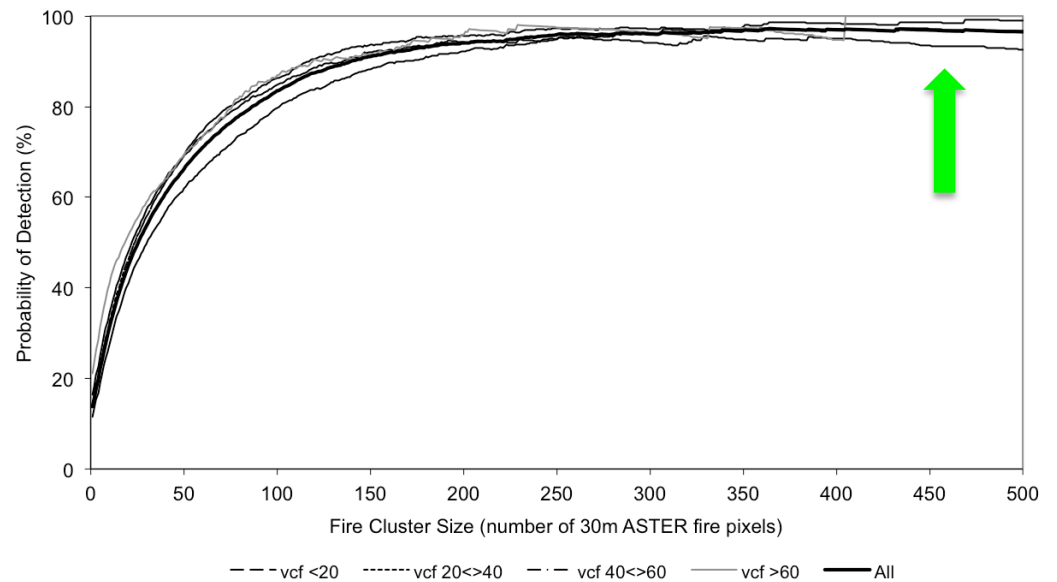


False alarm rates as a function of tree cover

C6

*MODIS results based on +2,300 reference ASTER scenes*

Probability of detection as a function of tree cover



# MODIS Burned Area Products

|                                  |                            |
|----------------------------------|----------------------------|
| MCD45A1                          | 500-m Monthly L3           |
| MCD45A1-based GIS Products (SCF) | Shapefiles + 500-m GeoTIFF |
| MCD64A1 (SCF)                    | 500-m Monthly L3           |

For all products burning is mapped to the nearest day.

# Algorithm/Product Characteristics

## MCD45A1

- BRDF-based approach
- 500-m, daily
- Uses no active fire data
- Less noise-tolerant
- Poorer mapping under cloudy conditions
- Better mapping of cropland burning

## MCD64A1

- VI time series approach
- 500-m, daily
- Exploits active fire data
- More noise-tolerant
- Better mapping under cloudy conditions
- Poorer mapping of cropland burning

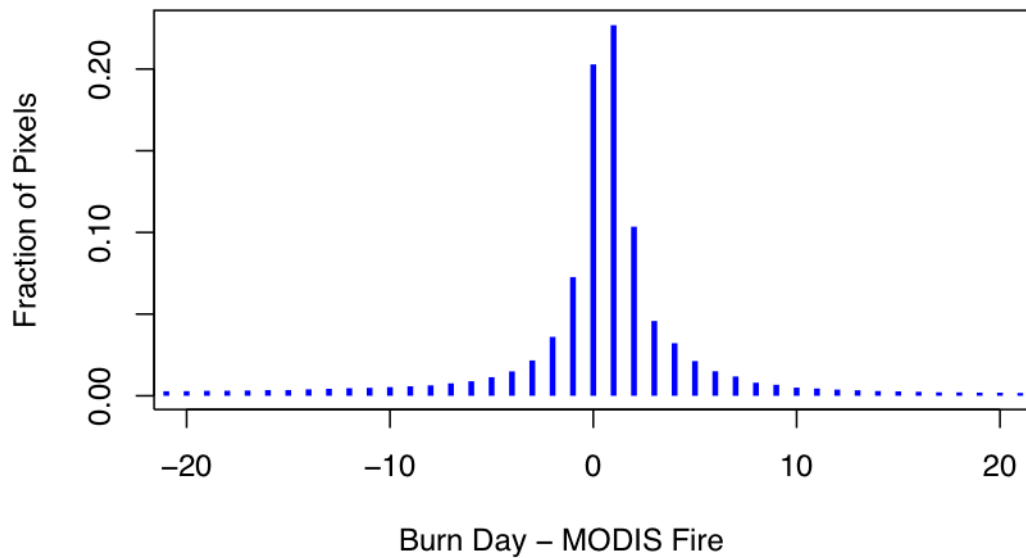
Merge features of the two different approaches to produce a better C6 product, i.e., a “Koala Goat”.

MCD45



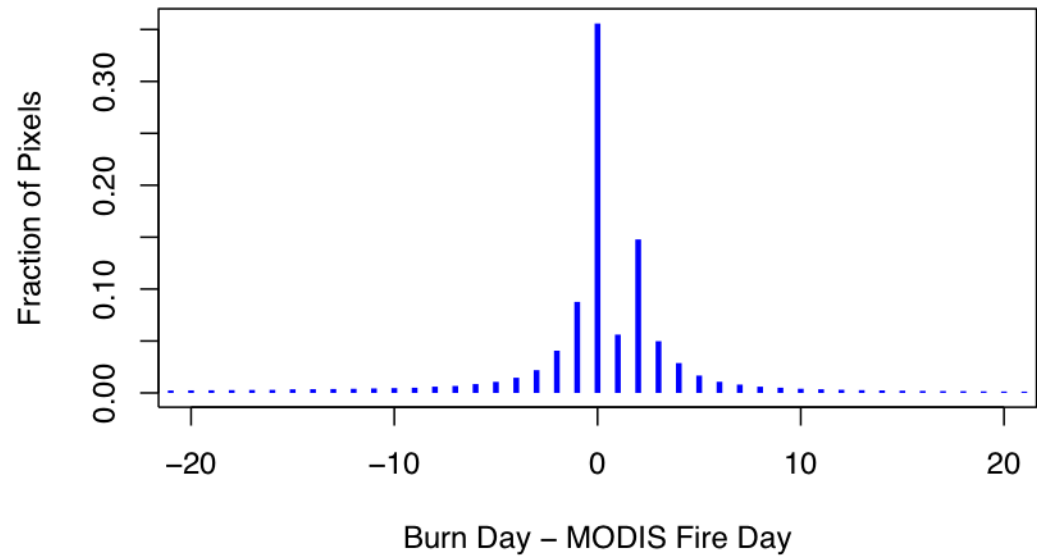
MCD64

## MCD45A1



Boschetti et al. (2010)  
MCD45A1 temporal  
uncertainty analysis  
applied to both  
products.

## MCD64A1



# 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