NASA Fire Products Update

Louis Giglio, Joanne Hall, David Roy, Luigi Boschetti, Michael Humber, Maria Zubkova, Tony Chen, Fernanda Argueta, and Wilfrid Schroeder

2024 GOFC Fire IT Meeting

17-18 September 2024

Milan

Scope

- MODIS
  - Active fire + burned area products
- VIIRS
  - Active fire + burned area products
- Landsat OLI
  - Active fire product
- AVHRR
  - Long-term burned area product

MODIS Fire Product Status

- Active Fire (MOD14/MYD14) + Burned Area (MCD64A1)
- Current collection is 6.1
- Collection 7 planned for ~~2024~~ 2025 *(likely optimistic)*
  - New MODIS/VIIRS Land products, Aqua MODIS/S-NPP VIIRS/NOAA-20 VIIRS cross-calibration, IT security mandates, GitLab transition, cloud migration, ...
- Terra and Aqua end-of-life plan extended through ~2026

VIIRS Fire Product Status

- Active Fire: 375-m VNP14IMG + 750-m VNP14
- Burned Area: “500-m” VNP64A1
- Current version is Collection 2
  - NOAA-like SDR → NASA Level 1B transition
- No date yet for Collection 3

NASA Active Fire + Burned Area Products

MODIS

MOD14/MYD14 active fire	1-km swath (L2)
MxD14A1, MxD14A2 active fire	1-km gridded daily, 8-day (L3)
Derived GIS products (SCF)	monthly fire locations, 0.25° monthly
MCD64A1 burned area	500-m gridded monthly (L3)
Derived GIS products (SCF)	shapefile, 500-m GeoTIFF, 0.25° monthly

VIIRS

VNP14IMG/VJ114IMG active fire	375-m swath (L2)
VNP14/VJ114IMG active fire	750-m swath (L2)
VNP14A1, etc. active fire	500-m gridded daily (L3)
Derived GIS products (SCF)	monthly fire locations
VNP64A1 burned area	500-m gridded monthly (L3)
Derived GIS products (SCF)	shapefile, 500-m GeoTIFF, 0.25° monthly

VIIRS Active Fire (VNP14/VNP14IMG)

Product Overview

- Level 2 swath + Level 3 gridded
- 375-m product is a significant improvement over MODIS and is widely used
- 750-m produce retained for continuity (more like MODIS)

Limitations and Strengths

- SDR-induced bad scans in C1 product (fixed for C2)
- No morning VIIRS overpass
- Sub-optimal M13 location (tweaked for later VIIRS)
- Responsivity across swath is much more uniform
- Unprecedented sensitivity to small fires

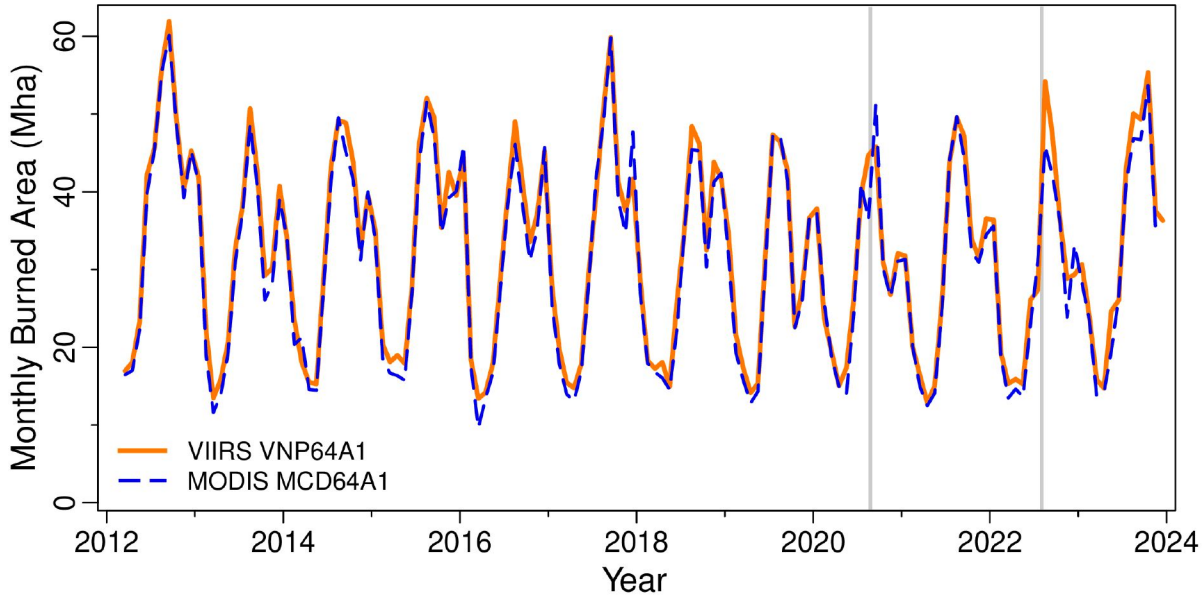
S-NPP VIIRS Burned Area (VNP64A1)

Distribution Plan

- September 2024: Product is in release queue
- Late 2024: Release C2 VNP64A1 add-on products (HDF, GeoTIFF, Shapefiles, CMG)

Limitations and Strengths

- Largely consistent with MODIS MCD64A1 predecessor (Luigi's presentation)
  - This is both a limitation and a strength



C3 Maintenance/Refinement

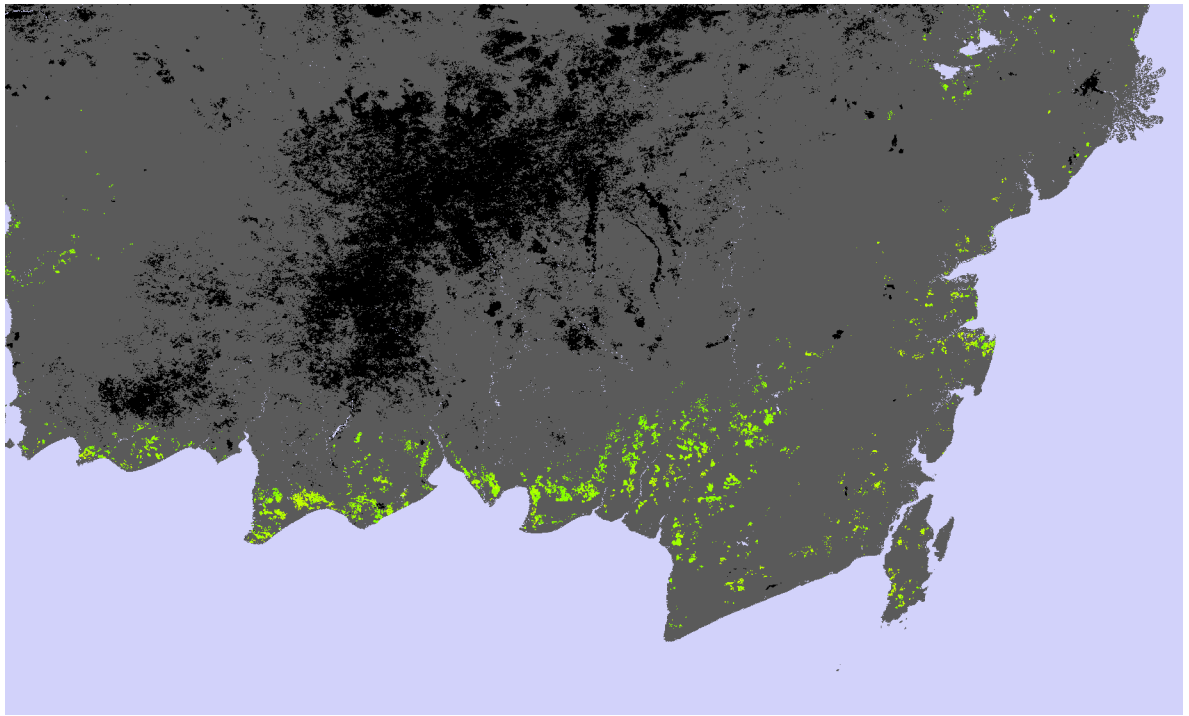
- Improve fidelity and robustness by combining S-NPP and NOAA-20 VIIRS observations
  - Possibly Sentinel-3 SLSTR observations as well
- Update with Collection-7 MODIS algorithm

MODIS C7 MCD64A1 + VIIRS C3 VCD64A1

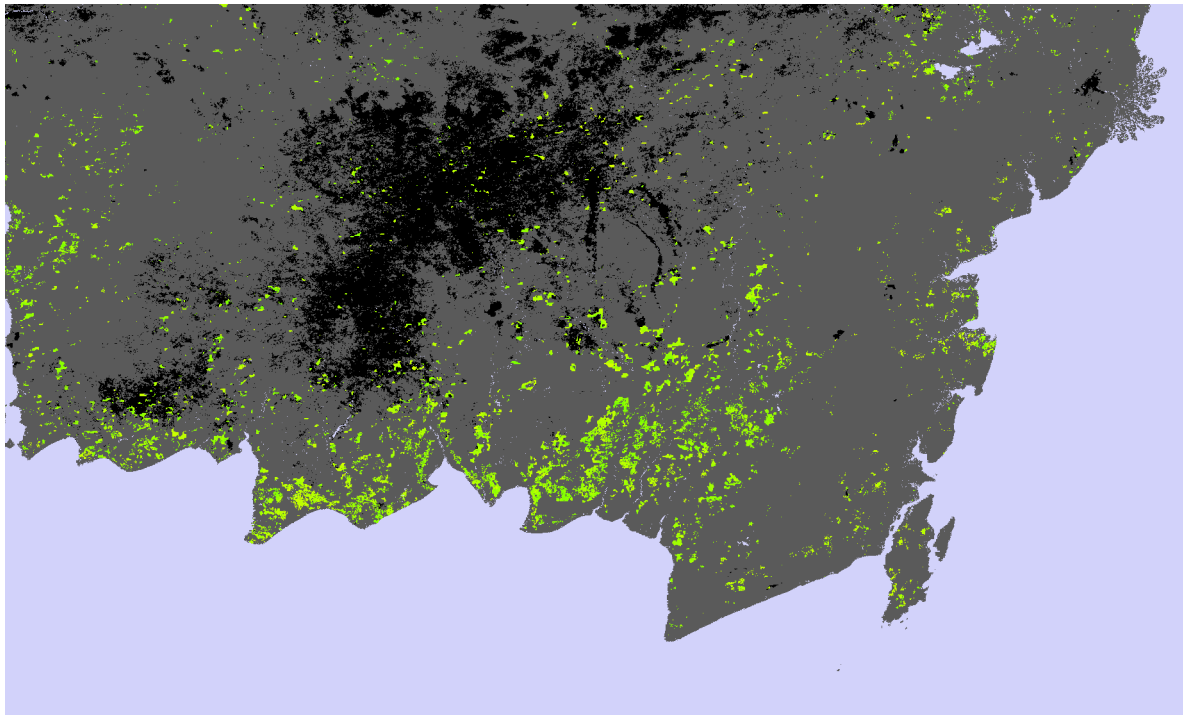
- Cross-tile
  - Capture smaller burns
- Modest improvement in cropland burn mapping
- Backup mode for extreme smoke conditions (→ no surface reflectance inputs)

Borneo, August 2015

C6.1

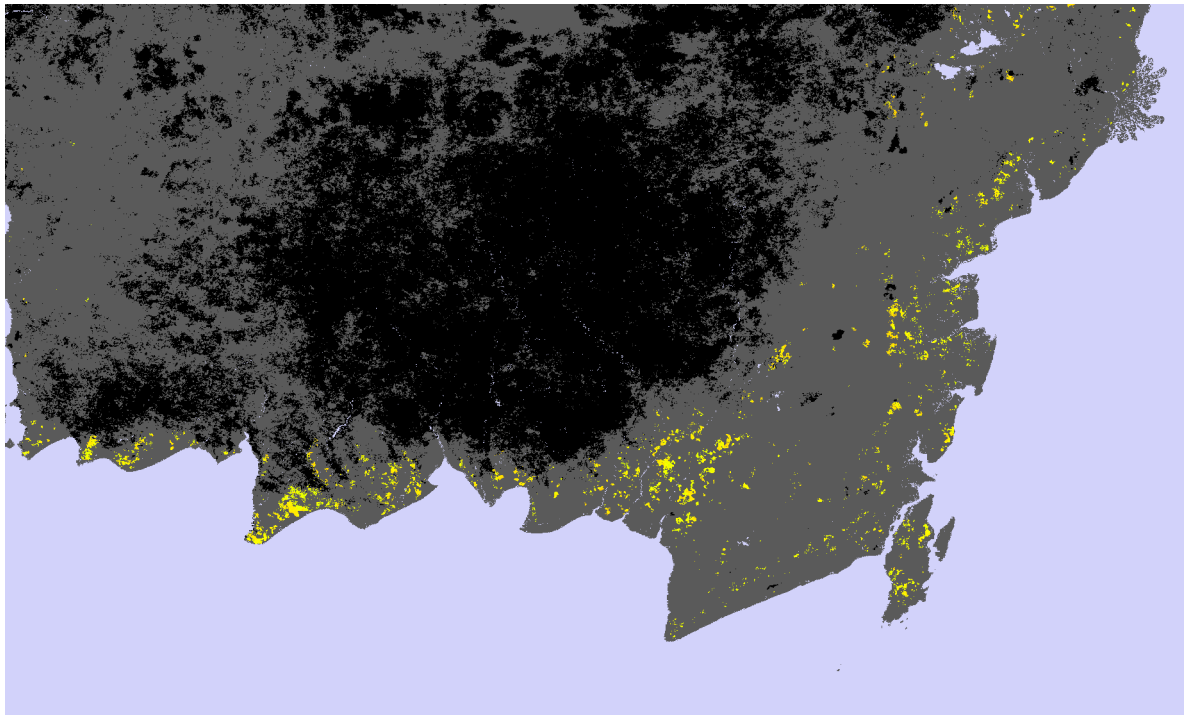


C7 Beta

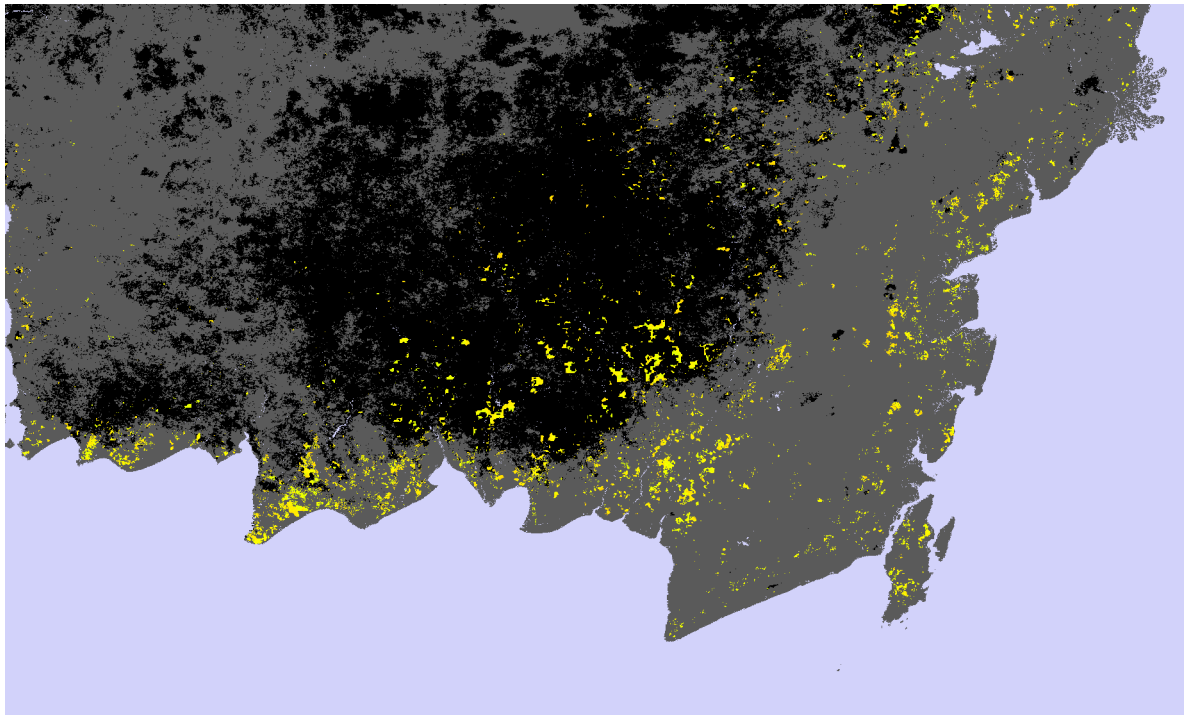


Borneo, September 2015

C6.1

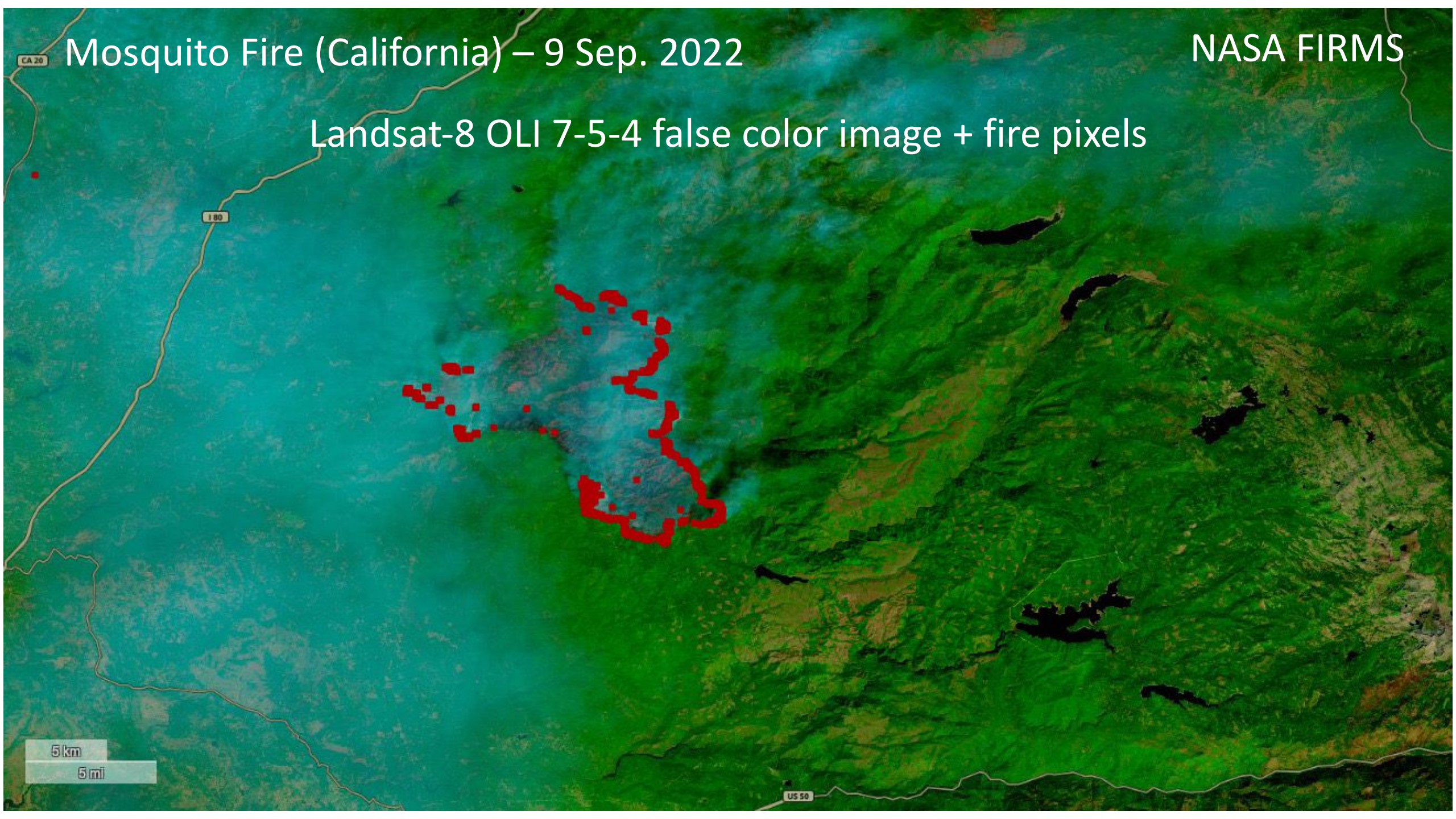


C7 Beta



Landsat OLI Active Fire Products

- Active Fire
  - NASA/USFS/NOAA-sponsored implementation of modified Schroeder et al. (2016) algorithm running at USGS
  - Fire data distributed through NASA's FIRMS
  - Product generation will migrate to NASA during the next year
  - Code/algorithm updates in progress


Mosquito Fire (California) – 9 Sep. 2022
NASA FIRMS
Landsat-8 OLI 7-5-4 false color image + fire pixels
CA 20
I 80
US 50
5 km
5 mi

VIIRS Near Real-Time Burned Area Product

- Map burning through present day on at least a daily basis
- Inputs
  - 375-VIIRS active fire observations
  - 375-m/750-m corrected reflectance or surface reflectance + quality flags
  - Land cover type
- Interrogate time series to continuously re-evaluate conditional probability that a given location recently burned
- Update probabilities back in recent time (i.e., wait a few days and map will generally get better)
- Sacrifice some burns for sake of speed/data volume
- Optimized for FIRMS

Pilot tile: California

Long-Term AVHRR Burned Area Data Sets

Global Change Biology (2005) **11,** 1537–1555, doi: 10.1111/j.1365-2486.2005.001003.x

Characterizing interannual variations in global fire calendar using data from Earth observing satellites

CÉSAR CARMONA-MORENO*, ALAN BELWARD*, JEAN-PAUL MALINGREAU†, ANDREW HARTLEY*, MARIA GARCIA-ALEGRE*, MIKHAIL ANTONOVSKIY‡, VICTOR BUCHSHTABER§ and VICTOR PIVOVAROV§

*European Commission, Joint Research Centre, Global Vegetation Monitoring Unit, Institute for Environment and Sustainability, TP. 440, 21020 Ispra (VA), Italy, †European Commission, Joint Research Centre, SDM85, Brussels, Belgium, ‡Institute of Global Climate and Ecology, 107258, Moscow, st. Glebovskaya 20-b, Russia, §National Russian Research Institute of Physical-Technical and Radiotechnical Measurements, 141570 Moscow region, Solnechnogorsky raion, p.Mendeleevo, Russia

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Remote Sensing of Environment xx (2006) xxx–xxx

www.elsevier.com/locate/rse

Burned area forecasting using past burned area records and Southern Oscillation Index for tropical Africa (1981–1999)

D. Riaño [a,b,*], J.A. Moreno Ruiz [a,c], J. Barón Martínez [c], S.L. Ustin [a]

[a] *Center for Spatial Technologies and Remote Sensing (CSTARS), University of California, 250-N, The Barn, One Shields Avenue, Davis, CA 95616-8617, USA*
[b] *Departamento de Geografía, Universidad de Alcalá, Colegios 2, E-28801 Alcalá de Henares, Madrid, Spain*
[c] *Departamento de Lenguajes y Computación, Universidad de Almería, 04120 Almería, Spain*

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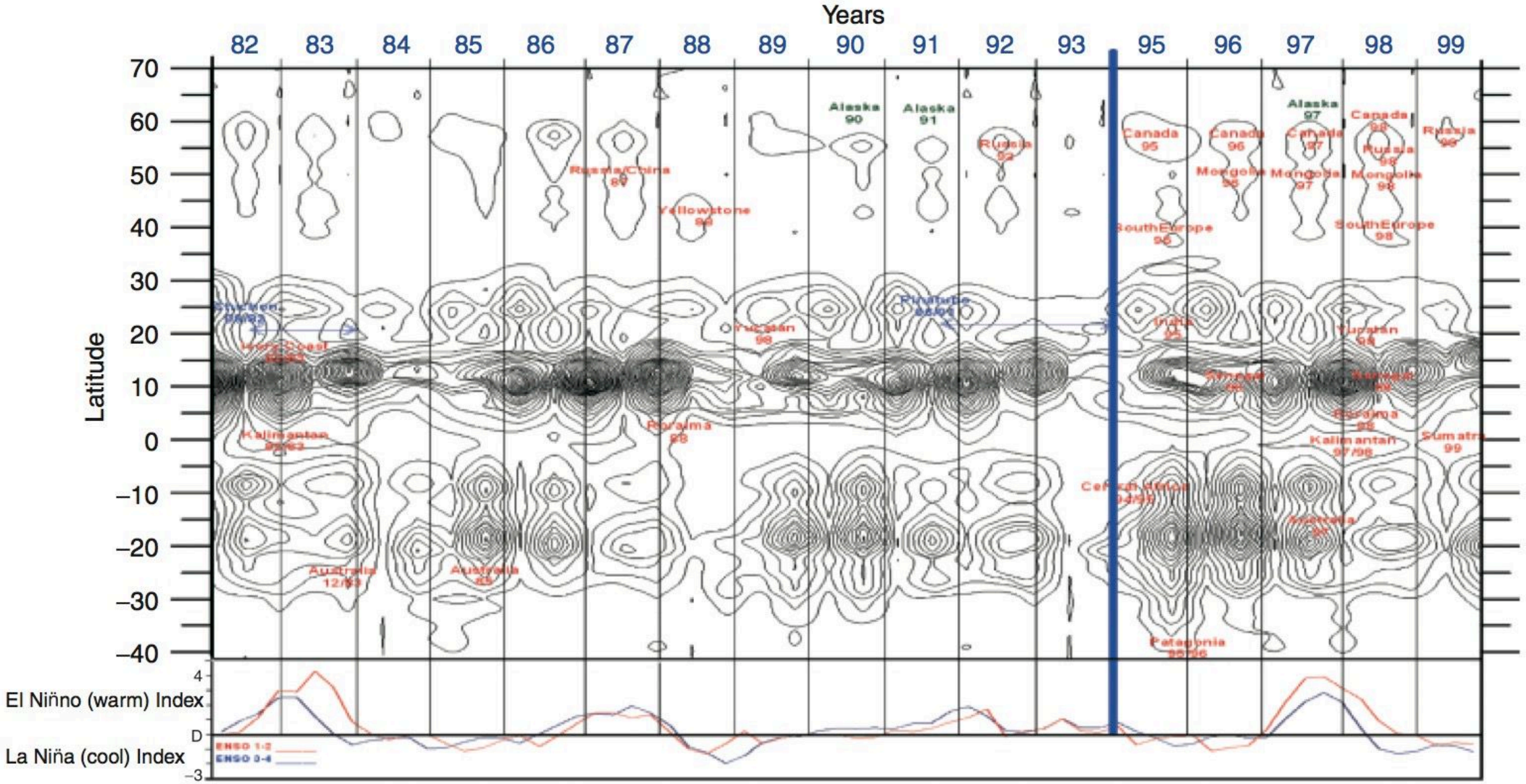
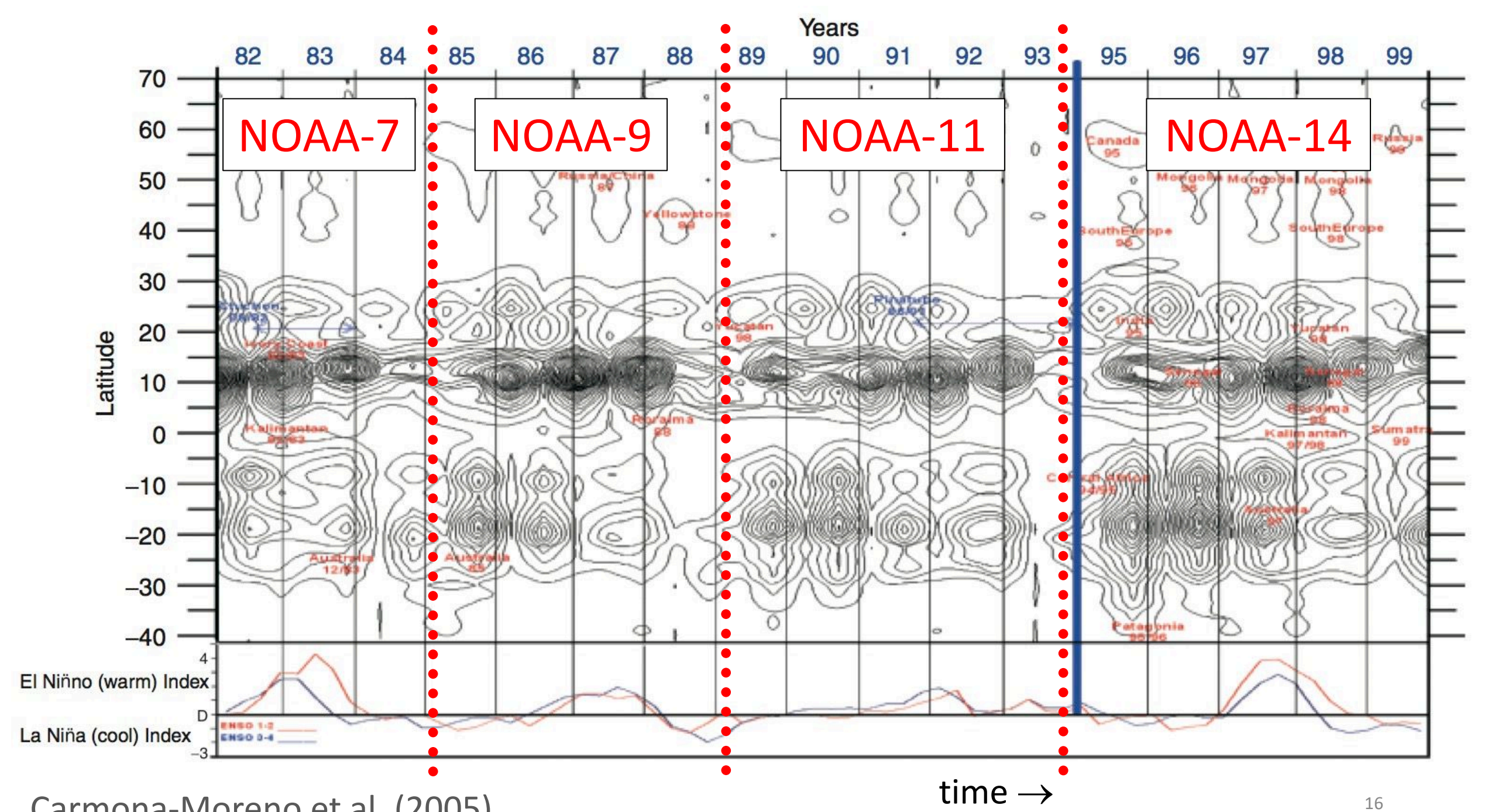
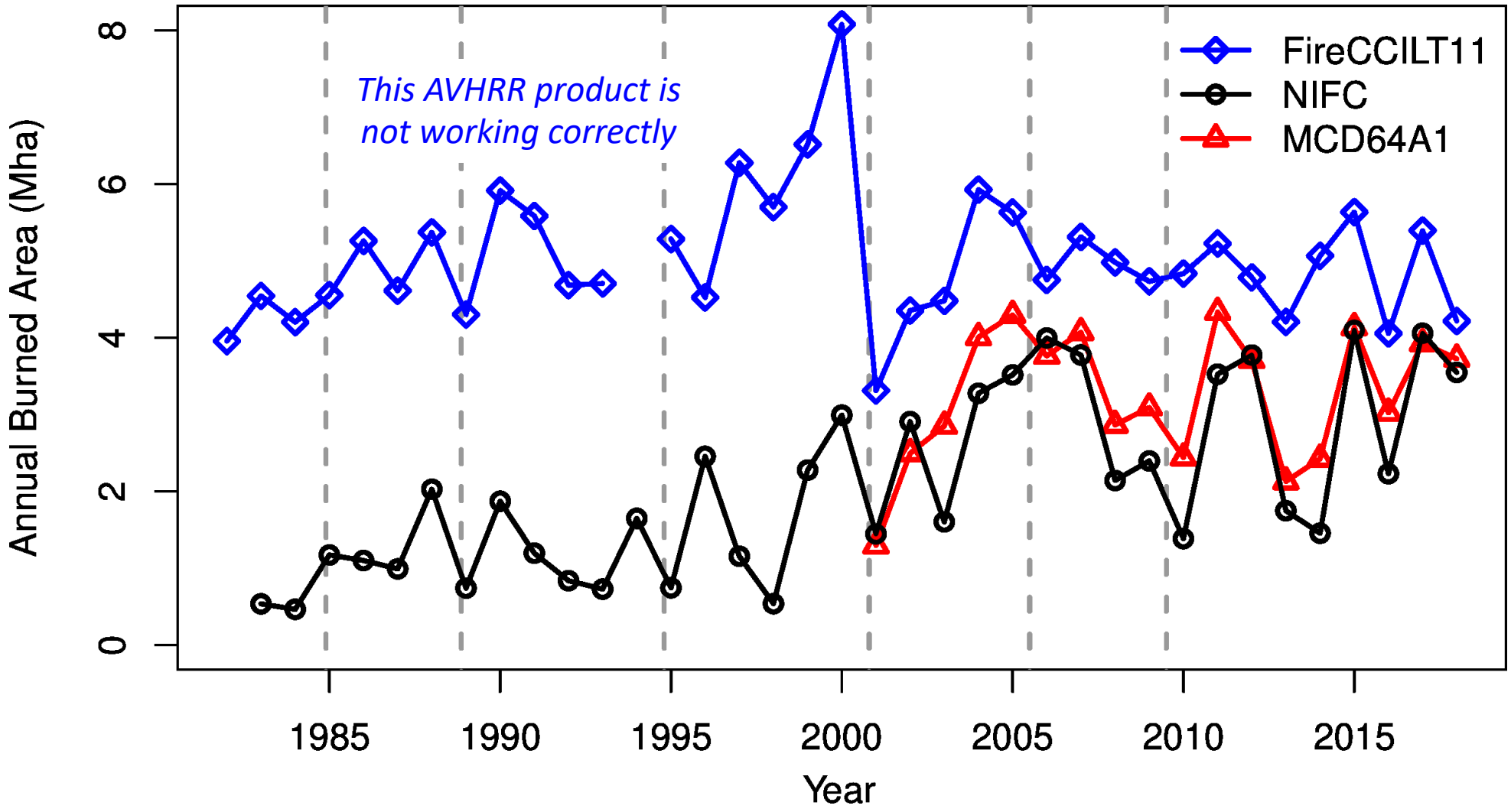


time →

Carmona-Moreno et al. (2005)



Carmona-Moreno et al. (2005)

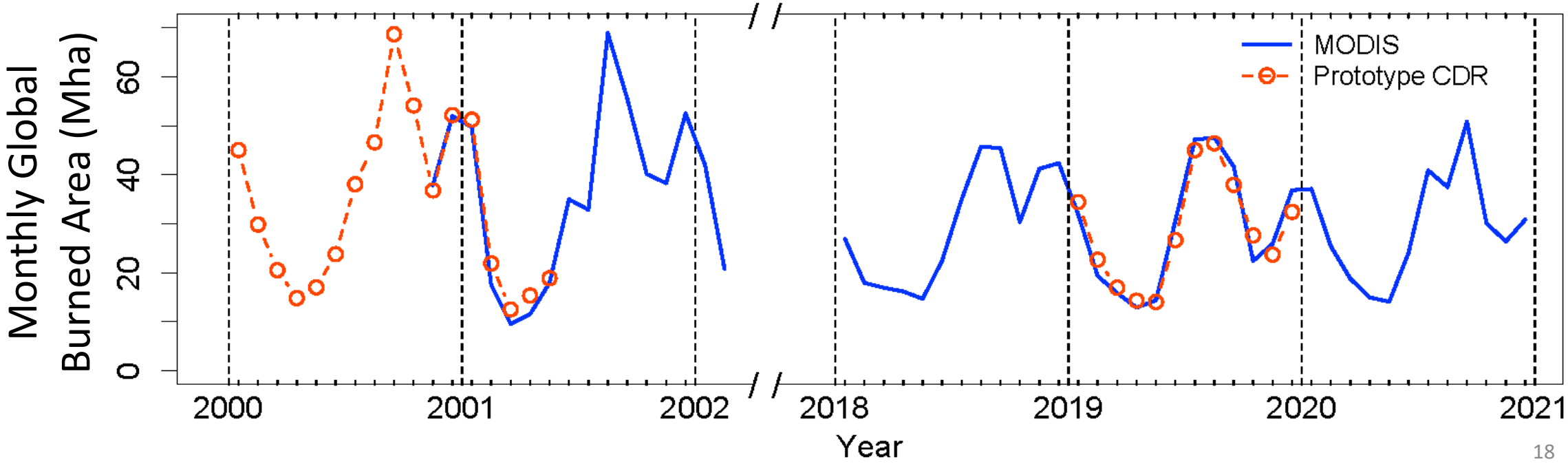


U.S. annual burned area as reported by the **AVHRR-based FireCCILT11** product, the **MODIS burned area product**, and as compiled by the U.S. National Interagency Fire Center (NIFC)

Giglio and Roy (2022)

Long-Term AVHRR Burned Area Product

- Gridded monthly global product spanning late 1978 through 2021
- Generate, quality assess, and validate the first consistent, continuous long-term AHRR-based global burned area Climate Data Record (CDR)
- Designed to avoid the many sensor- and satellite-related issues that have confounded previous attempts



Grazie!