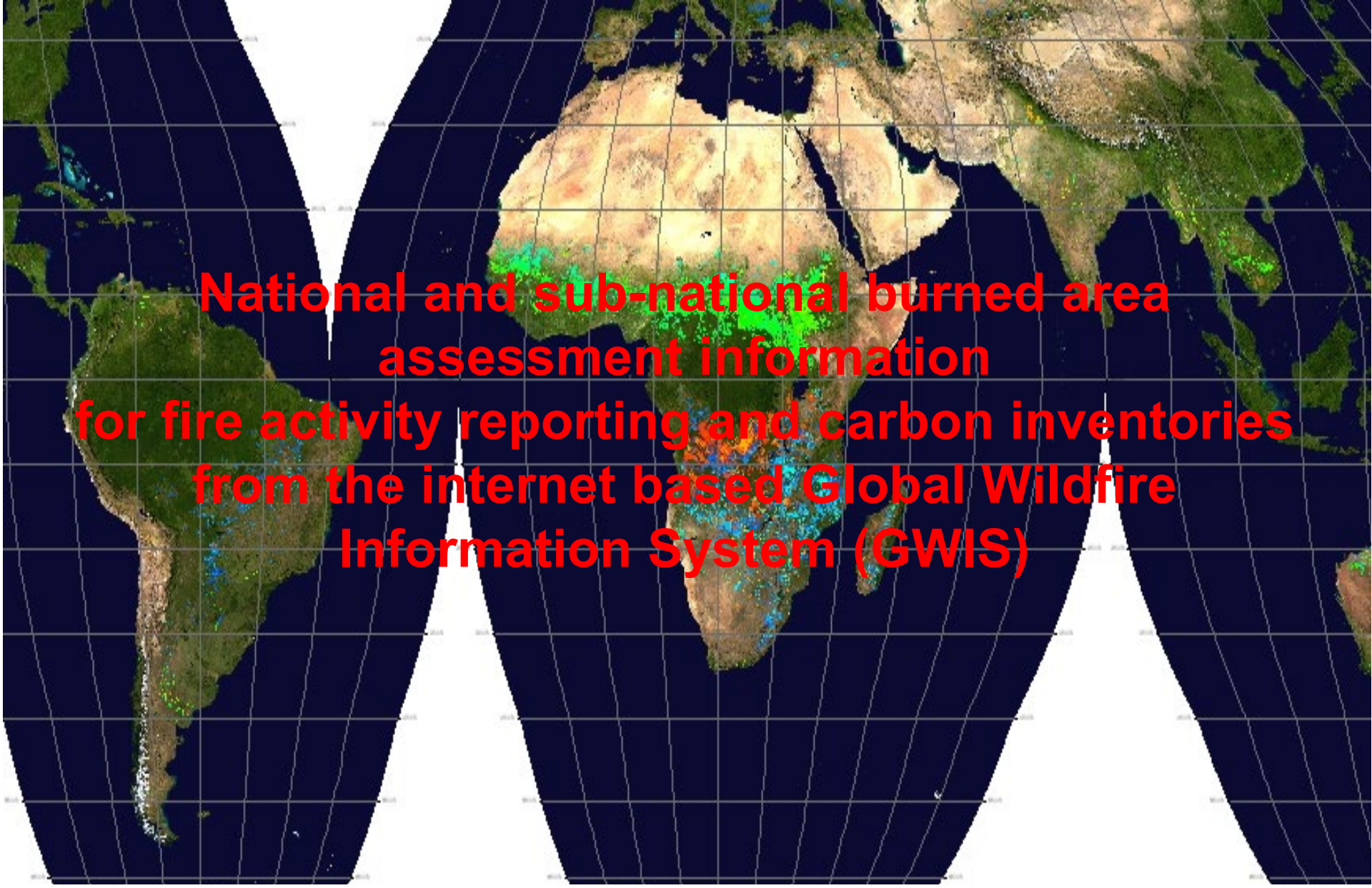


National and sub-national burned area assessment information for fire activity reporting and carbon inventories from the internet based Global Wildfire Information System (GWIS)

Luigi Boschetti, Aaron Sparks (University of Idaho)
David Roy (Michigan State University) Jesus San Miguel (JRC)

Overarching Goal of the Project

Funded under the NASA Applied Sciences Program, in support of GEO activities

Goal: Expanding GWIS by incorporating the NASA fire products, enabling a comprehensive view and evaluation of fire regimes and fire effects in support of policy making and national resource management.

Datasets

NASA burned area products:

- MODIS C6 MCD64 burned area product
- Pathfind the transition to VIIRS

Activities

Develop a new GWIS module (“Country Profile”) providing:

- visualization of Burned Area Products
- on-demand statistics
- tabular and graphical information

National and sub-national scale

Monthly, seasonal and annual time periods

GWIS Approach – support for fire reporting and assessment

Summary fire information for science and non-science users, in support of national fire assessment and national fire operations.
Designed for easy access by analysts (EFFIS model):

- overview of current season
- overview of historical fire regimes
- comparison between current season and historical data (detection of anomalies)

GWIS Approach – support for fire reporting and assessment

"Country dashboard" with easy access to fire information at the national and subnational level. Directly supports the task of analysists compiling a national fire assessment.

Spatial reporting Units: National (GAUL Level 0), Sub-National (GAUL Level 1)

Involvement of GOFC Fire Regional Network to identify the relevant metrics (e.g. sessions at 2018-2021 Safnet, collaboration with FAO, feedback on the pre-release system through NASA Servir)

Essential Metrics

- *Total area burnt and number of active fire detections (computed monthly and yearly)*
  - total area burned (ha and km^2) with uncertainty estimates
  - total number of active fire detections (counts)
  - temporal ranking of the above and the year/month that the ranked values occurred on
  - counts of the number of months or years where there was no fire (burned area = 0 km^2, or number of active fires detected = 0)
- *Fire seasonality metrics (computed yearly):*
  - start of the fire season and end of the fire season, peak month of burning
  - temporal ranking of the above and the year/month that the ranked values occurred on
- *Fire size metrics (computed yearly):*
  - mean, median and maximum fire size
  - number and minimum size of the fires responsible for 25%, 50%, 75% of the total annual burned area.

Documentation

Providing information for policy support requires:

- Documented, transparent and reproducible methods
- Statistically rigorous protocols for the assessment of uncertainties and propagation of the uncertainties into the summary metrics
- Tools designed to help analysts, not to replace them

https://gwis.jrc.ec.europa.eu/apps/country.profile/

https://gwis.jrc.ec.europa.eu/apps/country.profile/

GWIS

Global Wildfire Information System (GWIS) > COUNTRY PROFILE

MENU

- Home
- Continent overview
- Country overview
- Country maps
- Country charts
- Data downloads
- Documents

[Ver. 0.106.0]

COUNTRY PROFILE

North America

-- Please select a country --

Europe

-- Please select a country --

Asia

-- Please select a country --

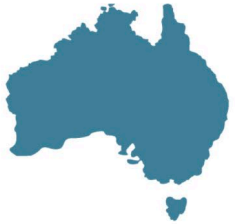
South America

-- Please select a country --

Africa

-- Please select a country --

Oceania



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European Commission | Copernicus Europe's eyes on Earth | NASA | GEO | University of Idaho Department of Forest, Rangeland and Fire Sciences | Department of Geography, Environment, and Spatial Sciences MICHIGAN STATE UNIVERSITY

https://gwis.jrc.ec.europa.eu/apps/country.profile/

Online since February 2021

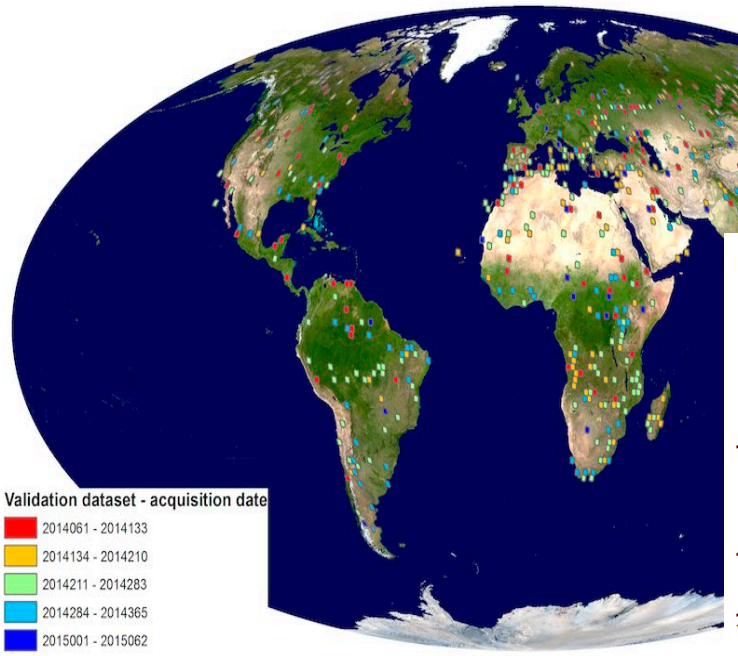
Comments and feedback always welcome!

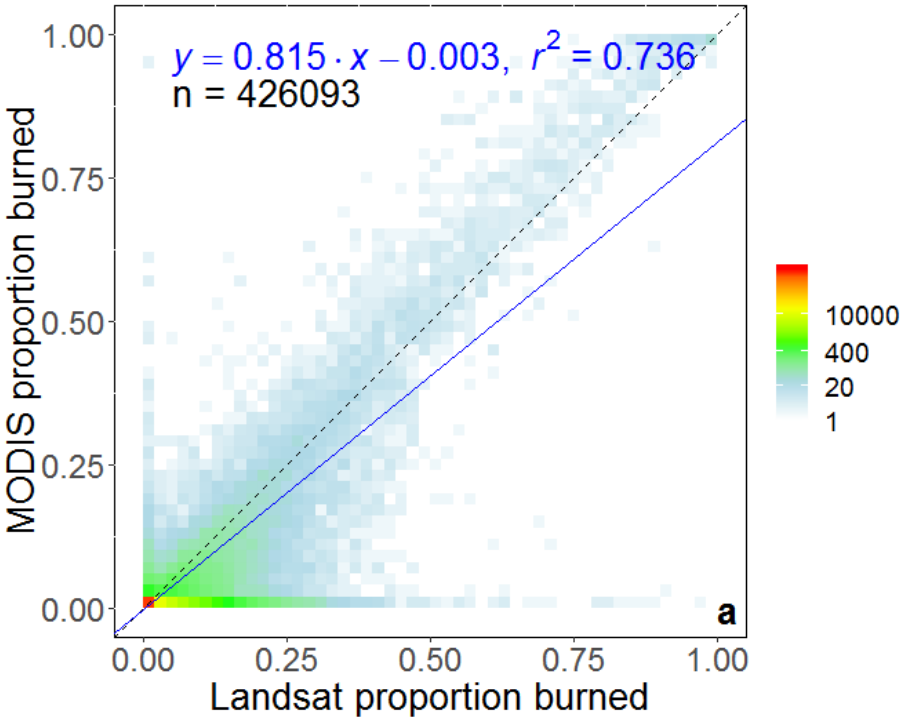
What's next

- Transition from Landcover CCI to MODIS MCD12 landcover classification
  - Difference in legend, MCD12 provides a more appropriate LC legend (savanna and savanna woodland are be separated from forest) and for better compatibility with IPCC guidelines for Tier 1 reporting

- NASA support ended – looking for funding opportunities to continue development
  - Transition to VIIRS
  - Small Fires

MODIS C6 MCD64





Boschetti, Roy, Giglio et al.
Stage 3 Validation of the MCD64 global burned area product, *RSE*

C6 MCD64A1

2002–2015 Mean Annual Area Burned (Mha yr^{-1})

Region	C5.1	C6	Δ (%)
Global	339.4	426.6	26
Boreal North America	2.79	2.6	-7
Temperate North America	2.0	2.8	43
Central America	1.6	2.8	78
NH South America	2.6	5.3	101
SH South America	17.9	29.6	66
Europe	0.6	1.0	71
Middle East	0.8	1.4	81
NH Africa	110.2	129.8	18
SH Africa	126.0	154.7	23
Boreal Asia	6.3	9.9	57
Central Asia	13.5	20.7	54
Southeast Asia	7.6	14.3	90
Equatorial Asia	1.4	1.8	30
Australia and NZ	46.3	49.8	7

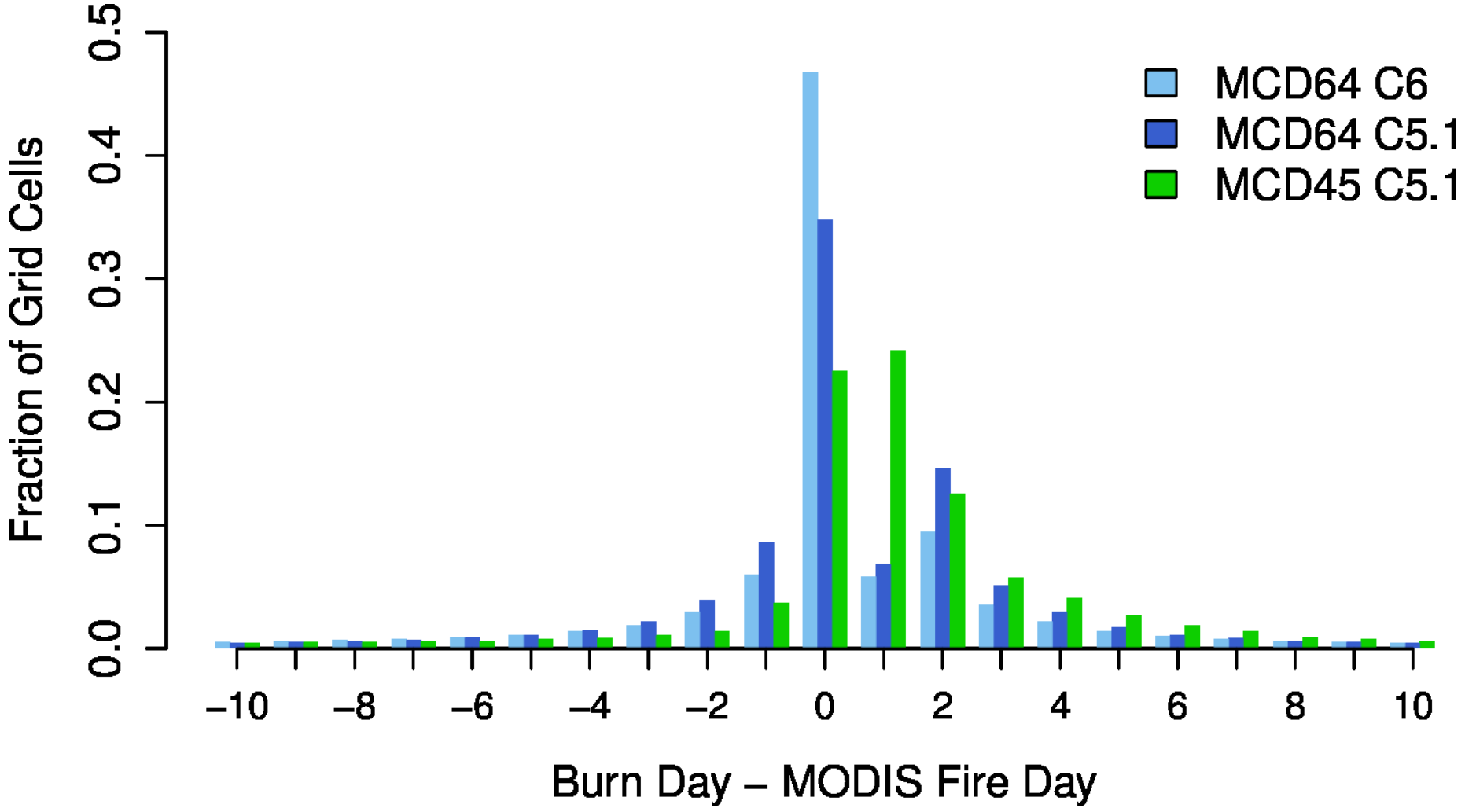
MODIS C6 Burned Area Product

- Overall increase in burned area from C5.1
  - ~26% globally
- Small burns no longer blindly eliminated

MCD64 C6 Validation

- temporal (day of detection) Stage 4
  - Product accuracy has been assessed, and the uncertainties in the product established via independent measurements made in a statistically robust way that represents global conditions, and is characterized by the selection of reference data via a probability sampling i.e., design-based validation, repeated annually.
- spatial (location and areal extent) Stage 3
  - Product accuracy has been assessed over a widely distributed set of locations and time periods, representative of the full range of conditions present in the product.

Temporal Uncertainty (Global, 2006)



Spatial Validation (location and areal extent)

Stage 3

Product accuracy has been assessed over a widely distributed set of locations and time periods, representative of the full range of conditions present in the product.

ELSEVIER

Remote Sensing of Environment
Volume 235, 15 December 2019, 111490

Global validation of the collection 6 MODIS burned area product

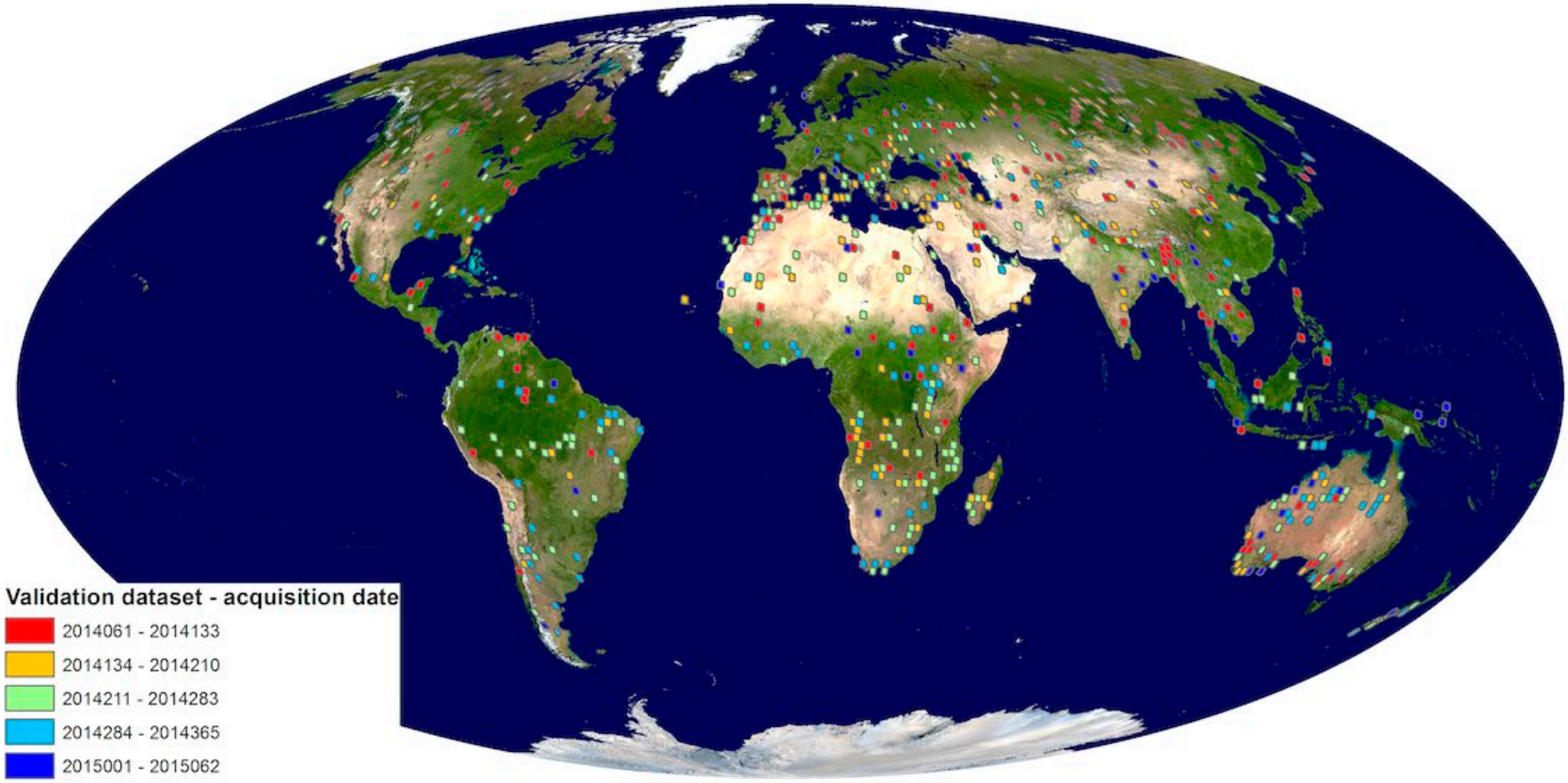
Luigi Boschetti [a], David P. Roy [b, c], Louis Giglio [d], Haiyan Huang [c], Maria Zubkova [a], Michael L. Humber [d]

ELSEVIER

Remote Sensing of Environment
Volume 186, 1 December 2016, Pages 465-478

A stratified random sampling design in space and time for regional to global scale burned area product validation

Luigi Boschetti [a], Stephen V. Stehman [b], David P. Roy [c]



558 Landsat-8 image pairs to validate one year of MCD64A1,
April 2014 - April 2015

Accuracy Metrics

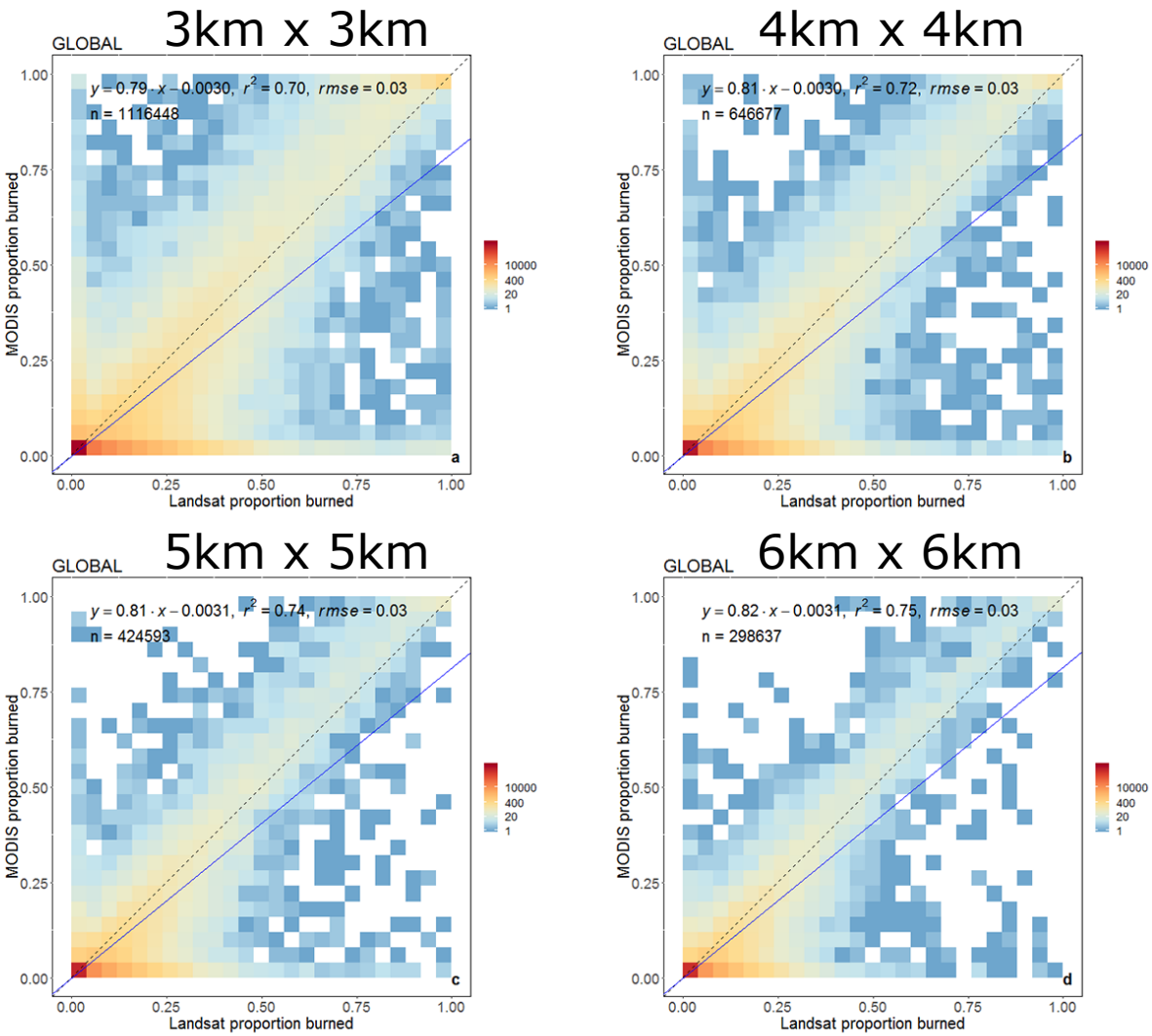
- Metrics derived from the confusion matrix evaluated at the 30m resolution of the reference data
  - Overall accuracy, Omission/Commission Error
  - Relative bias
  - Estimated burned area
- Coarse resolution regression metrics between the proportion of area detected in 3 km, 4 km, 5 km, and 6 km coarse resolution cells

Confusion Matrix Accuracy Metrics

Biome	$\widehat{OA}$ [%]	$\widehat{SE}(\widehat{OA})$ [%]	$\widehat{OE}$ [%]	$\widehat{SE}(\widehat{OE})$ [%]	$\widehat{CE}$ [%]	$\widehat{SE}(\widehat{CE})$ [%]	$\widehat{relB}$ [%]	$\widehat{SE}(\widehat{relB})$ [%]	$\hat{B}$ [km^2]	$CV(\hat{B})$ [%]
Tropical Forest	99.4%	0.4%	90.6%	1.5%	63.5%	8.0%	-74.1%	4.2%	2647584	14.5%
Temperate Forest	99.9%	0.1%	94.5%	2.1%	55.7%	7.9%	-87.6%	3.5%	319284	23.3%
Boreal Forest	99.9%	0.1%	27.0%	9.8%	23.9%	3.9%	-4.0%	9.1%	138031	34.6%
Tropical Savanna	99.2%	0.1%	60.7%	5.6%	35.2%	2.5%	-39.3%	7.6%	3934283	13.8%
Temperate Savanna	99.9%	0.1%	63.4%	11.8%	27.9%	7.9%	-49.2%	11.1%	370586	22.8%
Mediterranean	99.8%	0.1%	94.2%	8.2%	58.8%	10.6%	-85.9%	16.1%	124173	42.4%
Deserts/Xeric Shrublands	99.9%	< 0.1%	64.9%	6.4%	30.8%	6.0%	-49.3%	7.54%	99598	18.1%
Global	99.7%	< 0.1%	72.6%	3.9%	40.2%	2.4%	-54.1%	5.3%	7633539	8.9%

Globally, negative bias (-54%) due to the prevalence of Omission Errors (72%) over Commission Errors (40%)

Coarse resolution regressions



The errors of omission and commission largely compensate at relatively local scales.

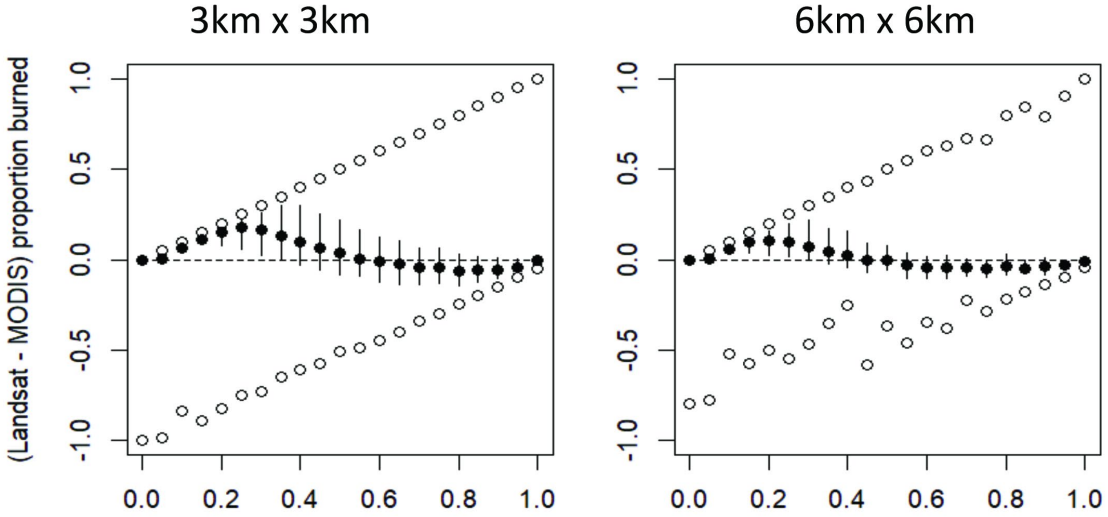
Globally:

- high correlation (r^2 = 0.70 to 0.75),
- slope close to unity (0.79 to 0.82)
- small negative intercept (-0.003)

Coarse resolution regressions

Deviations between the MODIS and Landsat proportion burned:

- Errors initially increase with the Landsat proportion burned and then decrease for higher proportions
- Errors close to zero for proportions greater than 0.6



MCD64A1 systematically underestimates the reference area burned in cells with smaller burned areas (i.e. omission errors prevail on commission errors), and correctly identifies the area burned in cells with larger burned areas (i.e. omission and commission errors compensate).

Pathway to calibrated country level statistics

Potential synergy with current NASA funded projects:

- Systematic Intercomparison of MODIS/VIIRS burned area and active fire products.
- Burned Area / Active Fire fusion to generate coarse resolution area estimates (0.25 deg) , calibrated against 30m L8/S2 reference data + uncertainty
- Aggregation of the 0.25° product to national and sub-national level