Imperial College London

Met Office

Making INFERNO

Assessing the role of fires in the earth system by developing a global fire model for the UK Met Office.

A talk by:

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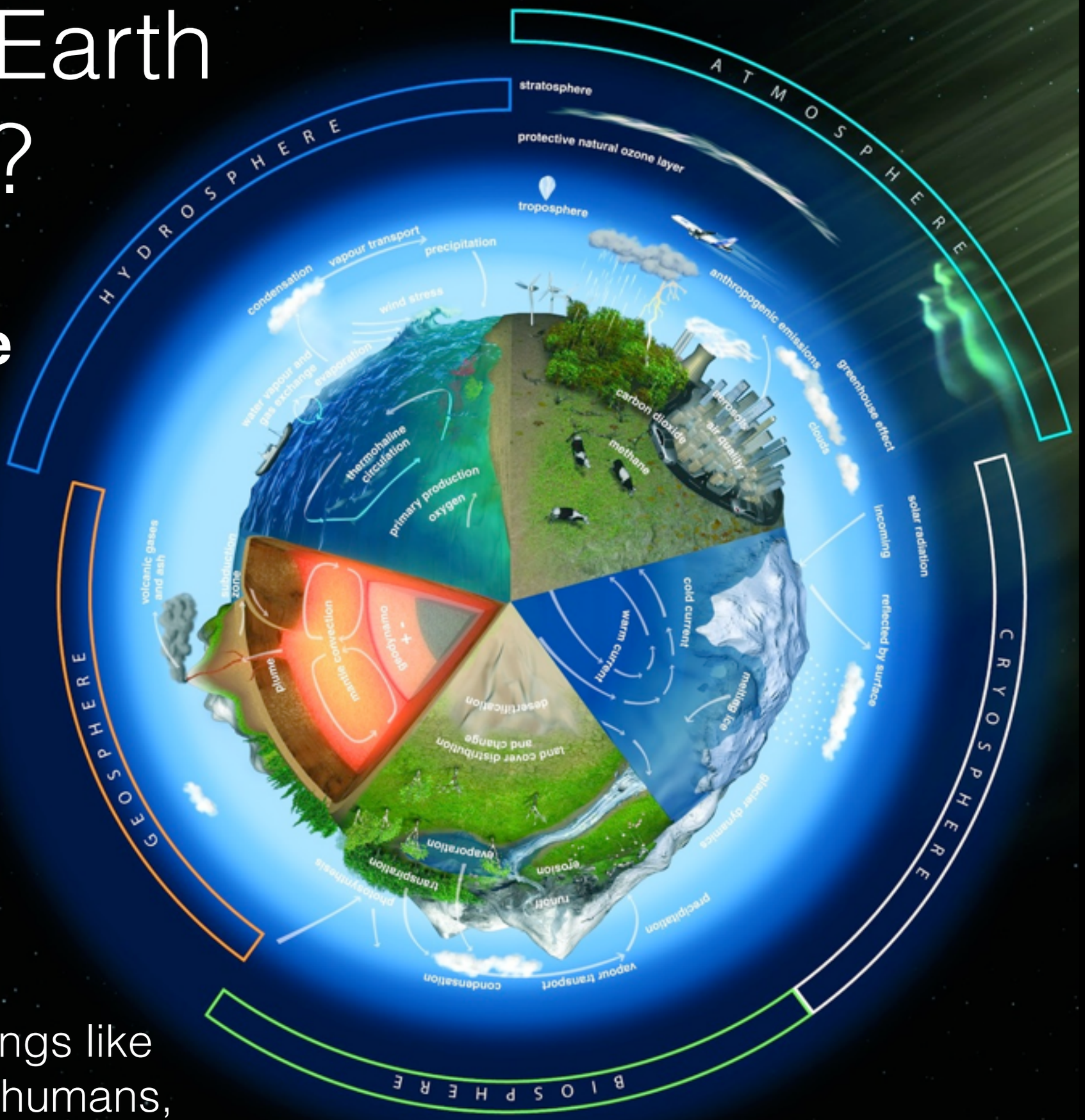
What is the Earth System?

ESM = Climate + **Life**

An ESM expand on a climate model mainly by considering the biosphere

This means including things like biogeochemical cycles, humans, … and **vegetation fires**



What fire does

It burns

It emits gases and aerosols

It threatens life

Yet fire remains an integral part of some ecosystems

Impacts on fire activity

(Anthro-pogenic)

- *Agricultural waste burning*
- *Land use change*
- *Ignition/suppression*

(Climate related)

- *Precipitation*
- *RH*
- *Temperature*
- *Wind*
- *Veg. species composition*
- *Lightning ignition*

LONG-RANGE TRANSPORT

Aerosol Direct Effect

Aerosol Indirect Effects

DRY DEPOSITION

WET DEPOSITION

N_2O

CO_2

CH_4

[OH]

O_3

Smoke contains:
- Greenhouse gases
- Carbonaceous aerosols
- Hydrocarbons and NOx

NMHCs, NOx

Carbon and Nitrogen

Biogeochemical Cycles

Aerosol Deposition on Ice Surfaces

Land Surface Albedo Changes

from Ward et al., 2012

But how can we account for fires?

Presenting the INteractive Fire and Emission algoRithm for Natural envirOnments, or

INFERNO

How does INFERNO work?

Ignitions

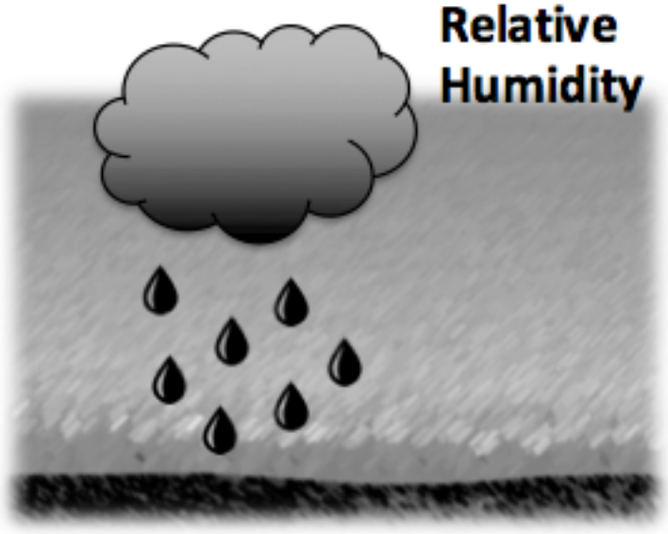
Lightning Strikes

Population Density
(Standalone only)

Flammability

Temperature

Relative Humidity



Fuel Density

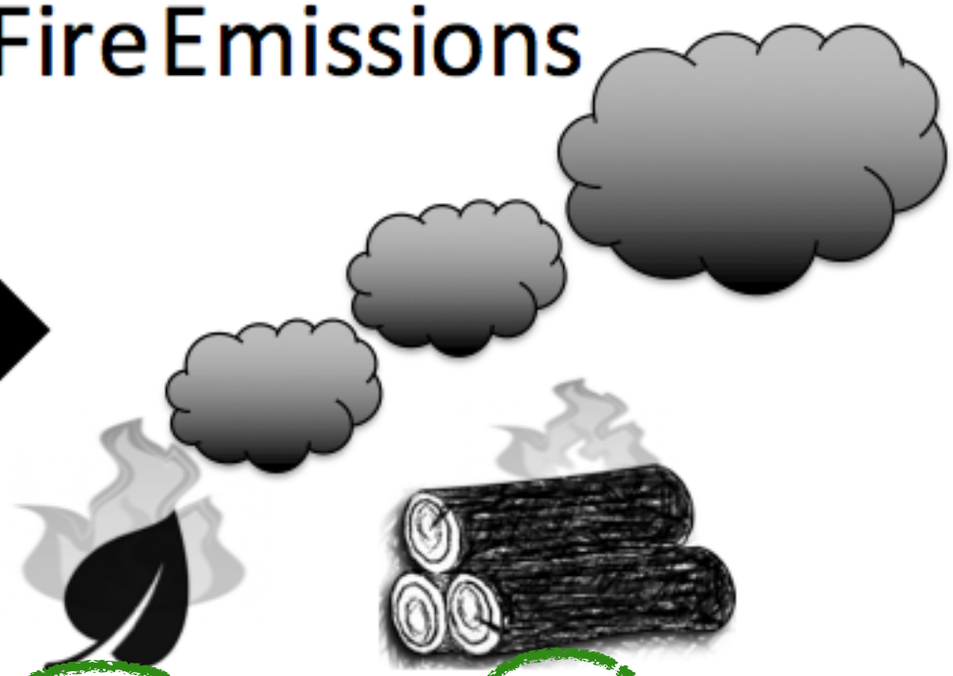
Precipitation and
Soil Moisture

Burnt Area

Grass

Trees

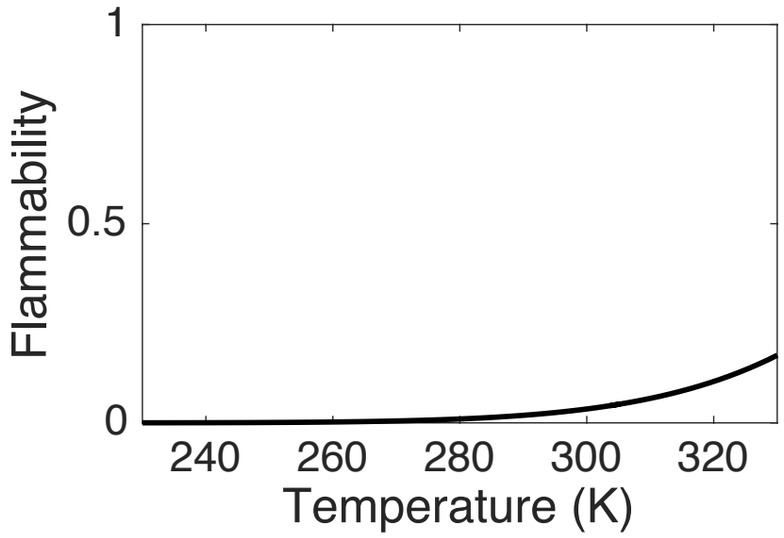
Fire Emissions

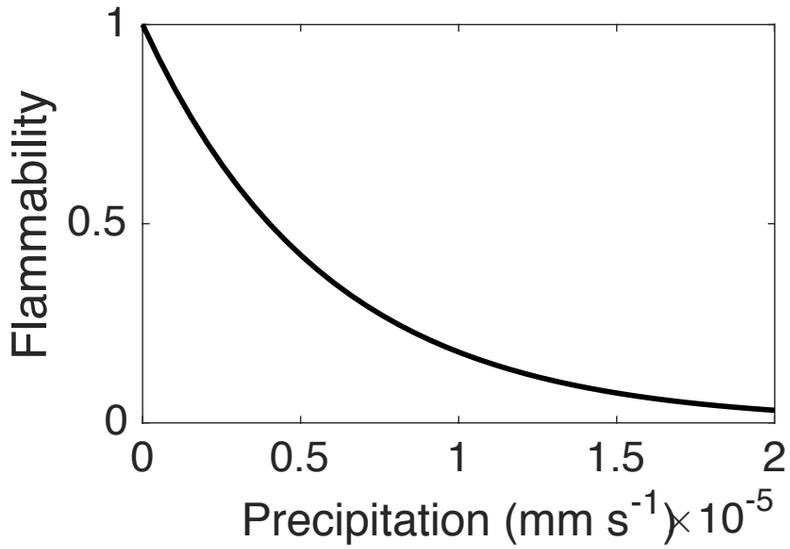


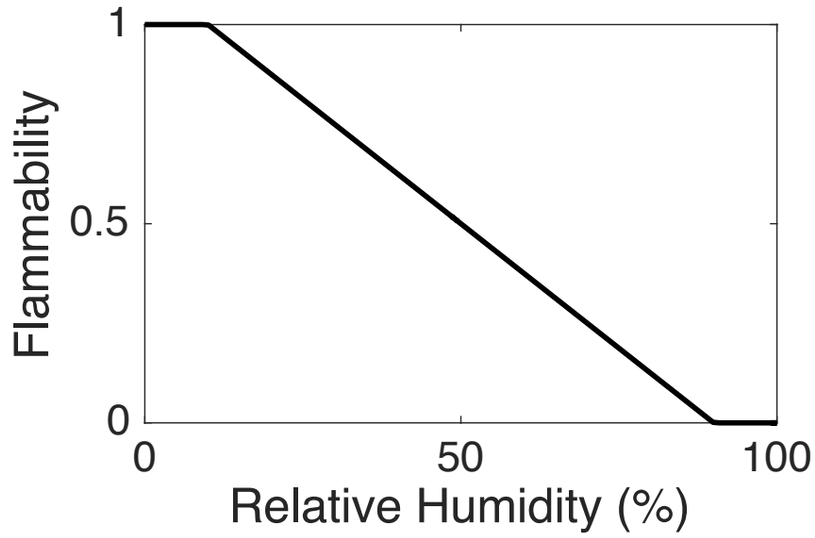
Leaves

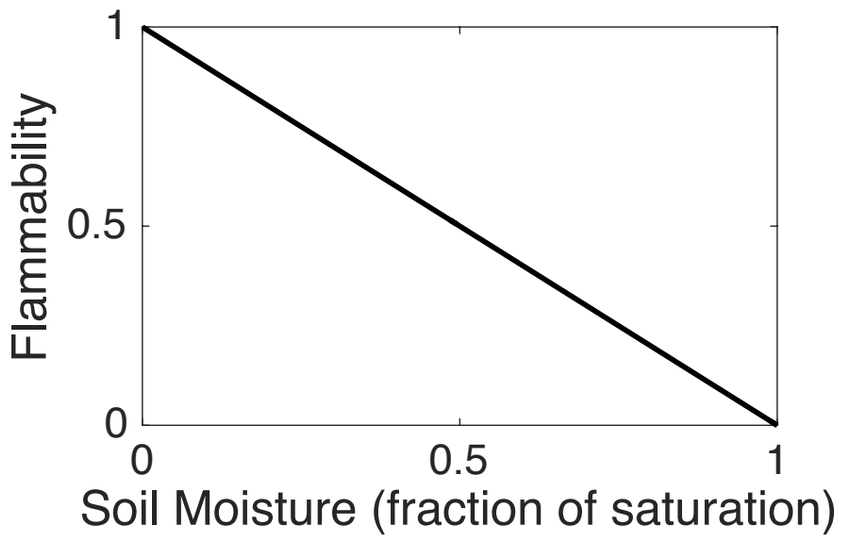
Stem

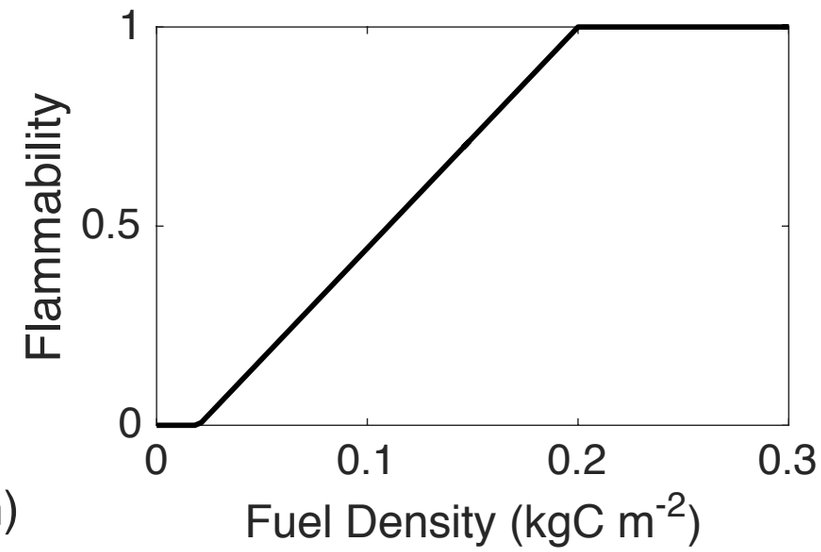
And mathematically?

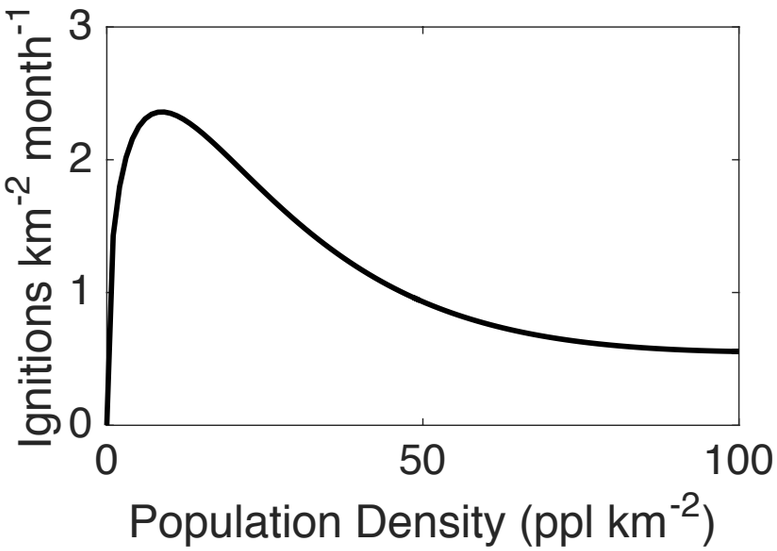






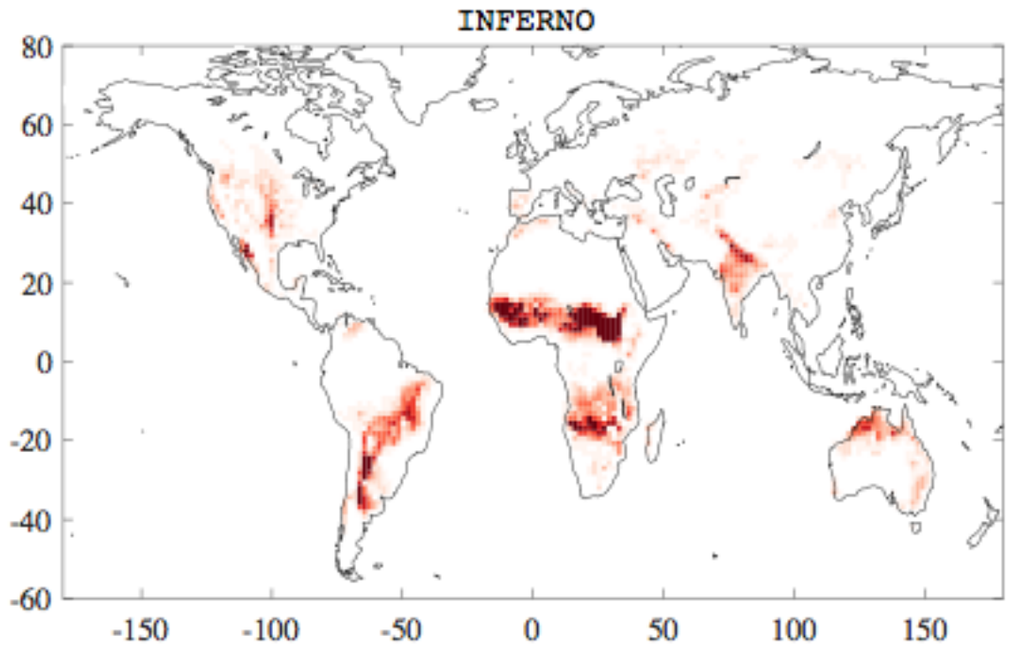


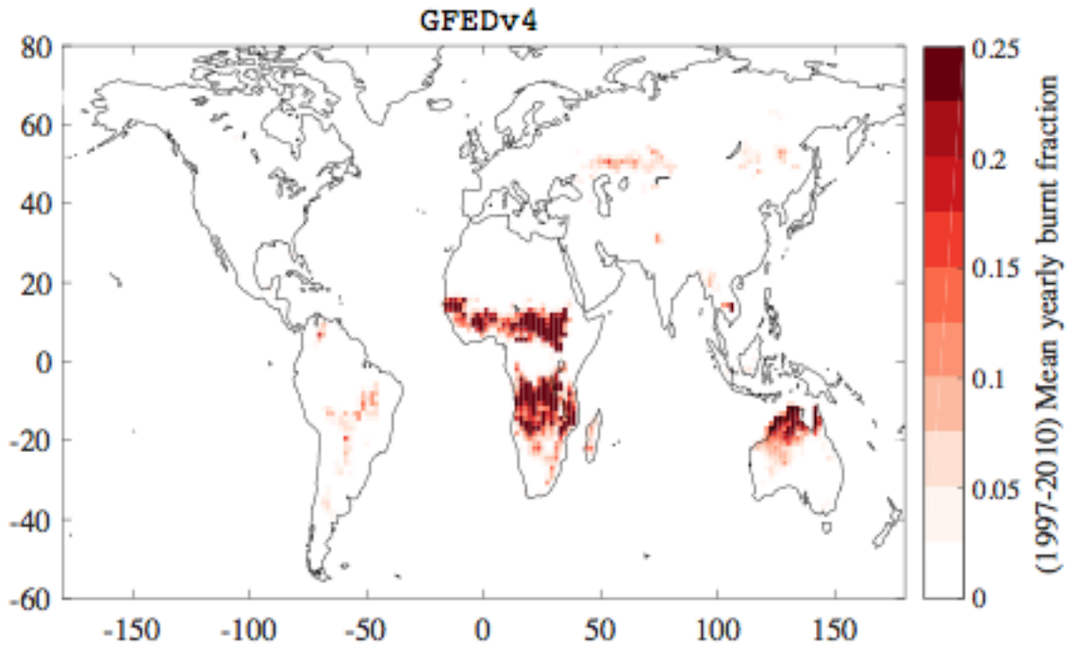




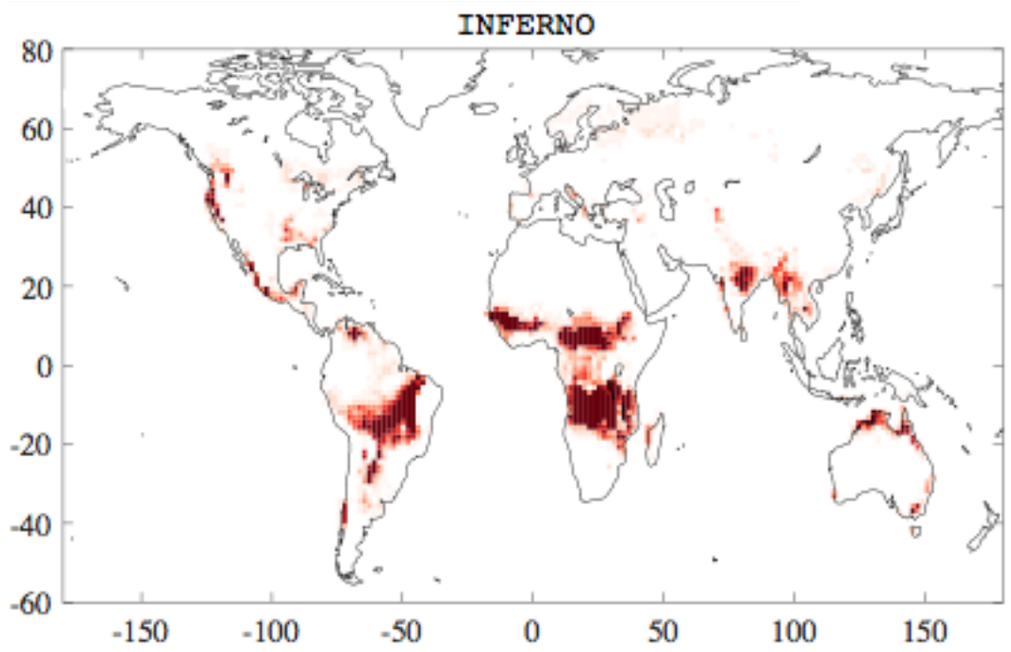
Does INFERNO Work?

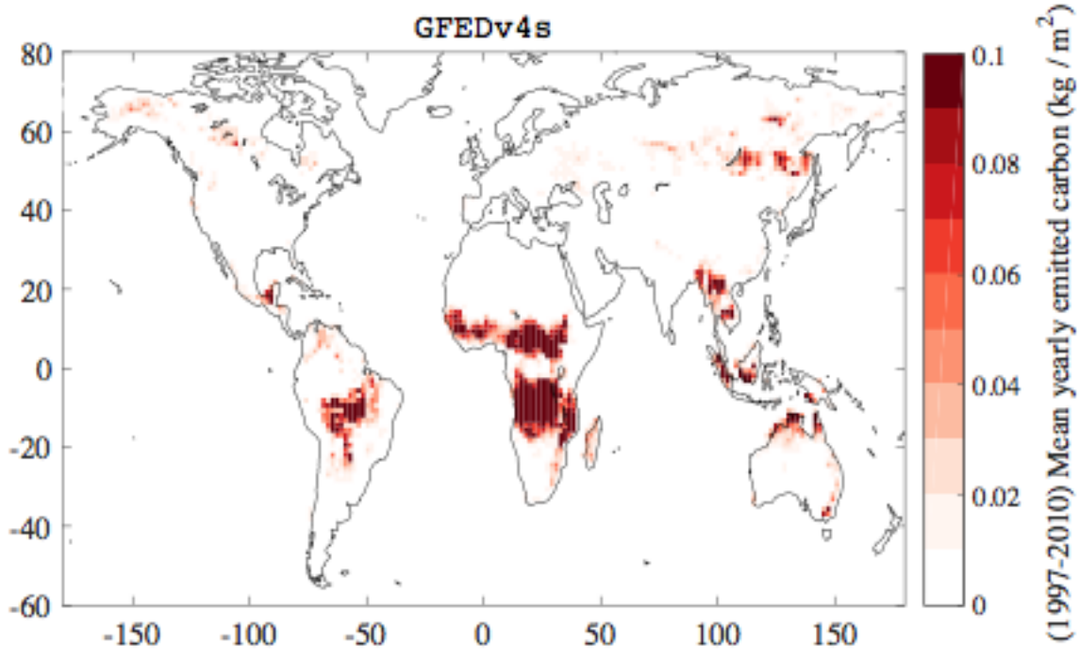
Burnt Area



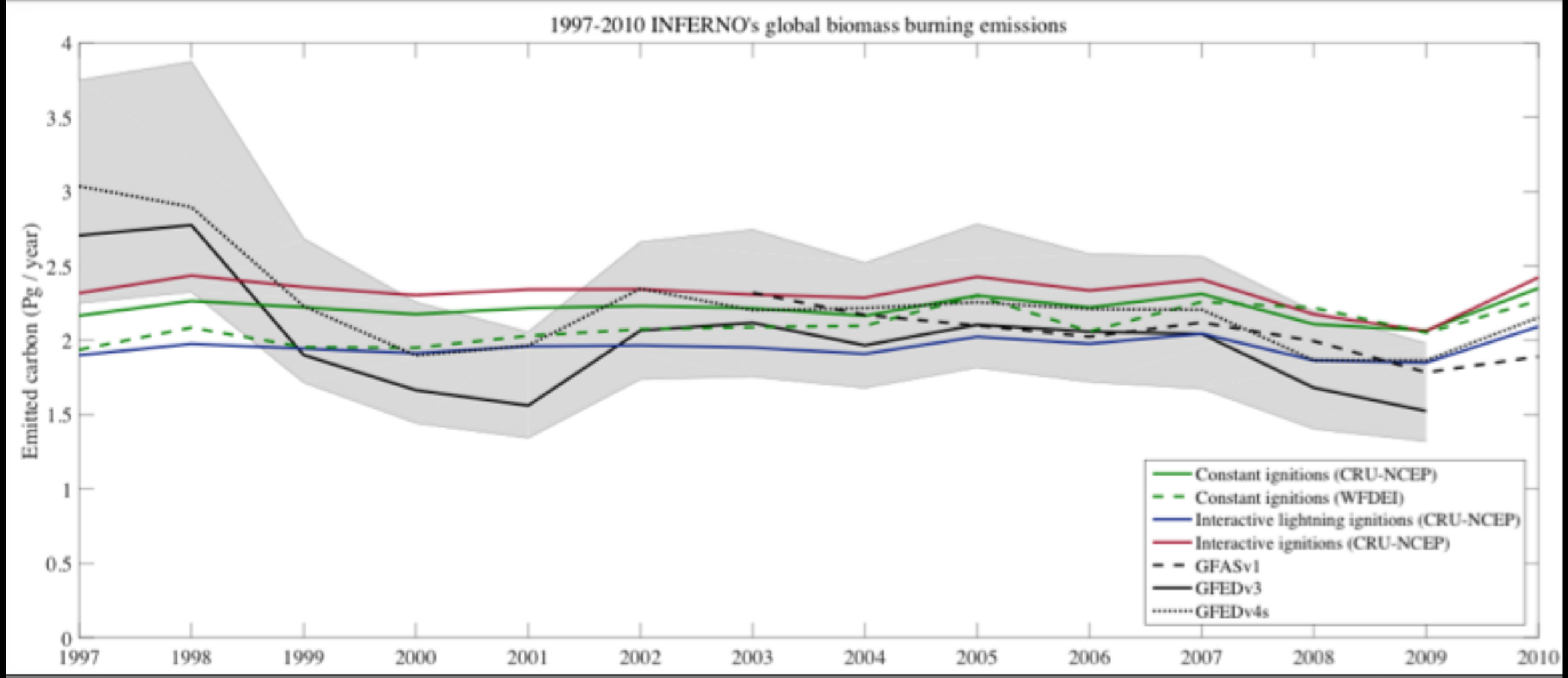


Carbon Emissions



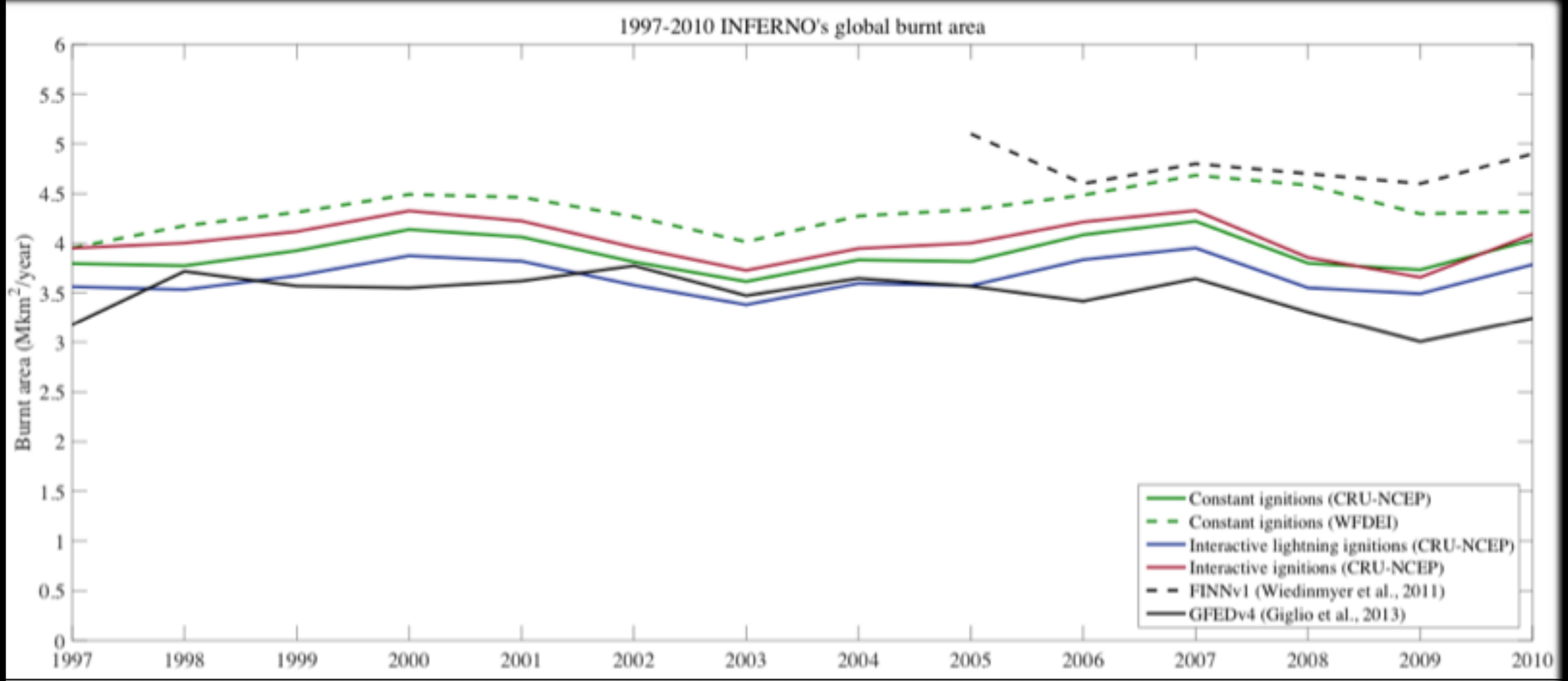


Model **Observations**



Global Totals

Biomass Burning Emissions
(Black - Observation-based; Colour - INFERNO estimates)



Global Totals

Burnt Area

(Black - Observation-based; Colour - INFERNO estimates)