High resolution fire monitoring for global change analysis: The FireBIRD Mission

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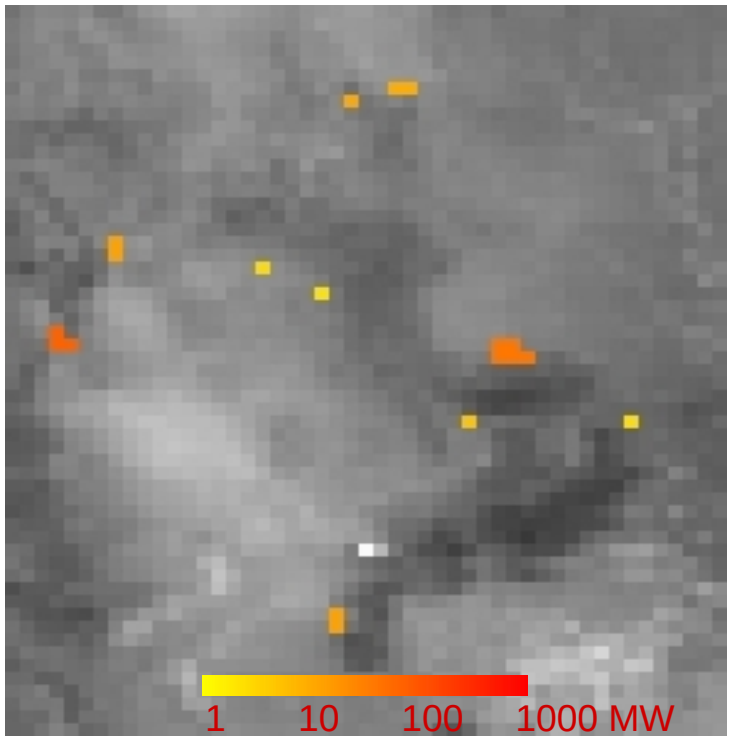

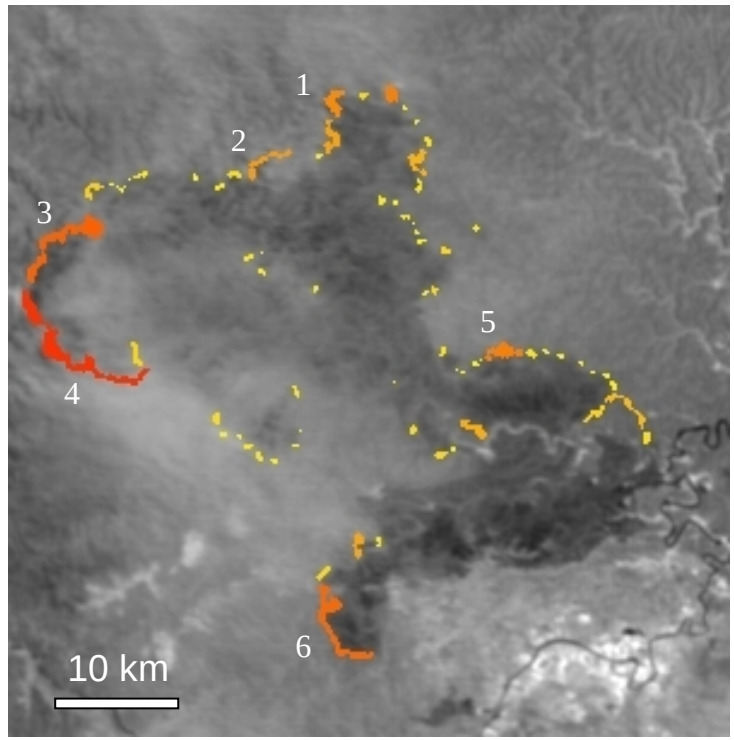

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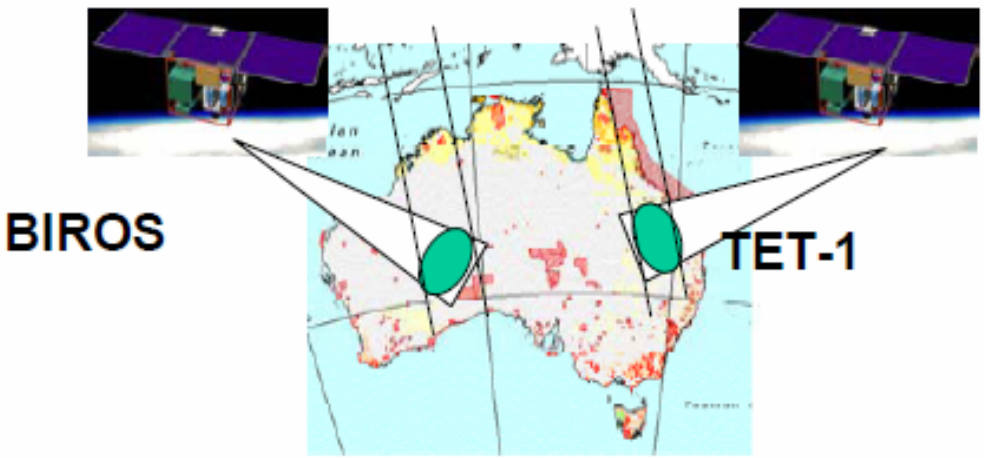
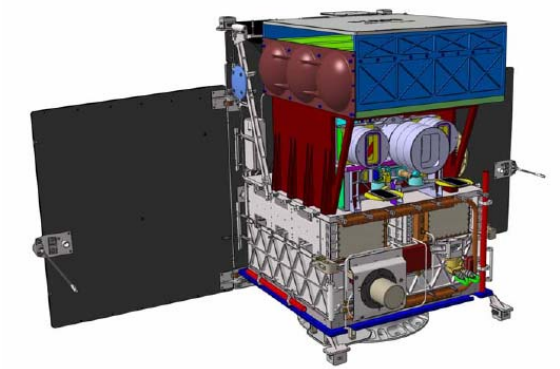
FireBird Mission characteristics





FireBIRD consists of two satellites:

TET-1 (Technologie Erprobungs Traeger 1)

Launch: 2011

And

BIROS

(Berlin Infrared Optical System)

Based on a BIRD-type spacecraft and sensor

Launch: 2013

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FireBIRD mission objectives

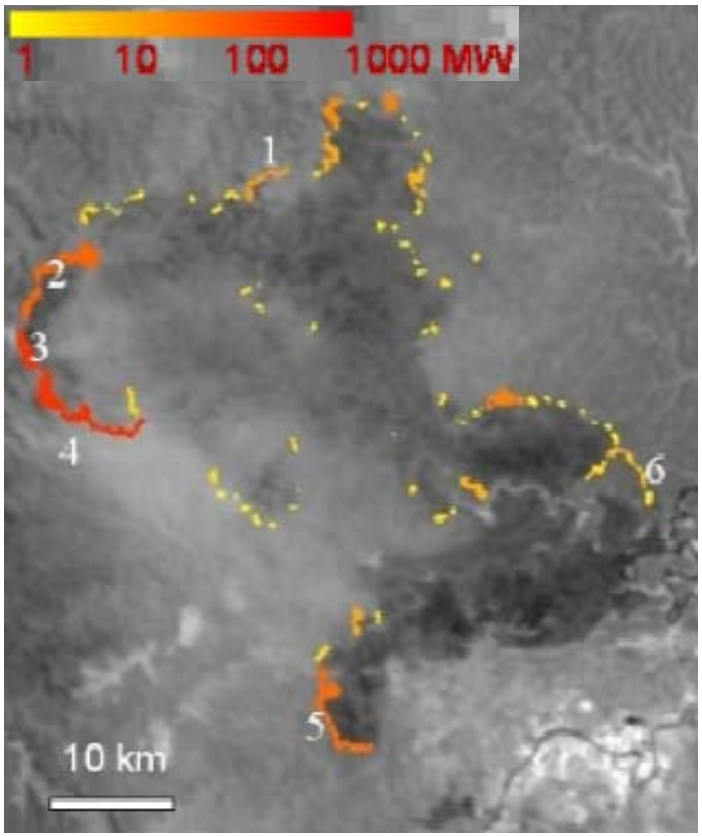
- Test of a two-satellite configuration for infrared remote sensing of High Temperature Events (HTE) on the earth surface
- Active fire detection and monitoring
- Supply of data products for estimating fire induced trace gas and aerosol emissions
- On board processing and near real time delivery of active fire attributes in support of fire management

Fire Essential Climate Variable (GTOS Report T13)

- Burned Area combined with other information (combustion rate, fuel load) provides estimates of emissions
- Active Fire information indicates regional, seasonal and inter-annual variability of fire frequency, shift in geographical location and timing of fire event
- Fire Radiative Power (FRP) provides information on the rate of combustions (combustion efficiency)
- Limitations are resolutions, revisiting time, fuel type and load information, fire weather conditions

How FireBIRD products may look like

Typical characteristics of fire fronts (BIRD, Australia, 5 January 2002)



No.	Eff. Fire temp. [K)	Eff. Fire area [ha]	Front length [km]	Fire Radiative Power [MW]	Radiative front strength [kW/m]
1	815	0.48	4	130	30
2	715	2.3	7.5	310	40
3	893	0.59	3	210	70
4	>670	<0.78	5	79	15
5	852	0.92	10	300	30
6	957	1.0	9	530	60

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Comparison of MODIS, BIRD and FireBIRD

	MODIS on EOS Terra/Aqua	**HSRS + WAOSS-B On BIRD**	**FireBIRD capacities On TET-1/BIROS**
Spectral channels (used for fire detection)	MIR: 3.9 - 4.0 µm TIR: 10.8 - 11.3 µm RED: 0.62 - 0.67 µm NIR: 0.84 - 0.88 µm	MIR: 3.4 - 4.2 µm TIR: 8.5 - 9.3 µm NIR: 0.84 - 0.90 µm	MIR: 3.4 – 4.2 µm TIR: 8.5-9.3 µm (Green: 460 - 560 nm) Red: 565 - 725 nm NIR: 790 – 930 nm
MIR channel saturation	450 K	600 K	600 K
Spatial resolution	1 km	370 m	MIR/TIR: 356 m VIS/NIR: 42.4 m
Swath width	2330 km	190 km	178 km
Revisit time	4 times a day	Experimental imaging of selected areas	TBD

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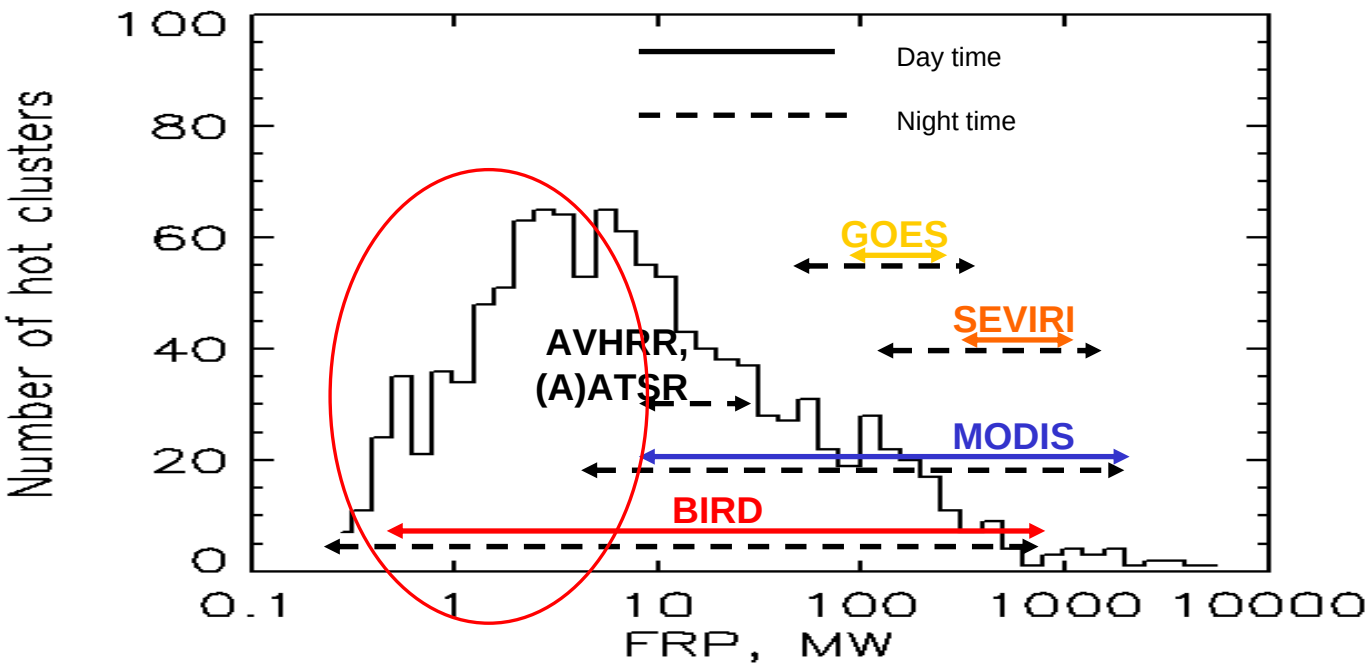
Comparison of (Fire)BIRD with other sensors

- Higher sensitivity for cooler fires, high saturation level for hot fires
- High spatial resolution for better fire characterisation



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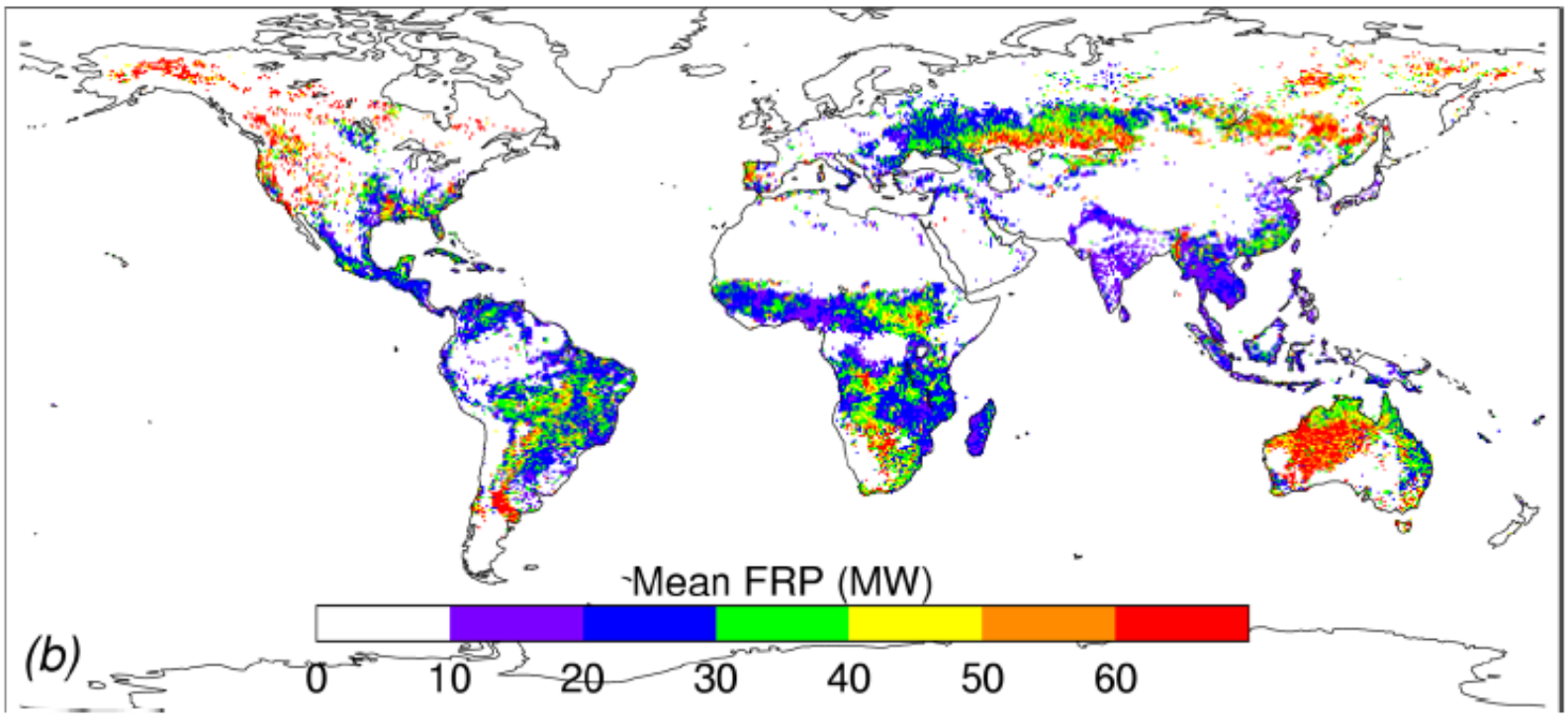
Global biomass burning - MODIS



Giglio et al., 2006

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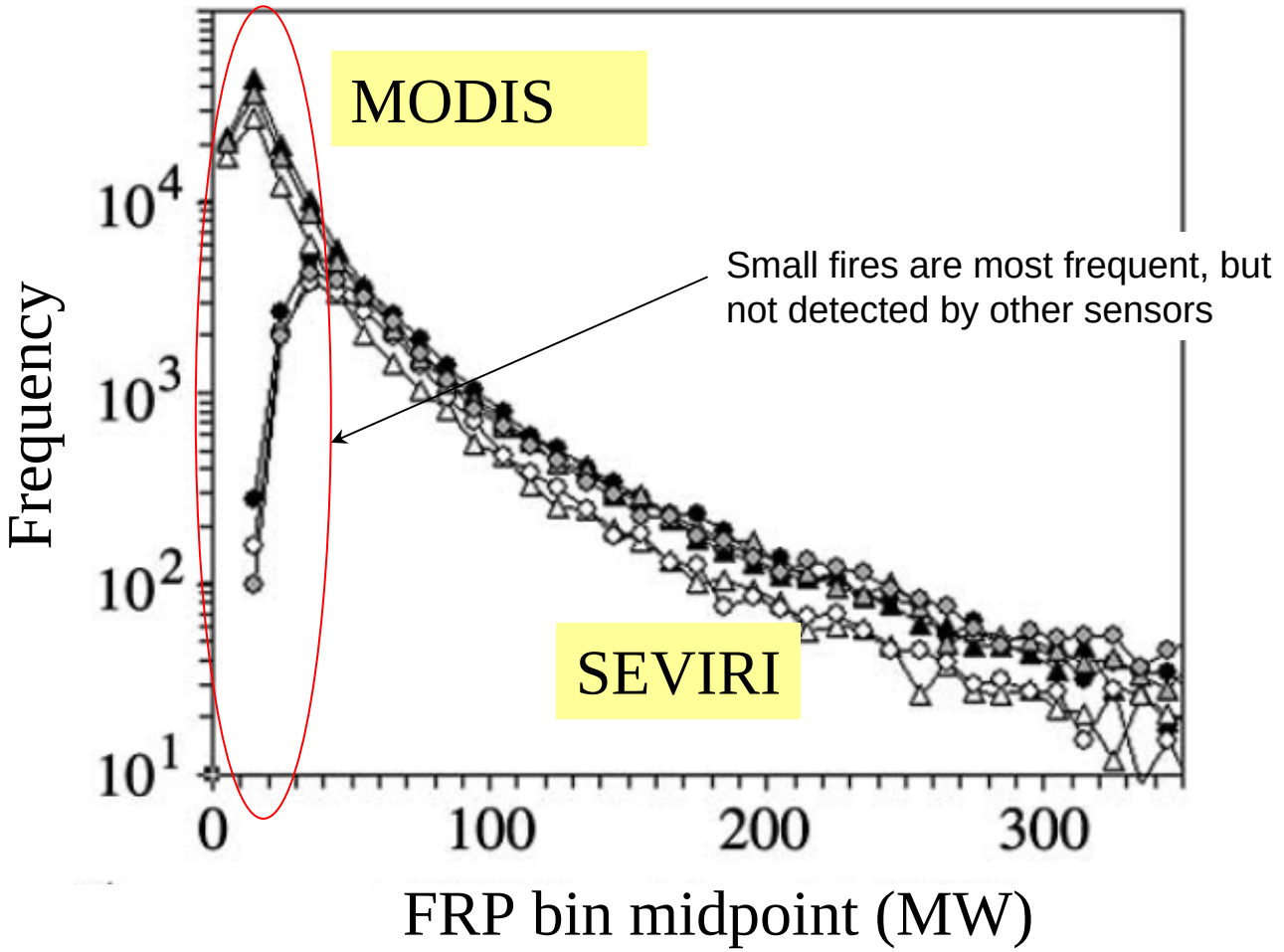
Biomass burning in Africa – MODIS and SEVIRI



Roberts & Wooster, 2008

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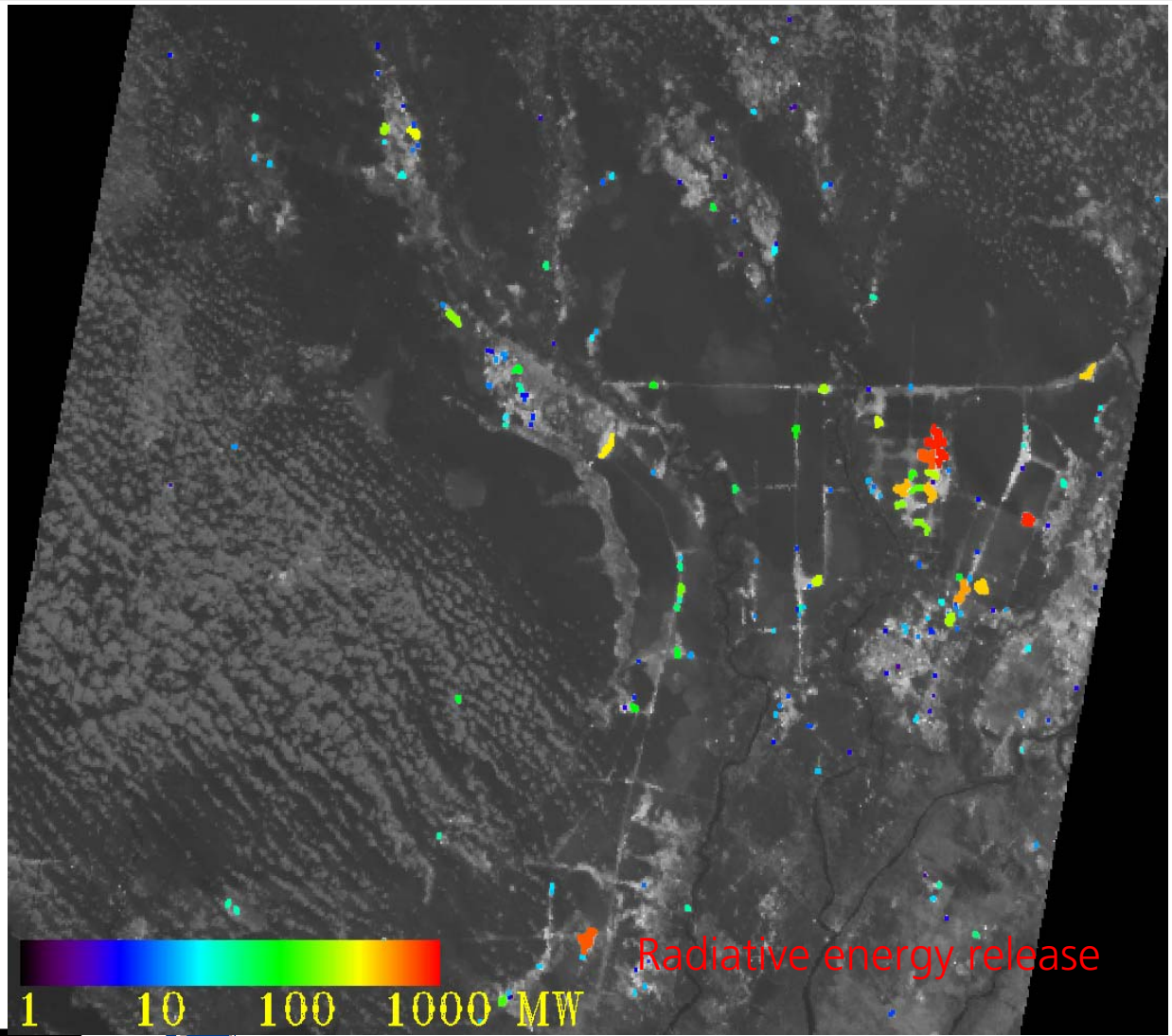
„Cool Fires“ – Peat Fires



Peat fires,
Kalimantan,
24 August 2002

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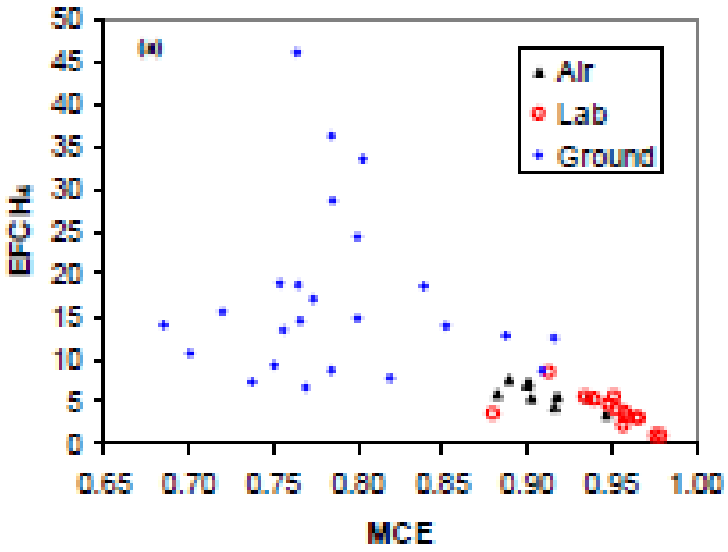
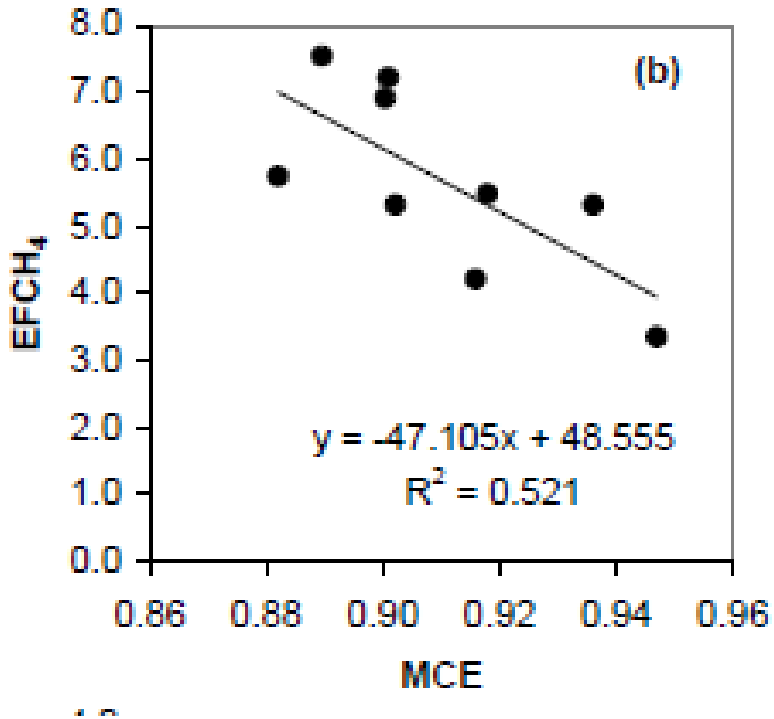
Emission Factors





Cool fires release more CO, methane, PM, NMVOC

Christian et al., 2008

Yokelson et al., 2007

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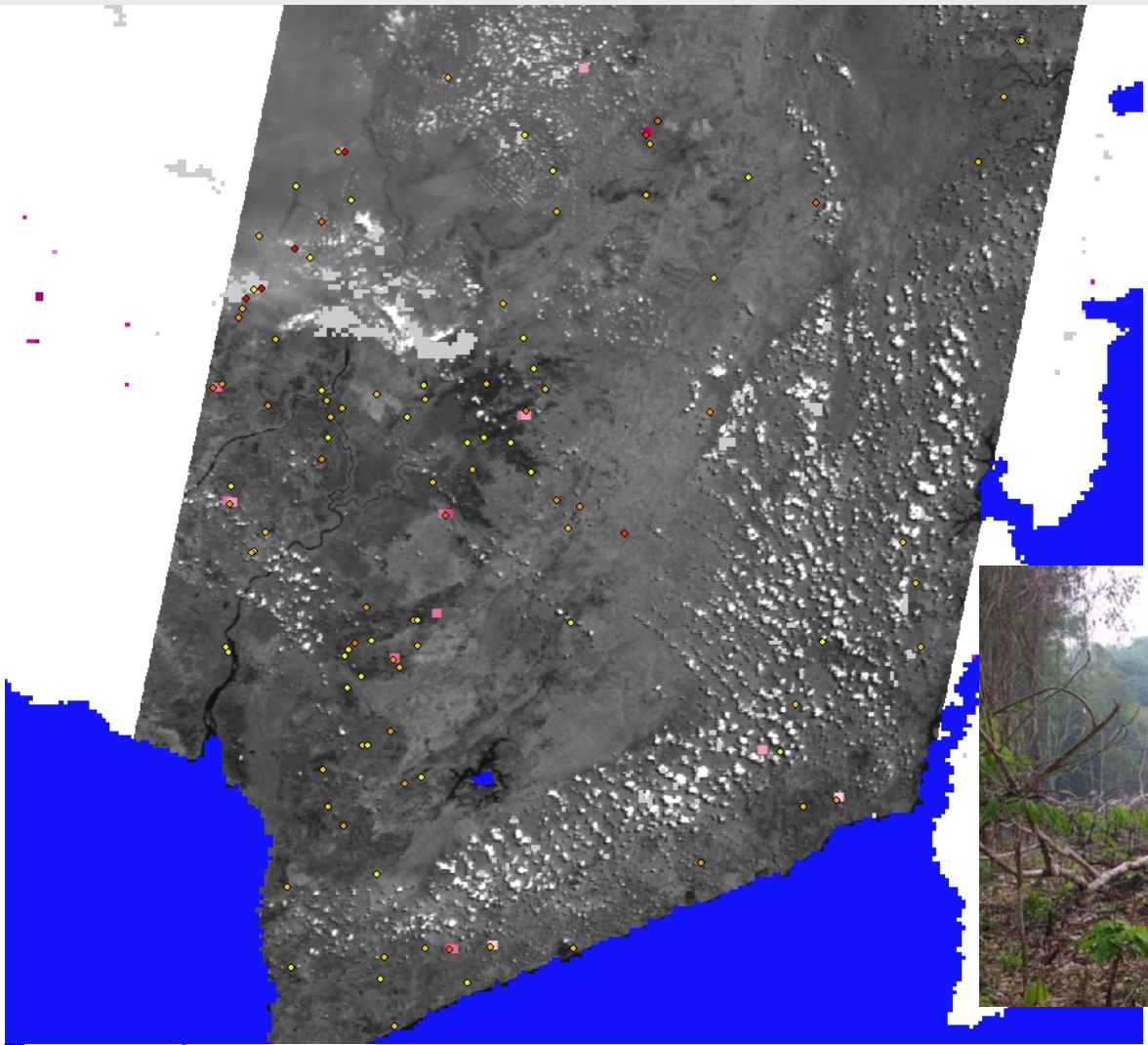
MODIS (Terra) and BIRD comparison



Borneo, 2002-08-25

BIRD: 156 fire clusters
cum. FRP: 1868 MW
MODIS: 34 fire clusters
Cum. FRP: 370 MW

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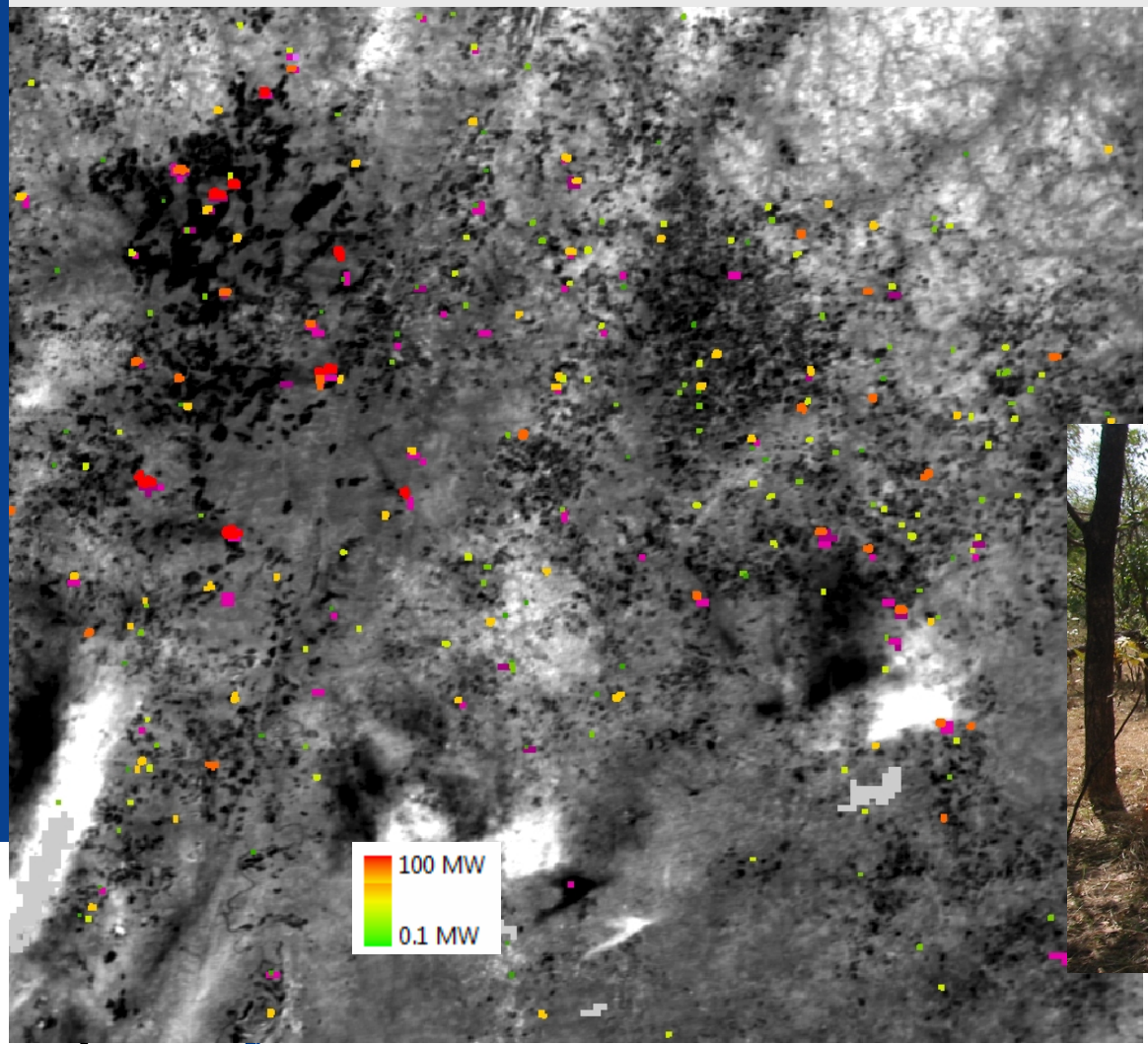
MODIS and BIRD comparison



Benin, 2002-12-01

BIRD: 334 fire clusters
cum. FRP: 3435 MW
MODIS: 140 fire clusters
Cum. FRP: 3952 MW

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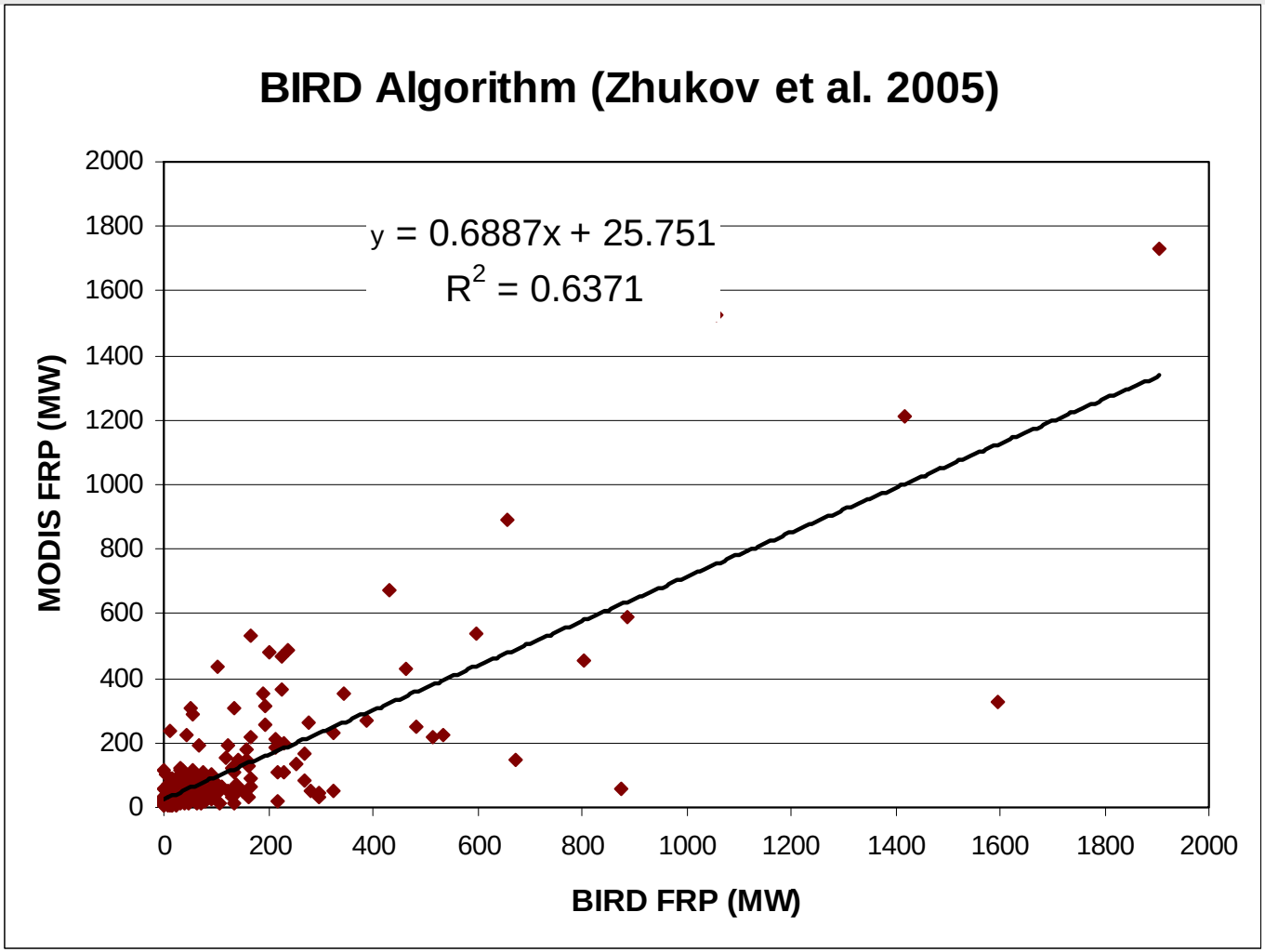
BIRD and MODIS per Cluster Comparison



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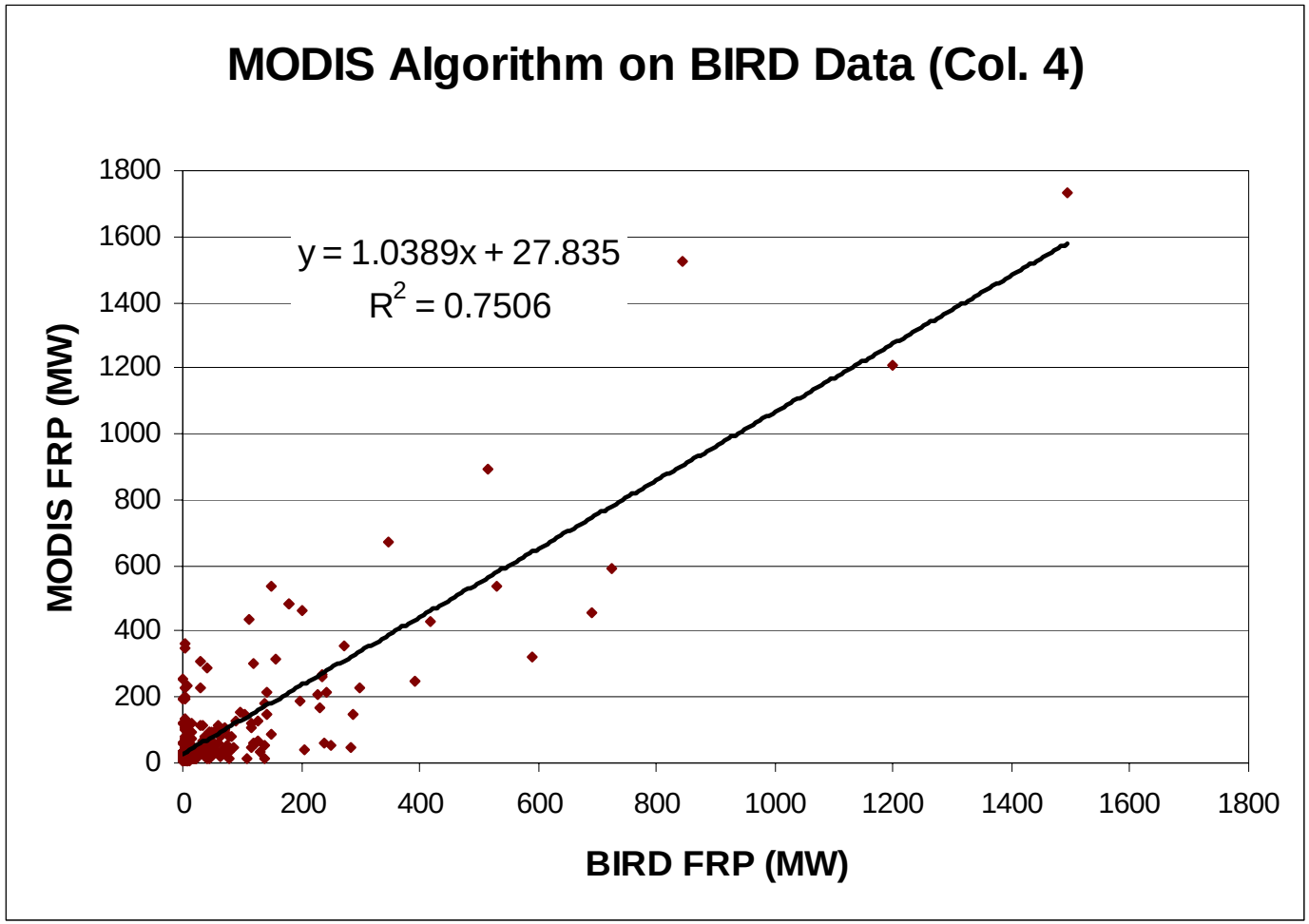
BIRD and MODIS per Cluster Comparison



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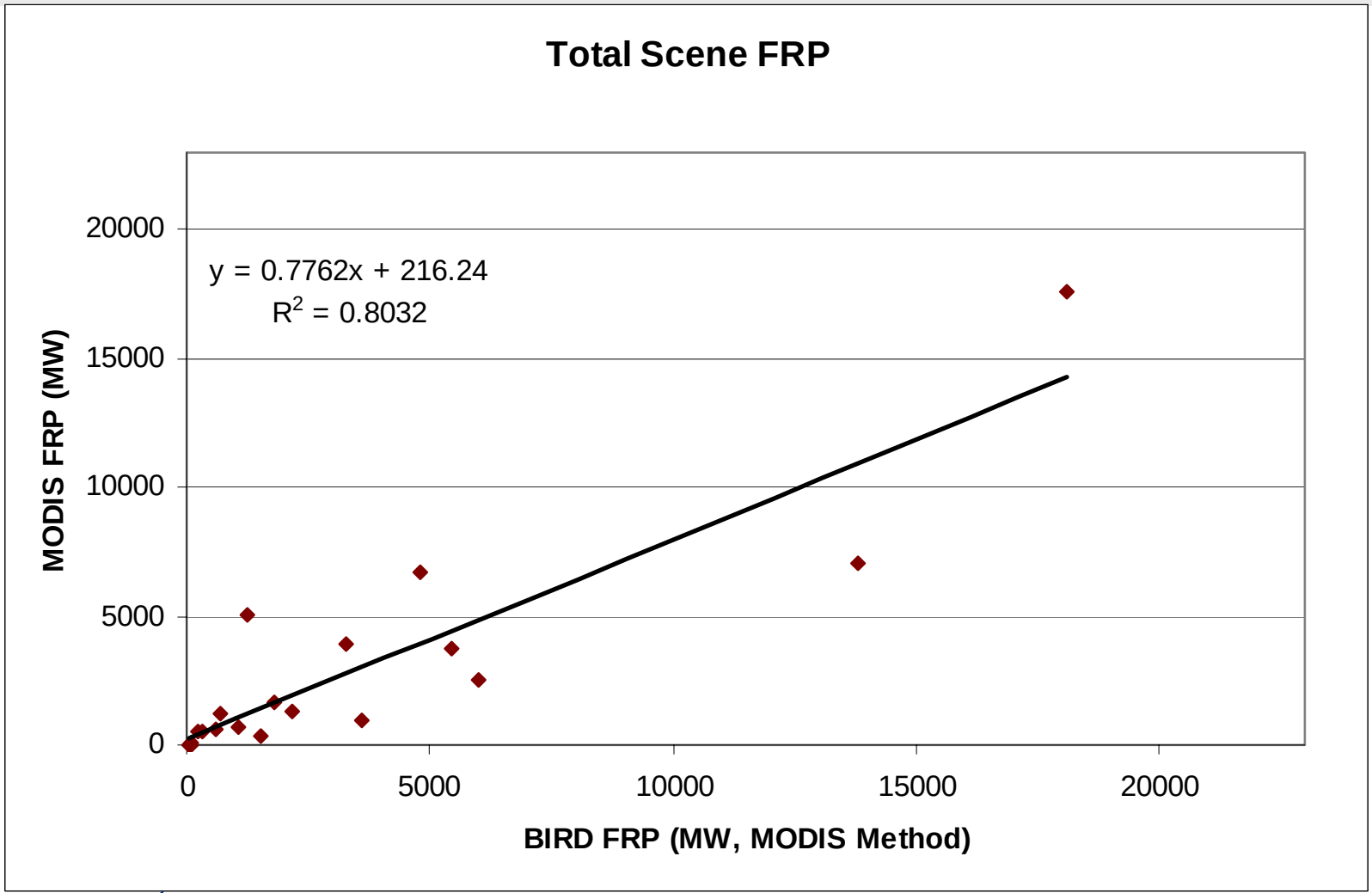
BIRD-MODIS per Scene Comparison



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Conclusions

- FireBIRD can detect and characterize fires that are missed by other sensors
- These fires contribute an unknown amount to global FRP, and thus to biomass burning
- Many of these fires have high emission ratios of CH4, NMVOC, PM, CO
- FireBIRD may help validate coarser resolution polar orbiting or geostationary sensors
- Thus, small fire corrected global to regional emission estimates could be produced

FireBIRD in a Global Fire Assimilation System

Global Fire assimilation system could consist of:

- SEVIRI type: Geostationary satellite Meteosat, GOES) providing high temporal resolution observation of the most intense fires, though not covering all continents
- MODIS type: Wide-swath moderate-resolution spectro-radiometers on major polar orbiting satellites providing daily global coverage of fire detection, and
- BIRD type: Moderate-to-high spatial resolution imagers allowing detailed monitoring and validation of the parameters of fires

Thank You!

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