THE MODIS FIRE ALGORITHM

KAUFMAN and JUSTICE

EVALUATION USING SCAR-B DATA

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- **MAS - A NEW BEAUTIFUL ~~TOY~~ TOOL**
- **WHAT'S NEW in MODIS about FIRES**
- **BRAZILIAN FIRES and MODIS FIRES**
- **EMISSIONS FROM FIRES**

MODIS FIRE ALGORITHM

- **fire detection**

(A) (B)

$$\{[(T_4 > T_{4b} + 4\delta T_{4b}) \text{ or } T_4 > 320K(315K \text{ at night})] \underline{\text{and}}$$

$$[(\Delta T_{41} > \Delta T_{41b} + 4\delta\Delta T_{41b}) \text{ or } \Delta T_{41} > 20K(10K)]\} \text{ or } \{T_4 > 360K(330K)\} \quad (1)$$

(a) (b) (X)

- **fire rate of emission of radiative energy**
  - a measure of the rate of combustion

$$E_f = 4.34 \cdot 10^{-19}(T_4^8 - T_{4b}^8) \quad \text{(MWatt per pixel)}$$

- **smoldering or flaming**

conclusions

- It was justified to use theory to design the MODIS algorithm

(The spectral properties of fires in Brazil are similar to theory.)

- MODIS channels will not saturate in the tropics (with 80% of biomass burning)

- The MODIS fire detection will be much better from AVHRR

(due to the better spectral characterization and the 250 m pixel resolution).

- Though 20% of the fires are detected, they represent 80% of the biomass burning.

- The MODIS fire energy will be a new product that will distinguish between fires with orders of magnitude different rate of combustion

- Fire energy is a measure of the emissions

- Smoldering fraction is still questionable

- Laboratory fires are used to strengthen some of the relationships

Table 1: Summary of the fire information from all location, based on the 40 m resolution MAS observations and on the reduced resolution simulated 1 km MODIS data

Parameter/location	Cuiaba	N. of Porto National	Alta Floresta	Port Velho
Rate of emission of radiative energy combined from all observed fires (MWatt)				
MAS: 3.9 µm	1600	22100	6200	2000
MAS: 11 µm, 1.6 µm	1400	14200	7100	1600
MODIS 3.9 µm	2100	13600	6700	2800
Number of observed fires	**360**	**1870**	**680**	**380**
fraction of radiative energy emitted in the smoldering stage				
MAS: $E_{f11} / (E_{f1.6}+E_{f11})$	0.44	0.79	0.93	0.90
MAS: $E_{f11} / E_{f3.9}$	0.45	0.77	0.89	0.69
MODIS detection				
fraction of fires detected	0.22	0.21	0.21	0.27
fraction of fire energy detected	0.59	0.73	0.78	0.85

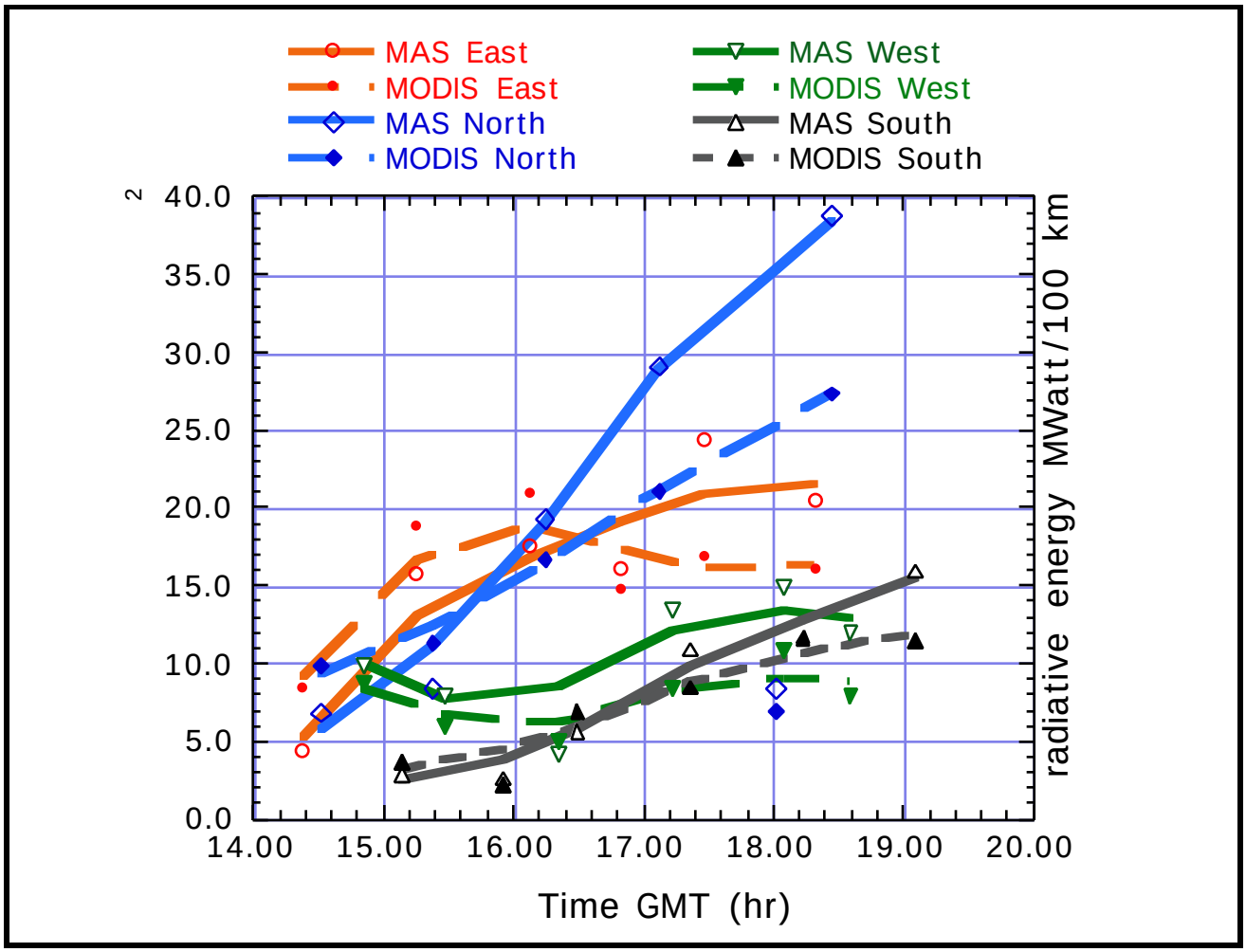

Fig. 13: Detection of the fraction of radiative energy emitted in the smoldering stage by MAS (40 m resolution) and MODIS (1 km resolution) using the 11 µm channel as an indicator of smoldering and the 3.9 µm channel for a measure of the total rate of emission of radiative energy from the fire. The MAS data show an increase of the smoldering phase with the fire size and stronger flaming in the low density biomass in the Cuiaba region. The MODIS data only partially depicts these characteristics.

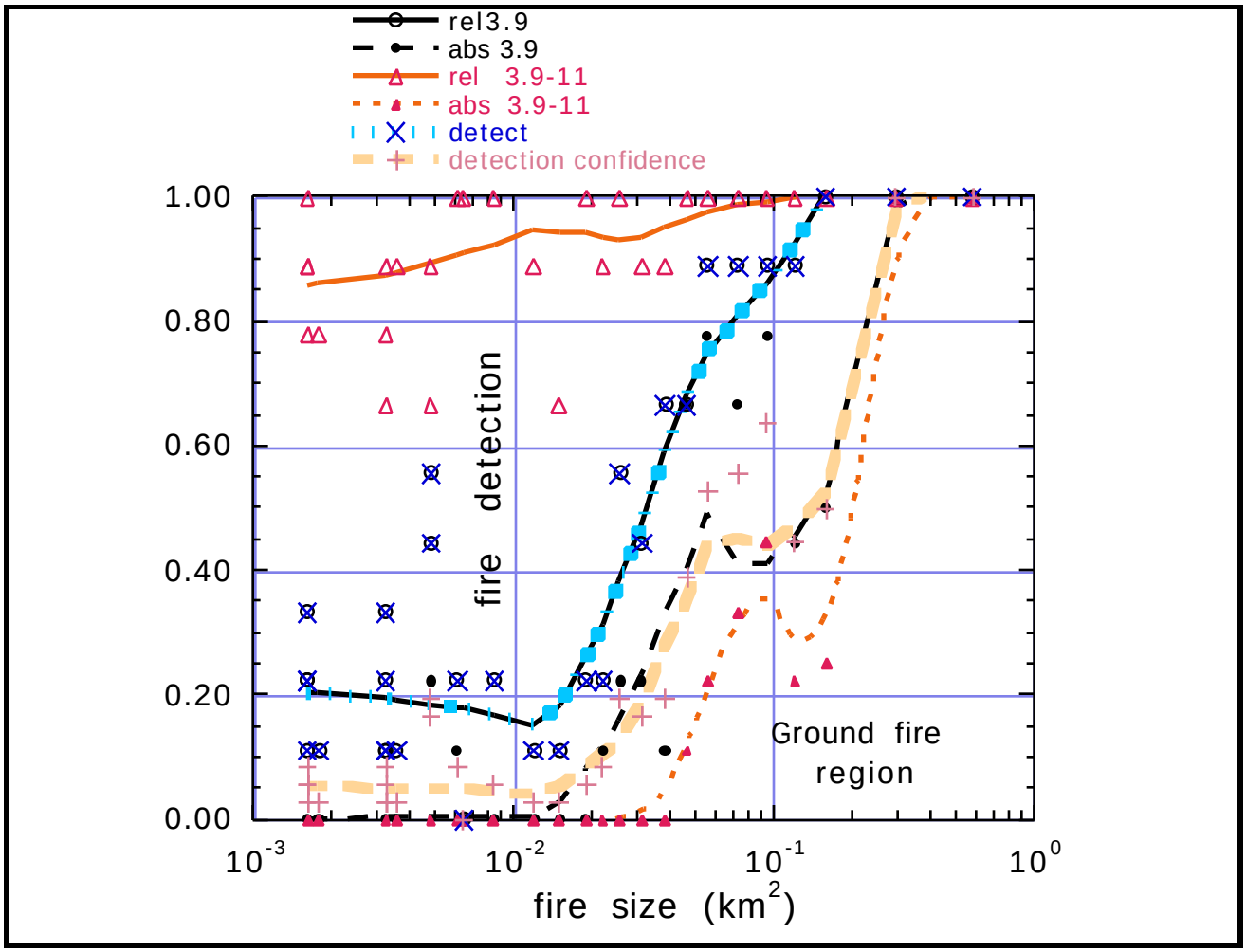

Fig. 14: The MODIS fire detection as a function of the fire size. The relative criteria, the absolute criteria and the detection is plotted after sorting as a function of the fire size and averaging in groups of 10.