

NASA MODIS and VIIRS Burned Area Products Update

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GOFC Fire Implementation Team Meeting

November 2016

MODIS Burned Area Products

MODIS Collections 5 and 5.1

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

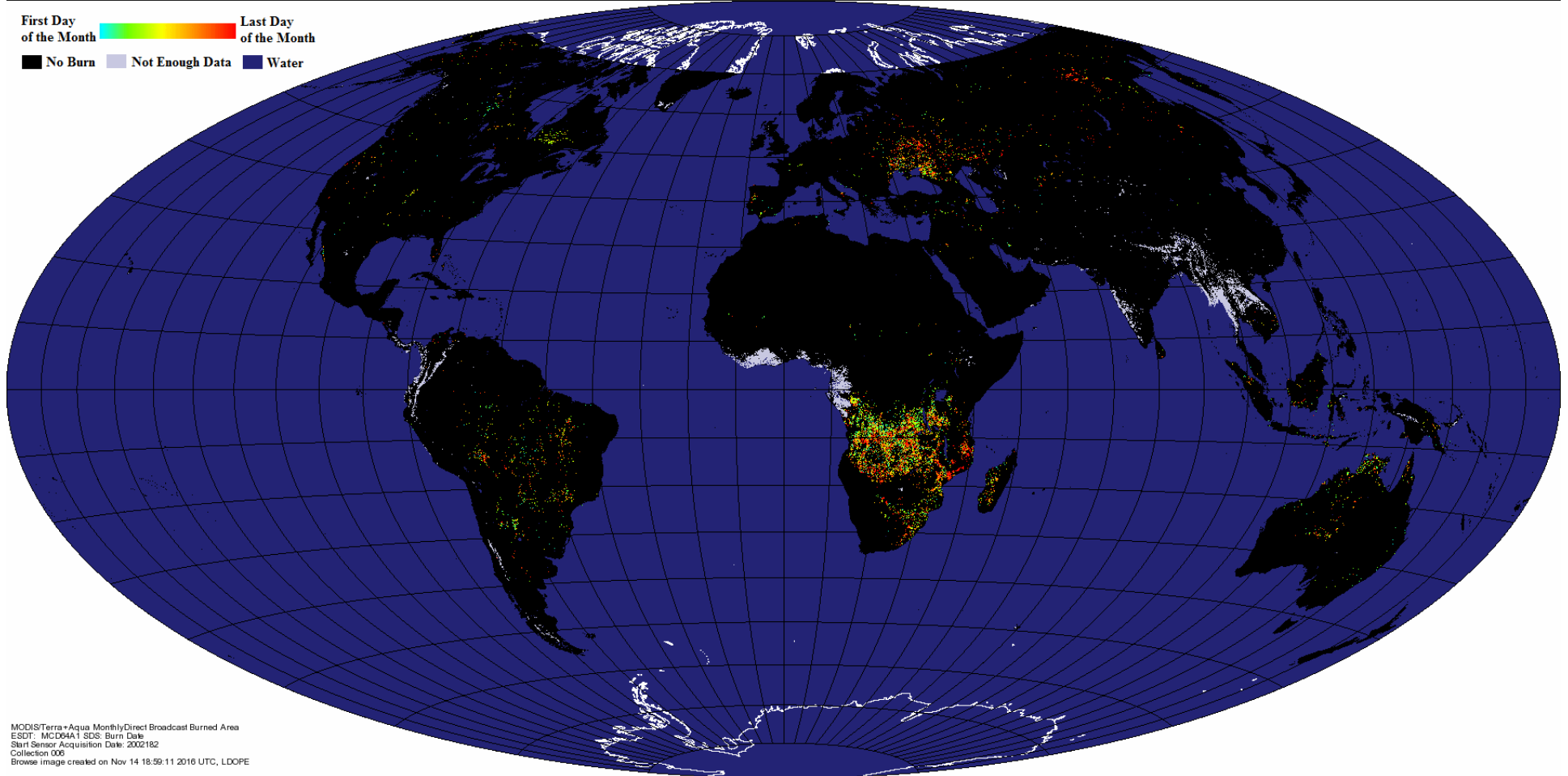
MODIS Collection 6

MCD64A1	500-m Monthly
MCD64A1-based GIS Products (SCF)	Shapefiles + 500-m GeoTIFF
MCD64CMQ (SCF)	0.25° Monthly
MCD64CDQ (SCF)	0.25° Daily

MODIS C6 BA Product Status

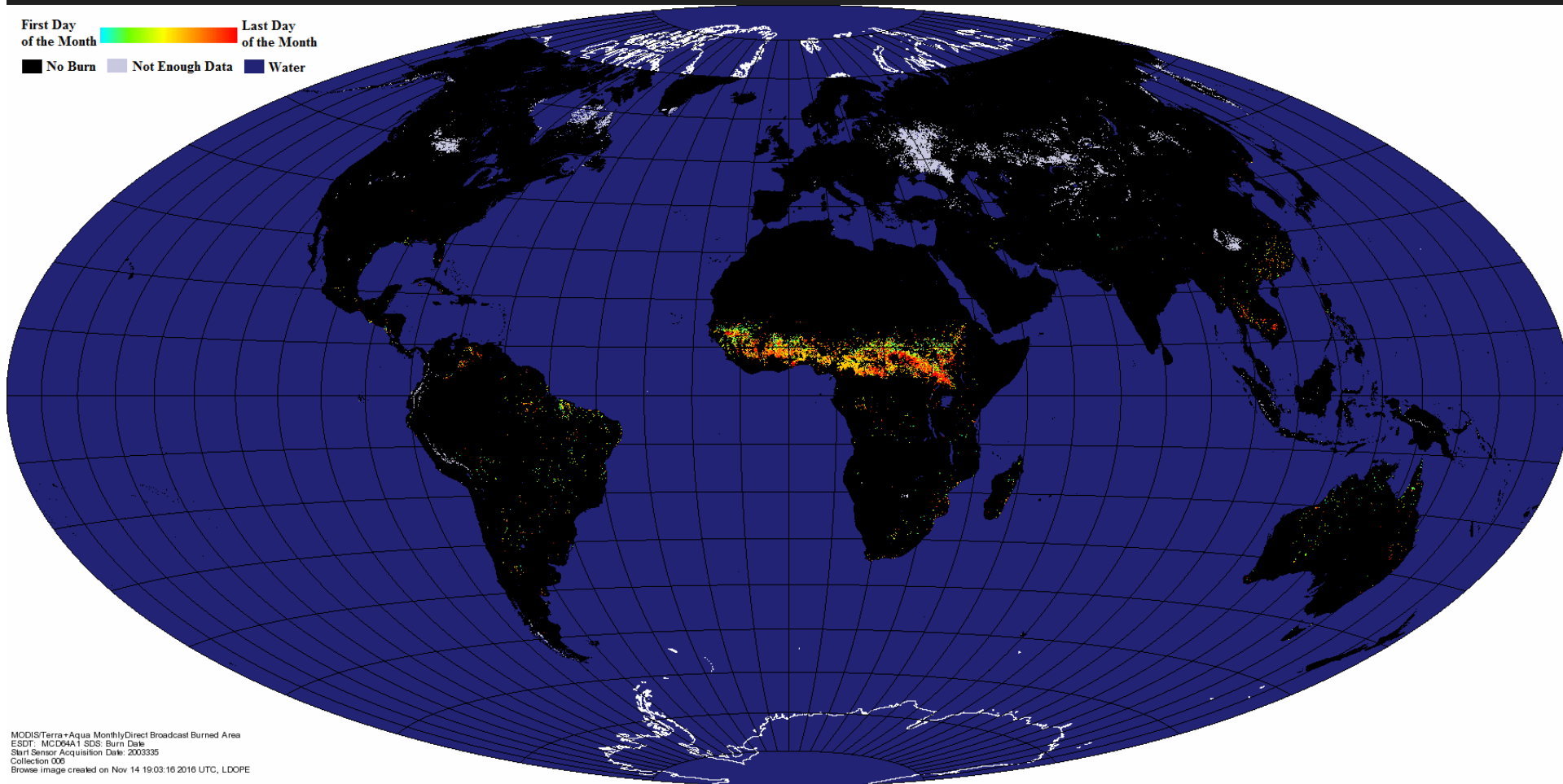
- C6 MCD64A1 operational production began five days ago
- Public release January 2017

July 2002 MCD64A1 Global Browse



<http://landweb.nascom.nasa.gov/cgi-bin/browse/browseMODIS.cgi>

December 2003 MCD64A1 Global Browse

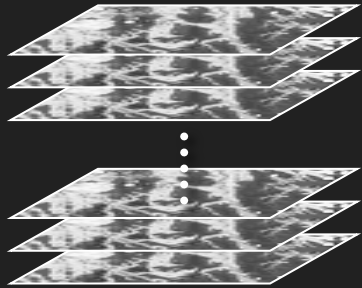


<http://landweb.nascom.nasa.gov/cgi-bin/browse/browseMODIS.cgi>

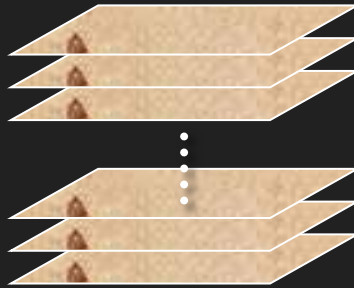
C6 MCD64A1 Improvements

- C6 input data
- 10-day → 8-day averaging window
- Final contextual relabeling phase now guided by neighbor statistics derived from training sample used for spectral classification
 - True small burns much less likely to be discarded
- No region growing in cropland
- Many smaller tweaks and refinements

DAILY SURFACE REFLECTANCE

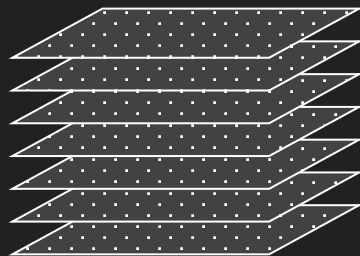


DAILY ACTIVE FIRE MASKS



C6 MCD64 Algorithm

TEMPORAL COMPOSITES



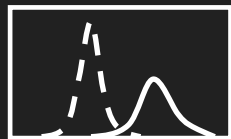
$\Delta VI^*, VI^*_{\text{post}}$
 S^*, t^*, t_f
 $IQR^*_{\text{pre}}, IQR^*_{\text{post}}$

change summaries

TEMPORAL TEXTURE



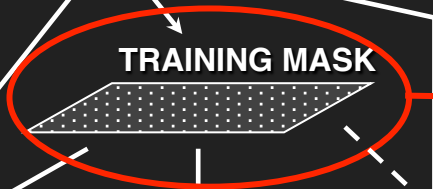
CONDITIONAL PDFs



LAND COVER



TRAINING MASK



SPATIAL PRIORS



INITIAL CLASSIFICATION

CONTEXTUAL FILTER

BURN MAP

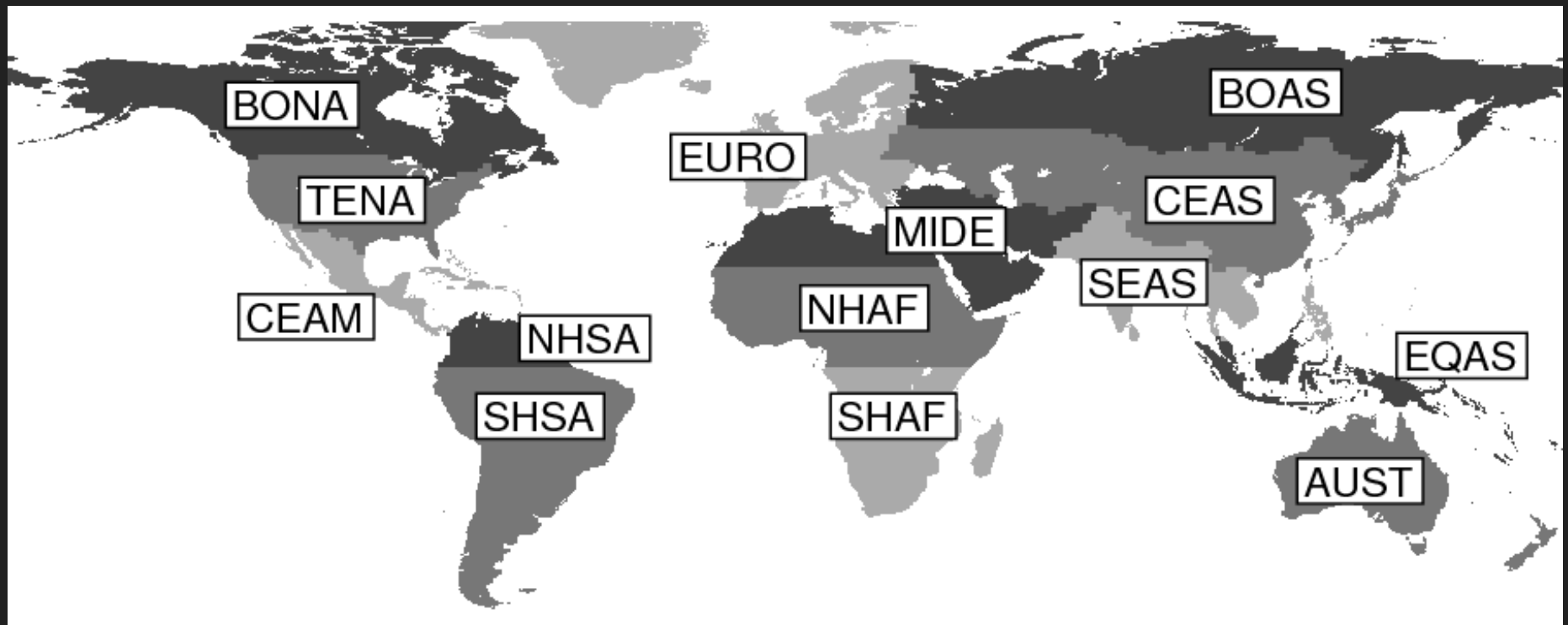


primary role of active fire map

$p(n_b \leq N|B)$

MODIS C6 Burned Area Early Results

- Overall increase in burned area
 - ~25% globally



MCD64A1 2007

Regional 2007 Burned Area Totals ($\times 10^4 \text{ km}^2 = \text{Mha}$)

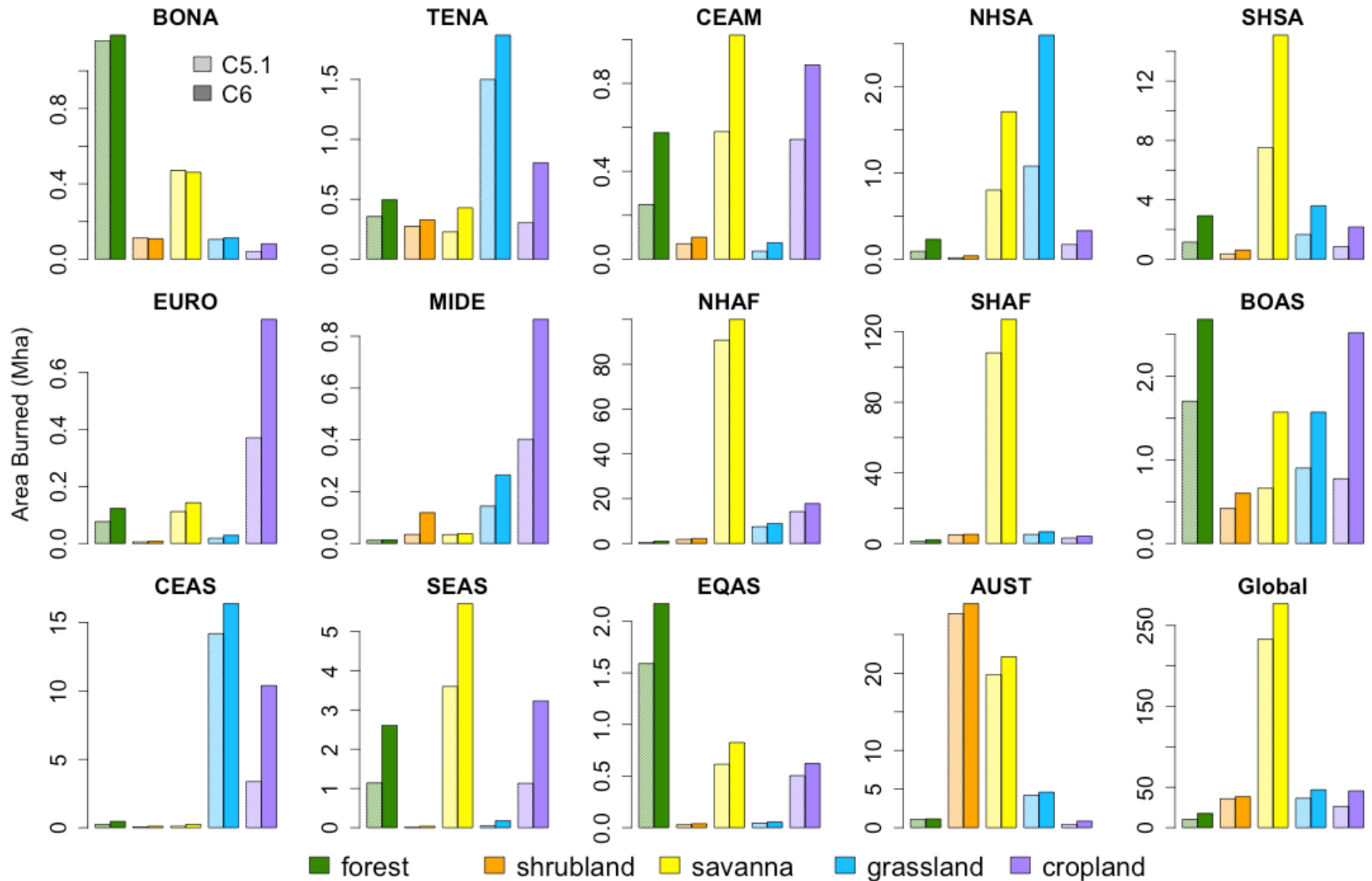
Region	C5.1	C6	
Global	364.4	460.4	26.3%
Boreal North America	1.6	1.6	1.1%
Temperate North America	2.9	4.1	40.6%
Central America	1.6	2.9	83.5%
NH South America	3.3	7.3	122.7%
SH South America	32.3	49.1	51.9%
Europe	1.0	1.5	49.4%
Middle East	0.8	1.6	95.8%
NH Africa	121.8	143.0	17.4%
SH Africa	123.6	151.1	22.2%
Boreal Asia	3.4	6.0	77.7%
Central Asia	12.8	22.1	72.8%
Southeast Asia	9.9	17.7	79.2%
Equatorial Asia	0.4	0.7	66.1%
Australia and NZ	48.8	51.5	5.6%

MCD64A1 2002

Regional 2002 Burned Area Totals ($\times 10^4 \text{ km}^2 = \text{Mha}$)

Region	C5.1	C6	
Global	377.4	458.2	21.4%
Boreal North America	3.2	3.1	-3.5%
Temperate North America	1.4	2.1	50.7%
Central America	0.9	2.4	171.8%
NH South America	2.2	4.4	98.2%
SH South America	20.6	36.1	75.2%
Europe	0.4	0.8	102.3%
Middle East	0.5	1.3	156.6%
NH Africa	125.3	136.9	9.3%
SH Africa	110.7	137.7	24.4%
Boreal Asia	7.6	10.2	33.8%
Central Asia	25.0	34.6	38.3%
Southeast Asia	4.7	8.5	80.3%
Equatorial Asia	2.4	3.3	38.2%
Australia and NZ	72.7	76.9	5.7%

MCD64A1 2006 Annual Area Burned

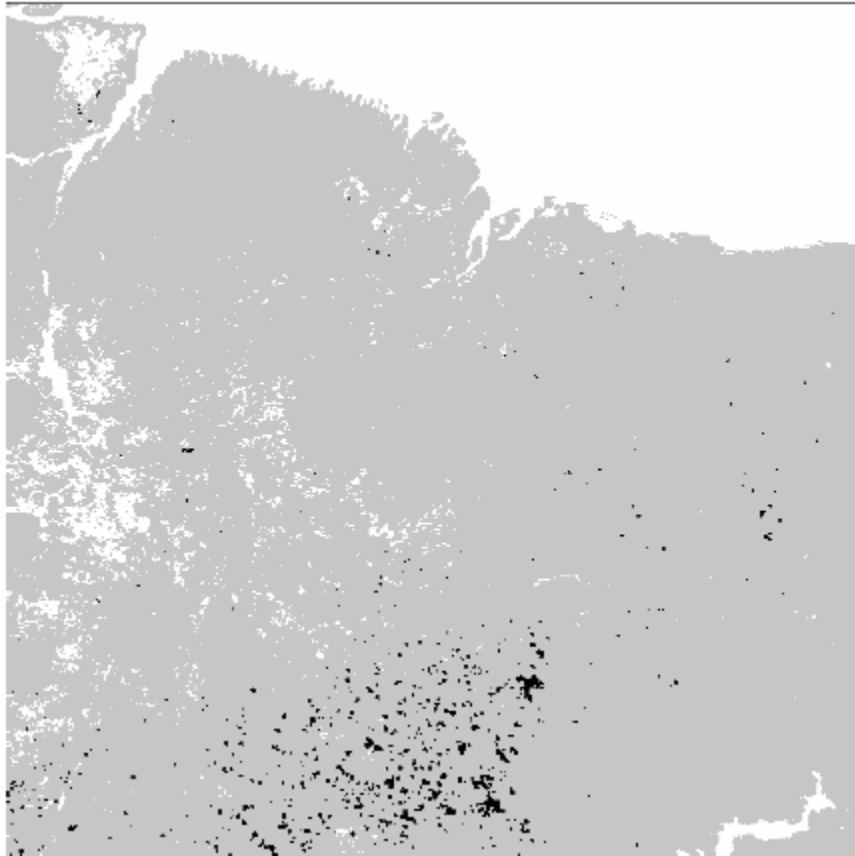


MODIS C6 Burned Area Early Results

- Overall increase in burned area
 - ~25% globally
- Small burns no longer blindly eliminated

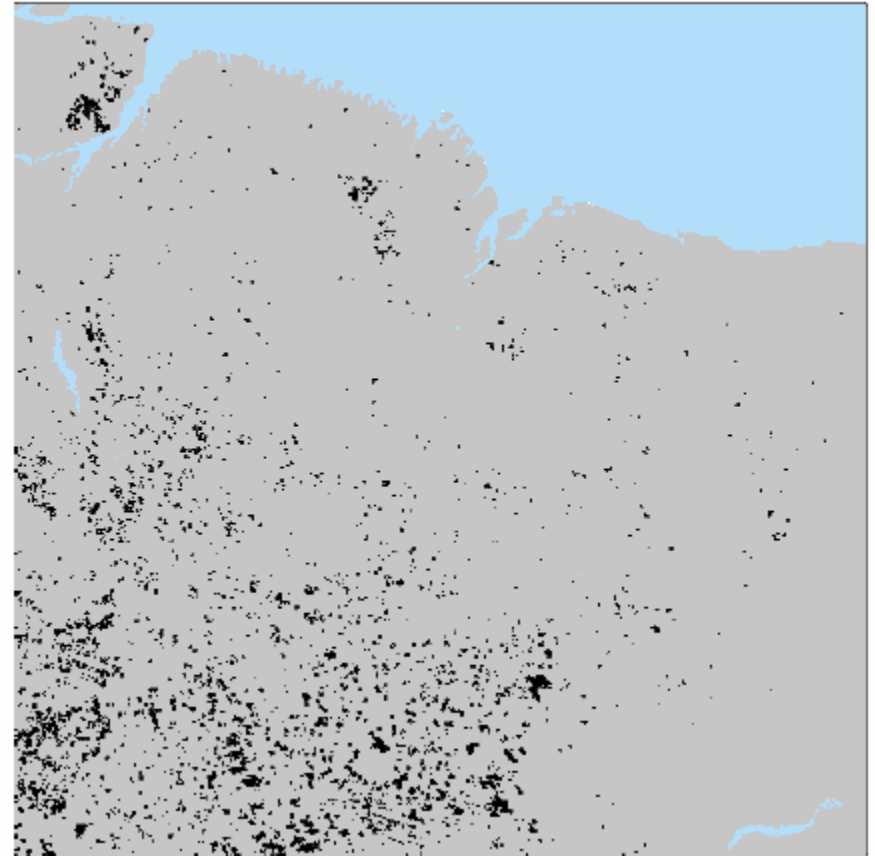
September 2002, MODIS tile h13v09 (eastern Brazil)

C5.1 MCD64A1 2002244 h13v09 17882



C5.1 MCD64A1

C6 MCD64A1 2002244 h13v09 71961



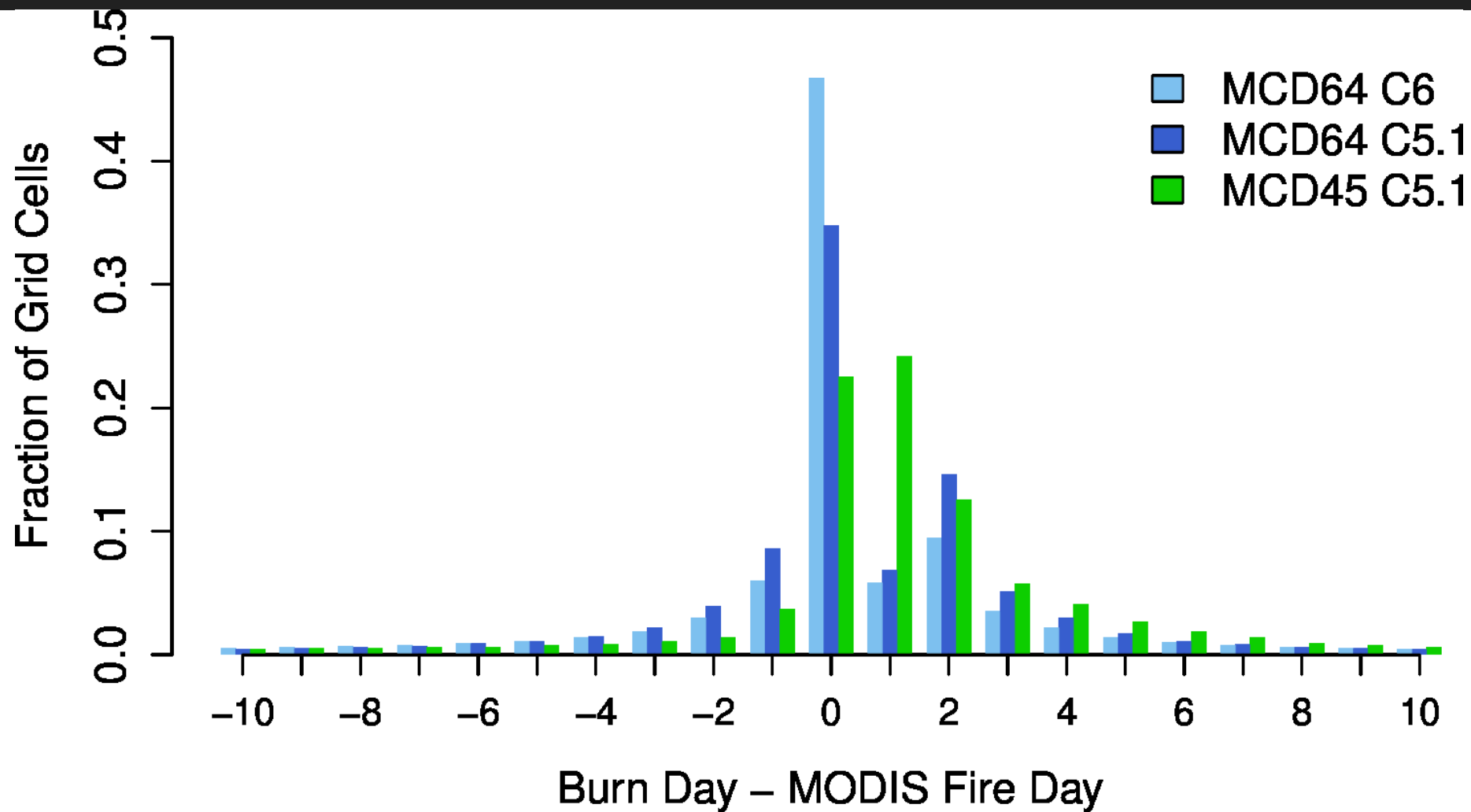
C6 MCD64A1

(4× increase)

MODIS C6 Burned Area Early Results

- Overall increase in burned area
 - ~25% globally
- Small burns no longer blindly eliminated
- Improved (i.e., smaller) temporal uncertainty

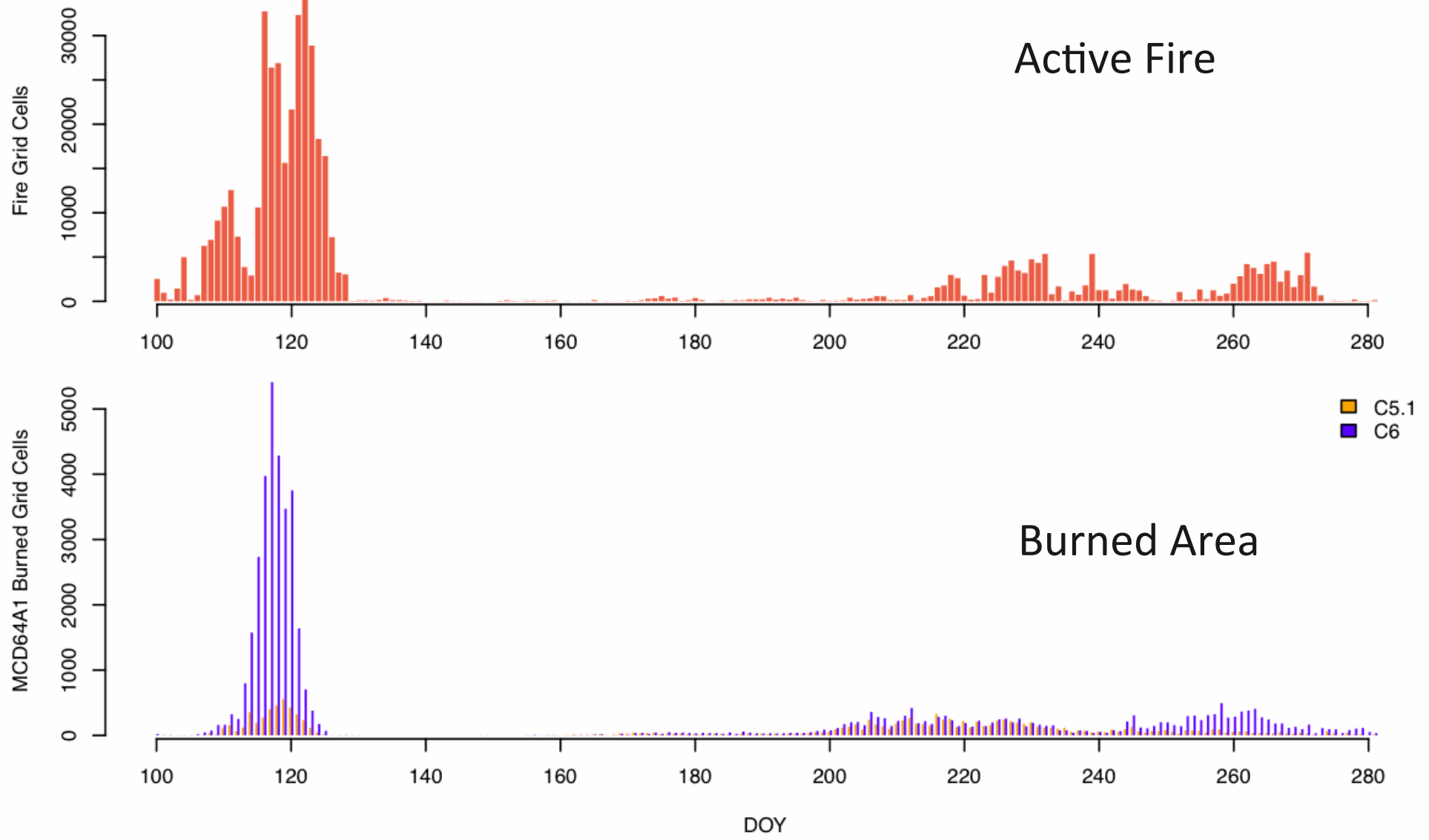
Temporal Uncertainty (Global, 2006)



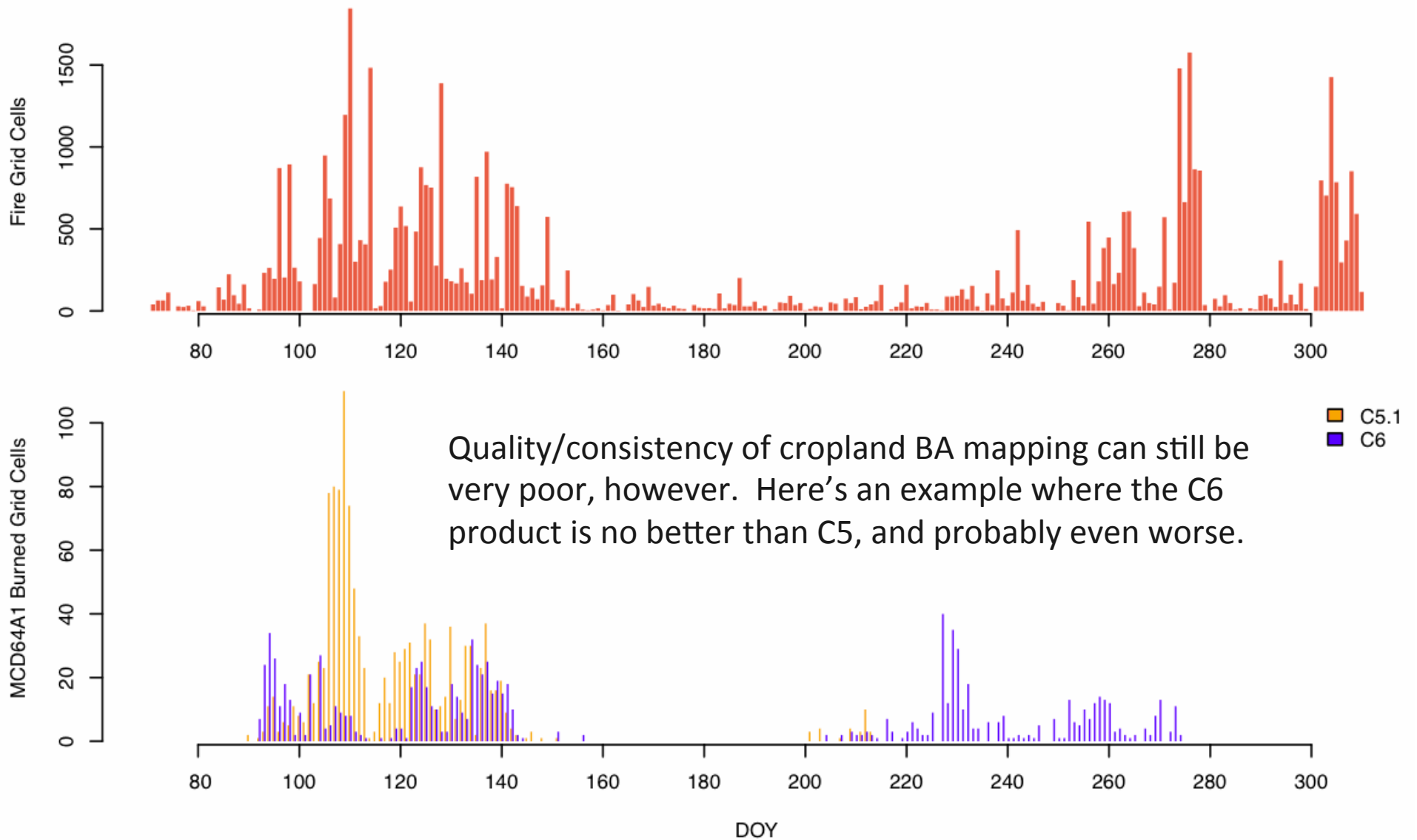
MODIS C6 Burned Area Early Results

- Overall increase in burned area
 - ~25% globally
- Small burns no longer blindly eliminated
- Improved (i.e., smaller) temporal uncertainty
- Mapping of cropland burning somewhat **cosmetically** improved
 - Timing can still be off due to confusion with harvest

h20v03 2006 crop

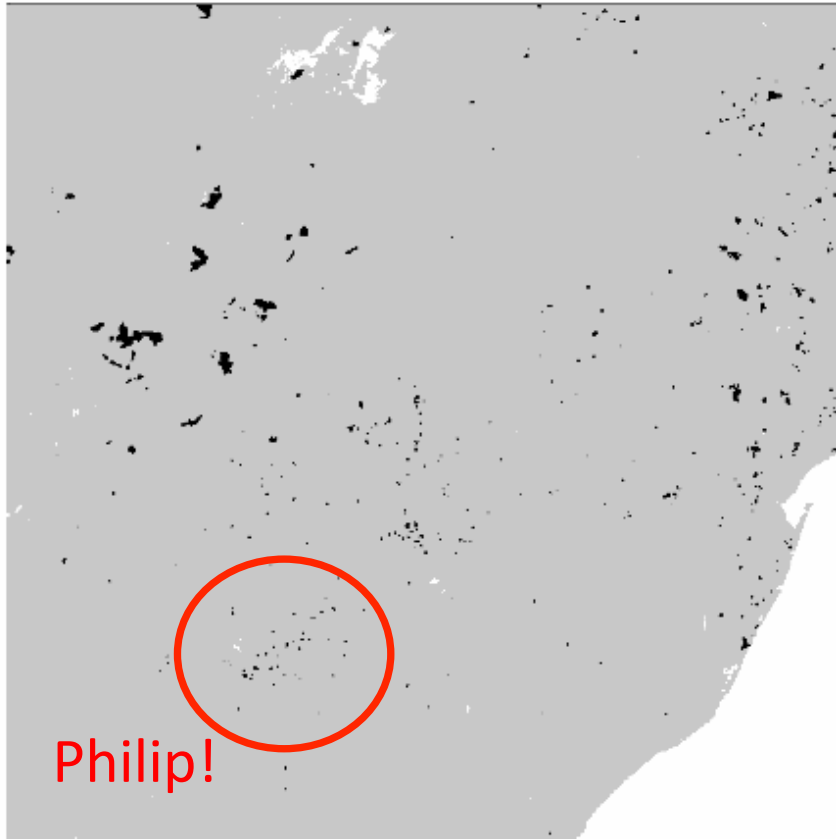


h11v04 2008 crop

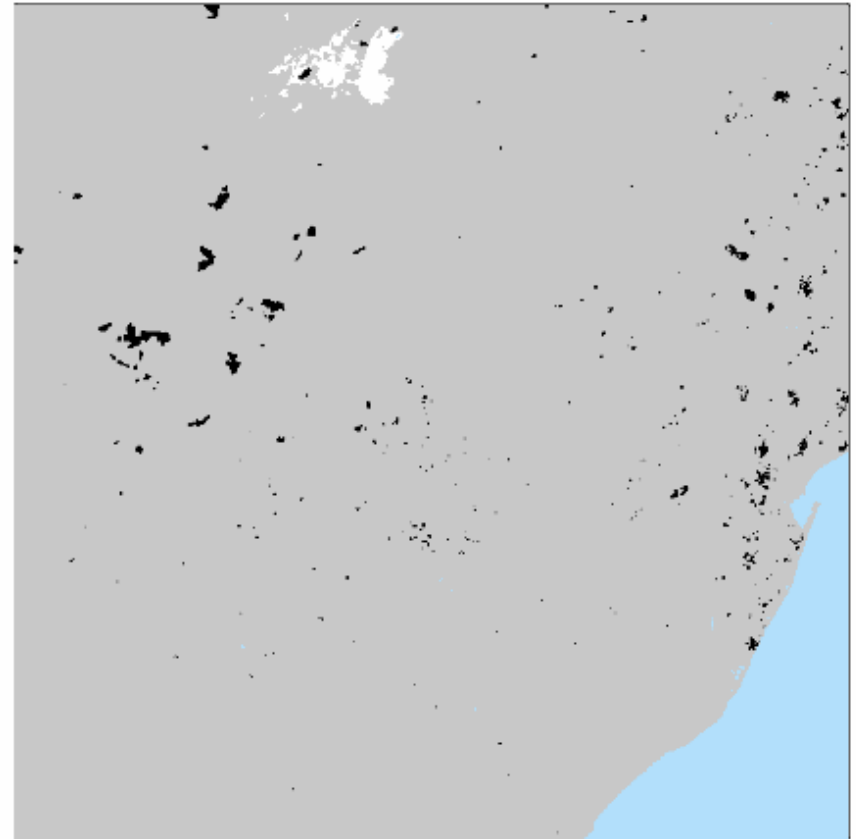


April 2002, MODIS tile h20v11 (southern Africa)

C5.1 MCD64A1 2002091 h20v11 19270



C6 MCD64A1 2002091 h20v11 20463

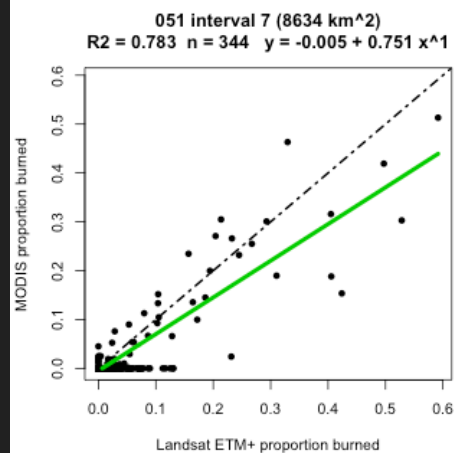
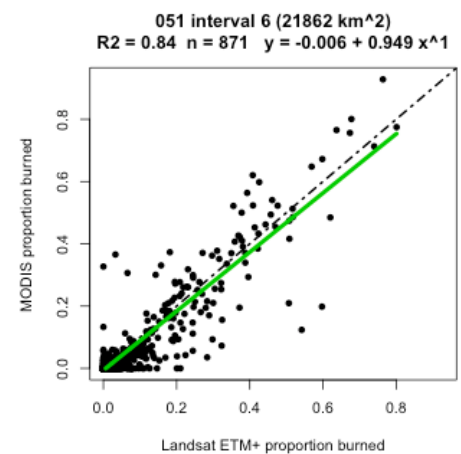
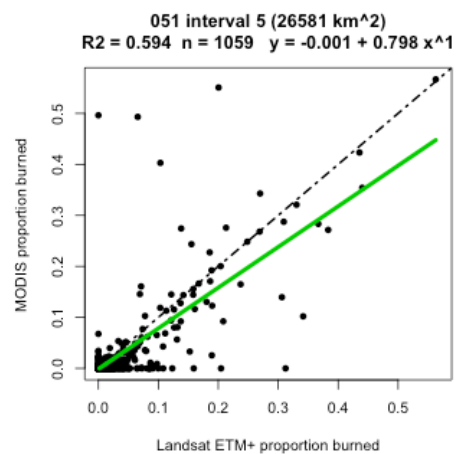
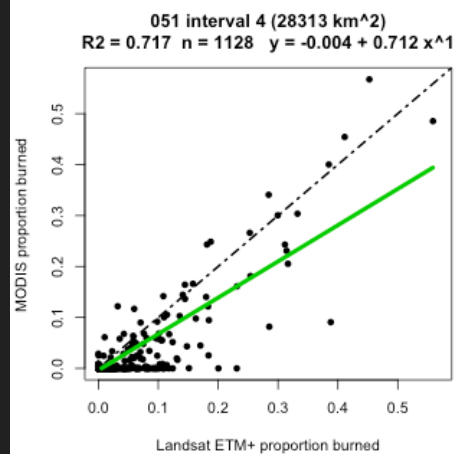
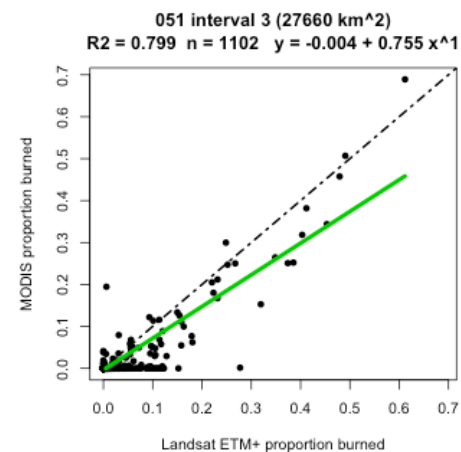
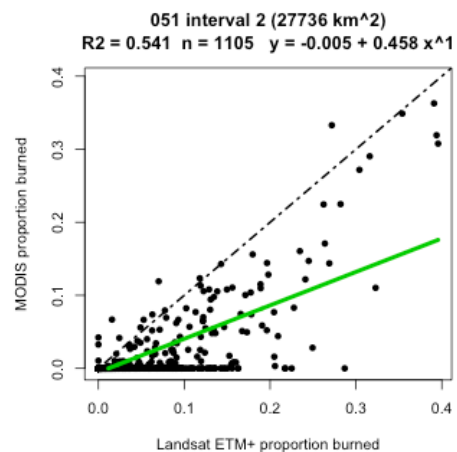
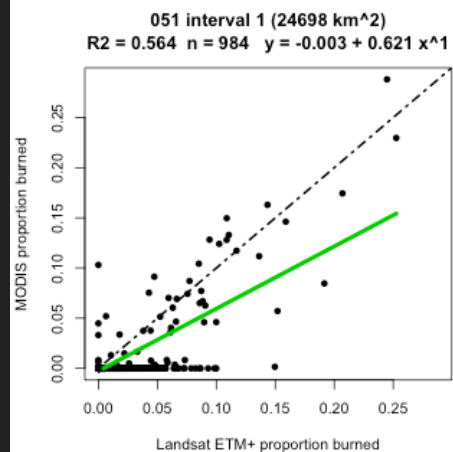


C5.1 MCD64A1

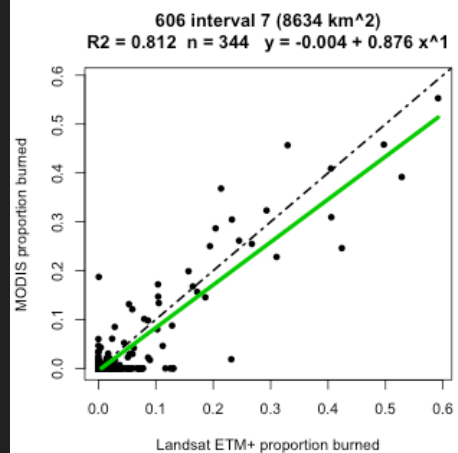
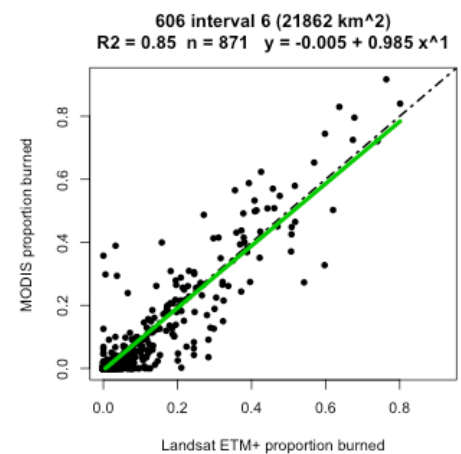
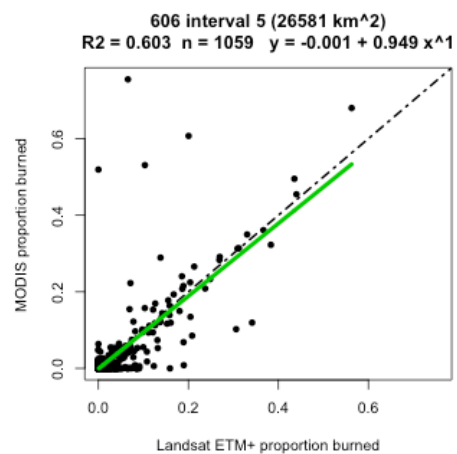
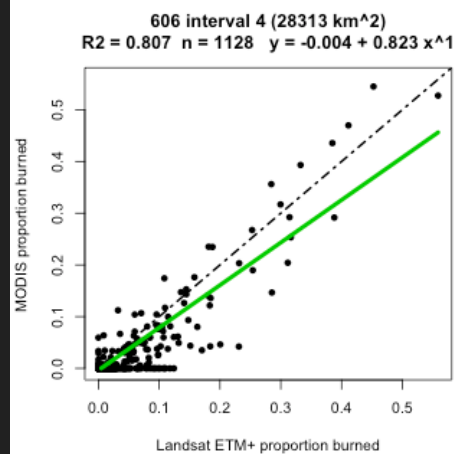
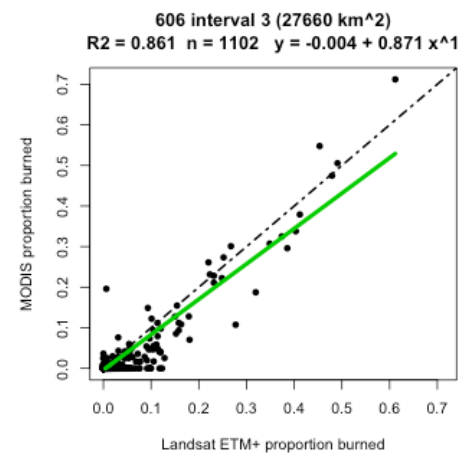
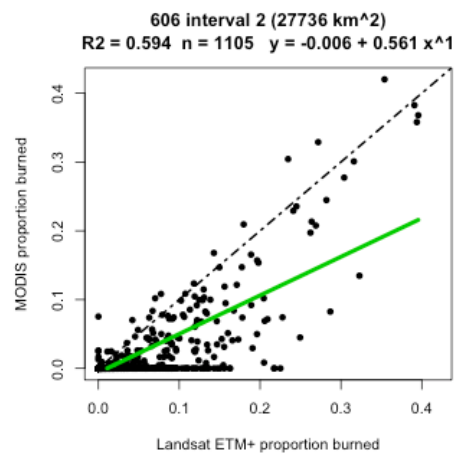
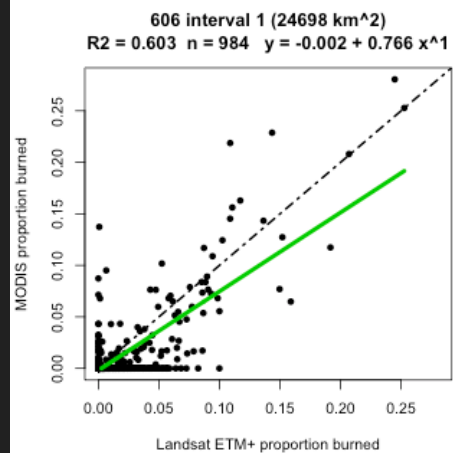
C6 MCD64A1

MODIS Collection 6/VIIRS Validation

- Landsat-8 imagery
- CEOS burned area validation protocol
 - Image-pair interpretation
 - Cloud free + within a set time period (~2 months)
 - Widely tested and used in peer reviewed literature
- CEOS “Stage 3”
 - “Product accuracy has been assessed, and the uncertainties in the product well established via independent measurements made in a systematic and statistically robust way that represents global conditions.”



Mali C5.1



Mali C6

VIIRS Burned Area Product Status

- Adapt MCD64 production code to use VIIRS data
 - 750-m versus 375-m bands
- Retain 500-m grid for MODIS compatibility

VIIRS Burned Area Products

VIIRS “Collection 1”

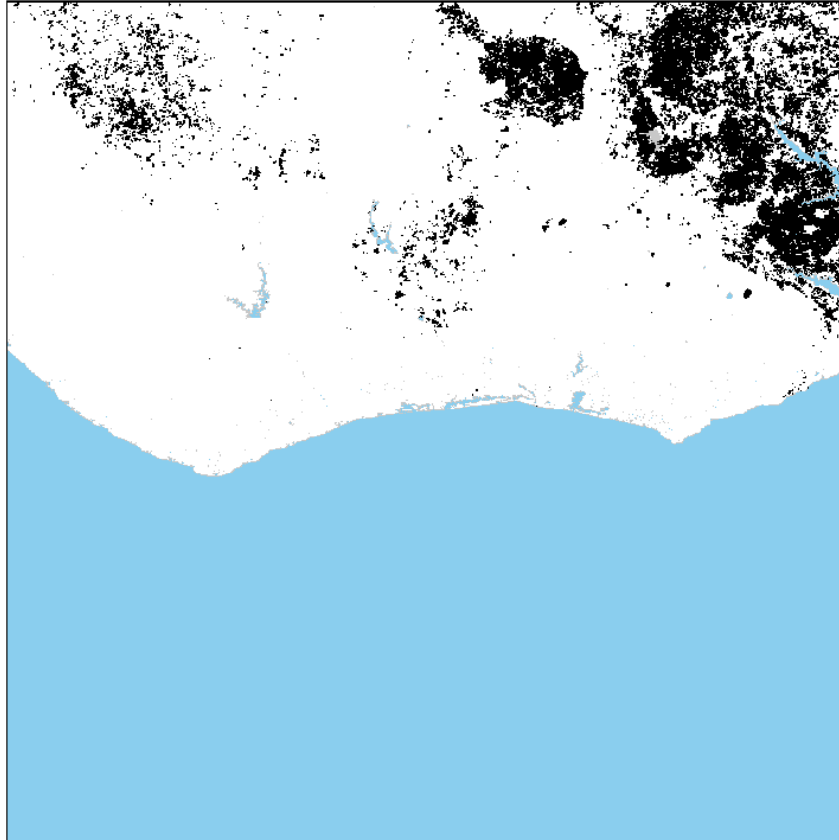
VNP64A1	500-m Monthly
VNP64A1-based GIS Products (SCF)	Shapefiles + 500-m GeoTIFF
VNP64CMQ (SCF)	0.25° Monthly
VNP64CDQ (SCF)	0.25° Daily

March 2017 release significantly behind schedule due to input-data implementation delays.

VIIRS VNP64A1 Prototype

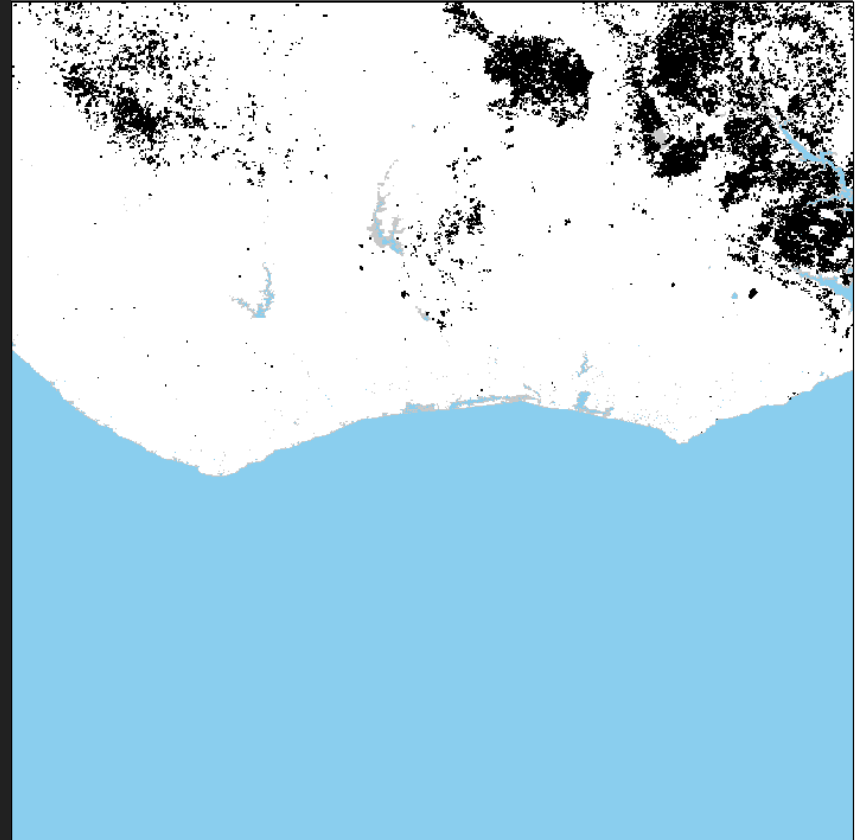
MODIS

MCD64A1 h17v08 2015 305-365 222530



VIIRS*

VNP64A1 h17v08 2015 305-365 201302



*1-km NPP_DSRFIP_L3 daily surface reflectance product used as stand-in for 500-m VIIRS daily surface reflectance.

