



Climate Change

Extending time series of burned area estimations: from Terra-MODIS 250 m to Sentinel 3-OLCI 300 m

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Chuvieco



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Introduction

Fire_cci



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climate.copernicus.eu

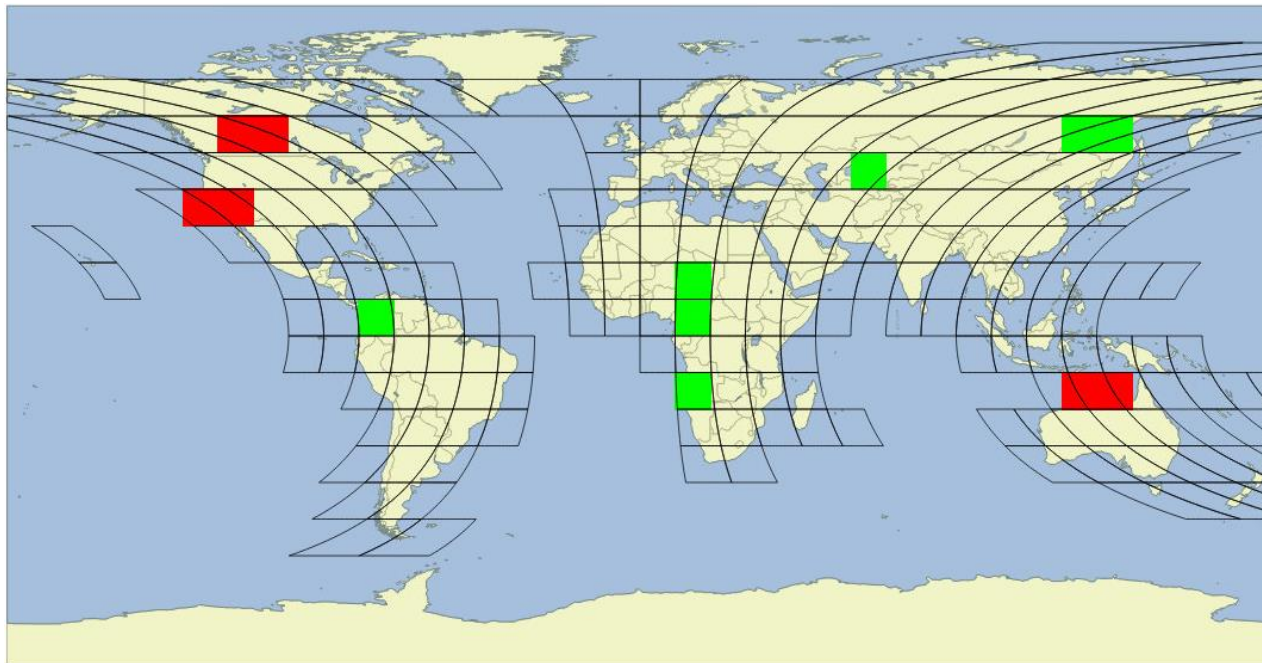
- Brokered: FireCCI50 (2001-2016) and FireCCI51 (2001-2018)
- New product (C3SBA10): 2017-2020
- Adaptation to Sentinel-3 OLCI
- Main objective: consistency (quality)



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BA algorithm

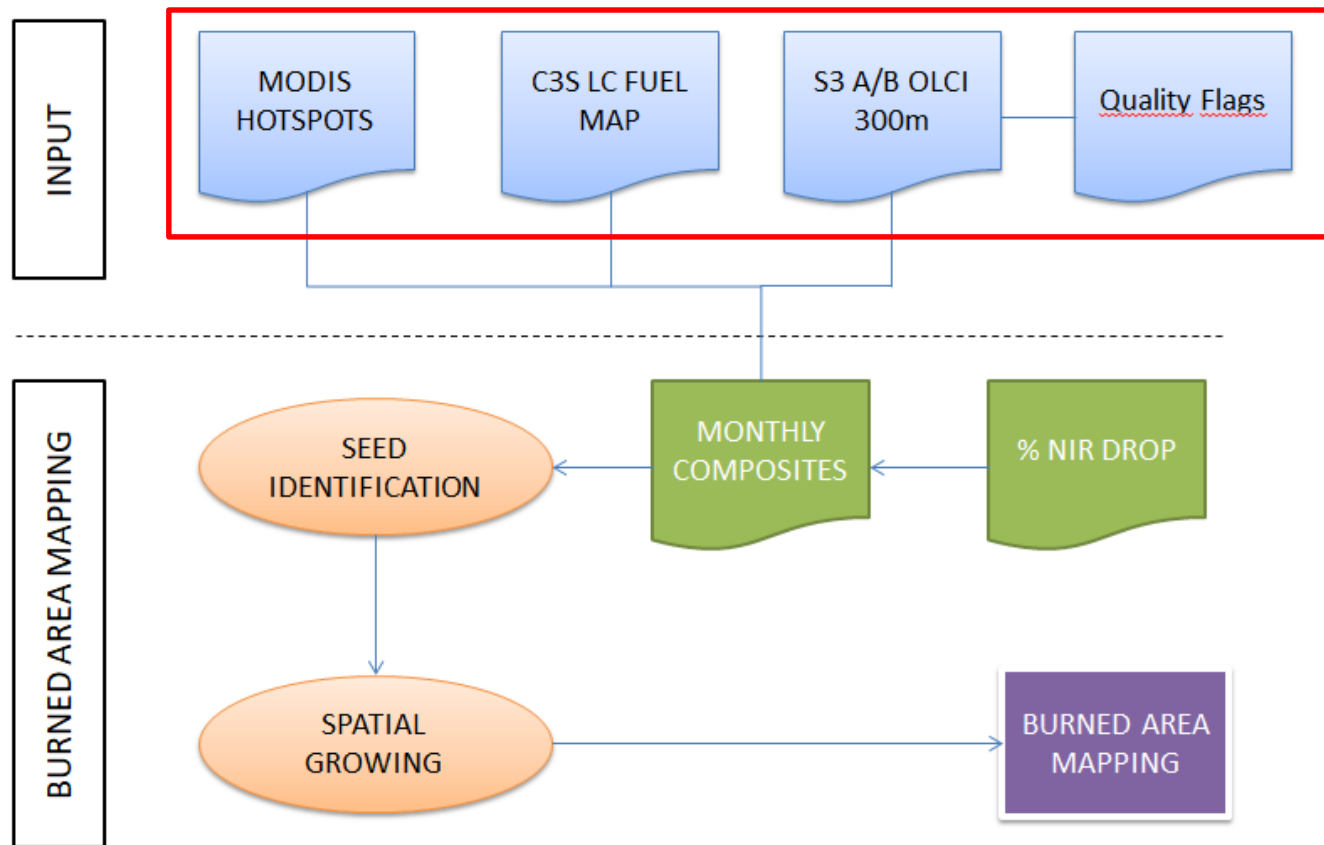
■ Calibration perimeters: Australia, California, Canada





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BA algorithm main scheme



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Input data: main changes

	FireCCI51	C3SBA10
Active fire	MODIS MCD14ML	MODIS MCD14ML
Spectral information	Terra MODIS 250m	Sentinel 3 A/B OLCI 300m
State information	Terra MODIS 1000 m	Sentinel 3 A/B OLCI 300m
Land Cover	Land cover CCI v2.0.7	Land cover C3S v2.1.1



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Input data: spectral information

	FireCCI51	C3SBA10
Active fire	MODIS MCD14ML	MODIS MCD14ML
Spectral information	Terra MODIS 250m	Sentinel 3 A/B OLCI 300m
State information	Terra MODIS 1000 m	Sentinel 3 A/B OLCI 300m
Land Cover	Land cover CCI v2.0.7	Land cover C3S v2.1.1

	MODIS	OLCI
product	MOD09GQ	BC ToC v1.7
Temporal resolution	1 or 2 image/day	0.45 or 0.9 image/day
Spatial resolution	250 m	300 m
Spectral resolution	NIR / Red	OLCI: 13 Vis-NIR bands
Swath	2330 km	1270 km
Level	Tile / ToC	Tile / ToC
State infor.	MOD09GA	Included

MODIS: 841 - 876



OLCI: 845 - 885

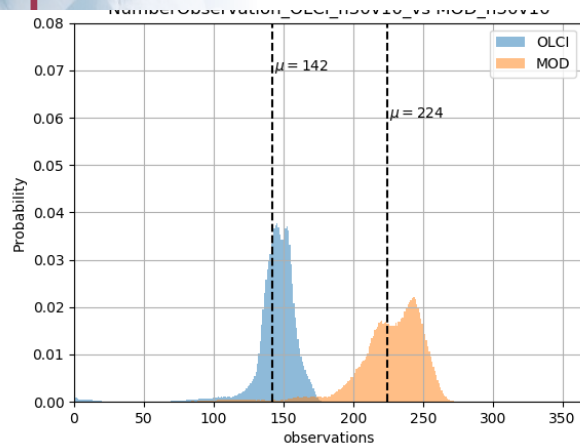


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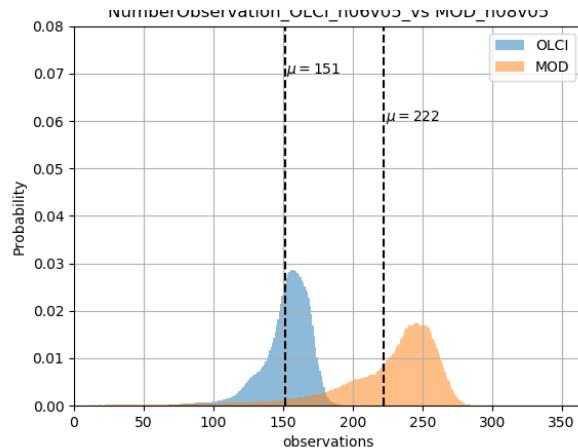
Input data: spectral information

- Spatial resolution: 250m vs 300m
- Number of valid observations (cloud, cloud-shadow)

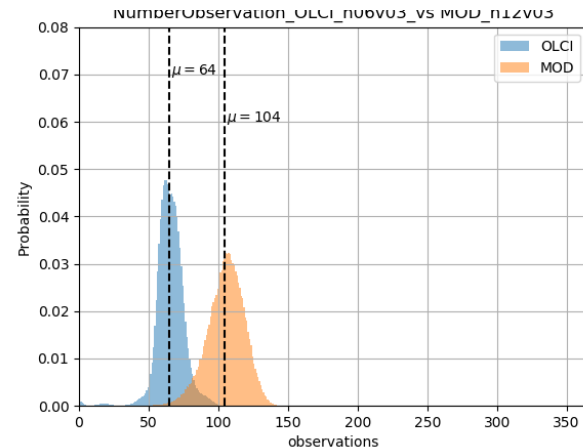
Australia



California



Canada



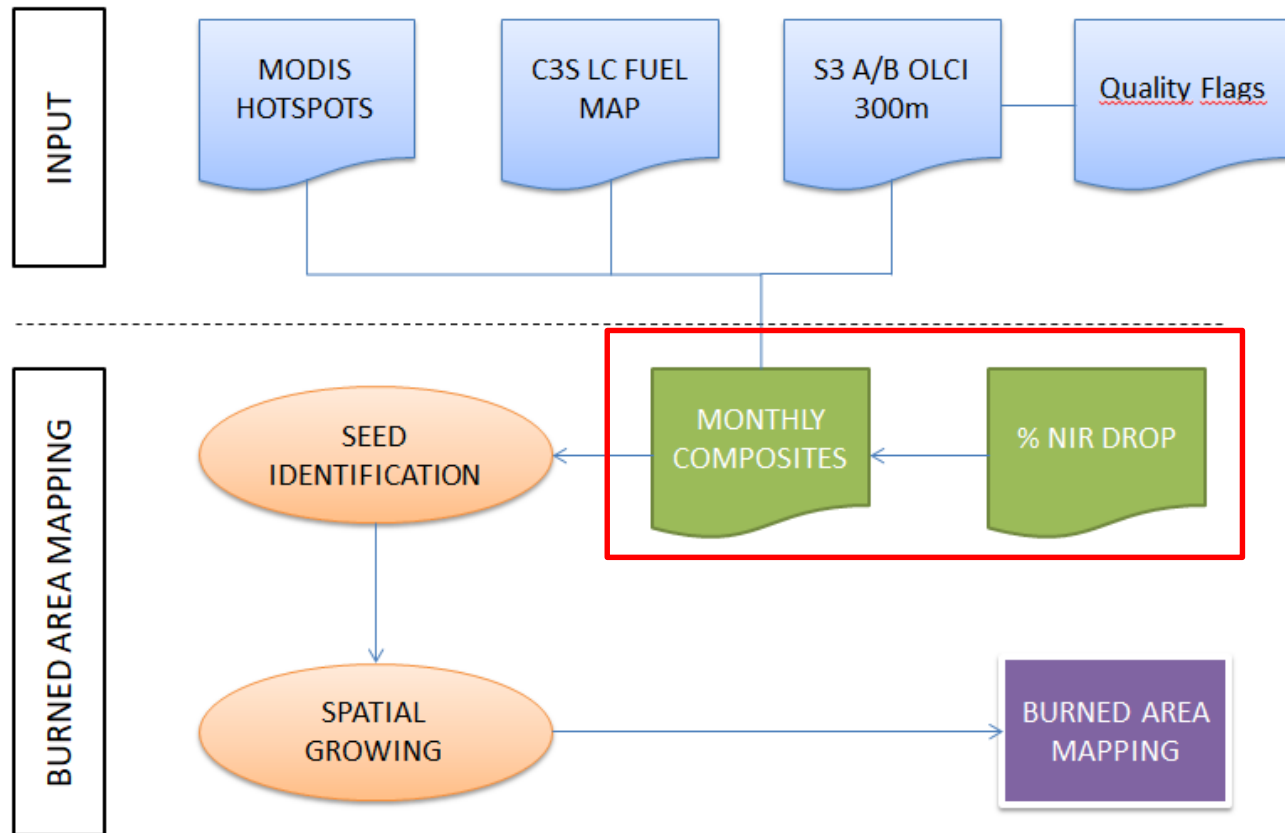
OLCI

MODIS



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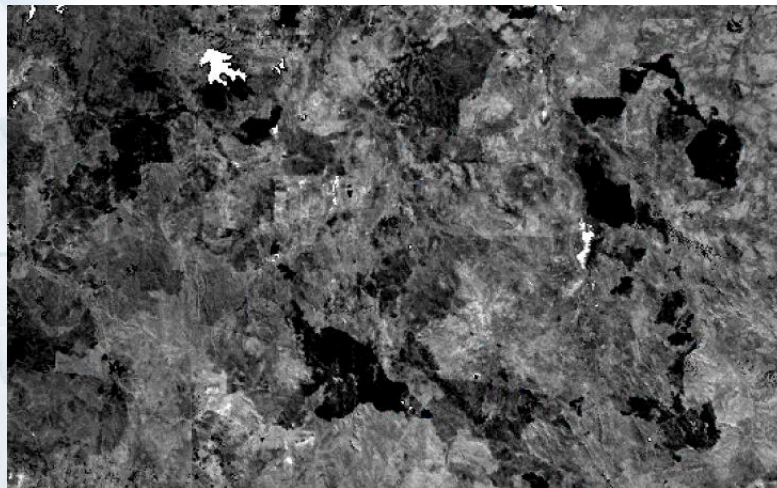
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Variables: NIR composite

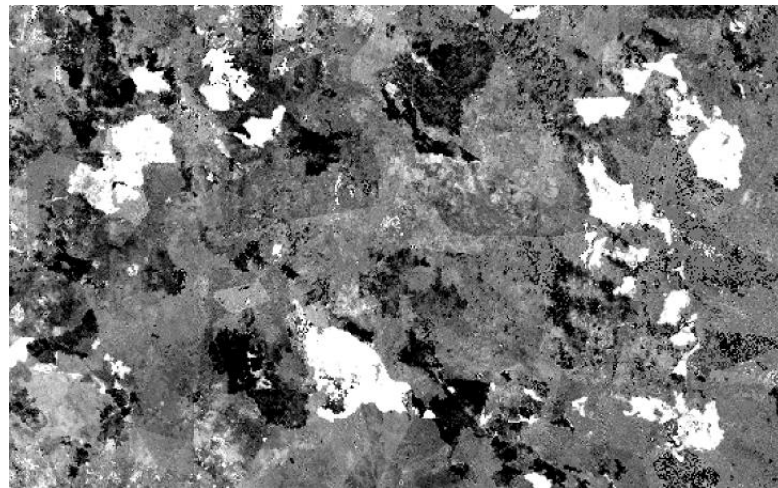
NIR composite
(HS date + minimum NIR)



0.12

0.35

Relative NIR drop



-400

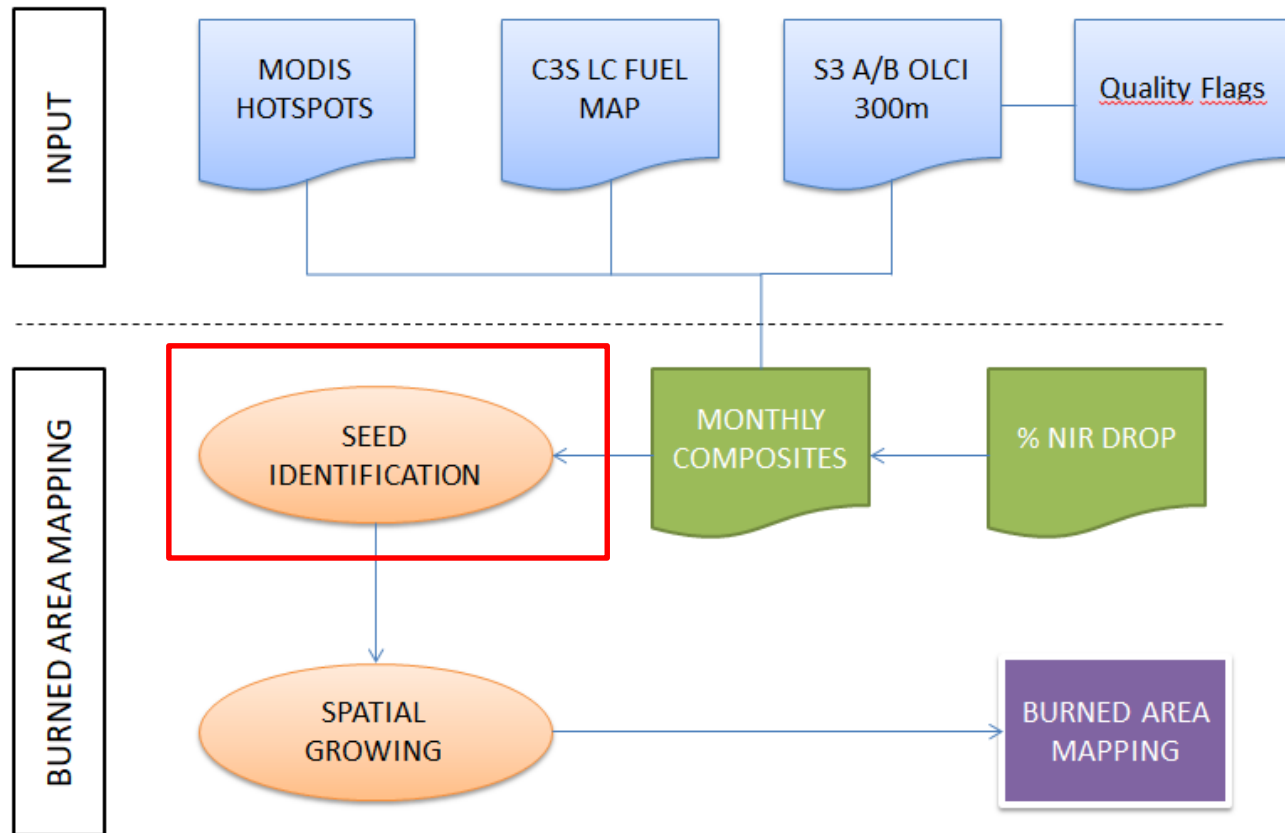
400

Australia, h31v10, July 2018



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C3S BA main scheme

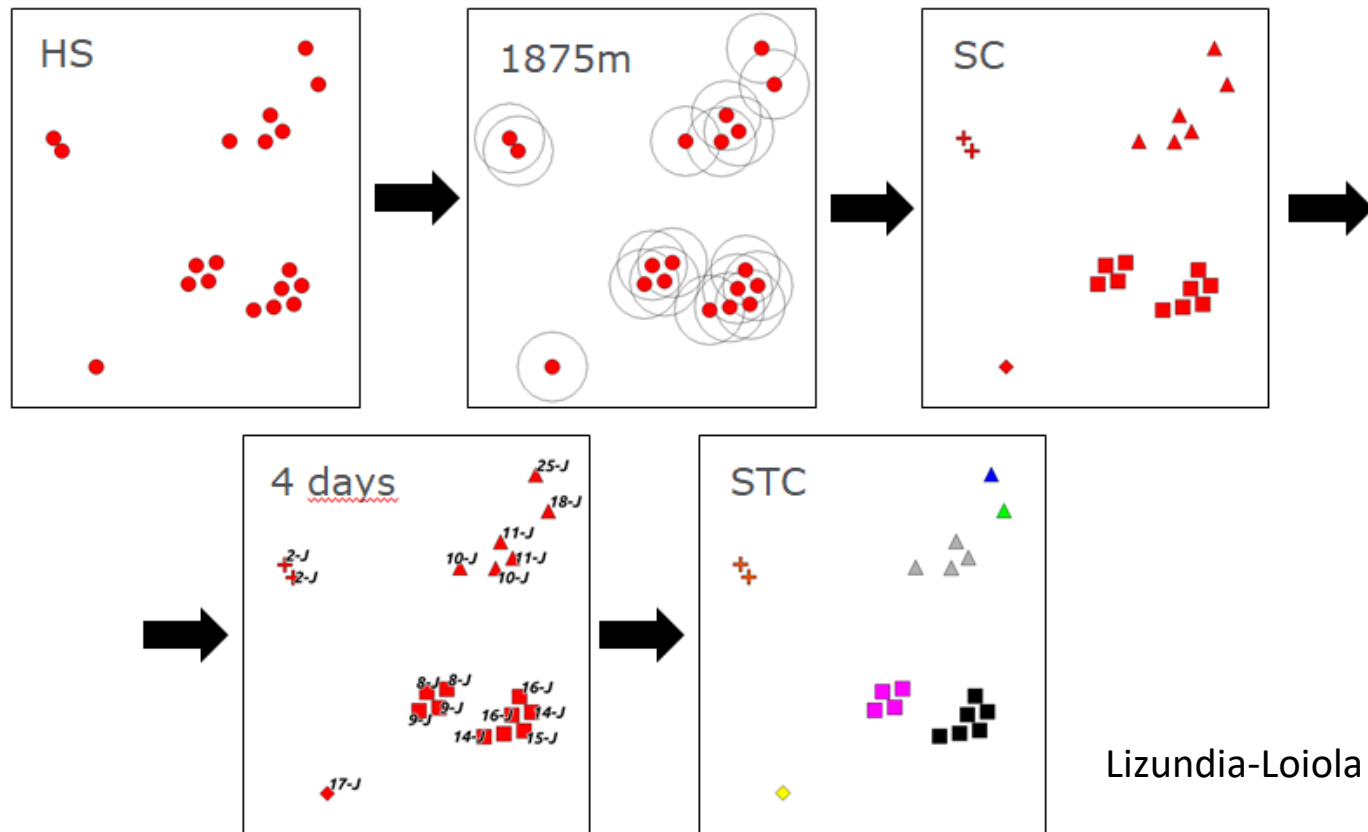


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Seed phase: HS clusters

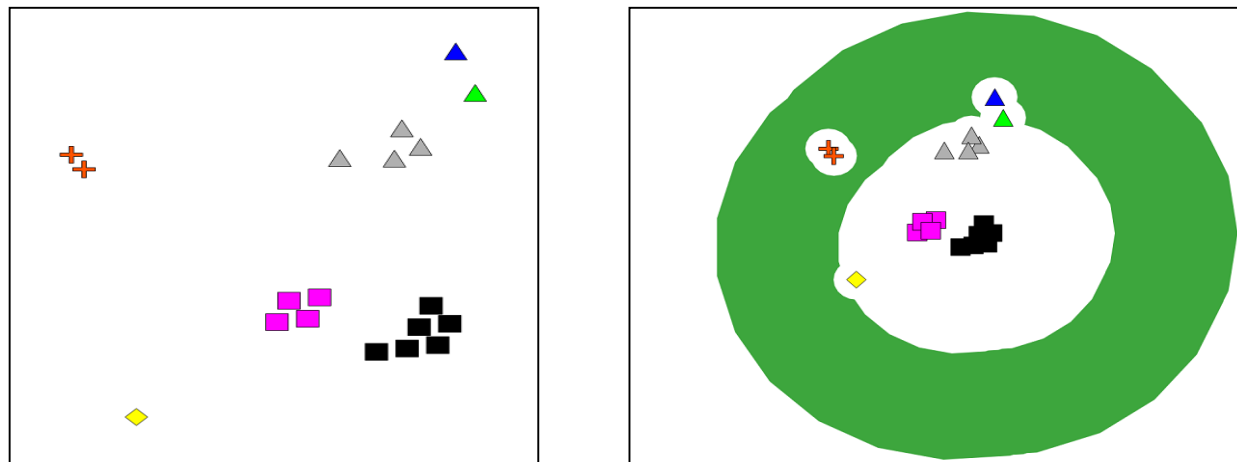


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Seed phase: thresholding



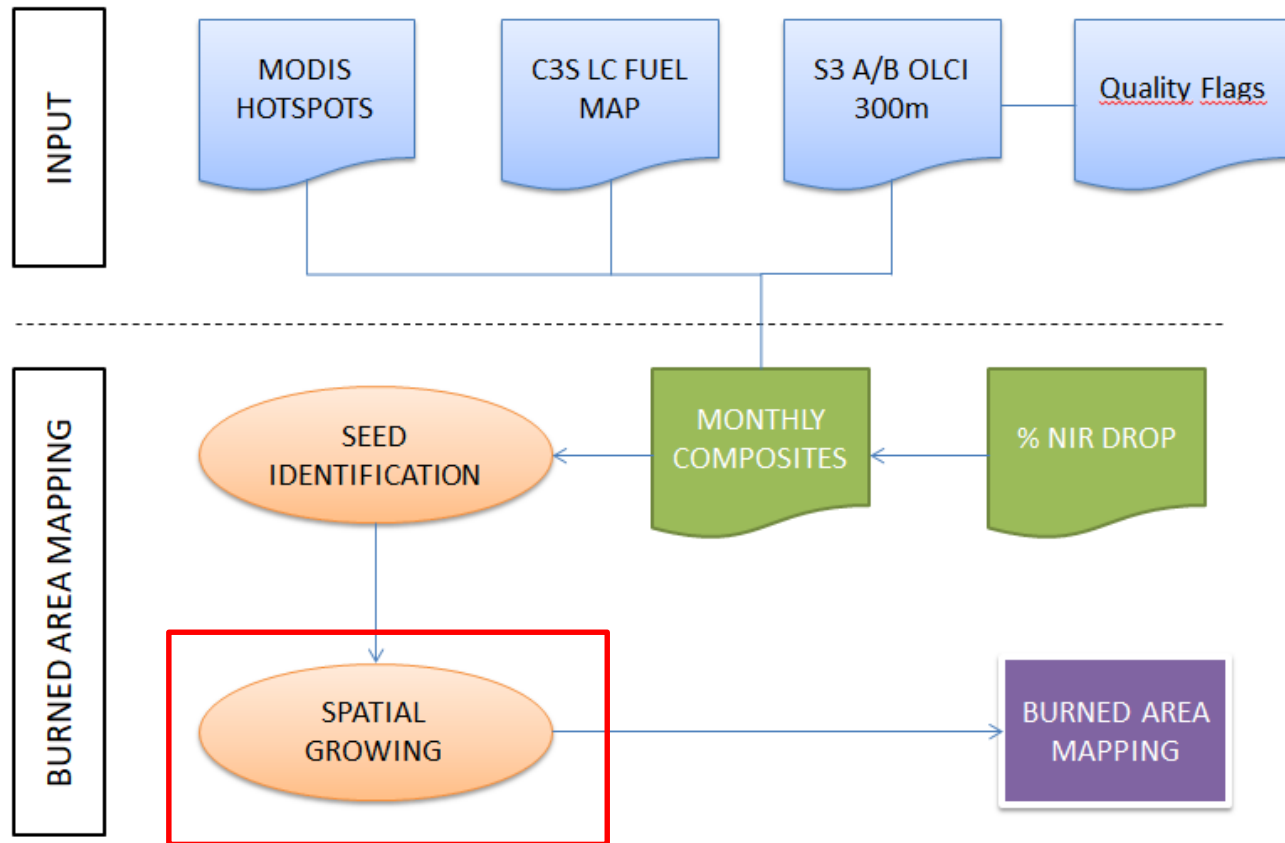
Regional TH

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C3S BA main scheme



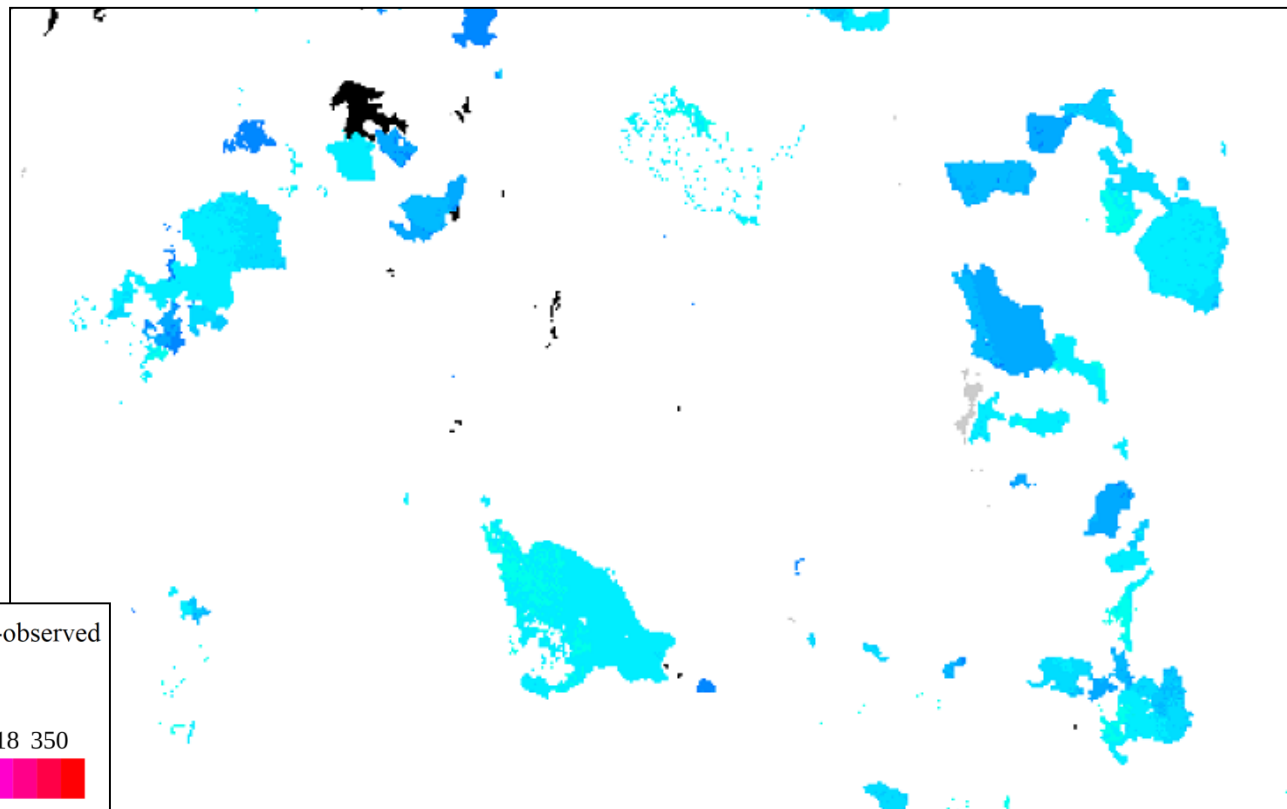
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Burned area map

- Australia, h31v10, July 2018

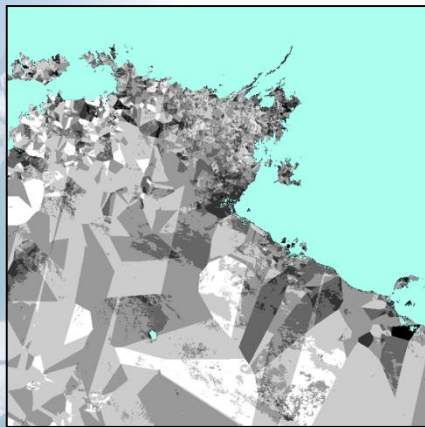




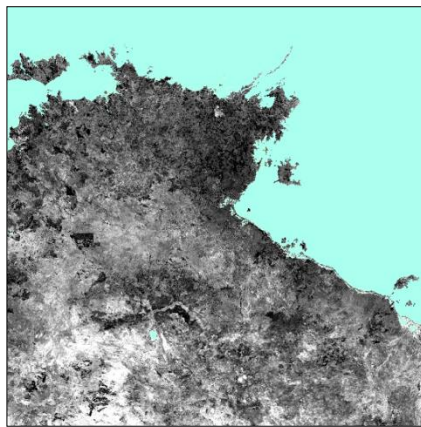
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Uncertainty

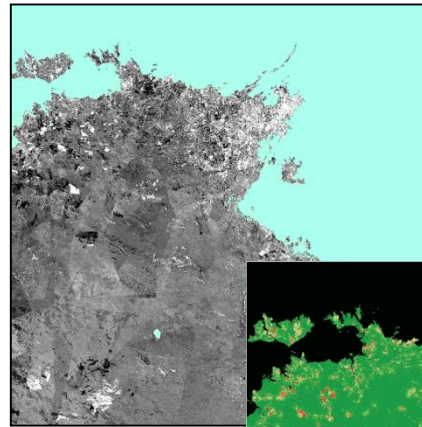
Observations in first
10 post-days



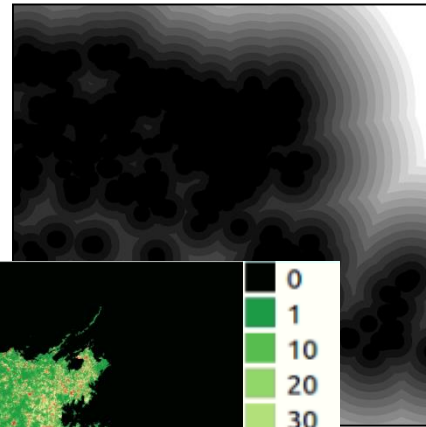
NIR composite



RelΔNIR

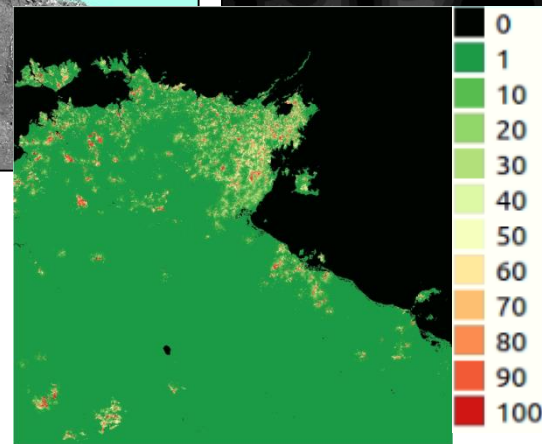


Distance



Probability of burn

$$p_i = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_{1,i} + \dots + \beta_k x_{k,i})}}$$

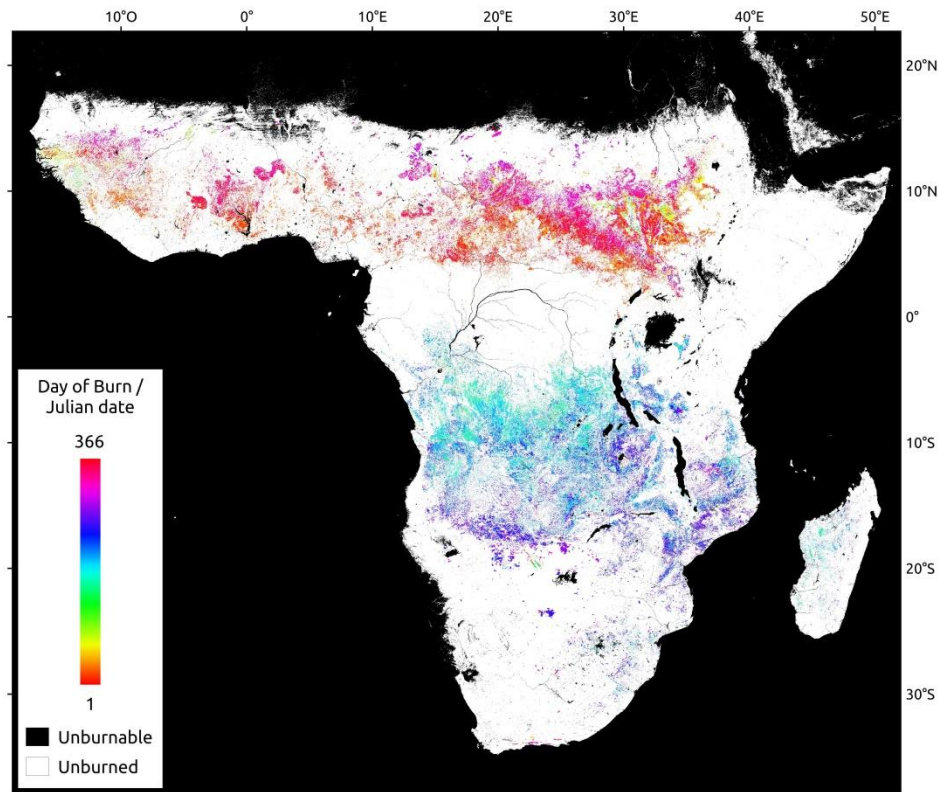




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Results: Final product

- PSD pixel:
 - 2017 - 2020
 - 300 m
- Layers:
 - Day of Detection
 - Confidence level
 - Land cover



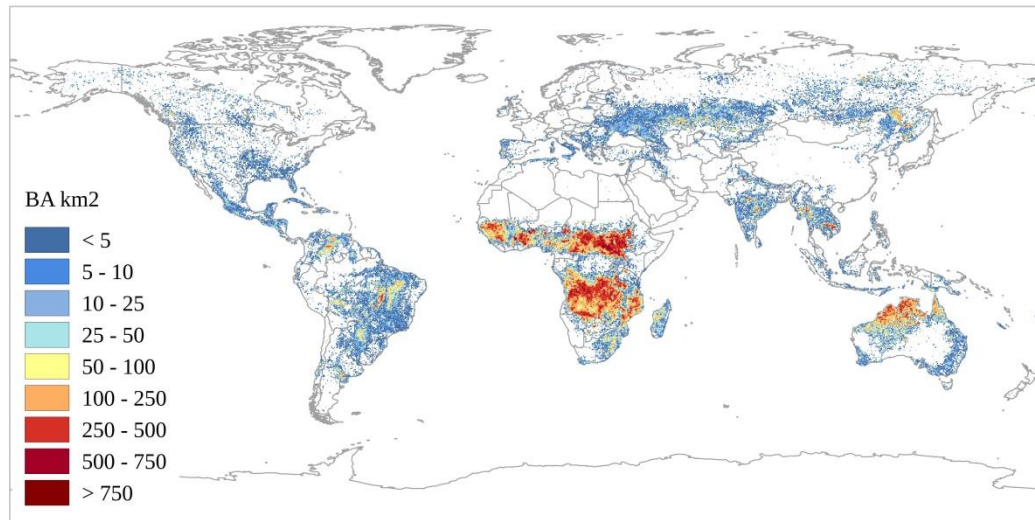
Sub-Saharan Africa, 2018



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Results: Final product

- PSD grid:
 - 2017-2020
 - 0.25°
- Layers:
 - BA
 - Standard error
 - Fraction of burnable area
 - Fraction of observed area
 - Number of patches
 - BA per LC



Average, 2017-2018



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Results: calibration

	FireCCI51		C3SBA10		BA
	Ce	Oe	Ce	Oe	Km2
Australia	9.2%	20.7%	8.0%	28.6%	221353
Canada	40.3%	35.4%	34.3%	32.8%	2002
California	32.8%	9.1%	32.1%	26.9%	4360
Global	10.3%	20.6%	9.3%	28.7%	



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Results: calibration

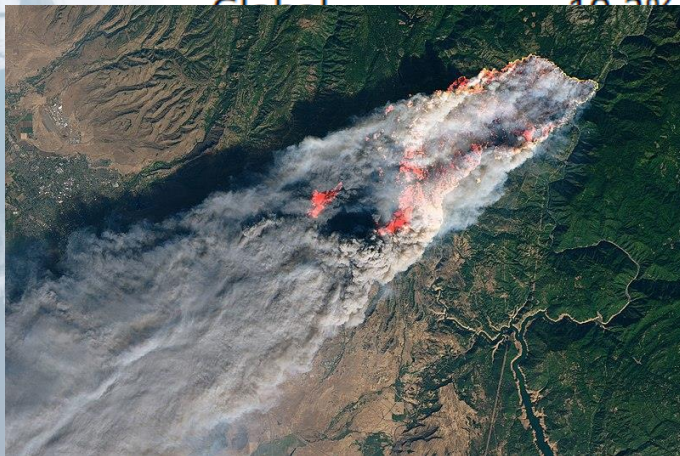
	FireCCI51		C3SBA10		BA
	Ce	Oe	Ce	Oe	Km2
Australia	9.2%	20.7%	8.0%	28.6%	221353
Canada	40.3%	35.4%	34.3%	32.8%	2002
California	32.8%	9.1%	32.1%	26.9%	4360
Global	10.3%	20.6%	9.3%	28.7%	



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Results: calibration

	FireCCI51		C3SBA10		BA
	Ce	Oe	Ce	Oe	Km2
Australia	9.2%	20.7%	8.0%	28.6%	221353
Canada	40.3%	35.4%	34.3%	32.8%	2002
California	32.8%	9.1%	32.1%	26.9%	4360
China	19.3%	20.6%	9.3%	28.7%	



Camp fire
Landsat 8, 8 Nov 2018



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Results: calibration

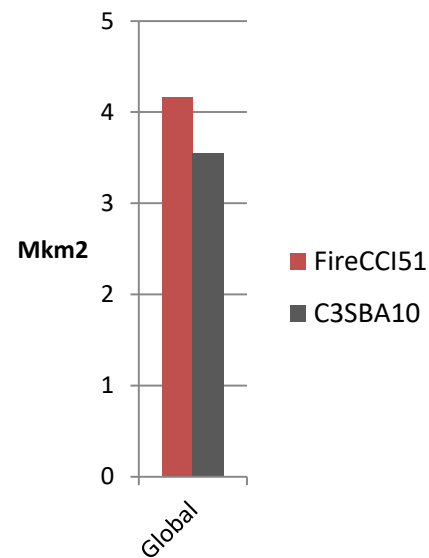
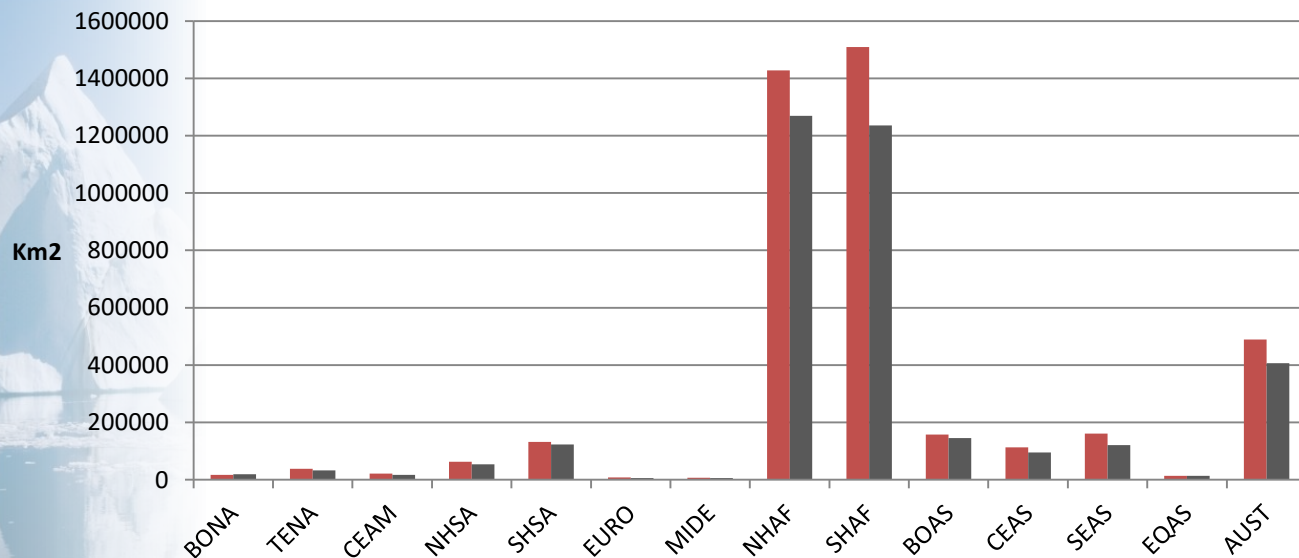
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California	32.8%	9.1%	32.1%	26.9%	4360
Global	10.3%	20.6%	9.3%	28.7%	



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Results: BA per biome

- 2018



	BONA	TENA	CEAM	NHSA	SHSA	EURO	MIDE	NHAF	SHAF	BOAS	CEAS	SEAS	EQAS	AUST	Global (Mkm2)
FireCCI51	17188	38199	21892	62396	131685	8191	7009	1427240	1509075	157354	113538	160926	13433	489363	4.16
C3SBA10	18873	32834	16625	54241	122727	5725	5742	1269108	1235929	145305	94964	121318	13521	406066	3.54
Difference	10%	-16%	-32%	-15%	-7%	-43%	-22%	-12%	-22%	-8%	-20%	-33%	1%	-21%	-17%



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Results: Consistency

Code	Name	Global contribution		r2 / grid cell		
		C3SBA10	FireCCI51	0.05°	0.1°	0.25°
NHAF	Northern Hemisphere Africa	35.82%	34.33%	0.89	0.94	0.97
SHAF	Southern Hemisphere Africa	34.88%	36.30%	0.90	0.94	0.97
AUST	Australia and New Zealand	11.46%	11.77%	0.85	0.89	0.94
SHSA	Southern Hemisphere South America	4.10%	3.78%	0.81	0.86	0.90
CEAS	Central Asia	3.46%	3.17%	0.80	0.87	0.93
BOAS	Boreal Asia	3.42%	3.87%	0.74	0.83	0.90
SEAS	Southeast Asia	2.68%	2.73%	0.63	0.70	0.78
NHSA	Northern Hemisphere South America	1.53%	1.50%	0.72	0.83	0.93
TENA	Temperate North America	0.93%	0.92%	0.82	0.88	0.93
BONA	Boreal North America	0.53%	0.41%	0.77	0.82	0.85
CEAM	Central America	0.47%	0.53%	0.50	0.60	0.67
EURO	Europe	0.38%	0.32%	0.53	0.68	0.83
EQAS	Equatorial Asia	0.16%	0.17%	0.72	0.80	0.89
MIDE	Middle East	0.16%	0.20%	0.57	0.68	0.80

0.8-0.9

>=0.9



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Conclusions

- Algorithm successfully adapted.
- Stable results.
- 2019 both satellites available = Increase in consistency?
- Next steps:
 - Better identify those differences
 - Annual validation (2017-2019)
 - New version
- Download: <https://cds.climate.copernicus.eu/#!/home>



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Extending time series
of burned area
estimations: from
Terra-MODIS 250 m to
Sentinel 3-OLCI 300 m

Thank you!

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