

Daniel Kinalczyk, Matthias Forkel, Jos de Laat, Niels Andela, Dave van Wees

# Estimating Fuels and Fire Emissions in Near Real Time (NRT) in African Savannahs

# Sense4Fire

## Previous Results



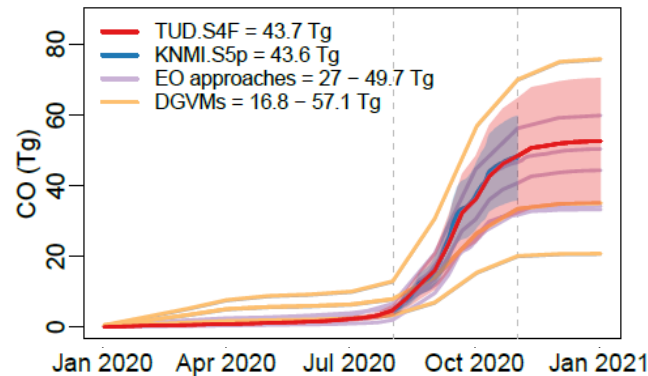
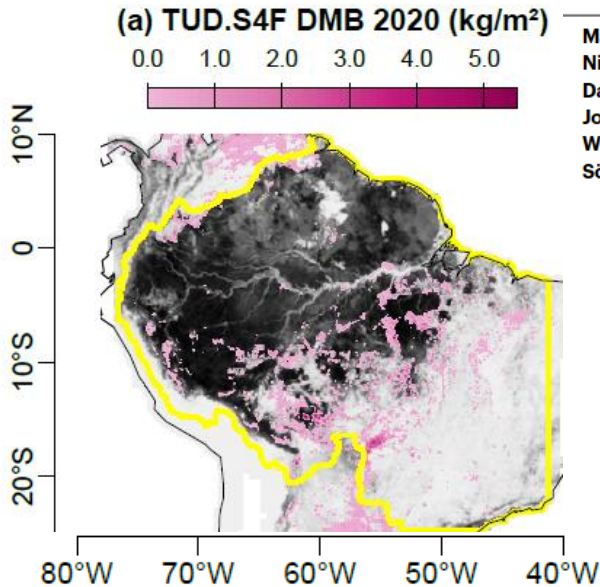
nature geoscience

Article

<https://doi.org/10.1038/s41561-024-01637-5>

### Burning of woody debris dominates fire emissions in the Amazon and Cerrado

Matthias Forkel<sup>1</sup>, Christine Wessollek<sup>1</sup>, Vincent Huijnen<sup>2</sup>, Niels Andela<sup>3</sup>, Adrianus de Laat<sup>2</sup>, Daniel Kinalczyk<sup>1</sup>, Christopher Marrs<sup>1</sup>, Dave van Wees<sup>3,4</sup>, Ana Bastos<sup>5</sup>, Philippe Ciais<sup>6</sup>, Dominic Fawcett<sup>7</sup>, Johannes W. Kaiser<sup>8</sup>, Carine Klauberg<sup>9</sup>, Erico Kutchartt<sup>10,11</sup>, Rodrigo Leite<sup>12</sup>, Wei Li<sup>13</sup>, Carlos Silva<sup>9</sup>, Stephen Sitch<sup>14</sup>, Jefferson Goncalves De Souza<sup>14</sup>, Sönke Zaehle<sup>15</sup> & Stephen Plummer<sup>16</sup>



### Geophysical Research Letters

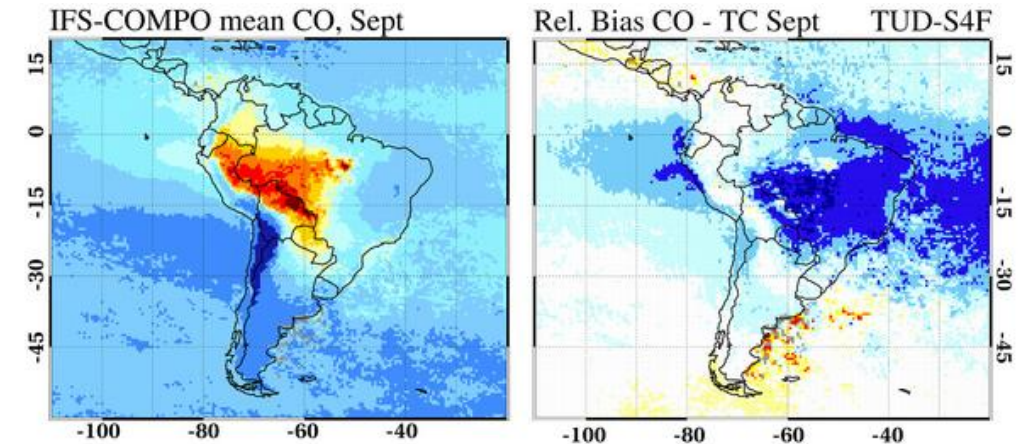
Research Letter | [Open Access](#) |

### Sentinel-5p Reveals Unexplained Large Wildfire Carbon Emissions in the Amazon in 2024

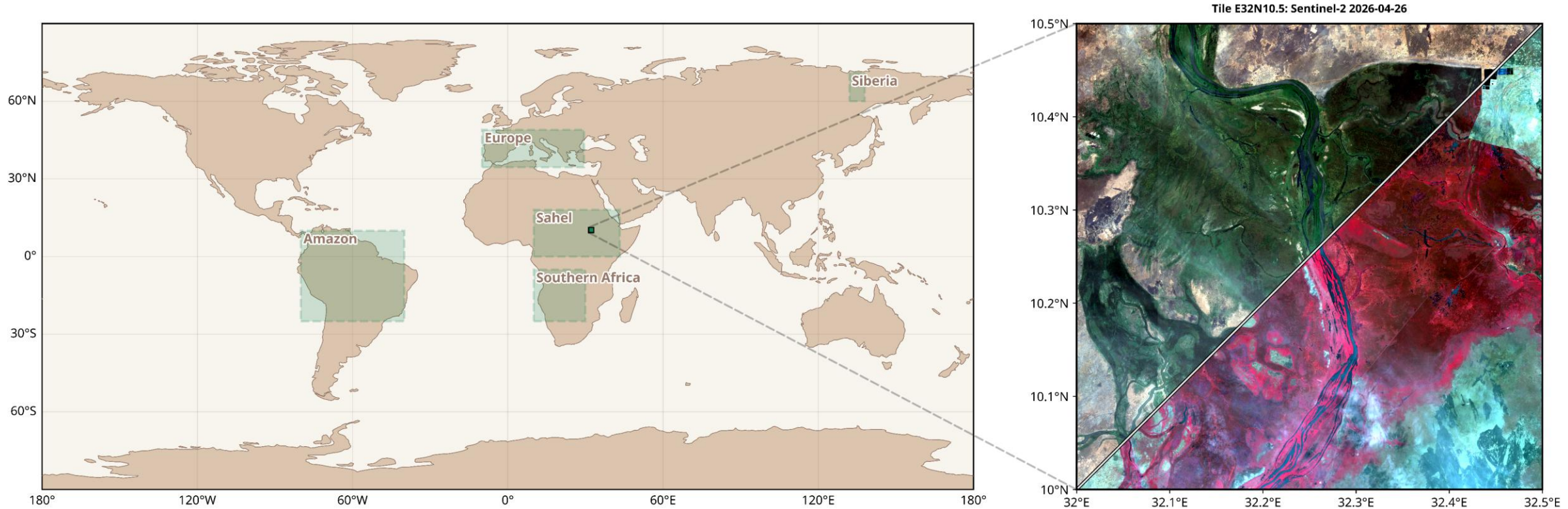
[A. T. J. de Laat](#), [N. Andela](#), [M. Forkel](#), [V. Huijnen](#), [D. Kinalczyk](#), [D. van Wees](#)

First published: 04 March 2026 | <https://doi.org/10.1029/2025GL115123> | [VIEW METRICS](#)

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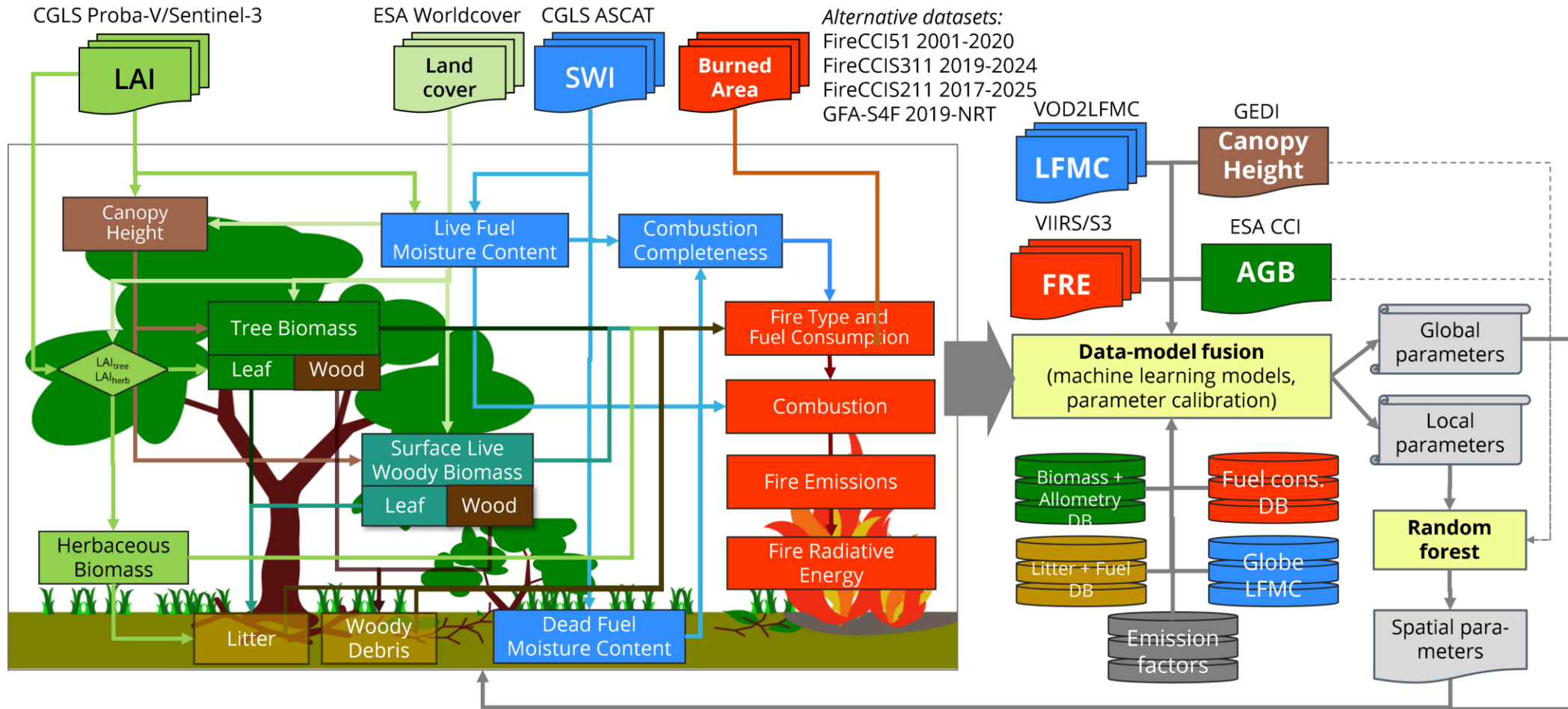


# Sense4Fire Study Regions



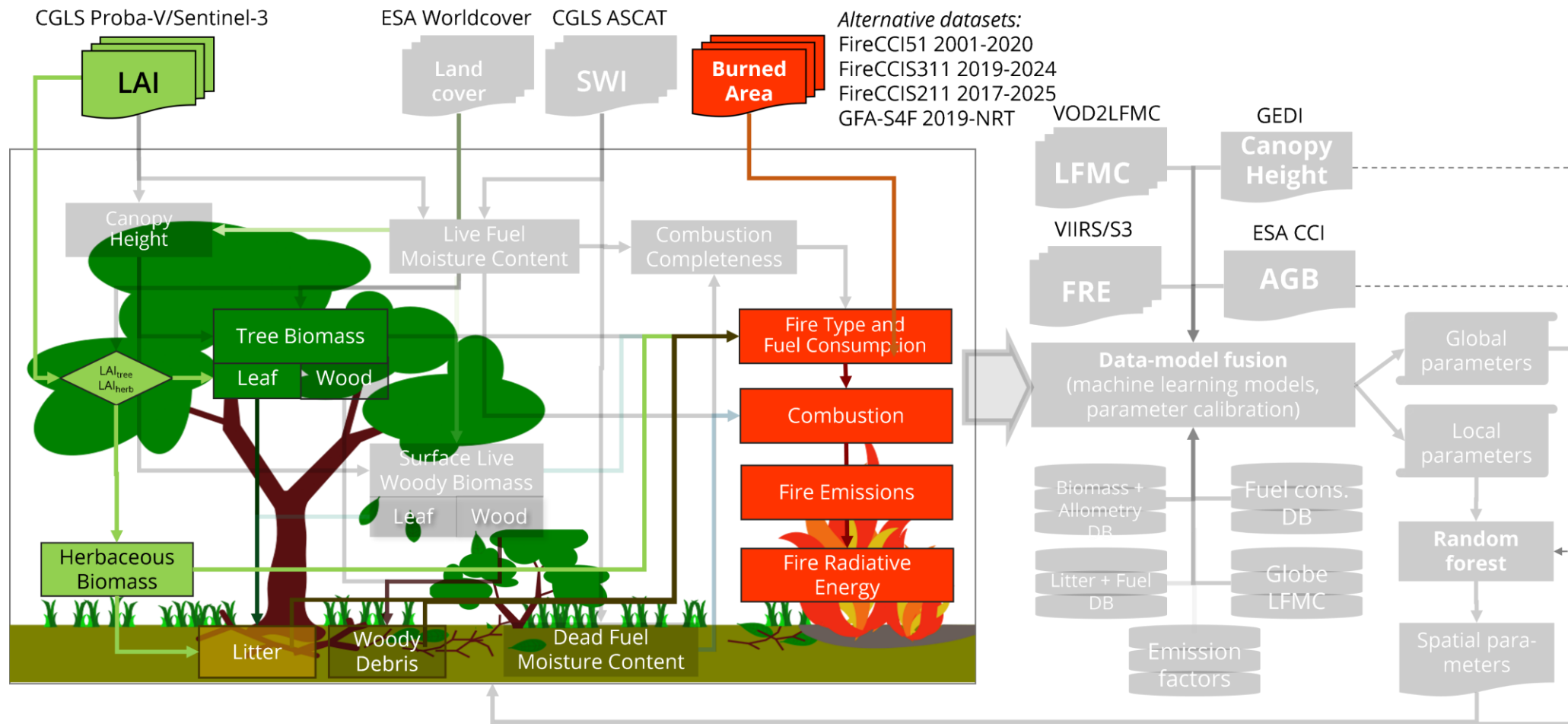
EPSG: 4326

# TUD-S4F Model



# TUD-S4F Model

## Near Real-Time Requirements



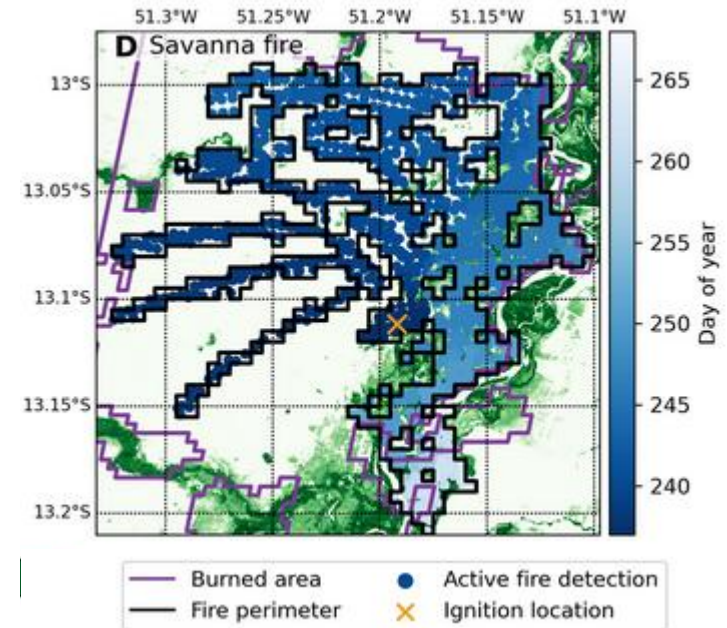
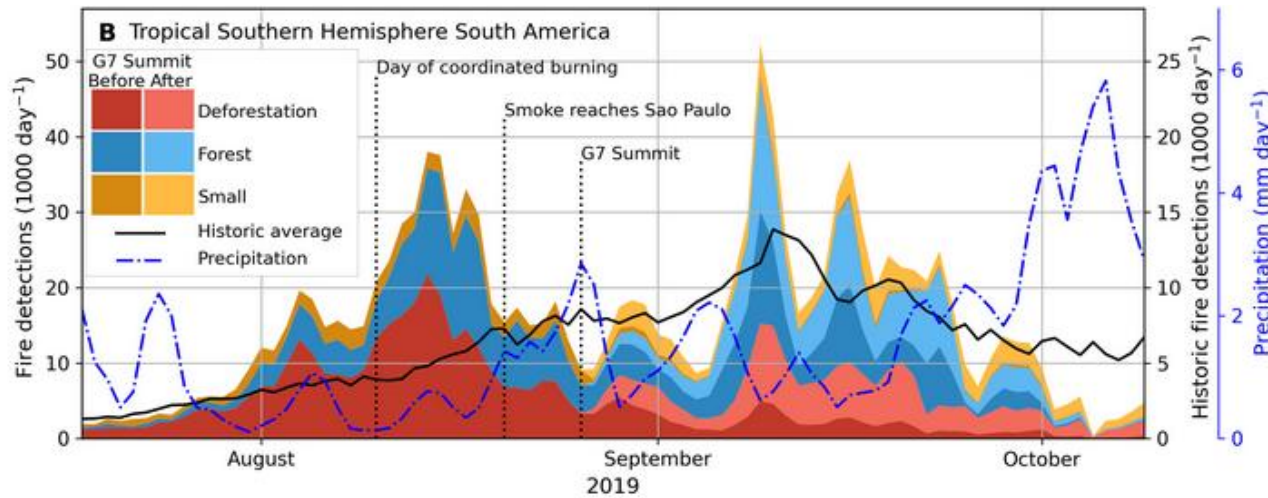
# NRT Burned Area (GFA-S4F)

SCIENCE ADVANCES | RESEARCH ARTICLE

## CLIMATOLOGY

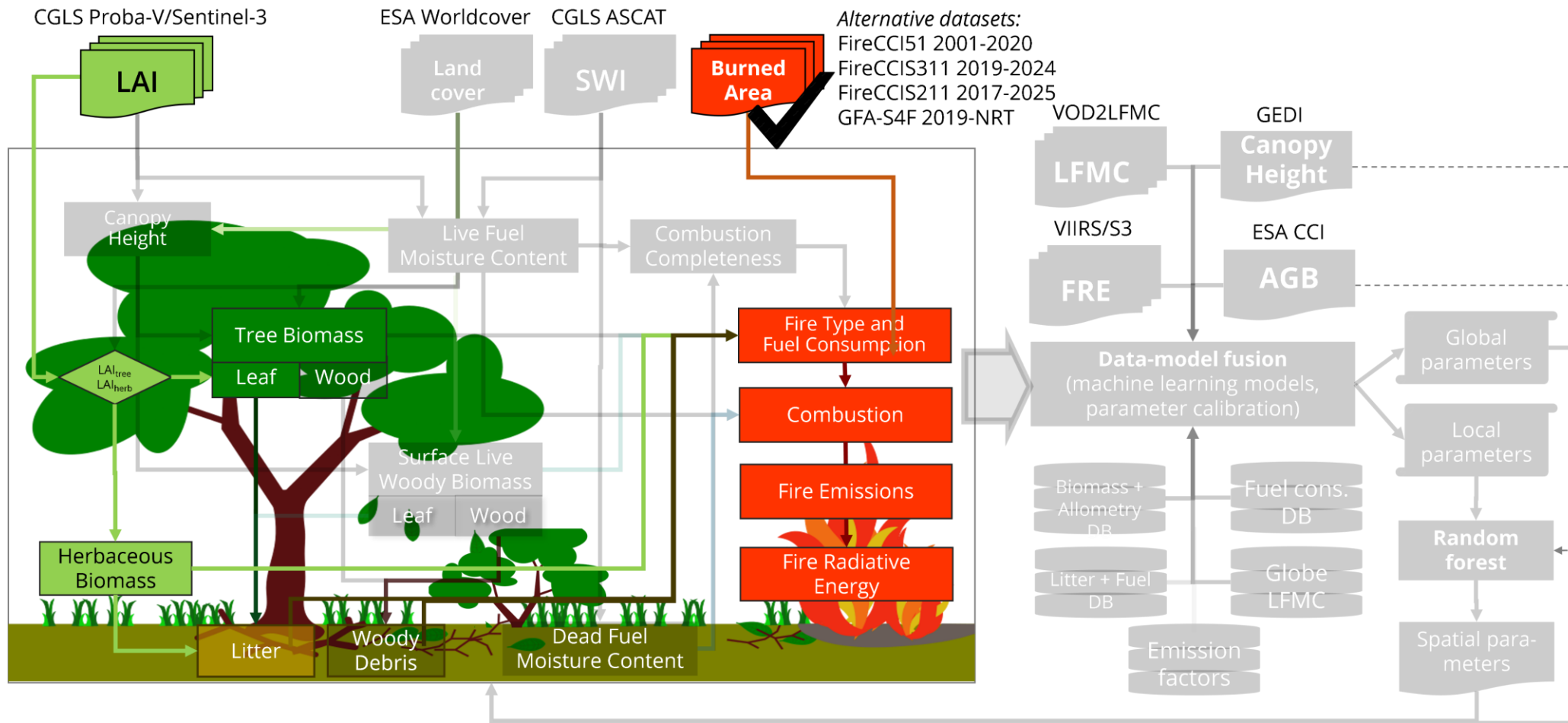
# Tracking and classifying Amazon fire events in near real time

Niels Andela<sup>1,2\*</sup>, Douglas C. Morton<sup>3</sup>, Wilfrid Schroeder<sup>4</sup>, Yang Chen<sup>5</sup>, Paulo M. Brando<sup>5,6,7</sup>, James T. Randerson<sup>5</sup>

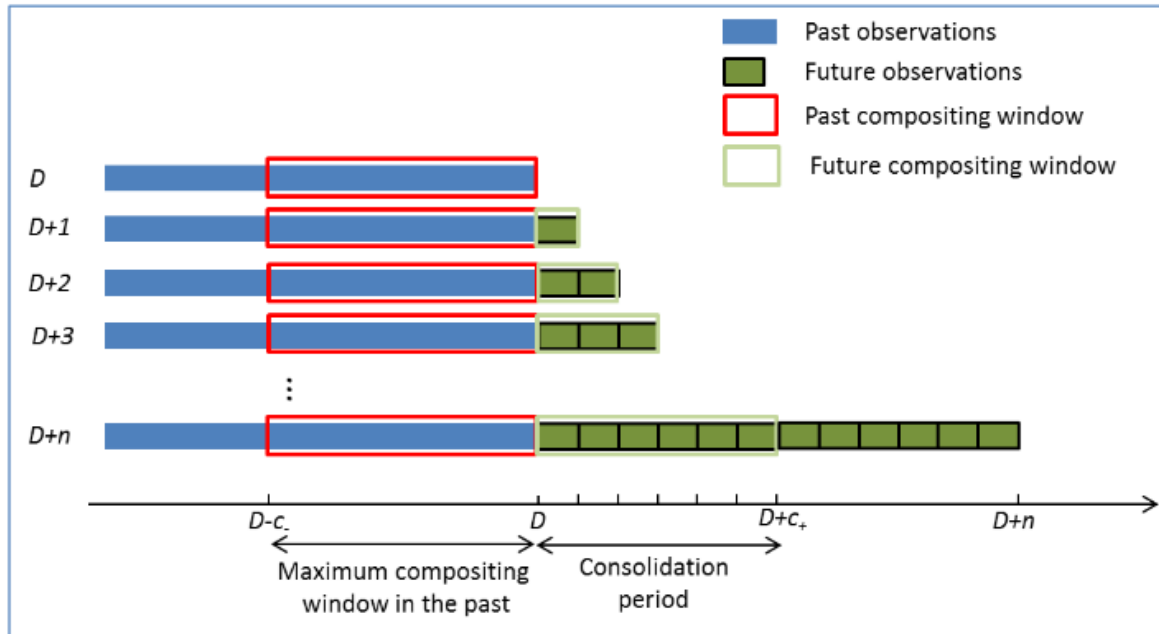


# TUD-S4F Model

## Near Real-Time Requirements



# CGLS Leaf Area Index

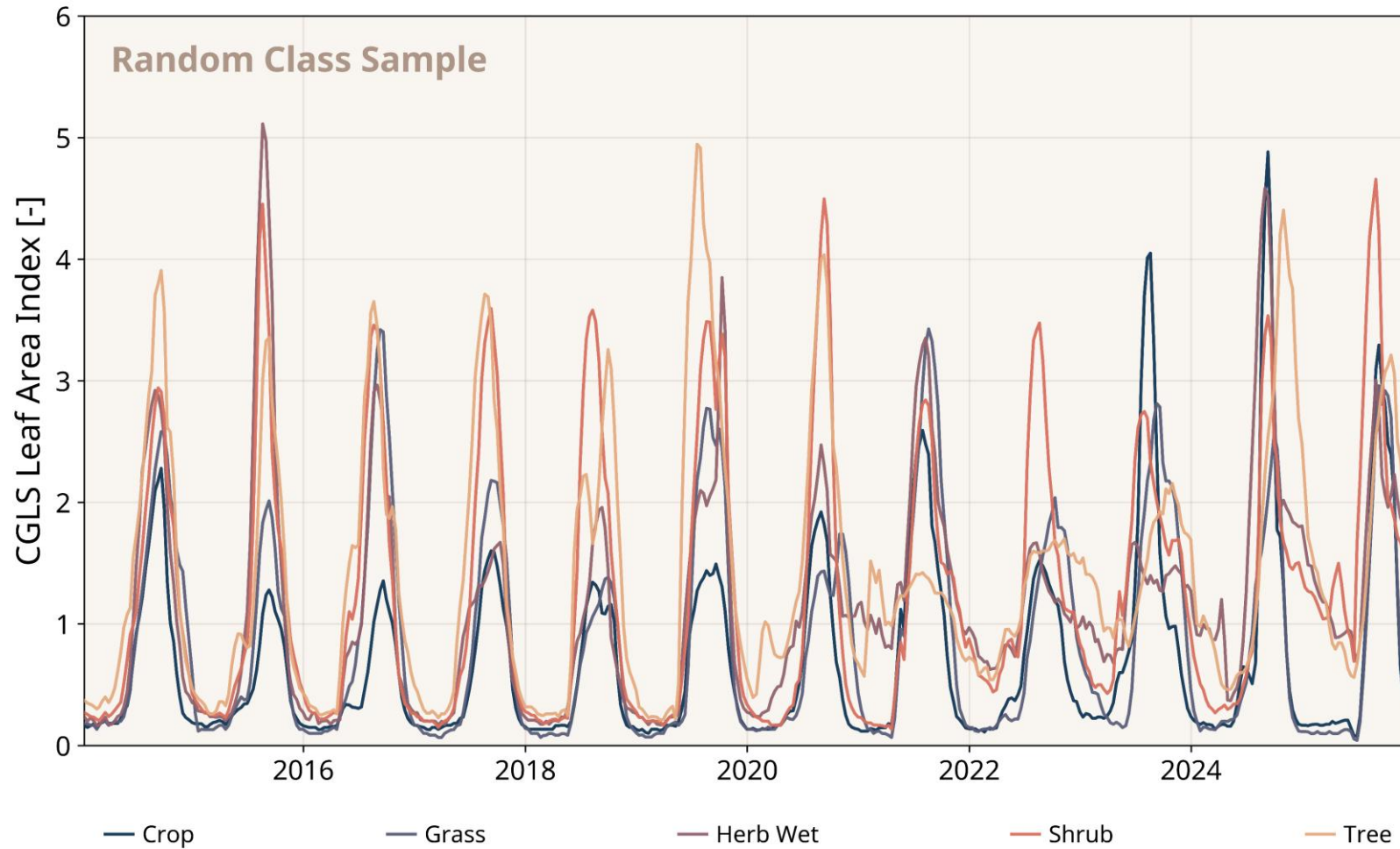


© CGLS LAI 300m ATBD 2022

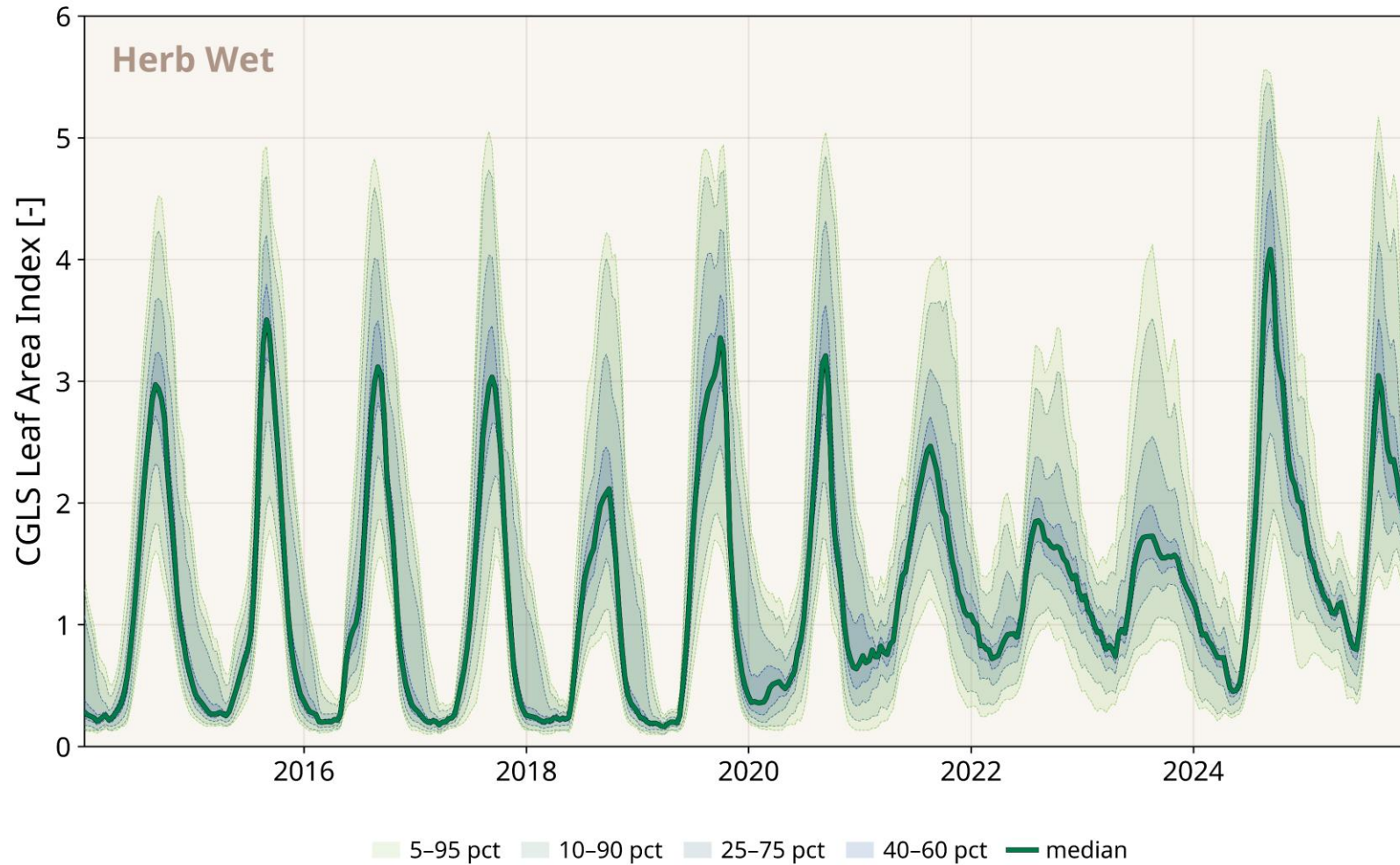
- per pixel algorithm (time-series)
- based on previous Sentinel-3 measurements (60 or 210 days depending on EBF)
- Real Time (RT0) product subject to spatial gaps and noise
- final product 60 days later (RT6) considering 60 days after the decadal

## S4F NRT Requirement: Forecast the CGLS LAI RT6 product

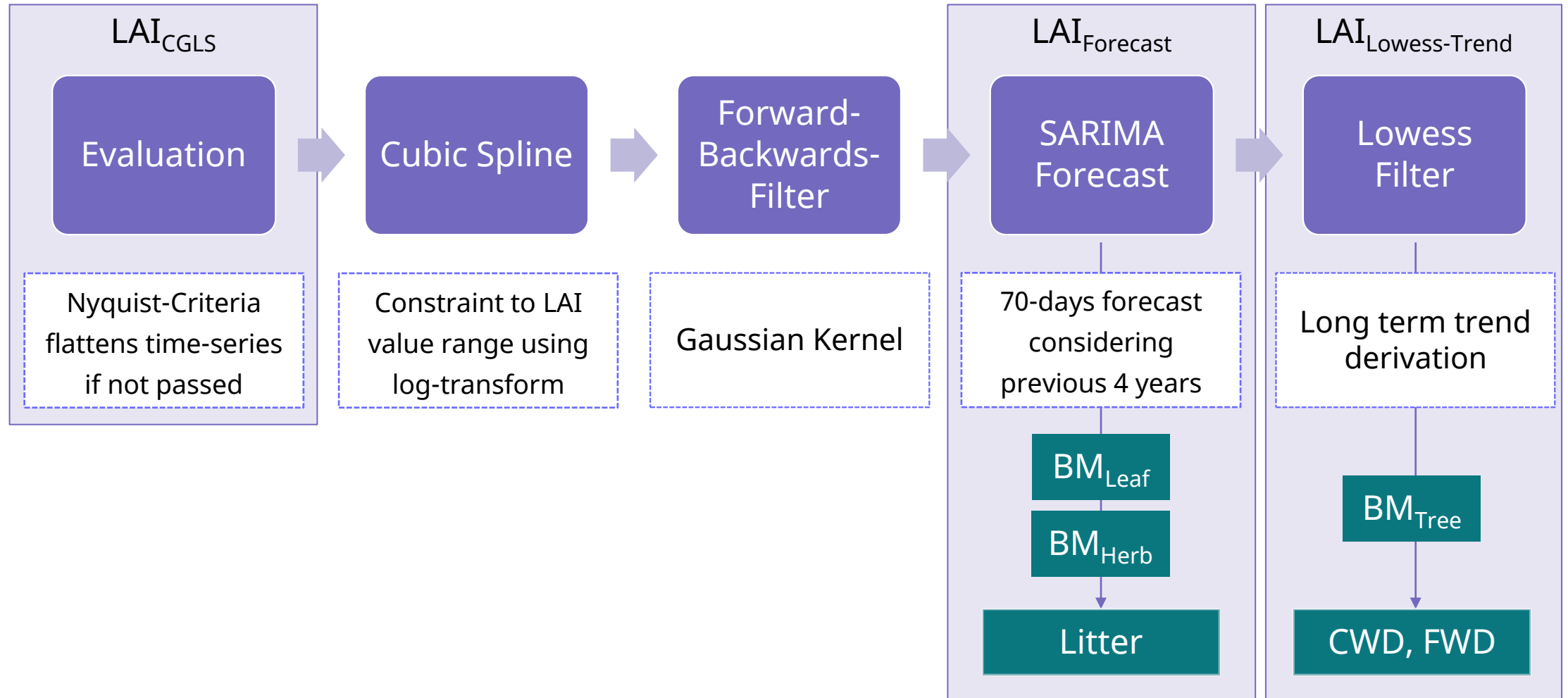
# CGLS Leaf Area Index (LAI)



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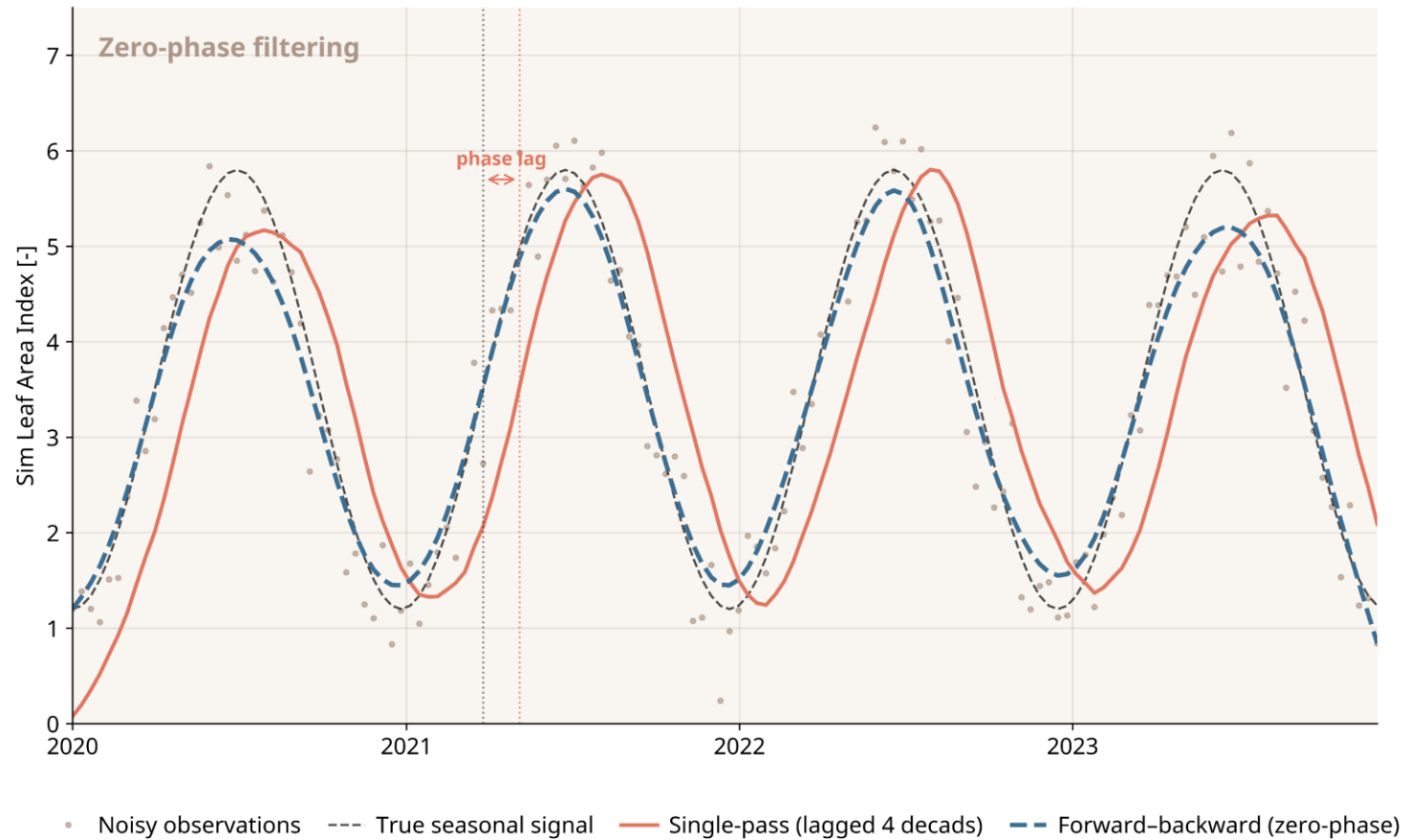


# Processing Pipeline



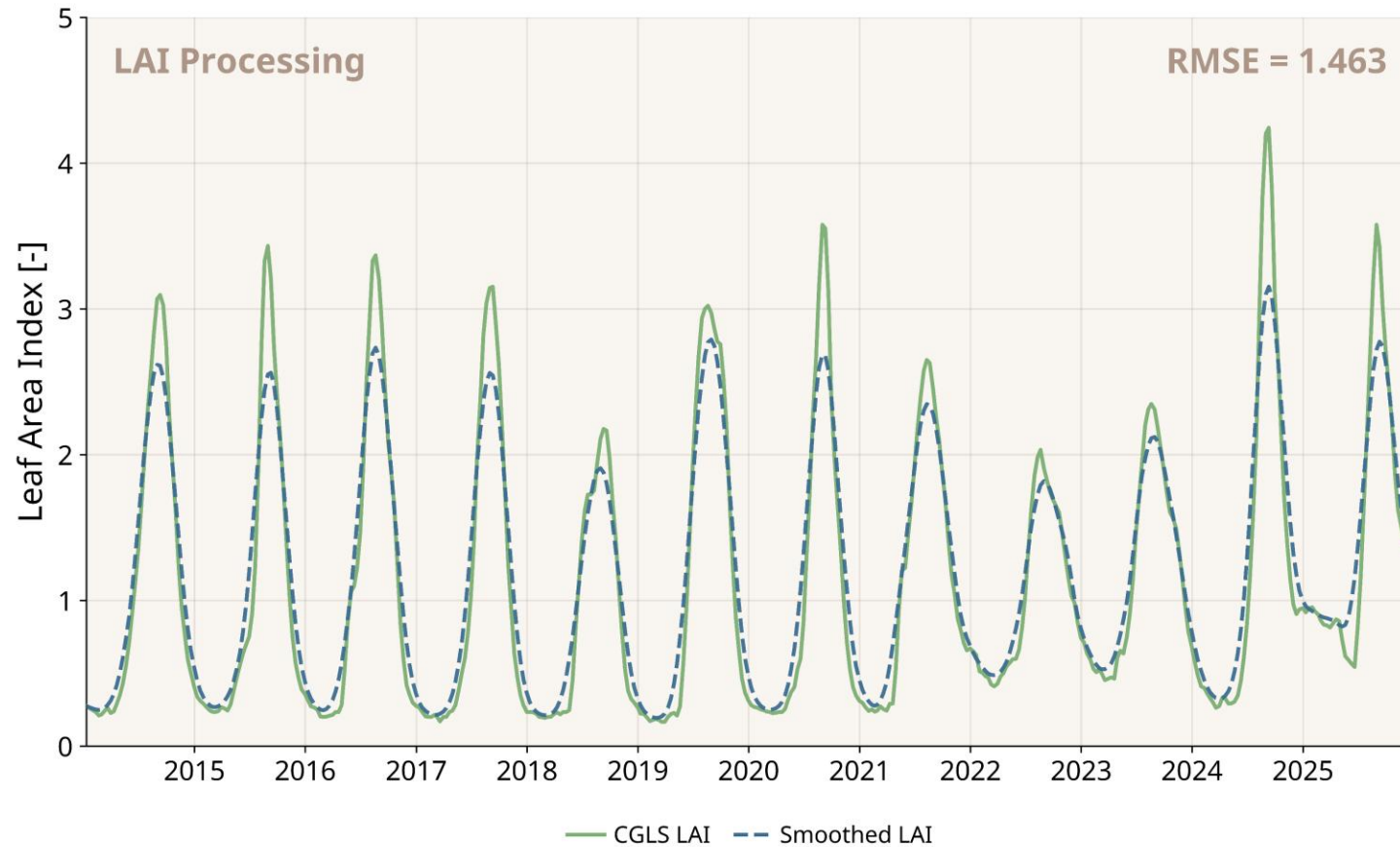
# Processing Pipeline

## Forward-Backwards-Filter



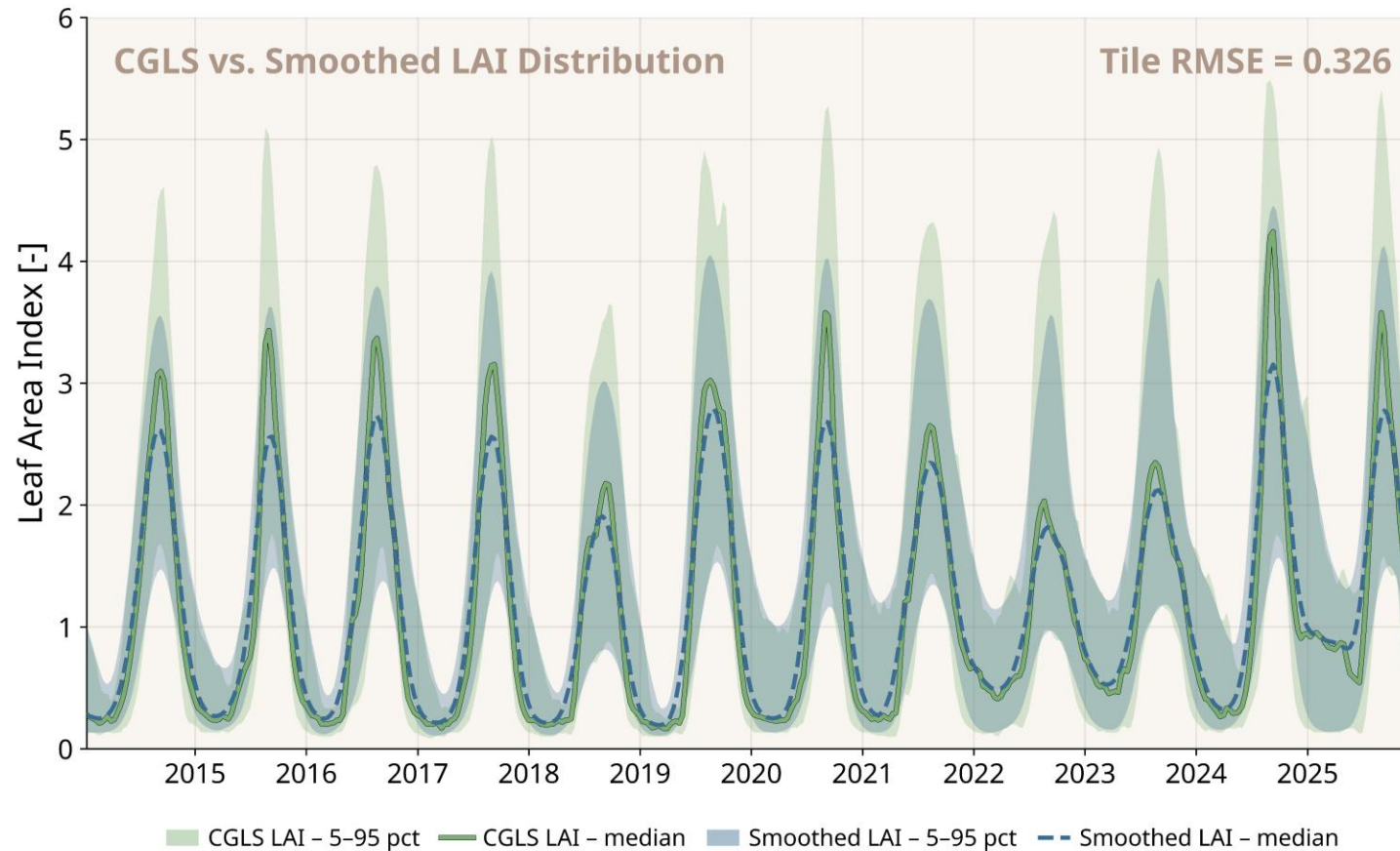
- uni-directional filtering introduces phase lag
- decadal aggregation would consider values too early
- Fwd-Bwd-Filter preserves correct seasonality

# Processing Pipeline Results



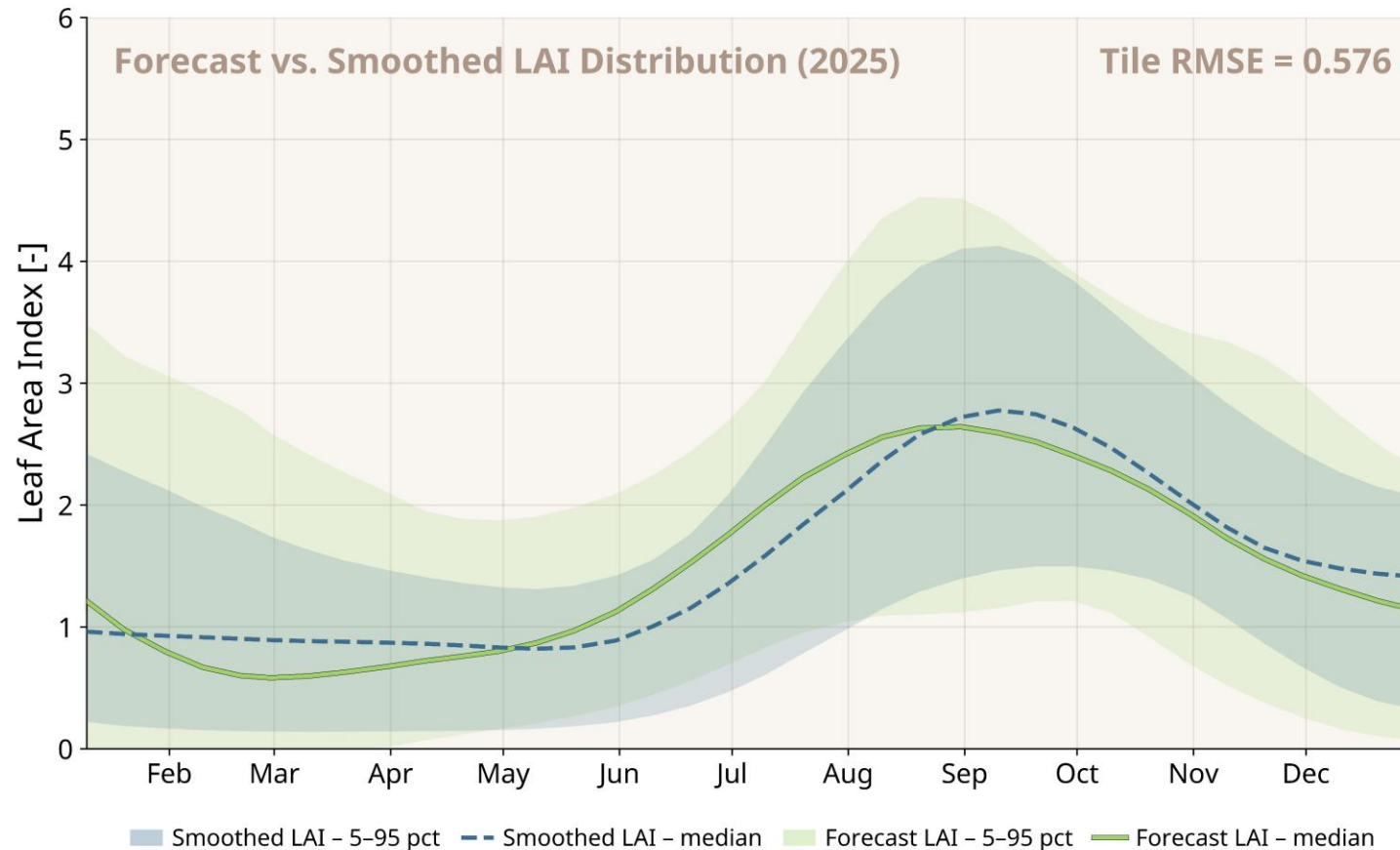
- lower value range end well captured
- local max values sometimes under-estimated
- most likely reason is the chosen kernel (standard Gaussian)

# Processing Pipeline Results



- across the whole tile RMSE drops significantly
- underestimation of local maxima stay

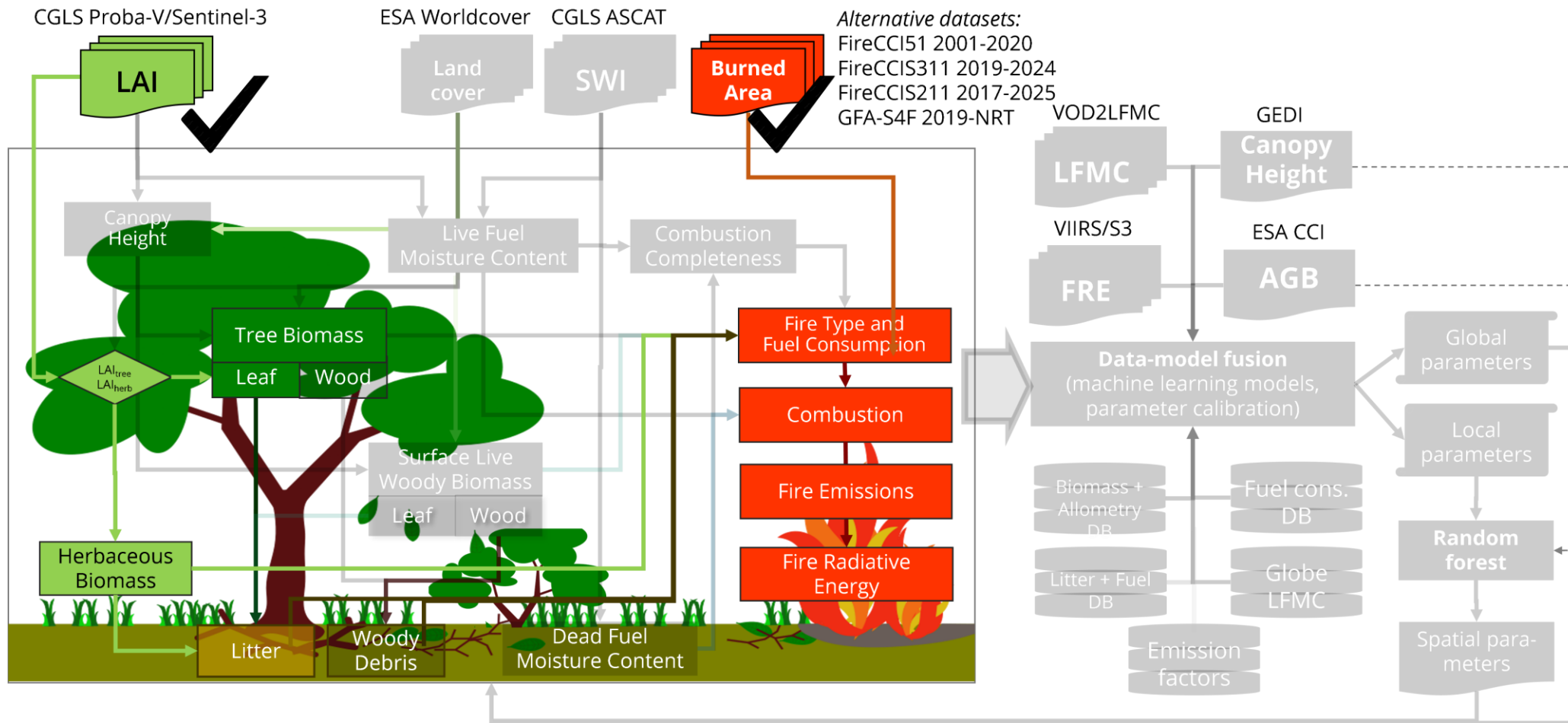
# Forecast Evaluation



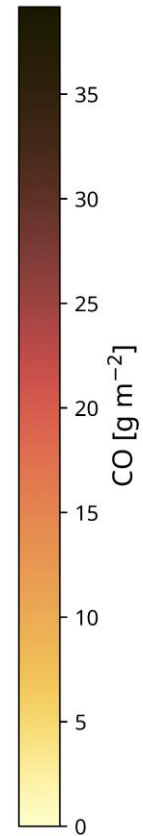
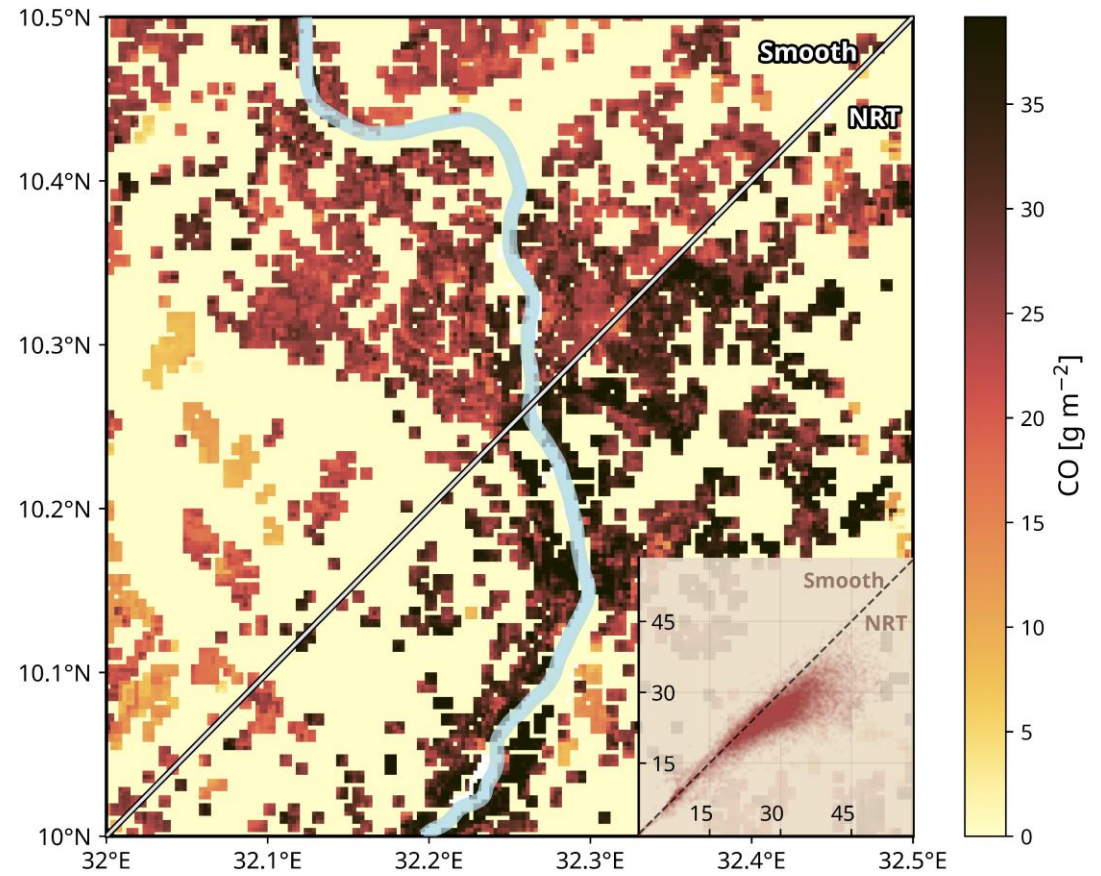
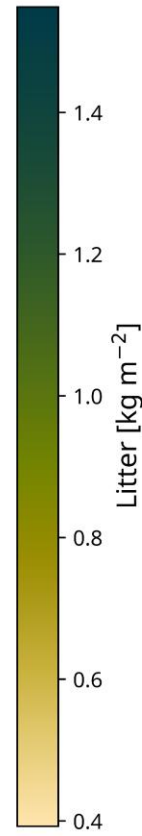
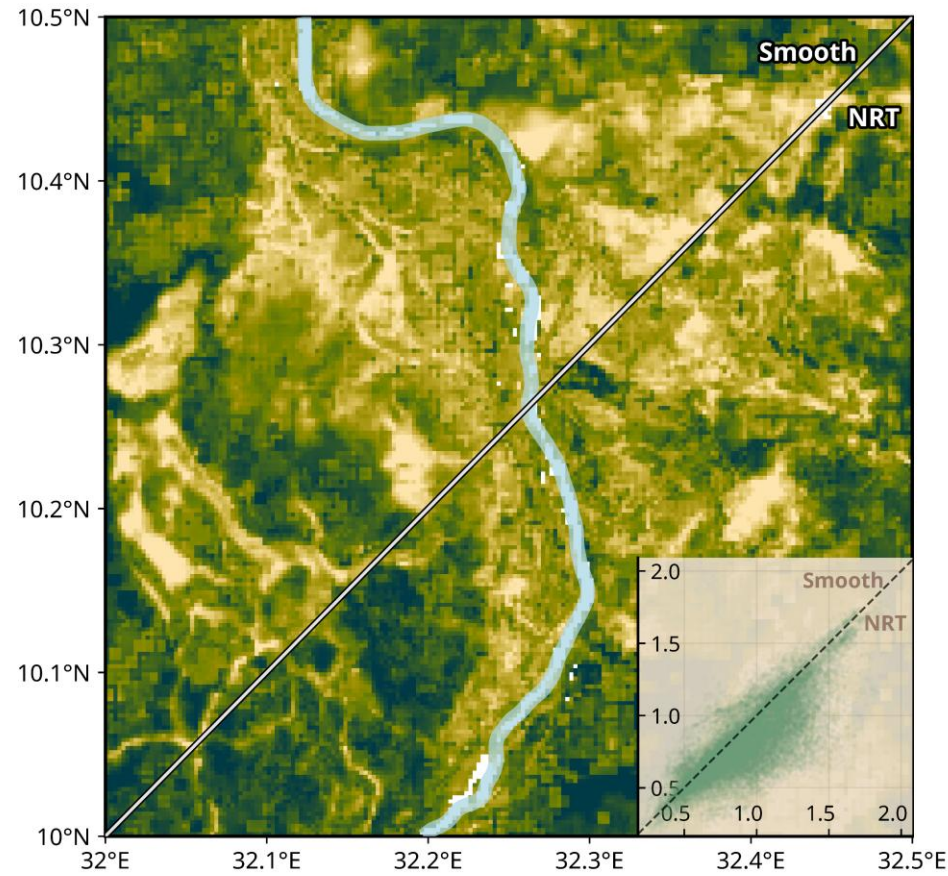
- lower value range well captured
- local max values slightly under-estimated
- slight seasonal shift

# TUD-S4F Model

## Near Real-Time Requirements



# Near Real-Time Results



# Wrap-Up

- NRT litter and emissions are slightly underestimated
- reason most likely is a combination of kernel choice and forecast being phased
- NRT computation time depends on region, for Sense4Fire Sahel region ~6 days
- improvements might be possible by time-series clustering
- fuel & emission estimates in high resolution →

