MCD45

Burned Area

(500m approximate day of burning)

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Overview

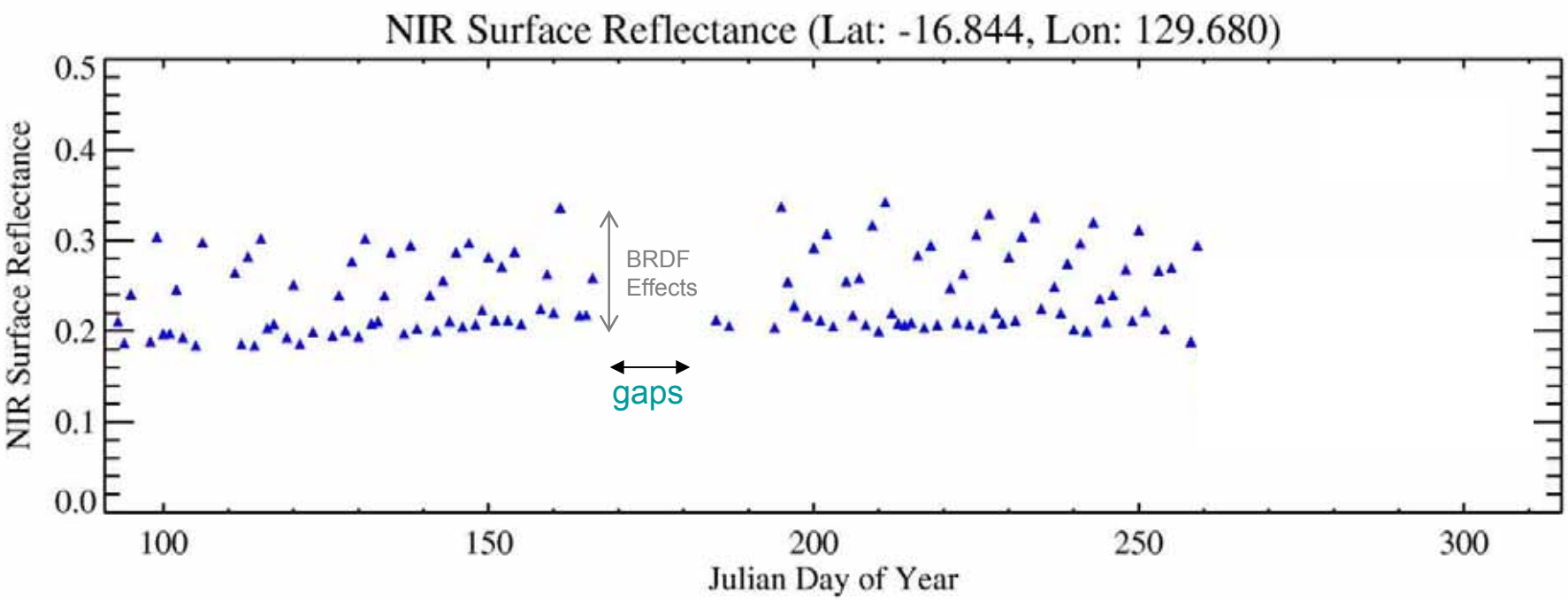
- Algorithm Background
- MCD45 Product Suite
- Product Examples
- Product Data Structure
- Validation
- Collection 5 Recommendations

Algorithm

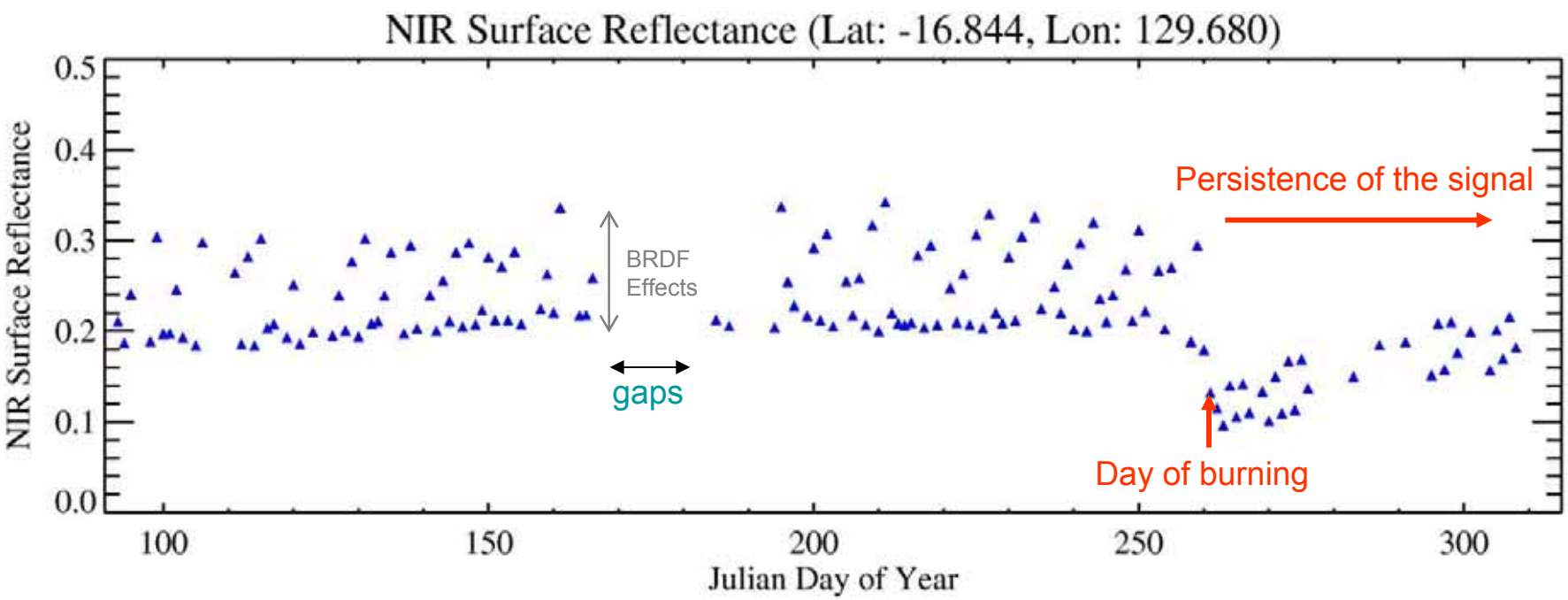
- New approach - *Rolling BRDF based expectation change detection*
- Semi-Physically based; less dependent upon imprecise but noise tolerant classification techniques
- Automated, without training data or human intervention
- Applied independently per pixel to daily gridded MODIS 500m land surface reflectance time series

=> map 500m location and approximate day of burning

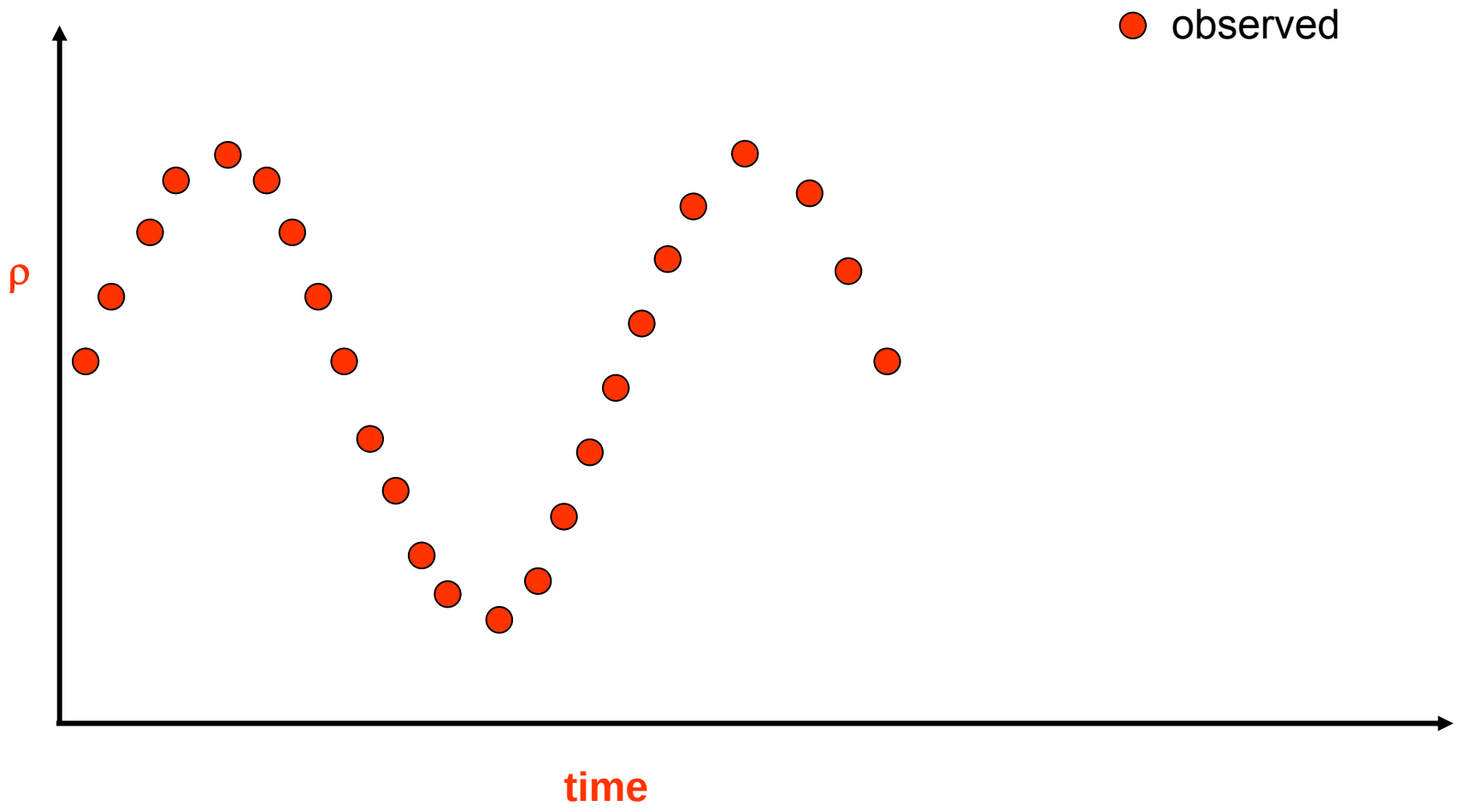
The challenge: change detection of Burned Areas



The challenge: change detection of Burned Areas



Conceptual Scheme



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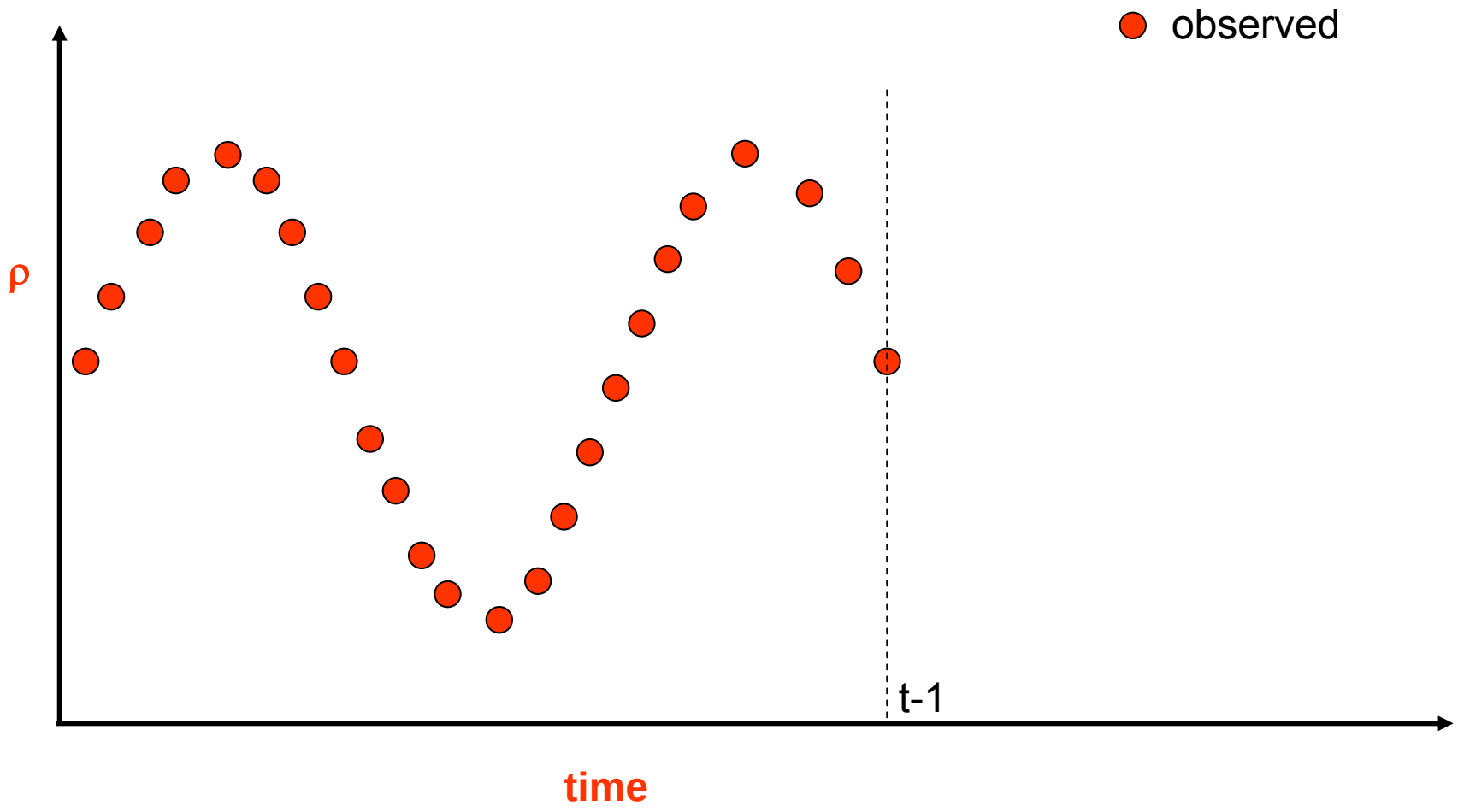

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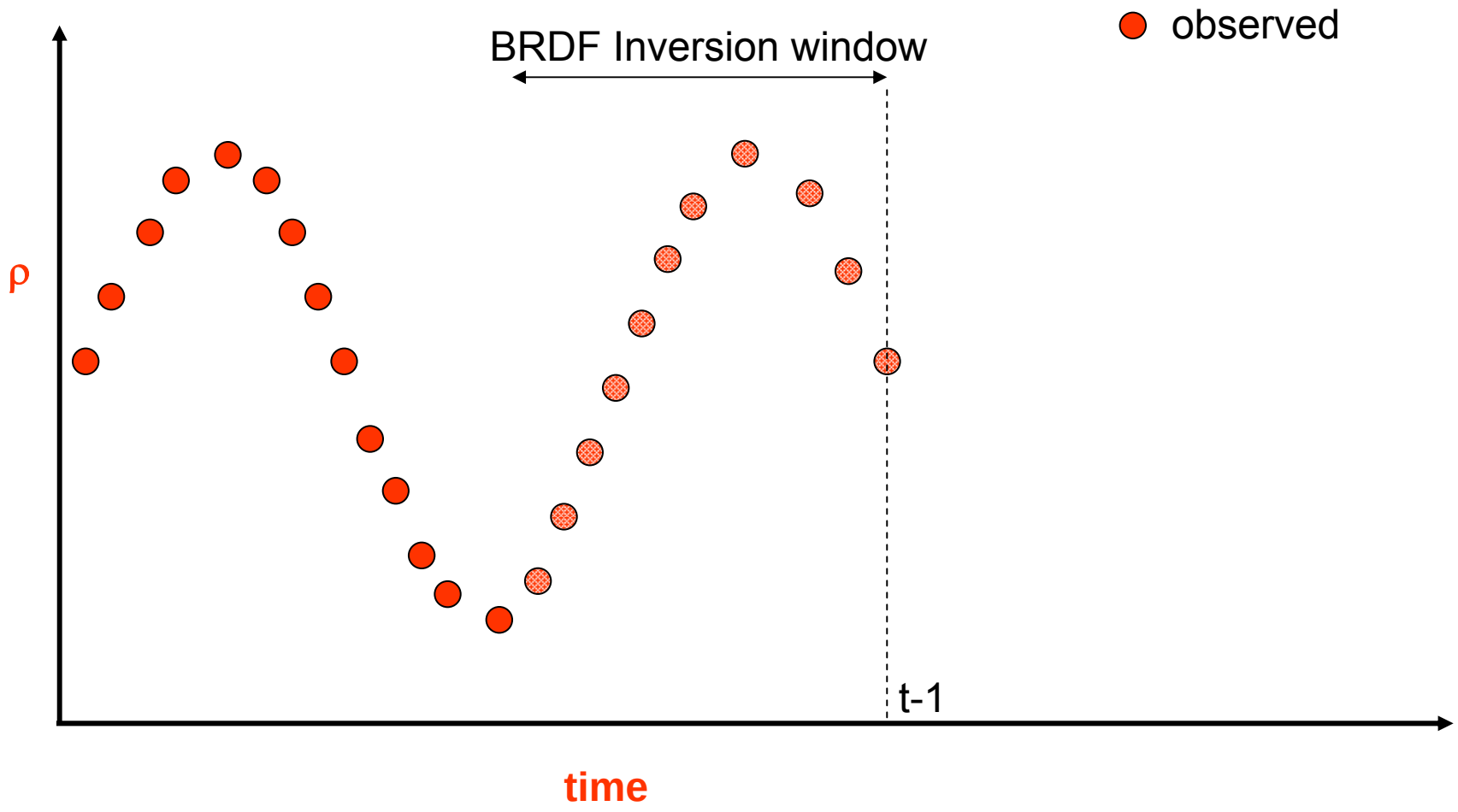

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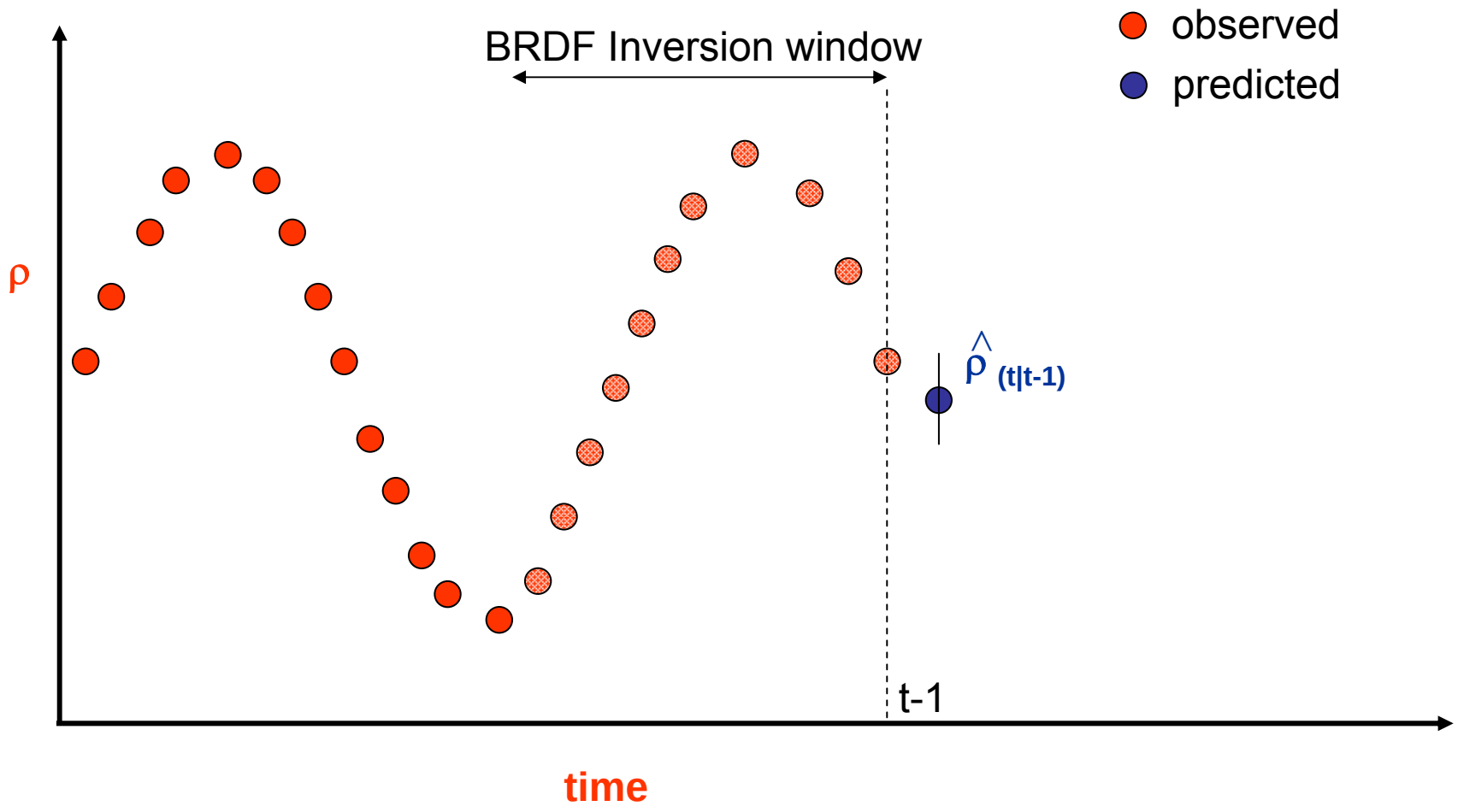

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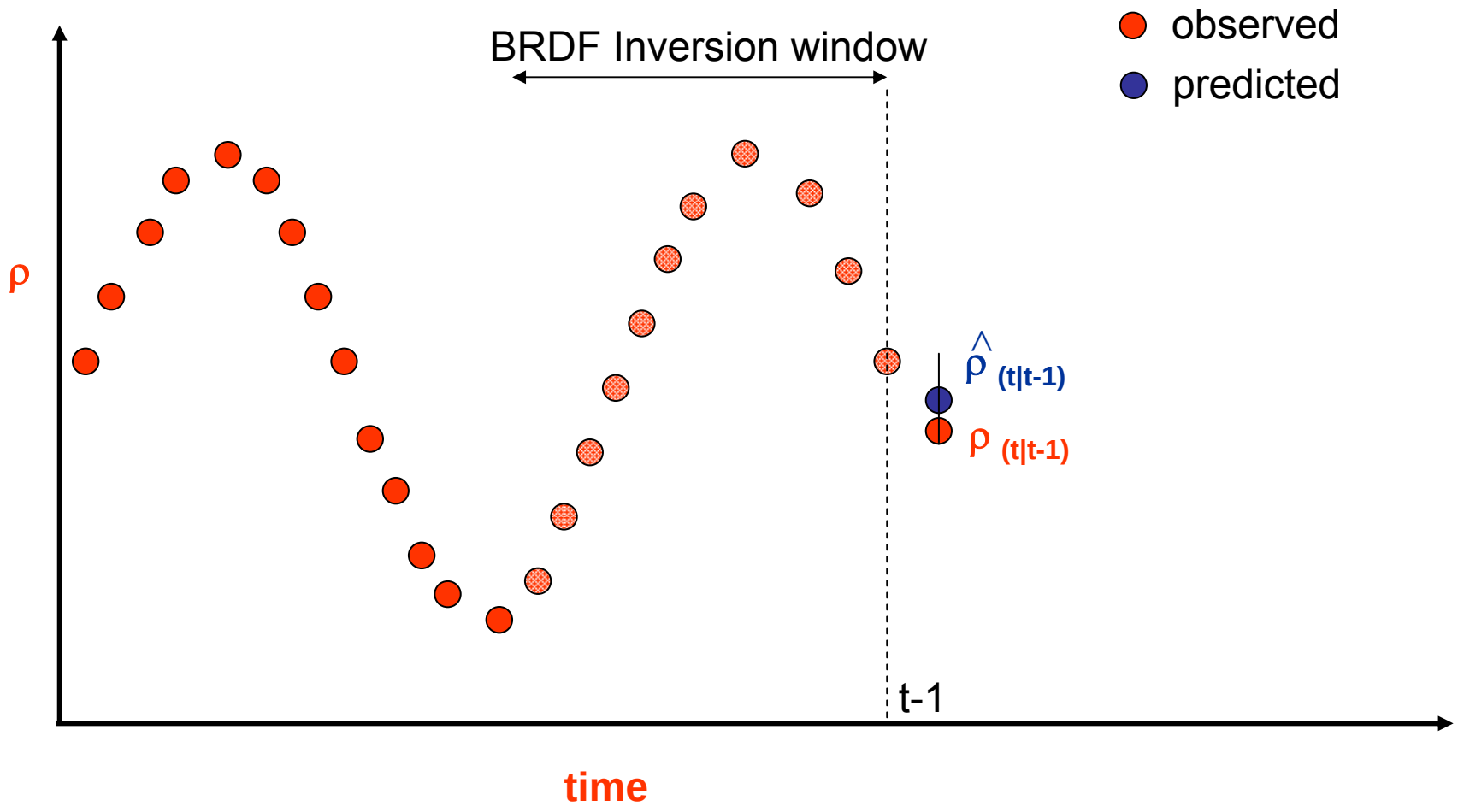

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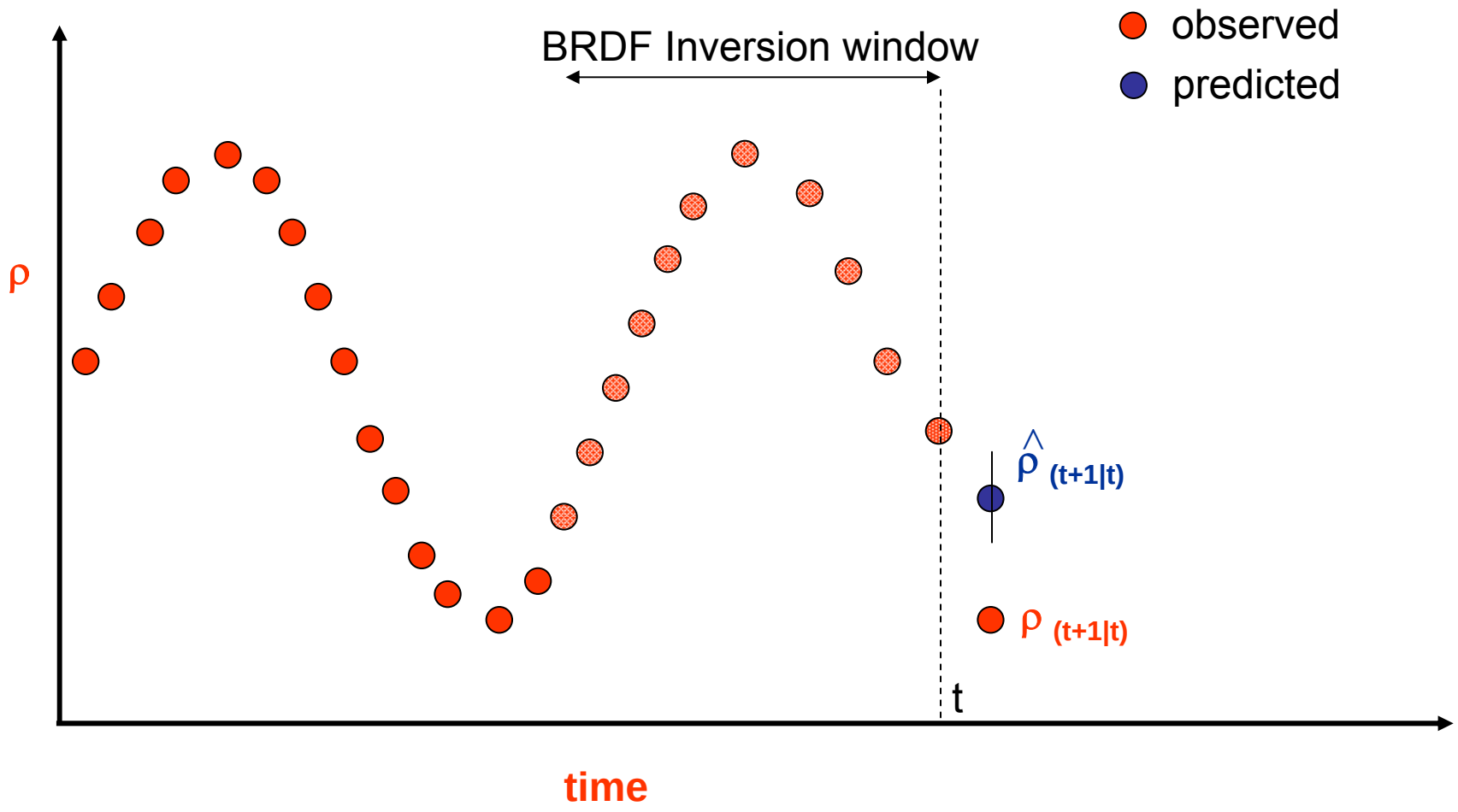
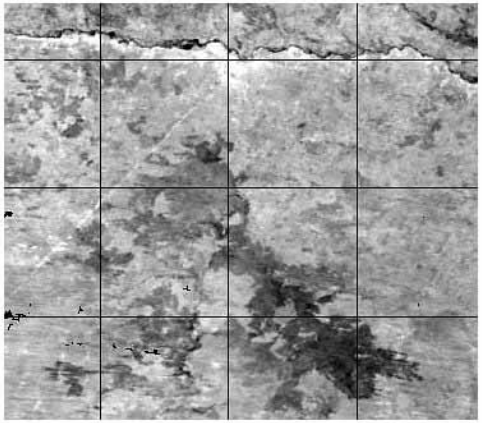


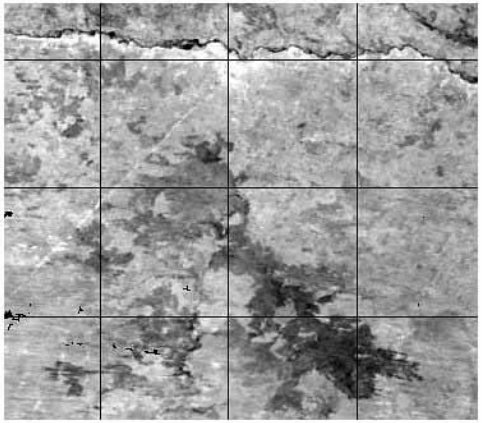
…looking at one algorithm step:



BRDF predicted 1.24 micron reflectance (500m) day 275

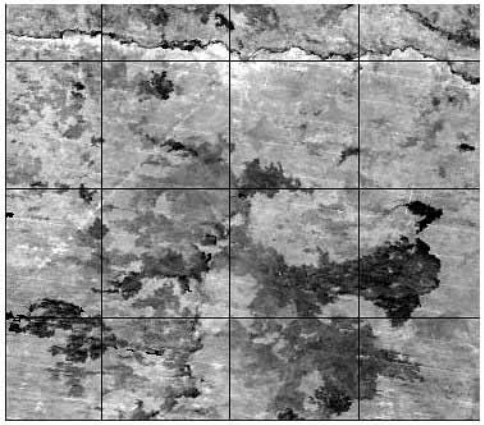
Predicted Reflectance

…looking at one algorithm step:



BRDF predicted 1.24 micron reflectance (500m) day 275

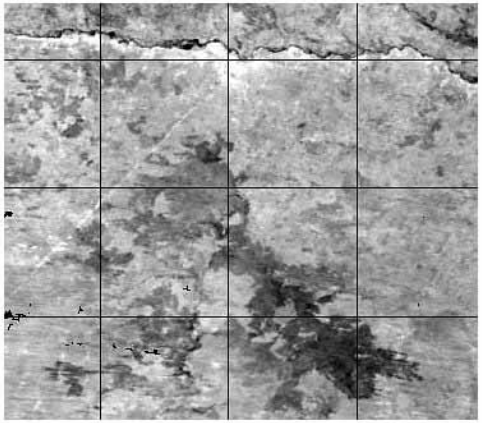
Predicted Reflectance



Observed 1.24 micron reflectance (500m) day 275

Observed Reflectance

…looking at one algorithm step:



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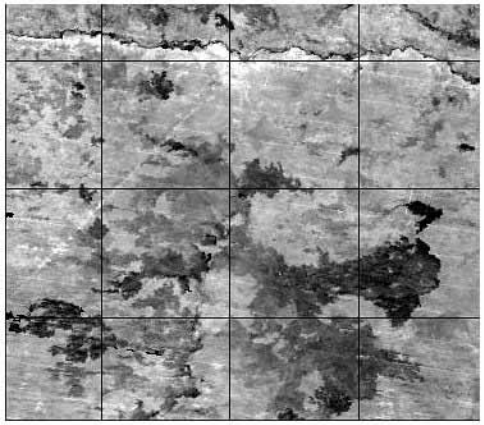

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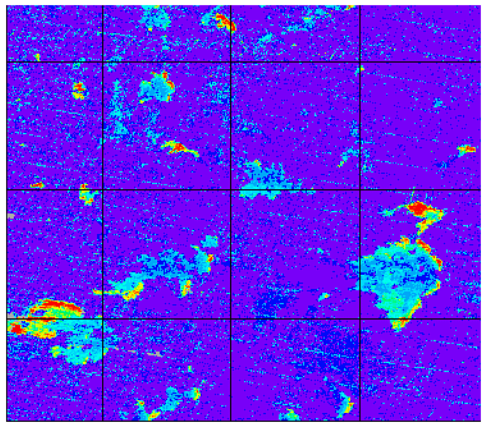
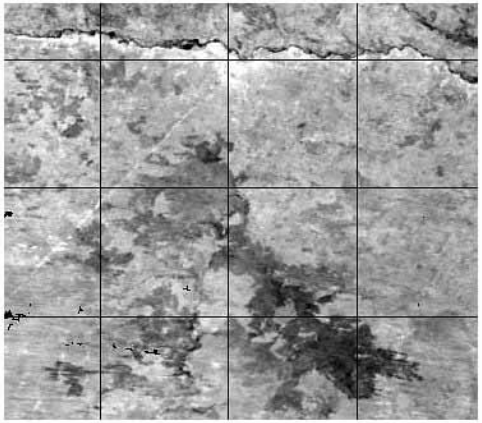


Z-score 1.24 micron reflectance (500m) day 275

…looking at one algorithm step:



BRDF predicted 1.24 micron reflectance (500m) day 275

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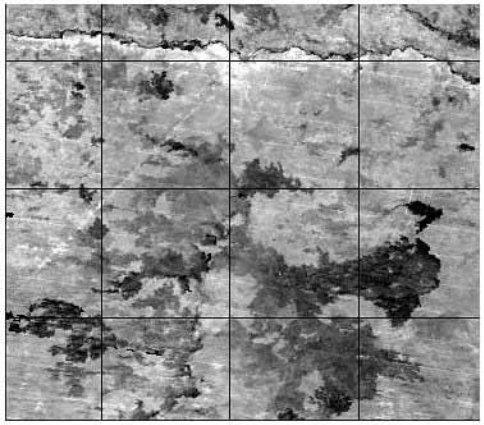

Observed 1.24 micron reflectance (500m) day 275

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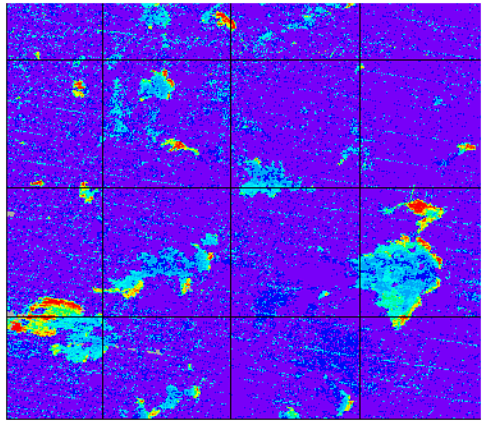
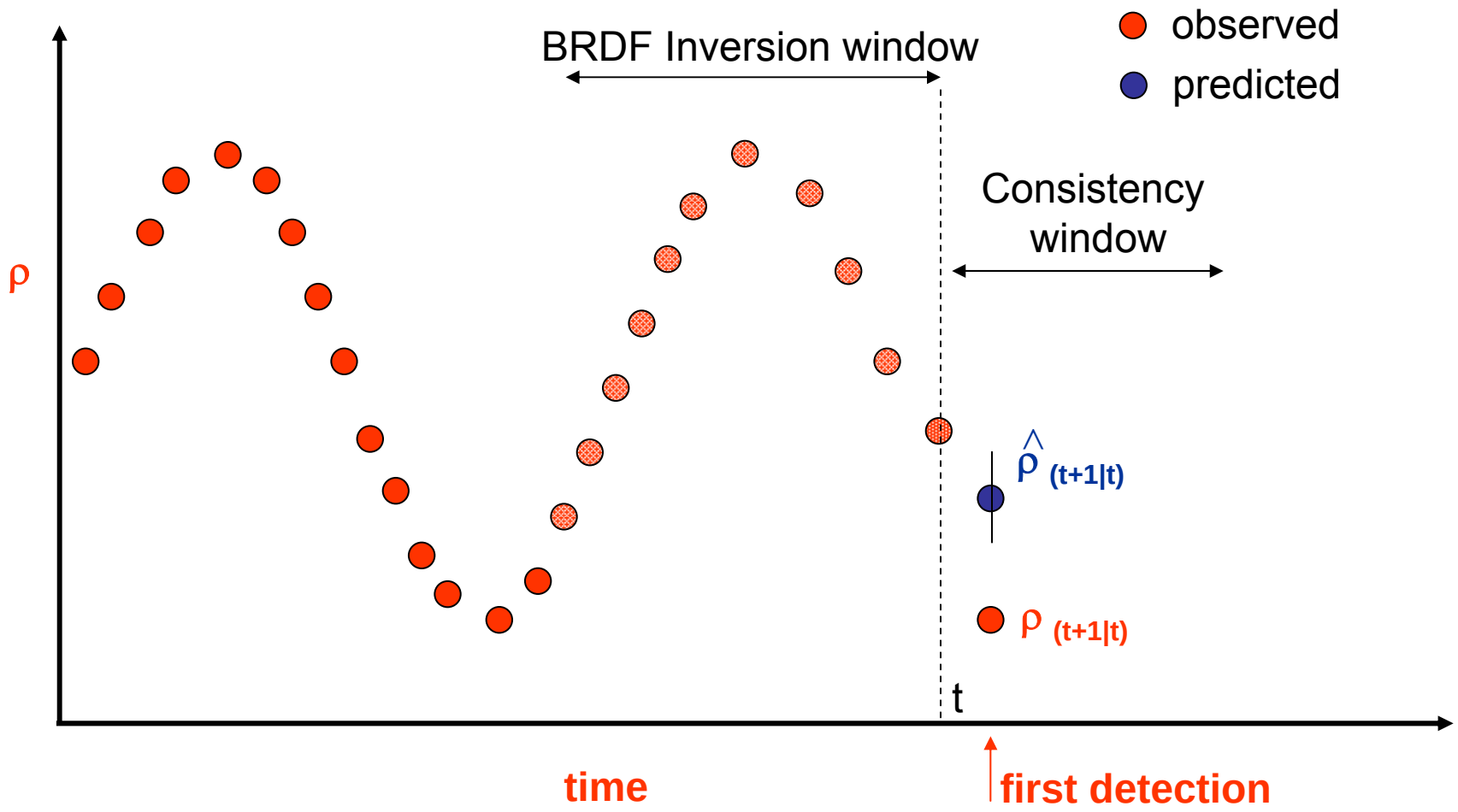


Z–score 1.24 micron reflectance (500m) day 275

probability of change:

Z-score = (predicted-observed)/error

Conceptual Scheme



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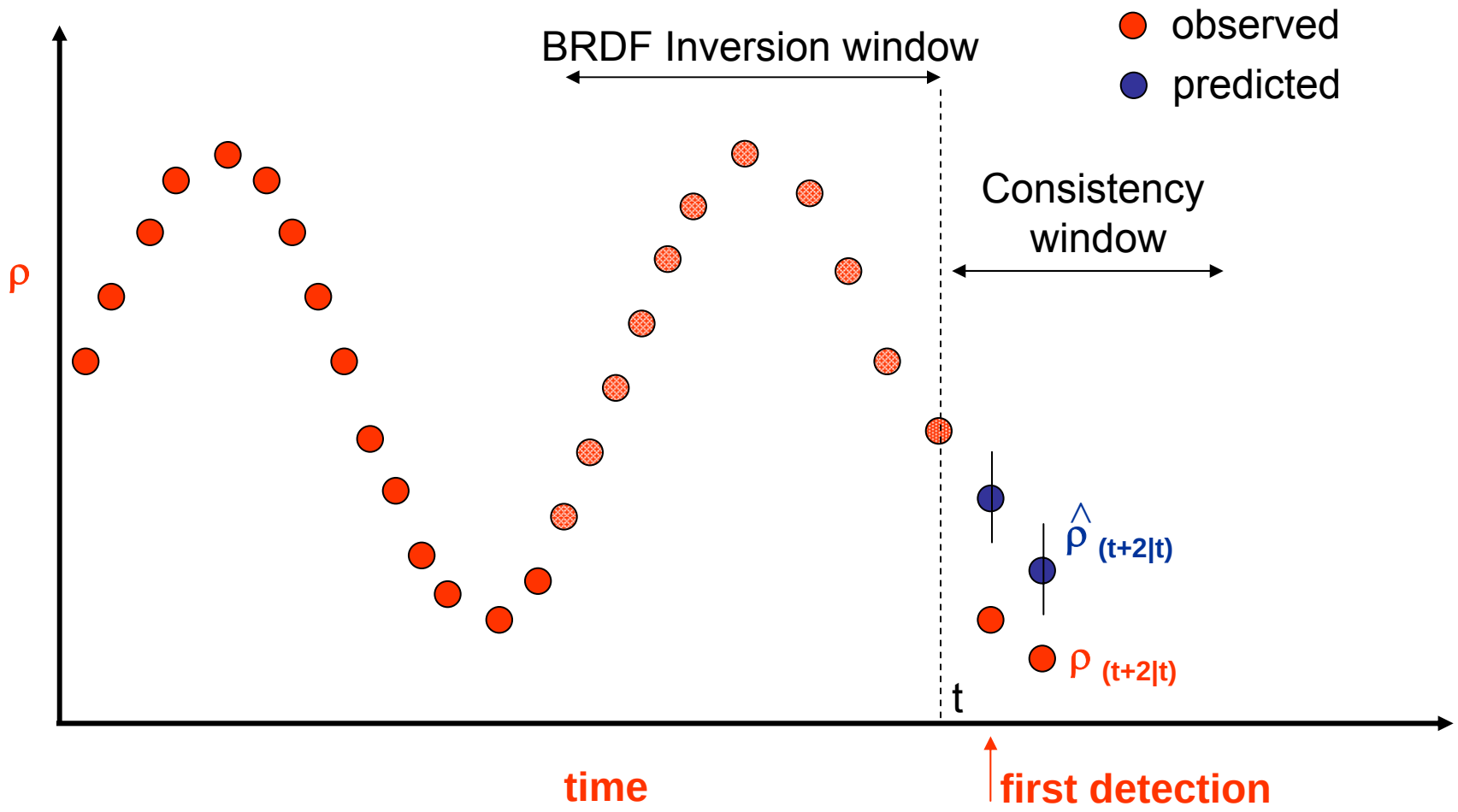

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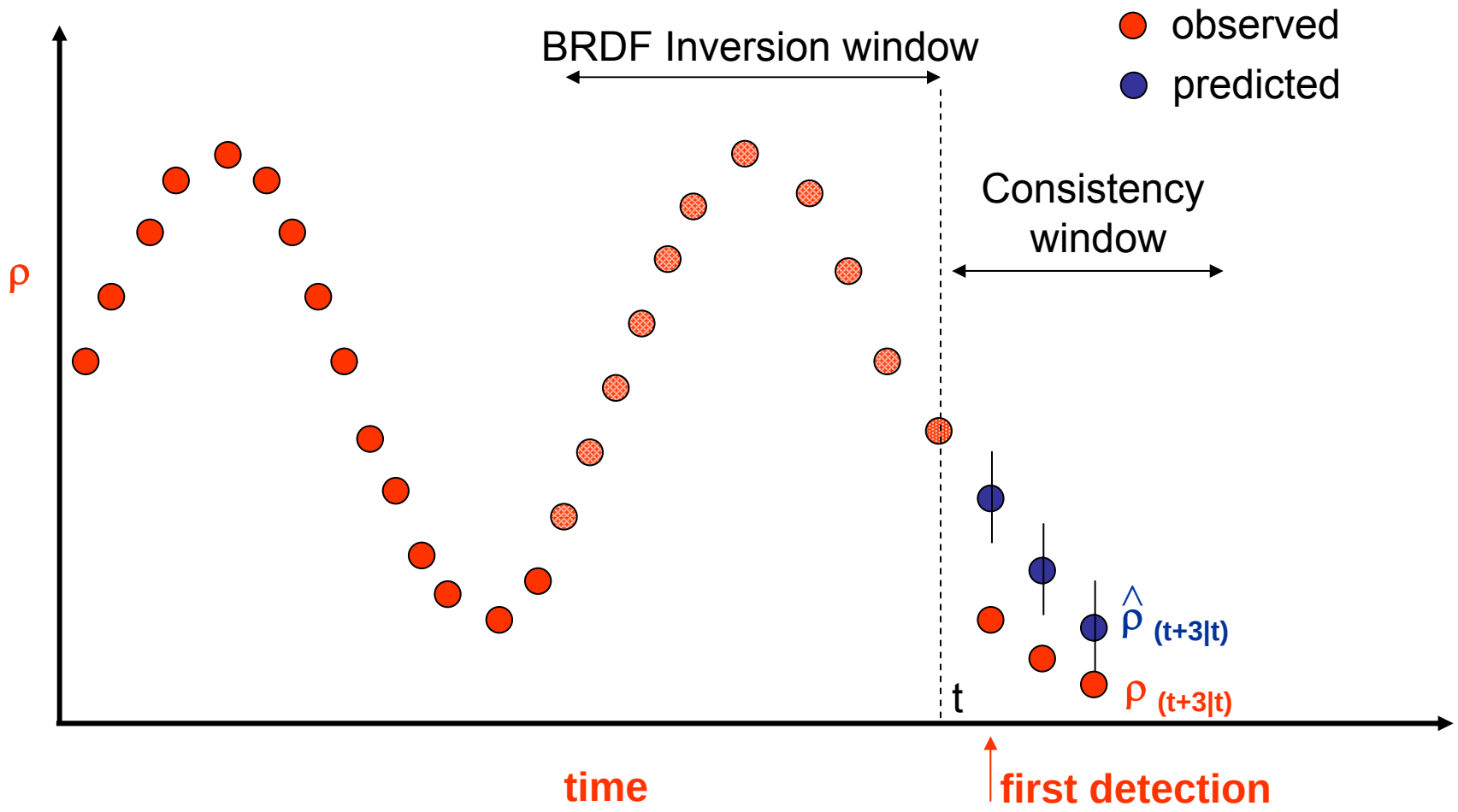

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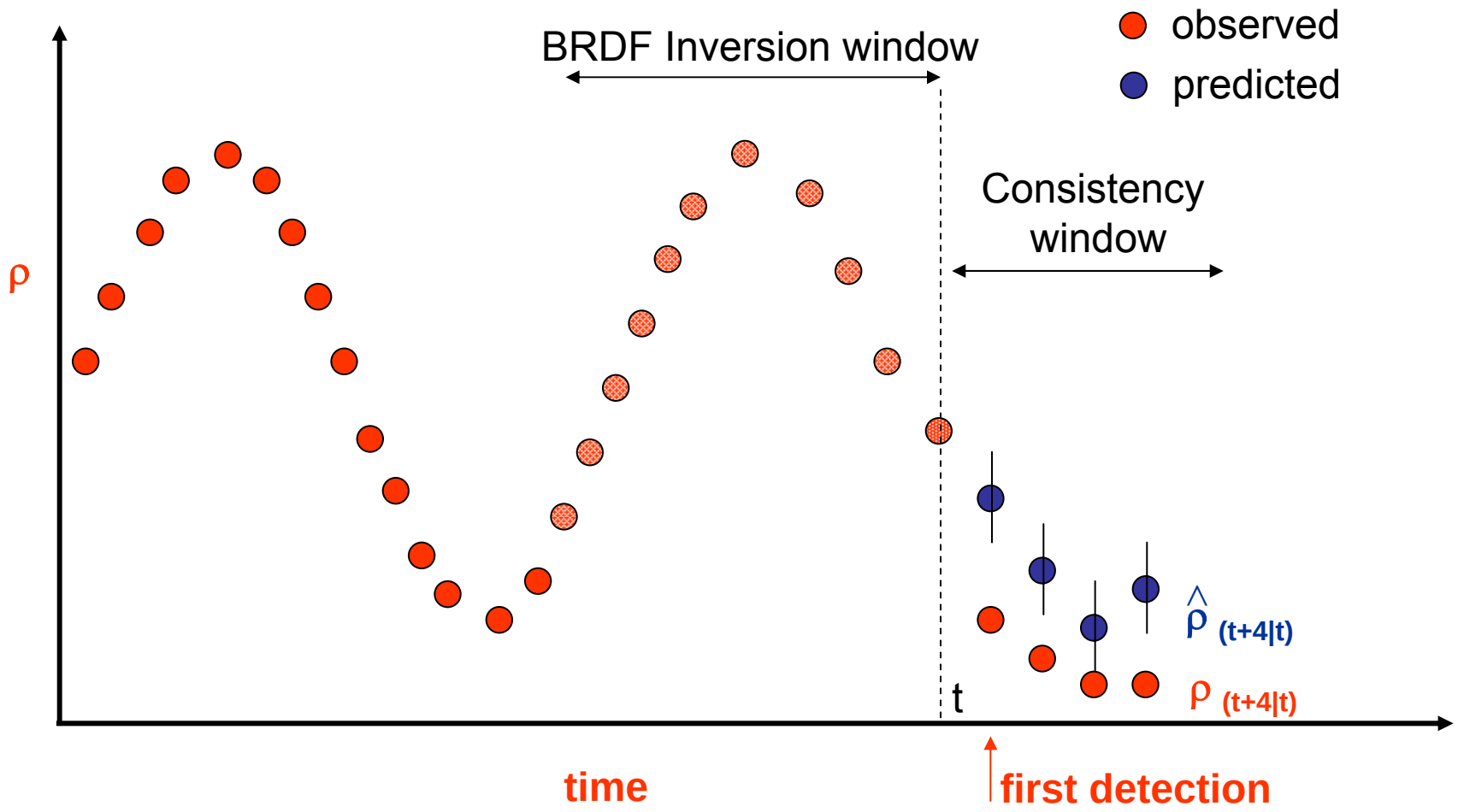
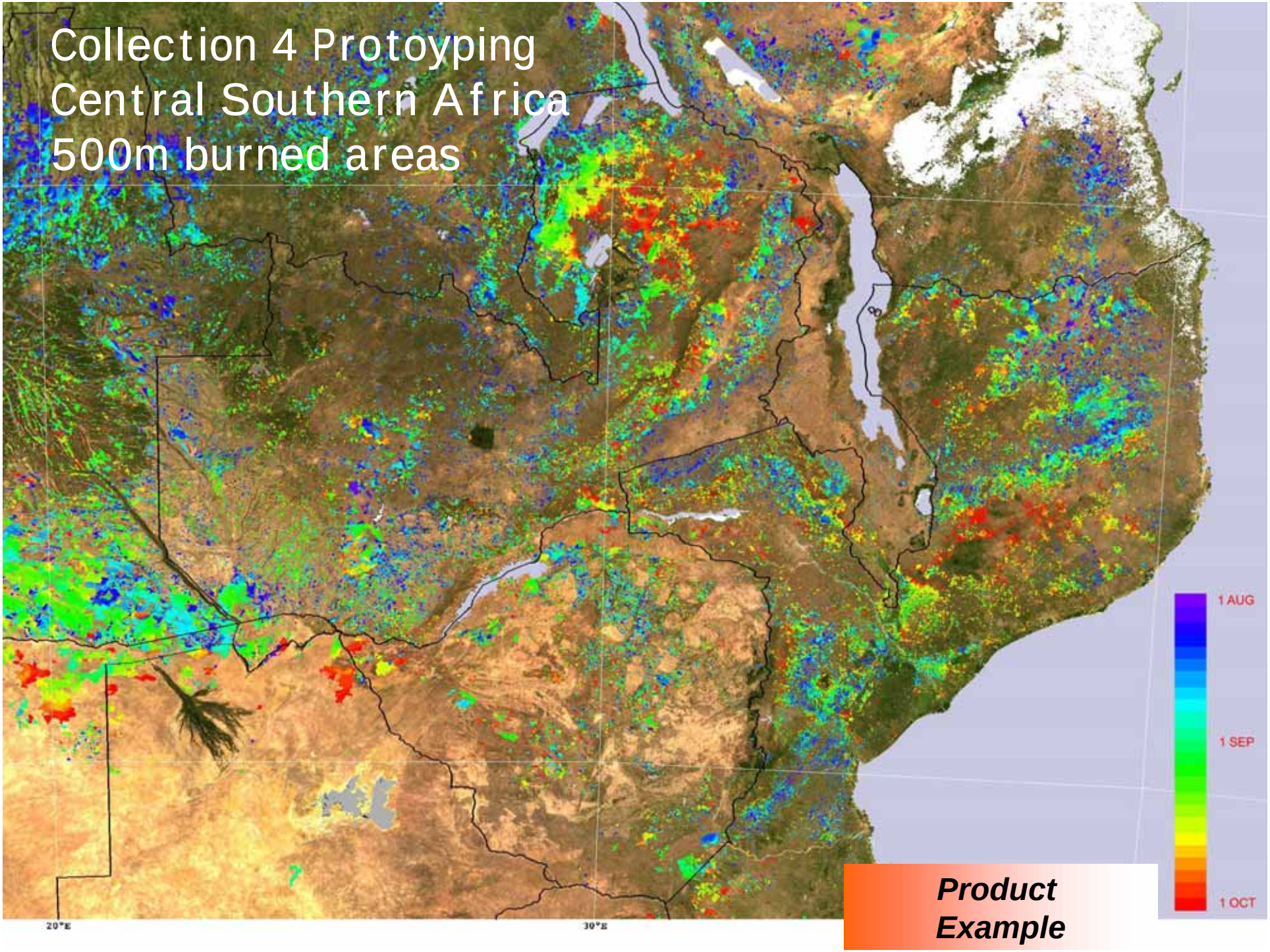
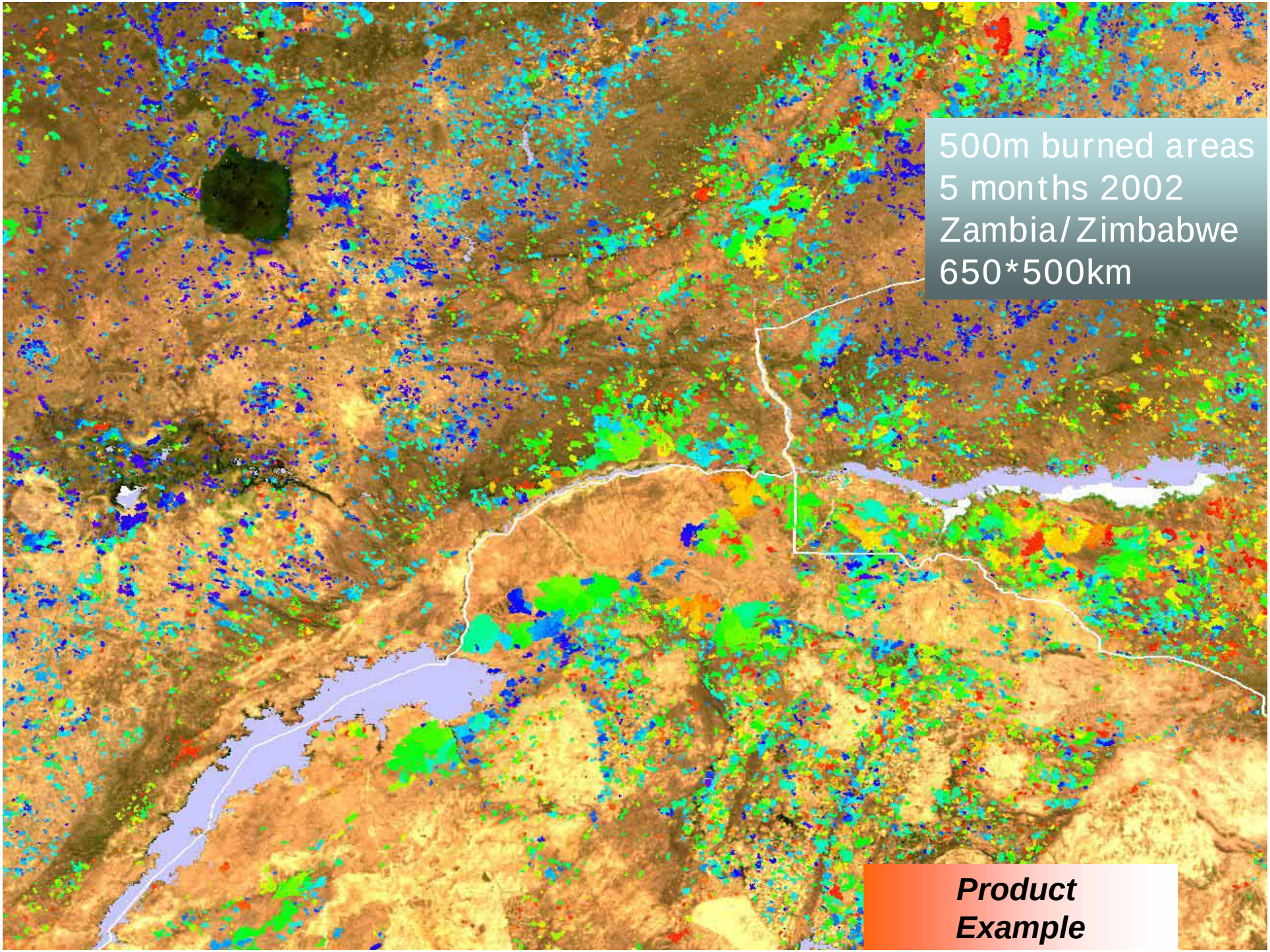
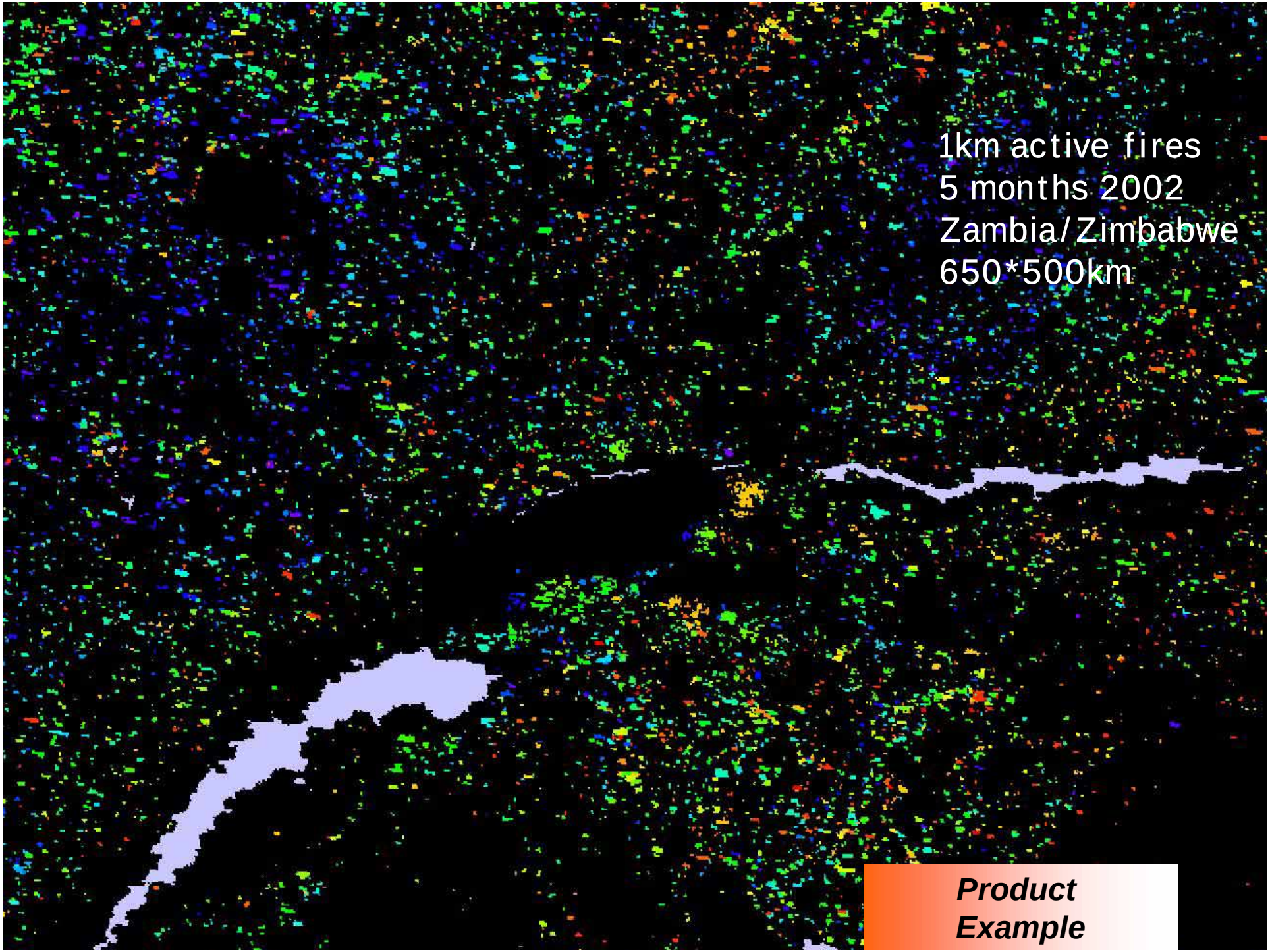


The MCD45 product suite

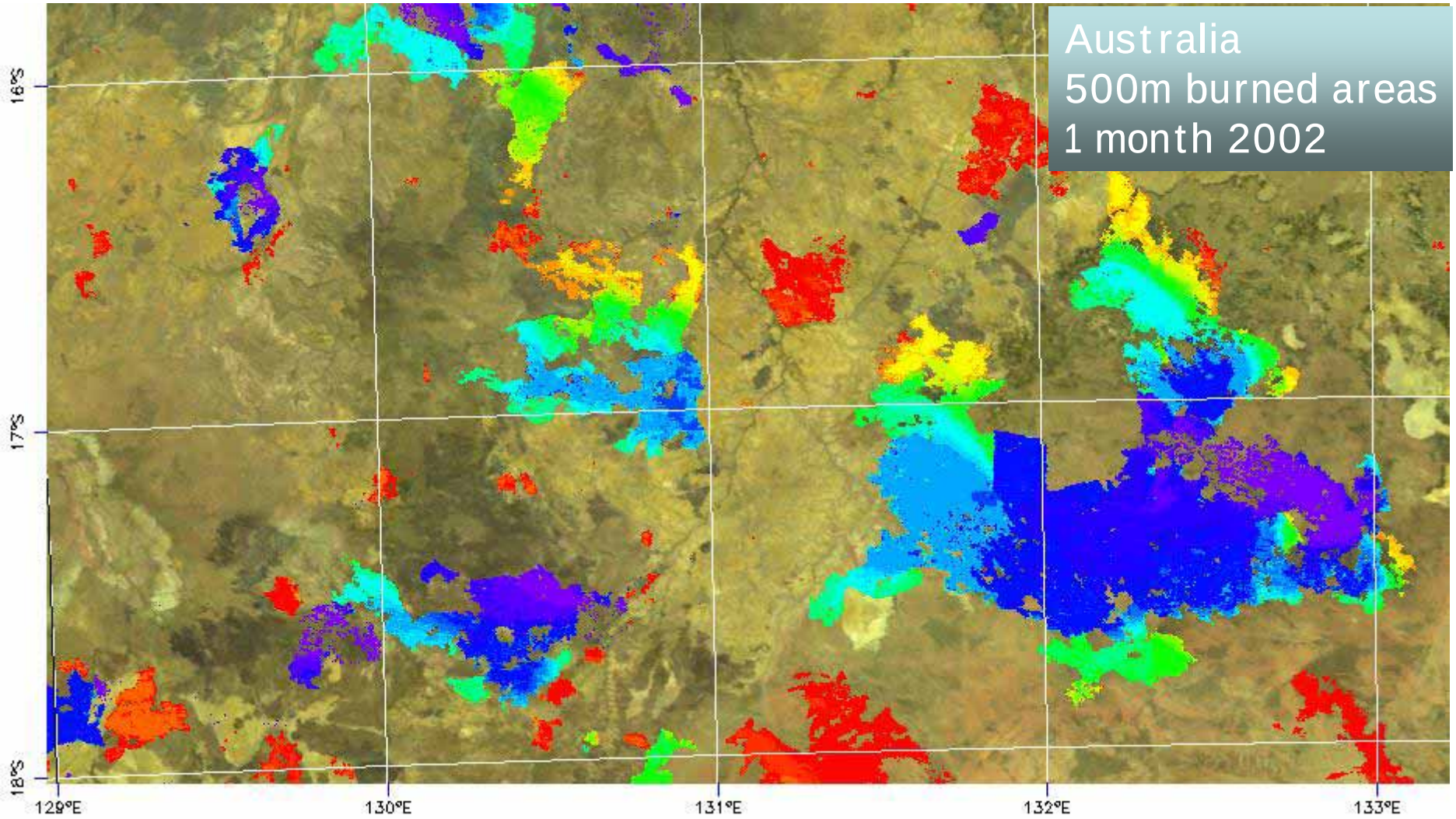
- **Monthly Product (MCD45A1)**
  - 500m approximate day of burning over month +/- 8 days
  - MODLAND 10x10 degree tiles
  - extensive QA & metadata
  - EOS-HDF
- **Annual Synthesis Product (forthcoming)**
  - as monthly product but for calendar year
- **CMG 0.25 deg product (forthcoming)**
  - aggregated information for climate modeling community (continental scale, easily accessible format)

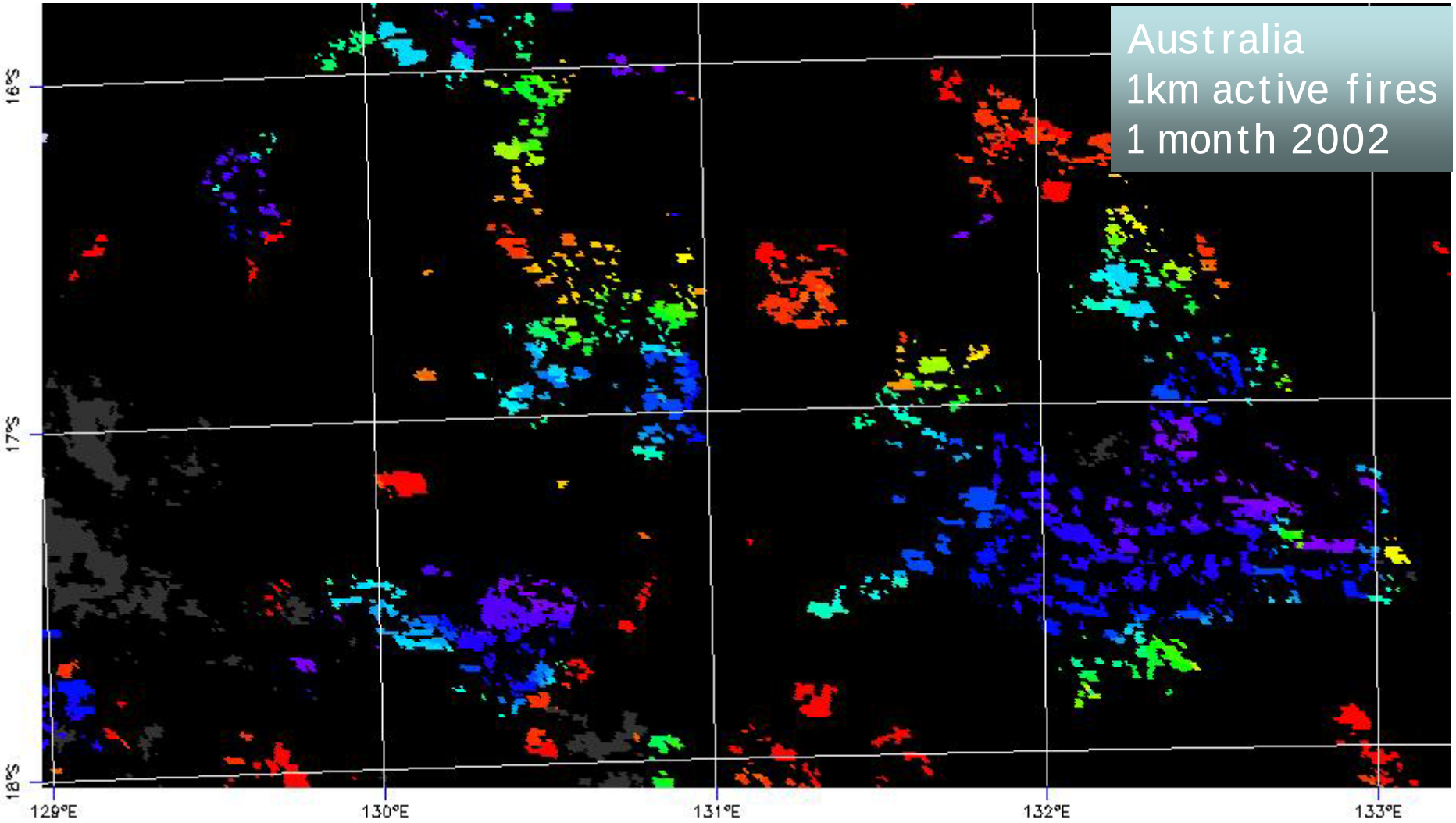

Collection 4 Protoyping
Central Southern Africa
500m burned areas
1 AUG
1 SEP
1 OCT
20°E
30°E
Product
Example

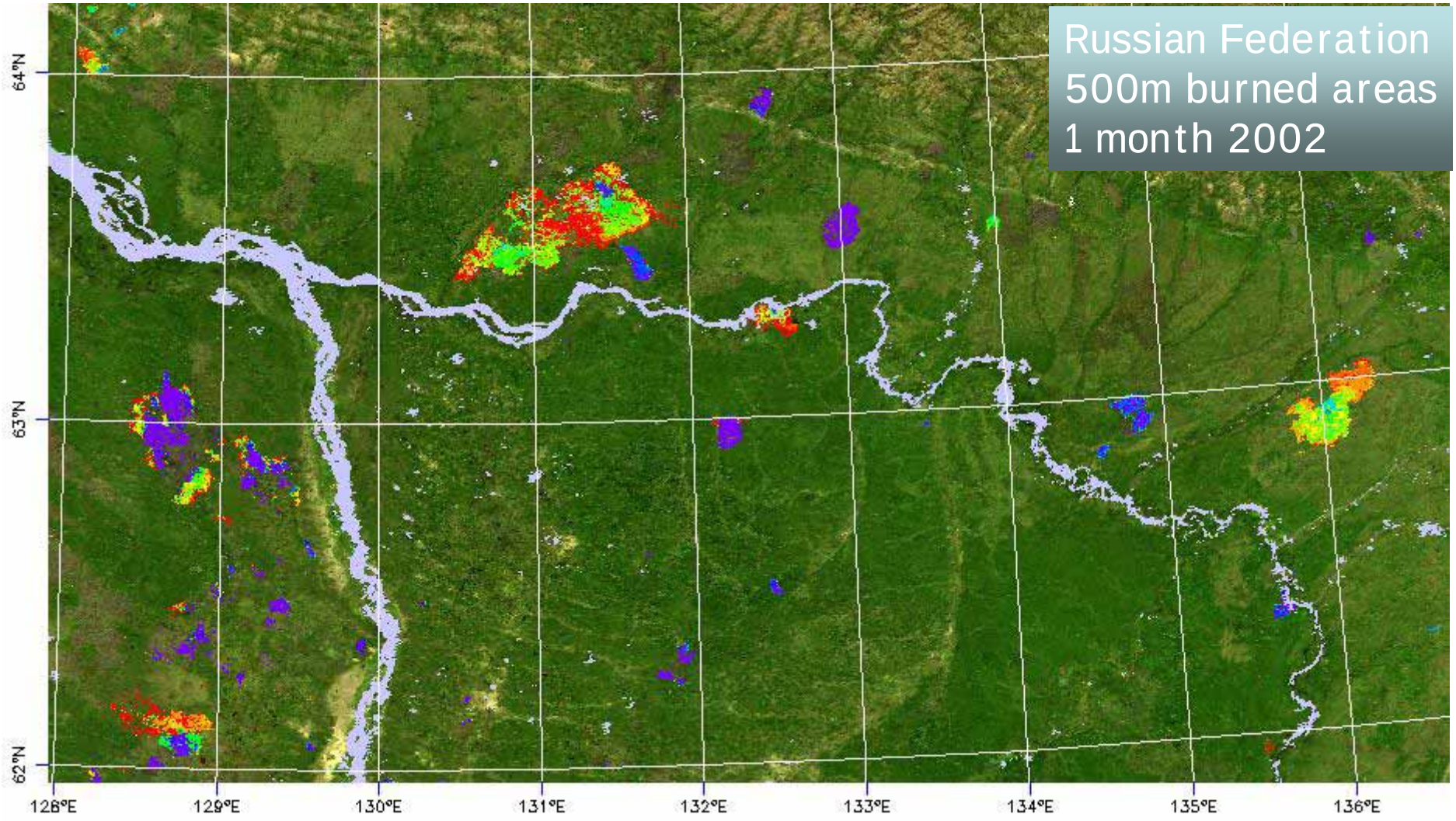

500m burned areas
5 months 2002
Zambia/Zimbabwe
650*500km
Product
Example

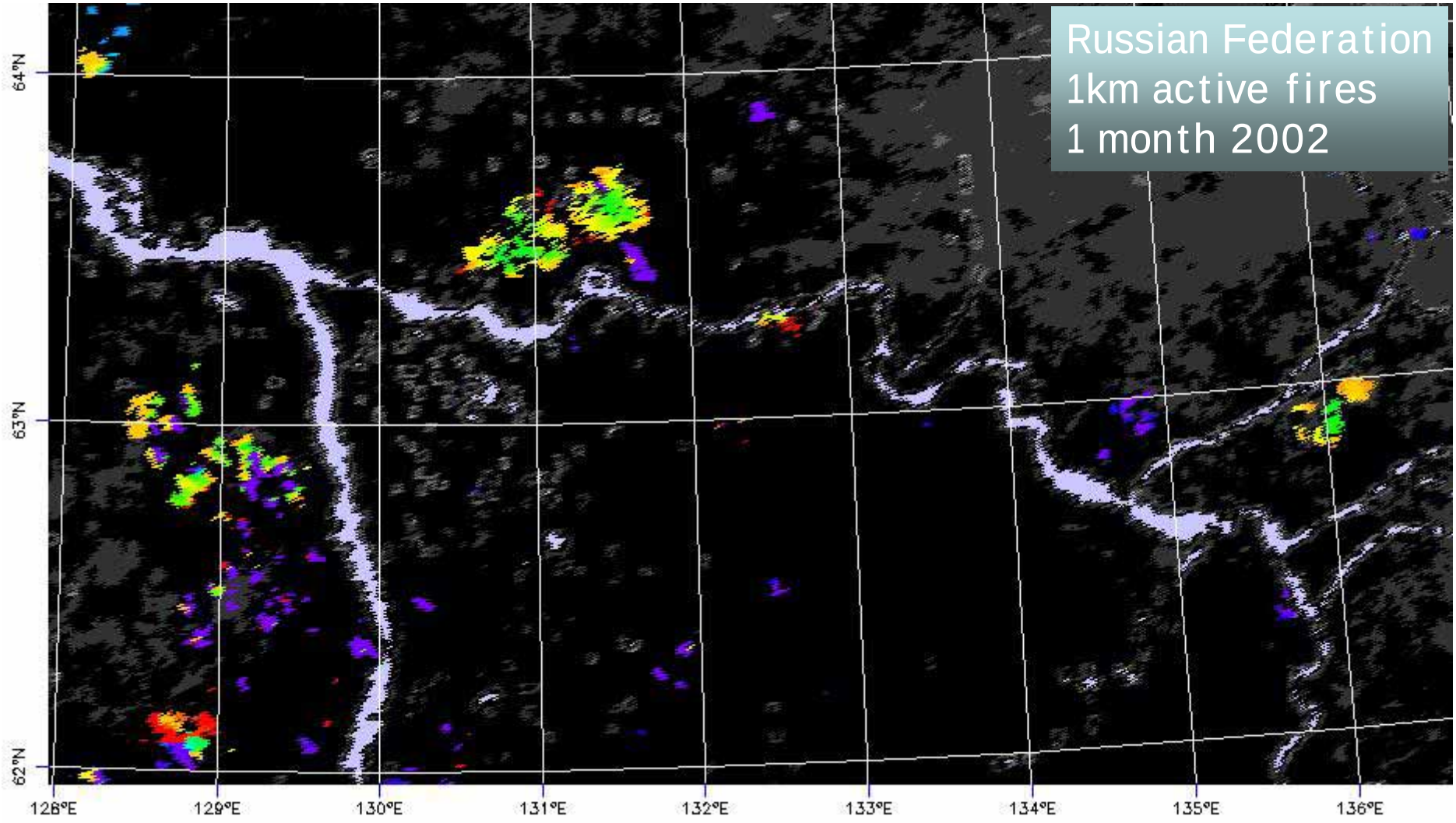


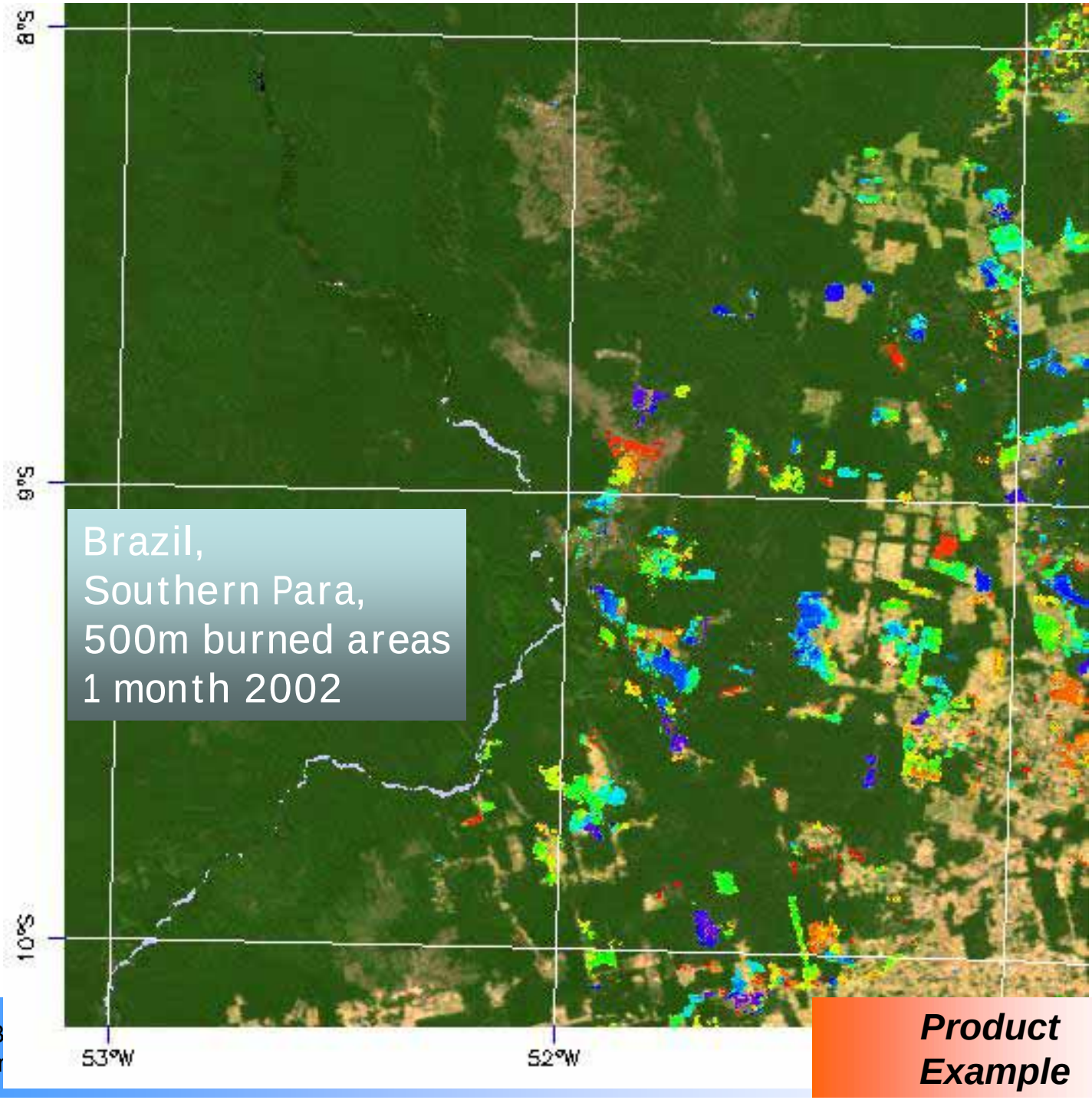
Product Example


Australia
500m burned areas
1 month 2002
16°S
17°S
18°S
129°E
130°E
131°E
132°E
133°E


Australia
1km active fires
1 month 2002
16°S
17°S
18°S
129°E
130°E
131°E
132°E
133°E


Russian Federation
500m burned areas
1 month 2002
64°N
63°N
62°N
128°E
129°E
130°E
131°E
132°E
133°E
134°E
135°E
136°E

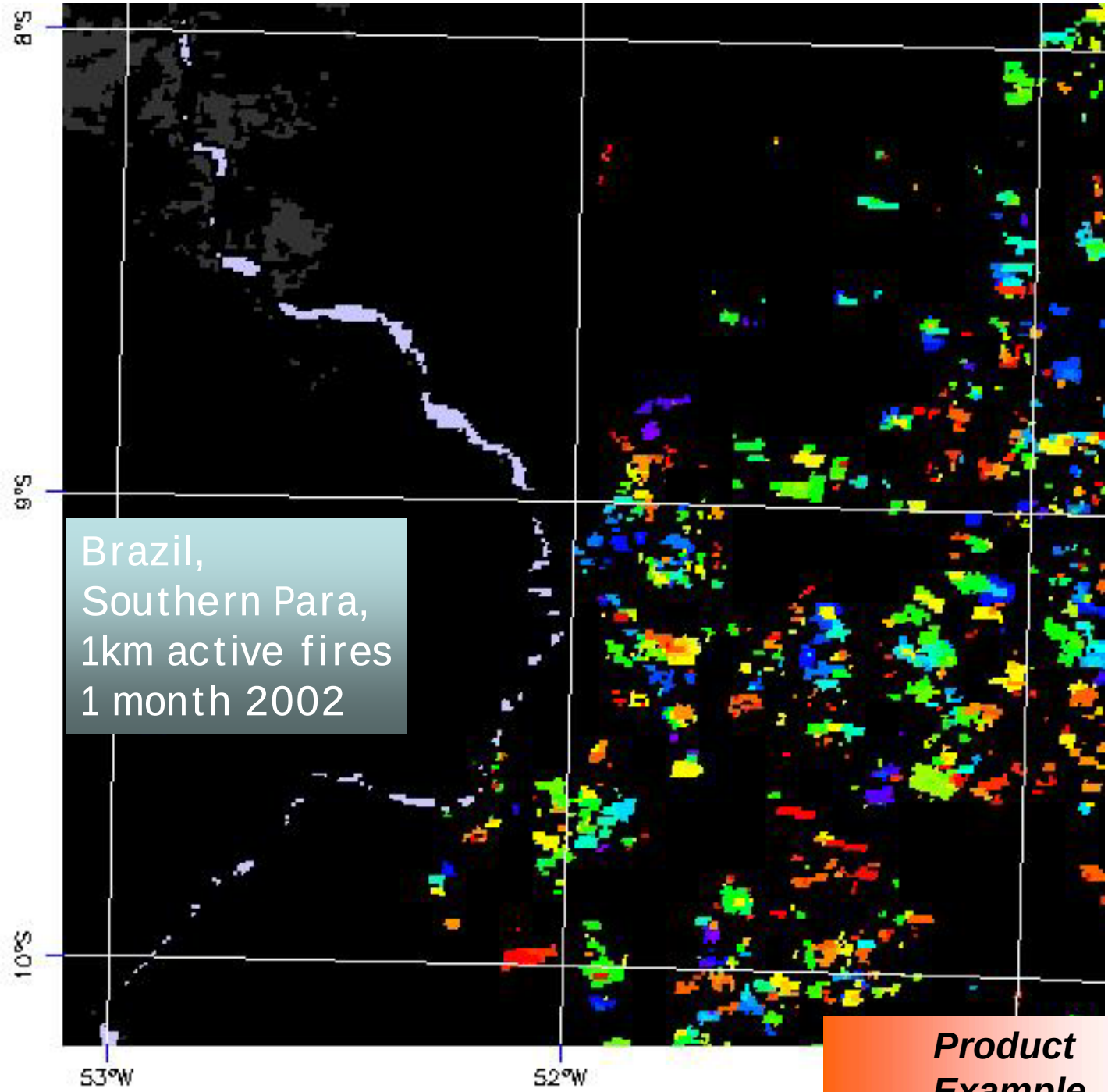

Russian Federation
1km active fires
1 month 2002
64°N
63°N
62°N
128°E
129°E
130°E
131°E
132°E
133°E
134°E
135°E
136°E



Brazil,
Southern Para,
500m burned areas
1 month 2002

Roy, B
C5 Wor

Product Example



Brazil,
Southern Para,
1km active fires
1 month 2002

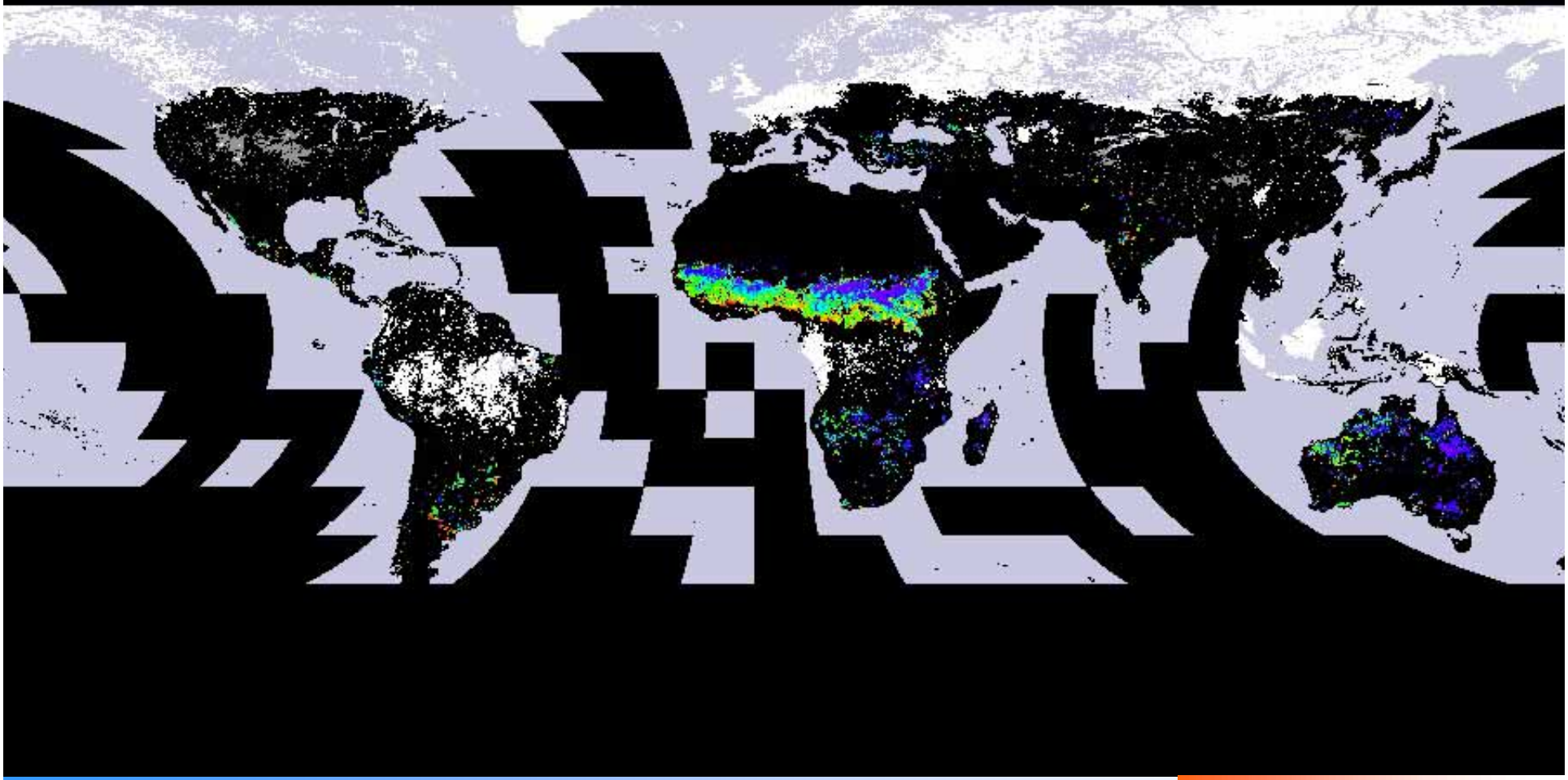
Roy, B
C5 Wor

Product Example

First Global Collection 5 Product

November 2000

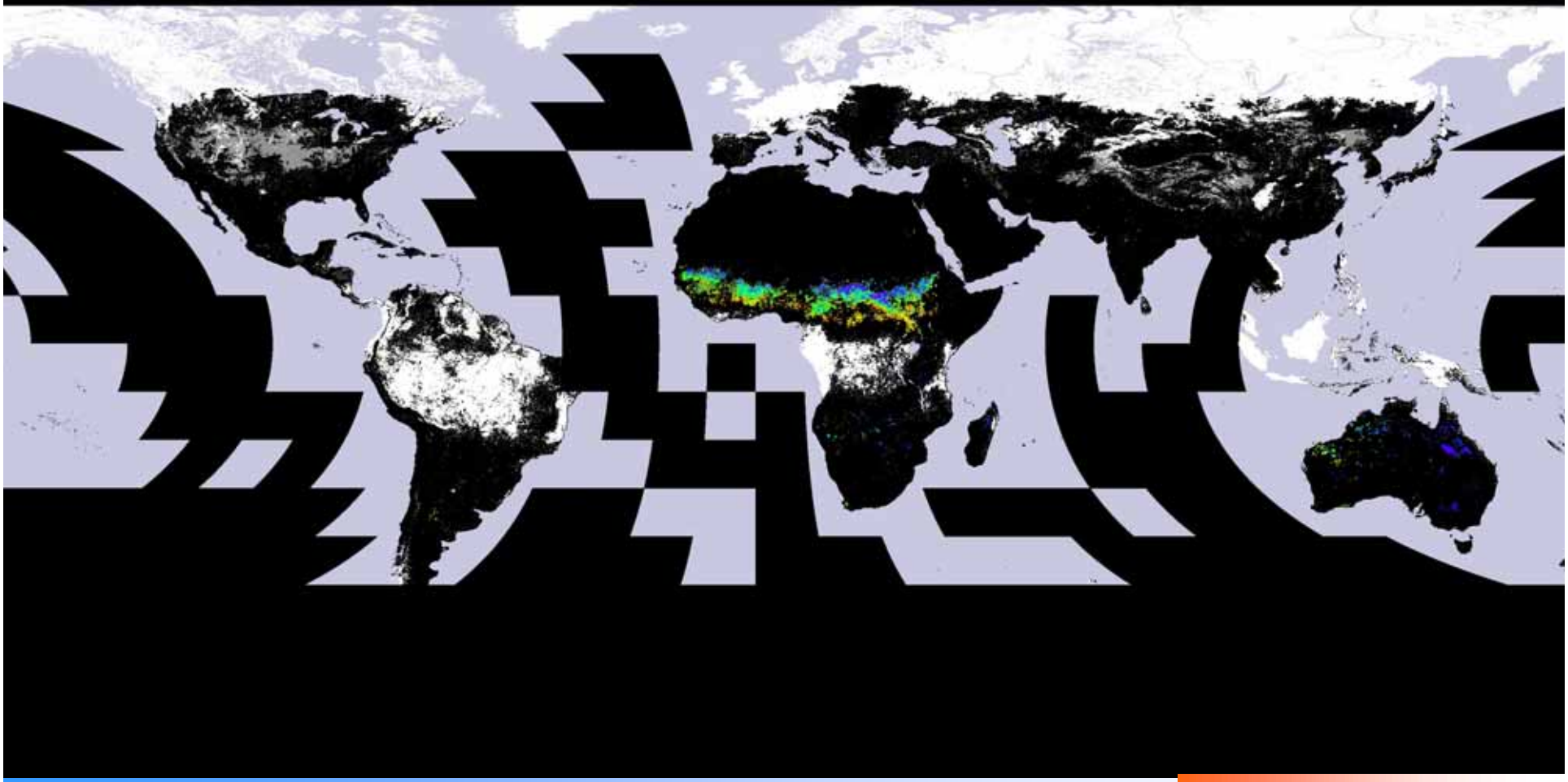
(shown in 40 x 40km grid cells)



First Global Collection 5 Product

November 2000

(shown in 10 x 10km grid cells)



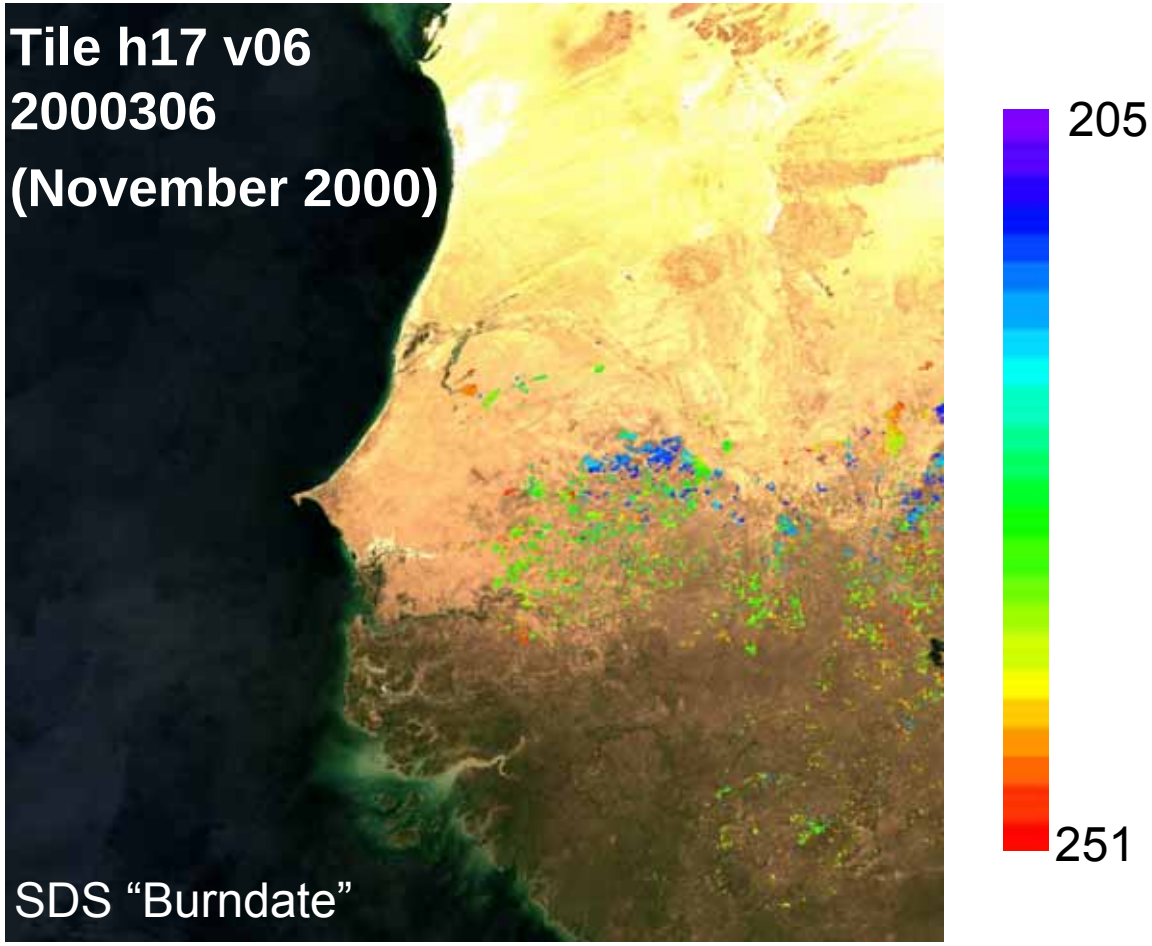
Product Data Structure

For each 500m pixel:

- **"Burndate"** the approximate day of burning
- **"BA pixel QA"** confidence of the detection (high, moderate, low).
- **"Number Passed"** number of observations in the time series after/before "Burndate" that were labeled as burned.
- **"Number Used"** number of observations in the time series after/before "Burndate" that were available for consideration ("Number Used" ≥ "Number Passed").
- **"Direction"** direction in which burning was detected (forward in time, backward, or both).
- **"Surface Type"** information describing the static land cover type, worst sensing acquisition and aerosol state conditions over the input time series.
- **"Gap Range"** information describing the largest and the second largest number of missing/cloudy days (if any) in the time series

+ Tile level ECS, MODLAND and product specific metadata

A closer look at the monthly product…



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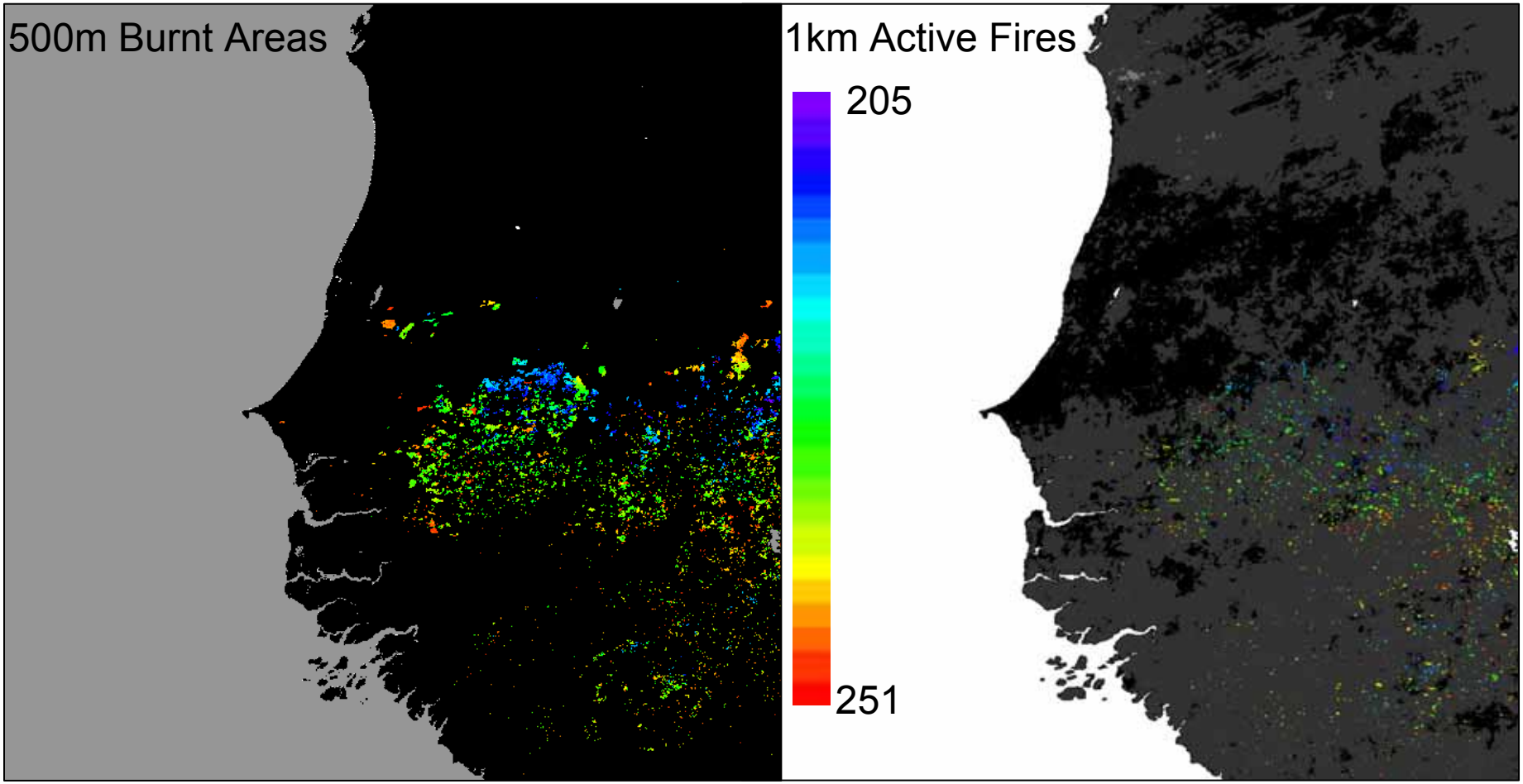

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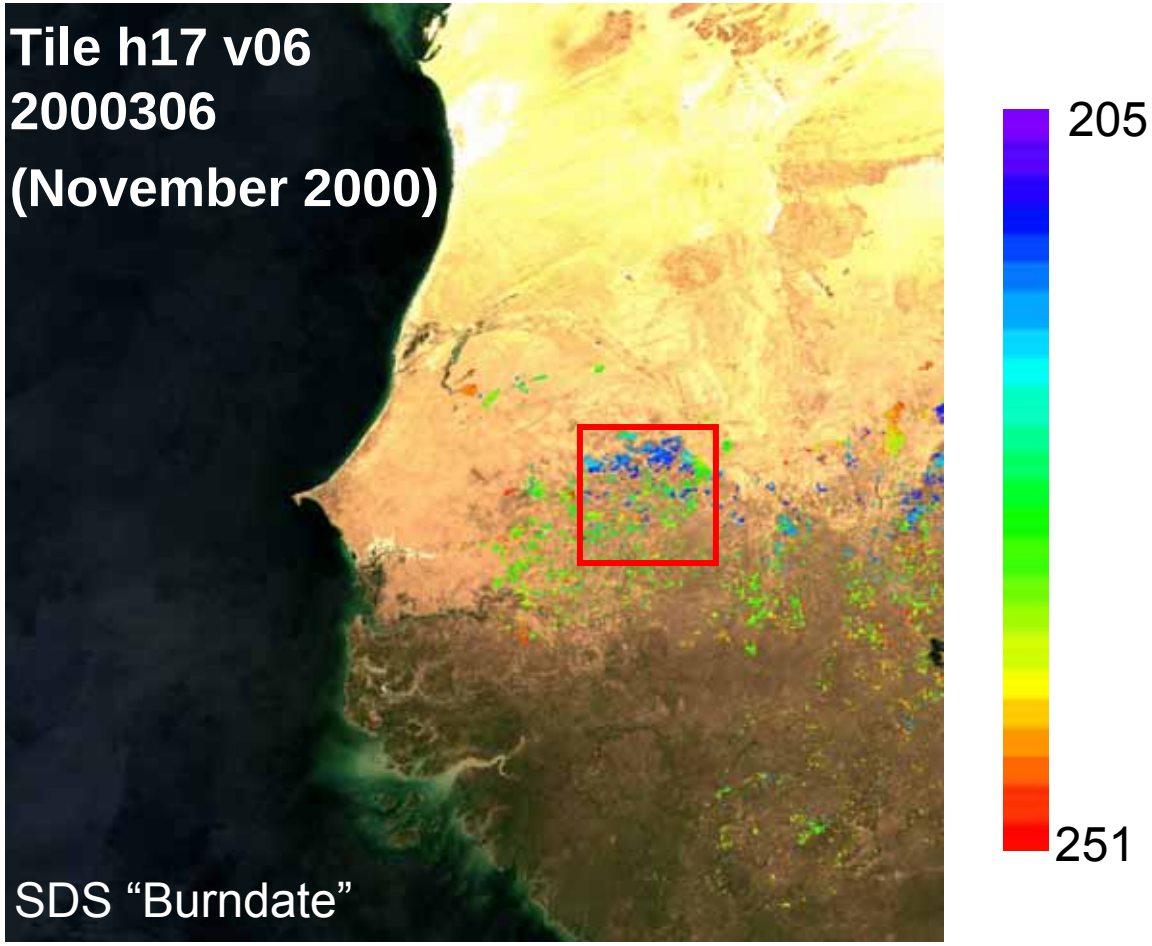

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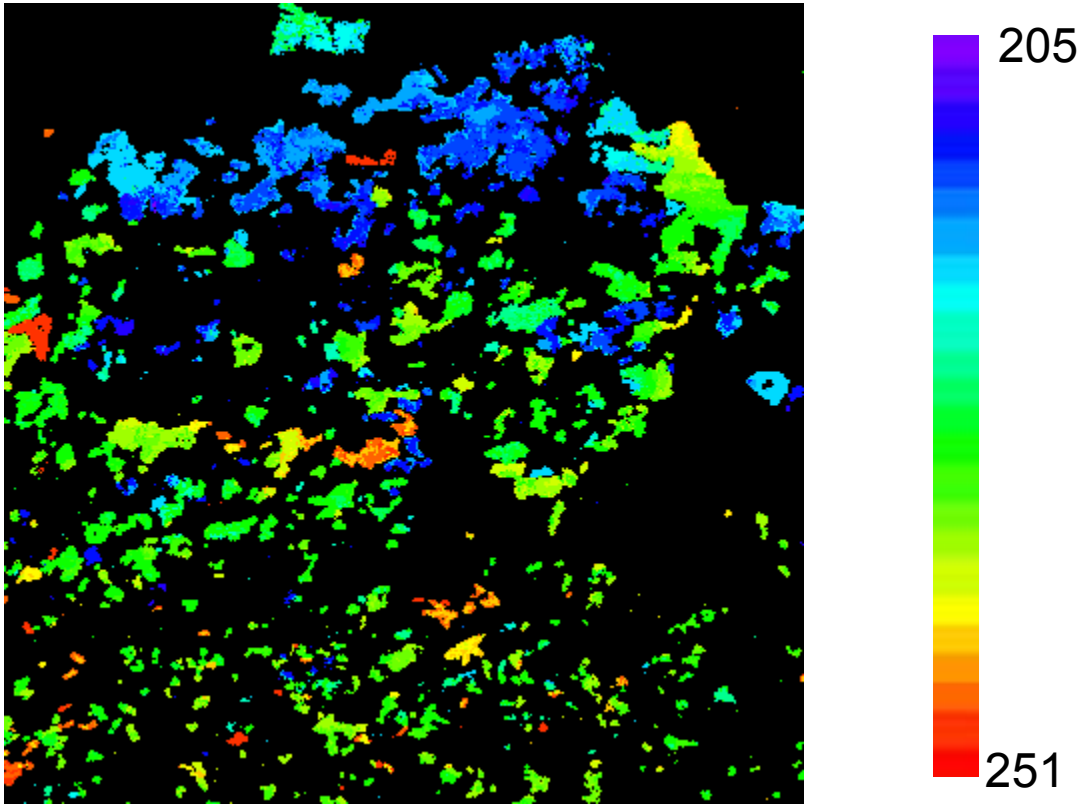
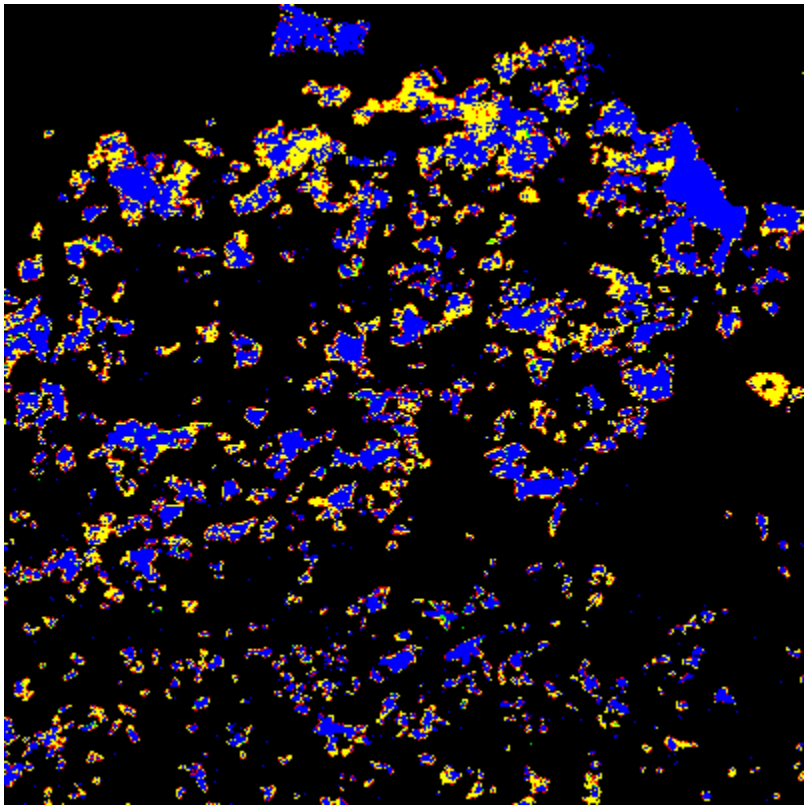


SDS “Burndate”

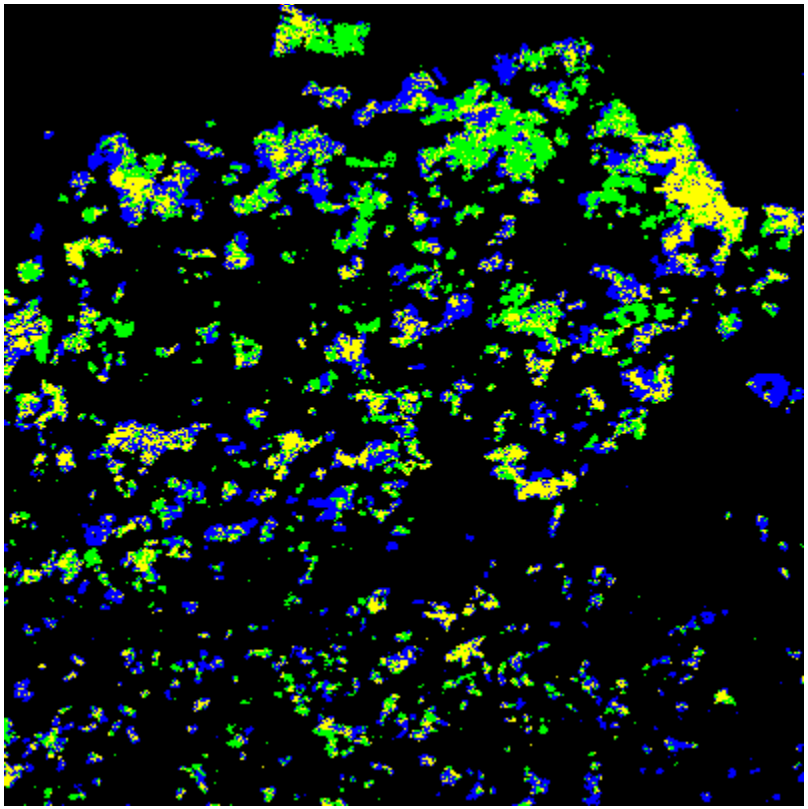
A closer look at the monthly product…



1
2
3
4

SDS “BA Pixel QA”

A closer look at the monthly product…



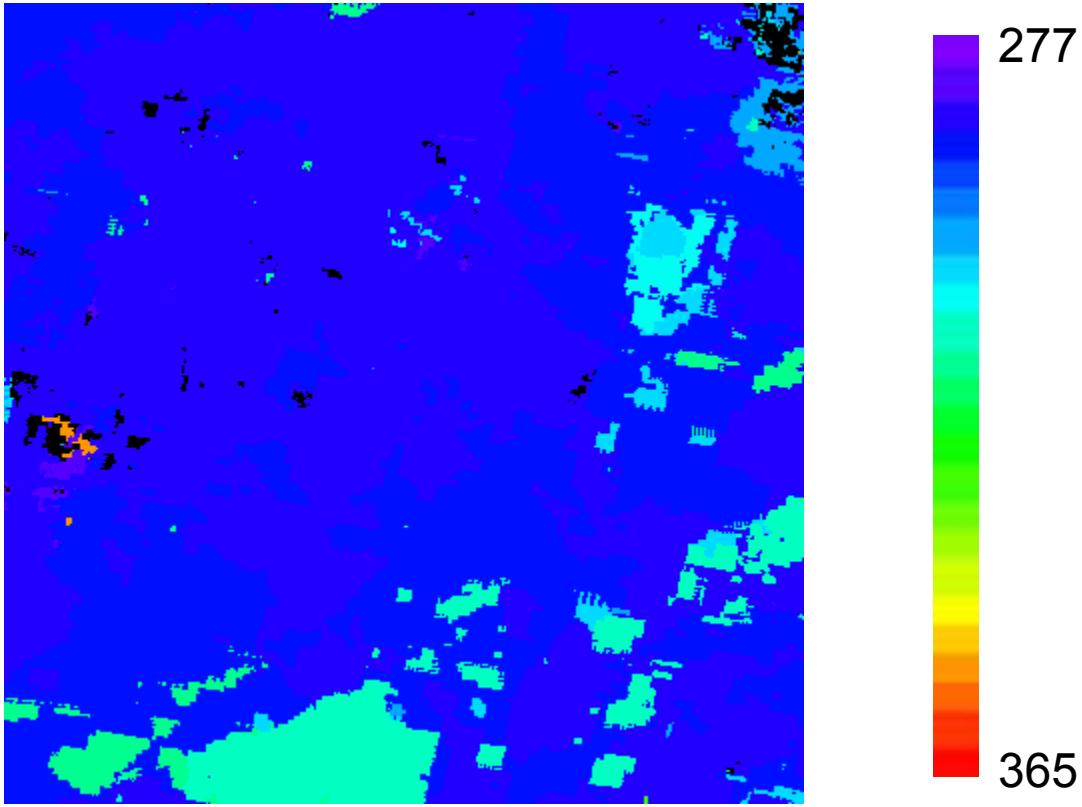
1(forward)

2(backward)

3(both)

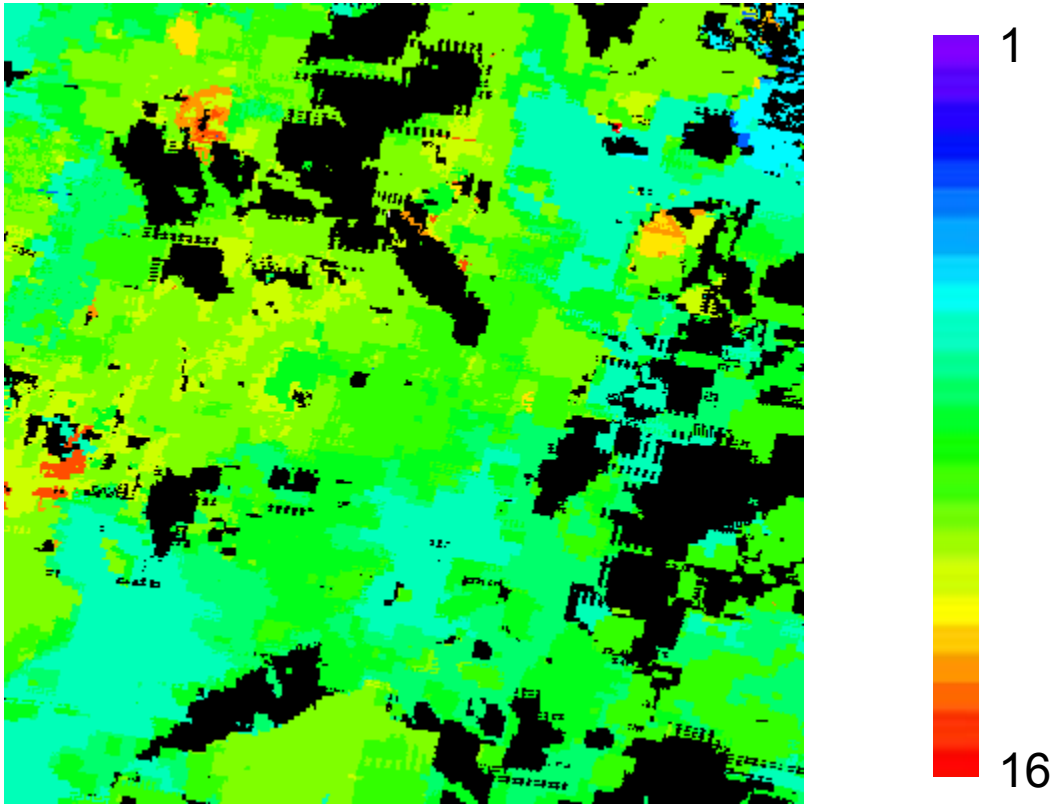
SDS “Direction”

A closer look at the monthly product…



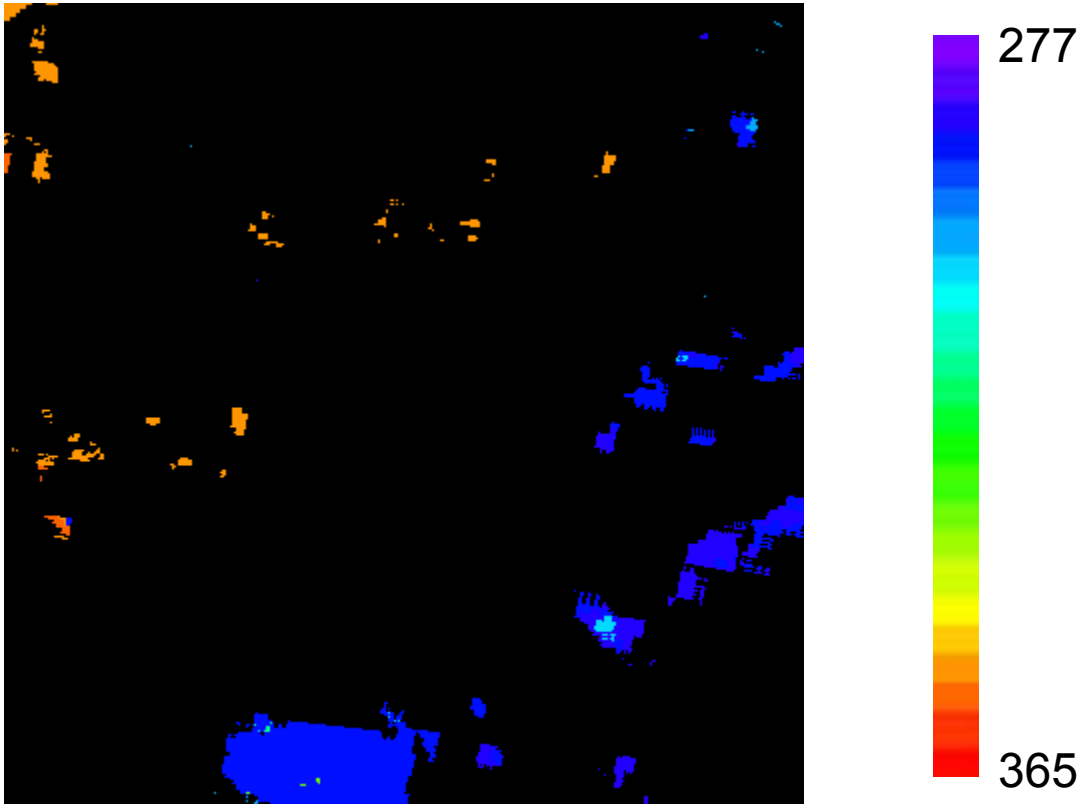
SDS “gap_range1”: gap start

A closer look at the monthly product…



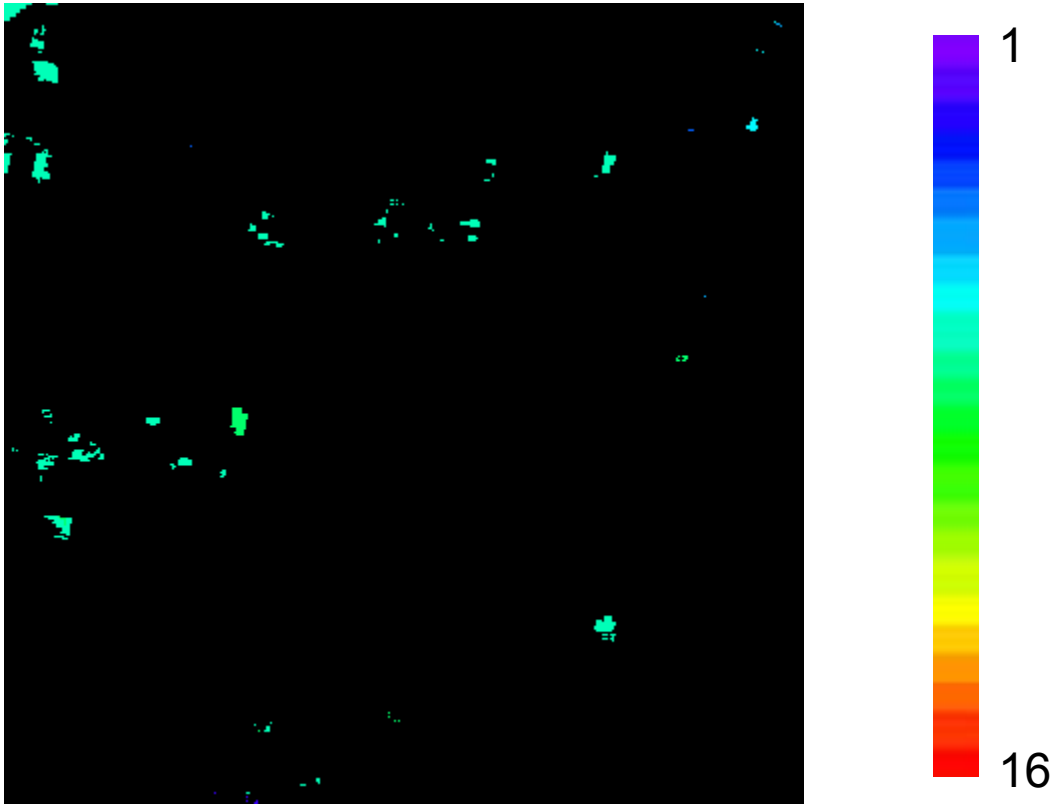
SDS “gap_range1”: gap duration

A closer look at the monthly product…



SDS “gap_range2”: gap start

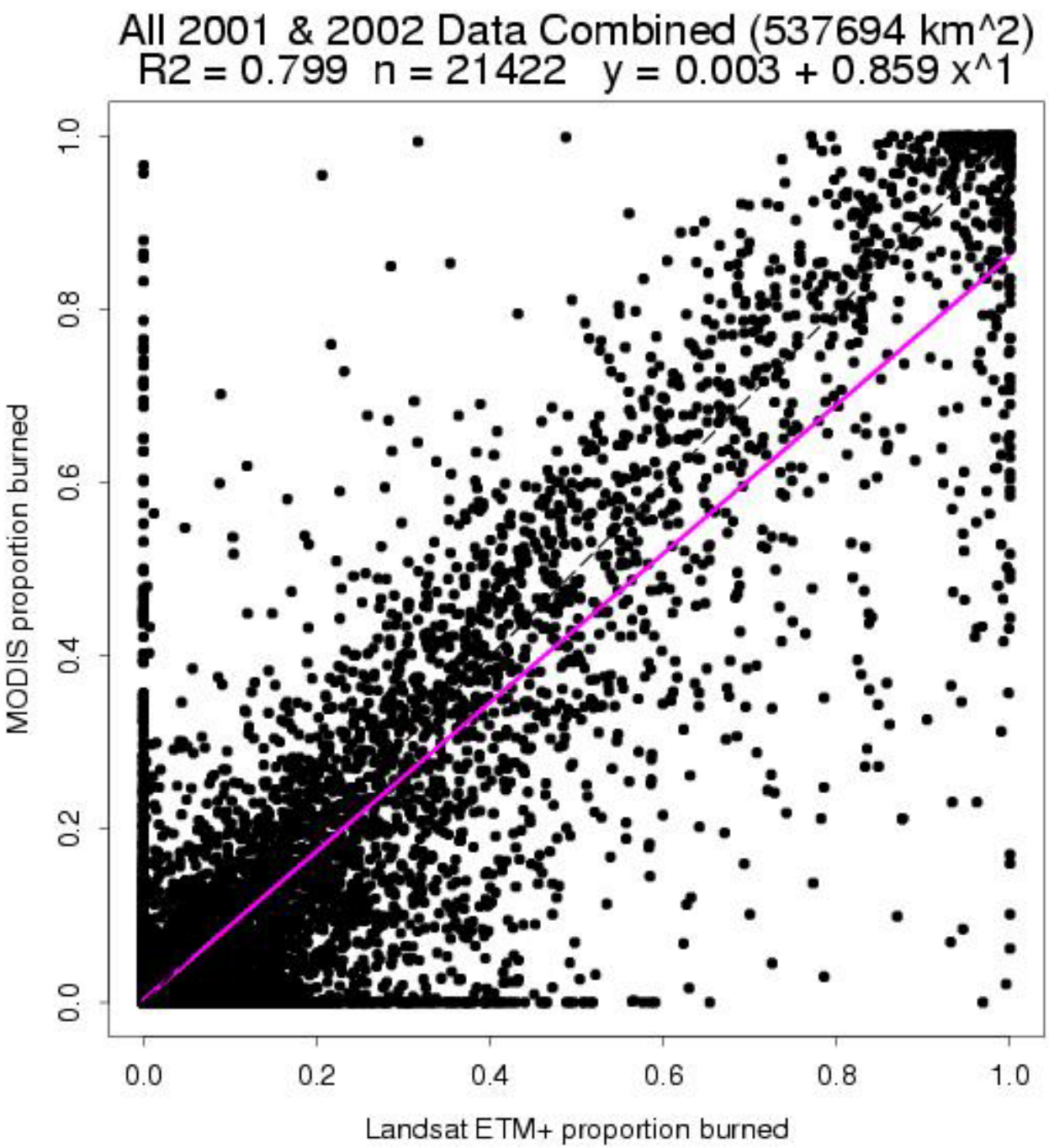
A closer look at the monthly product…



SDS “gap_range2”: gap duration

Validation Plan

- **Currently CEOS stage 1 validation**
  - "*the product accuracy has been estimated using a small number of independent measurements obtained from selected locations and time periods and ground-truth/field program efforts*"
- **Stage 2 by the end of Collection 5**
  - "*the product accuracy has been assessed over a widely distributed set of locations and time periods via several groundtruth and validation efforts*"
- **Stage 3 in Collection 6**
  - "*product accuracy has been assessed and the uncertainties in the product well established via independent measurements in a systematic and statistically robust way*"



Southern Africa
STAGE 1 Validation

40 ETM+ acquisitions
- 20 ETM+ scenes
- 500,000 km2

MODIS Burned area
= 0.85 "true" burned area

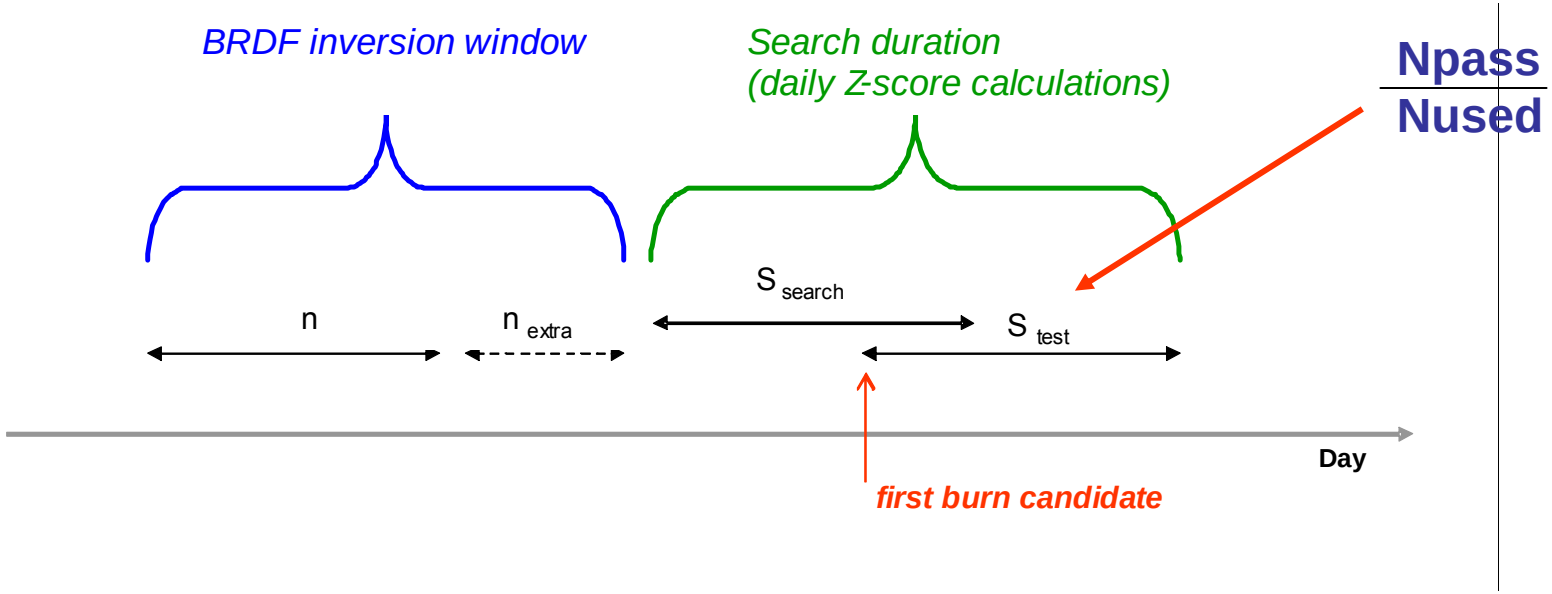
Validation

Burned Area
Collection 5 Recommendations

- This is a new product - there is no Collection 4 product
- Product user manual and ATBD are posted on the MODIS Fire website
  http://modis-fire.umd.edu
- Collection 5 production of MCDA1 has started
  - reprocessing of November 2000+
  - forward production of February 2007+
- Note, changes to the Collection 5 algorithm are likely
- Change descriptions will be posted on the MODIS Fire website
- Product version reflected in the product PGEVersion metadata
- Product quality issues posted on the LDOPE QA Web Site

THANKS

Scheme of the detection



Contextual iterative procedure:

Burn candidates are selected if they provide persistent evidence of fire occurrence.

The measured persistence varies depending on gaps in the reflectance time series and the timing of the fire relative to non-missing data, an iterative rather than simple thresholding approach is used