

LSA SAF FRP-PIXEL Product Performance Evaluation

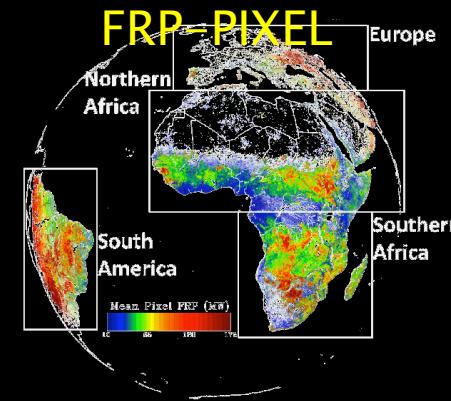
Weidong Xu, Martin J. Wooster,
Gareth Roberts, Daniel Fisher
and Jiangping He

LSASAF workshop Reading University 8–10 June 2015

Background



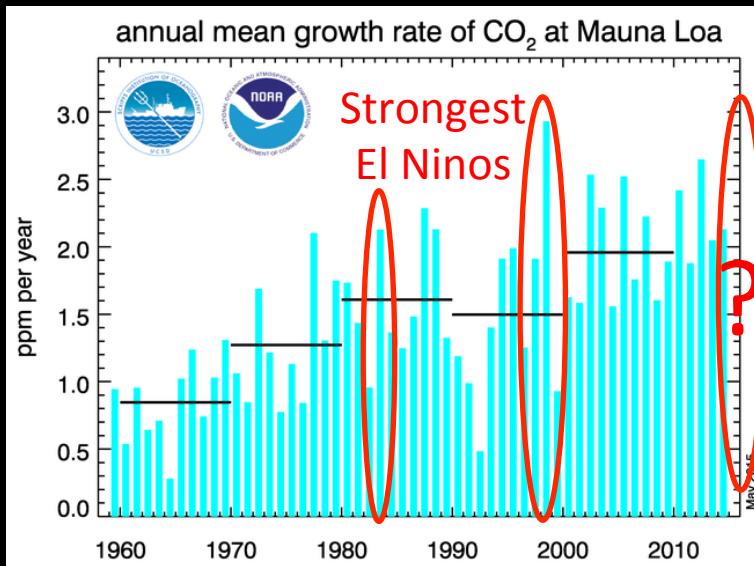
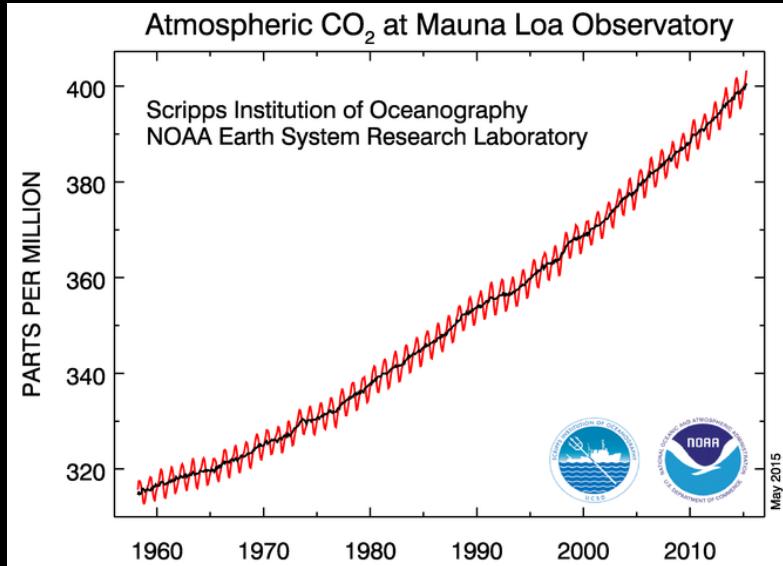
SEVIRI



Inputs to Models



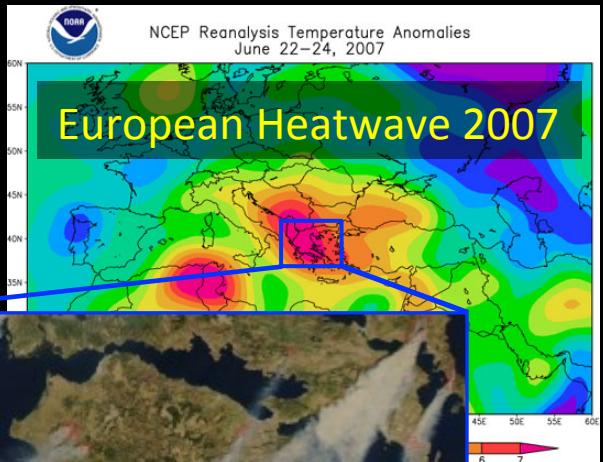
Biomass Burning Atm. CO₂ Contribution



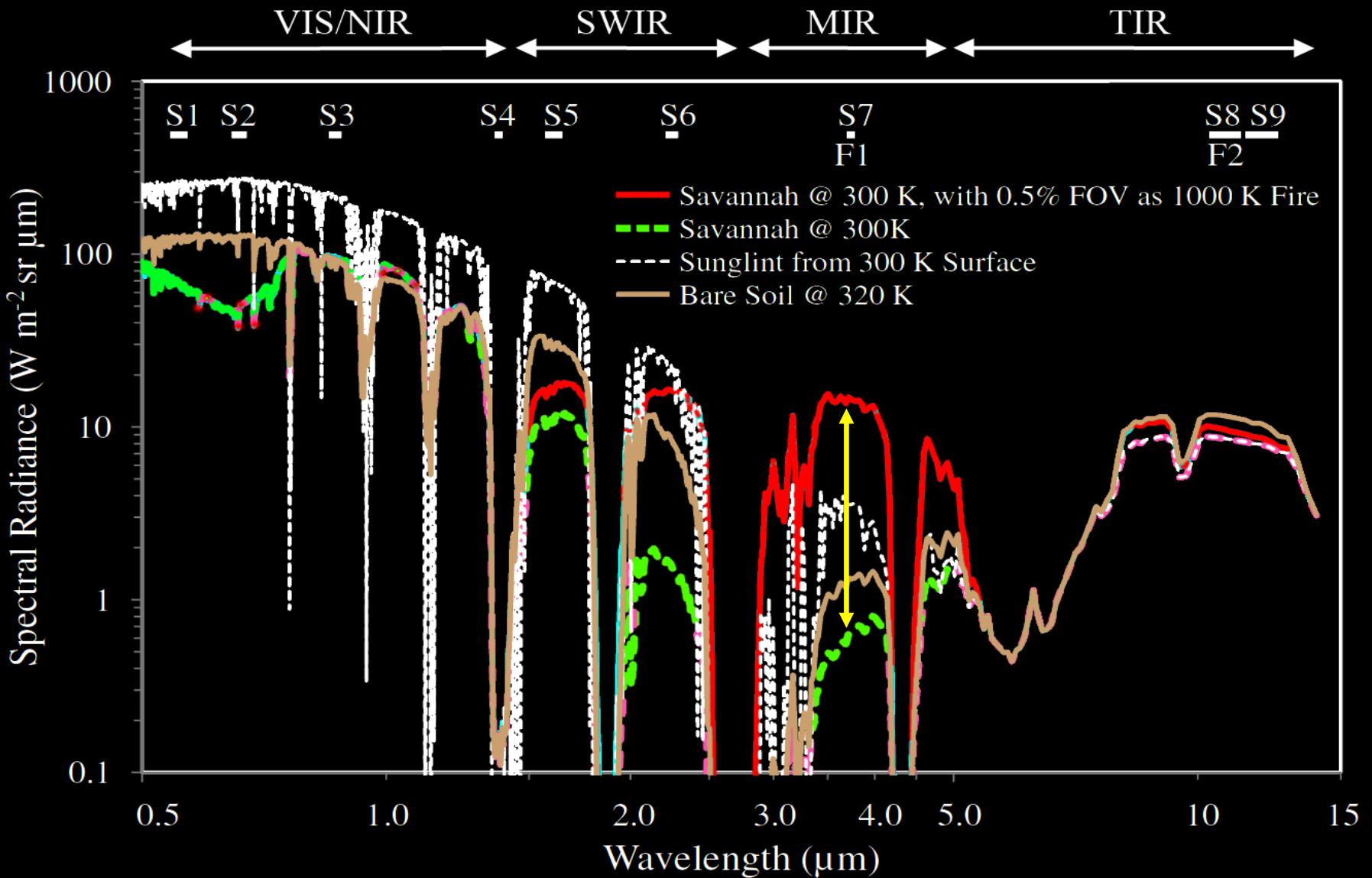
- Fire CO₂ emissions average 2.0 Pg C yr⁻¹
- Deforestation & forest degradation is 2nd largest anthropogenic CO₂ source after fossil fuel combustion.
- Together estimated as ~ 15% of net global annual average CO₂ emissions.

Biomass Burning Emissions

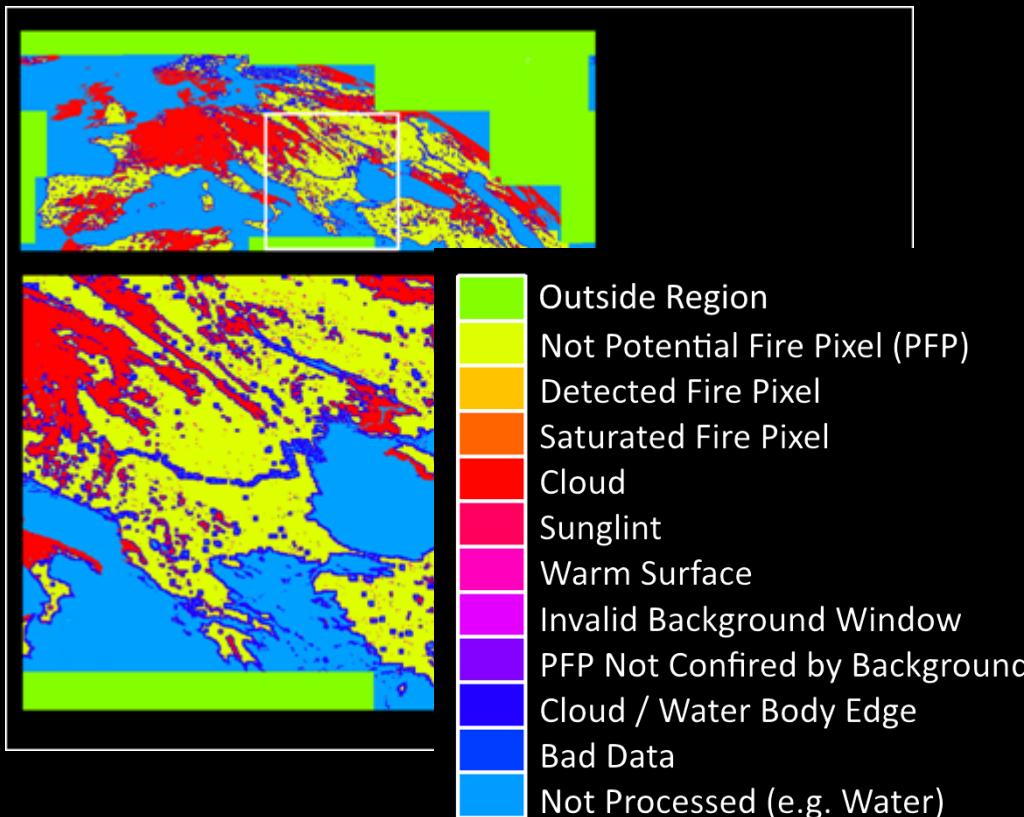
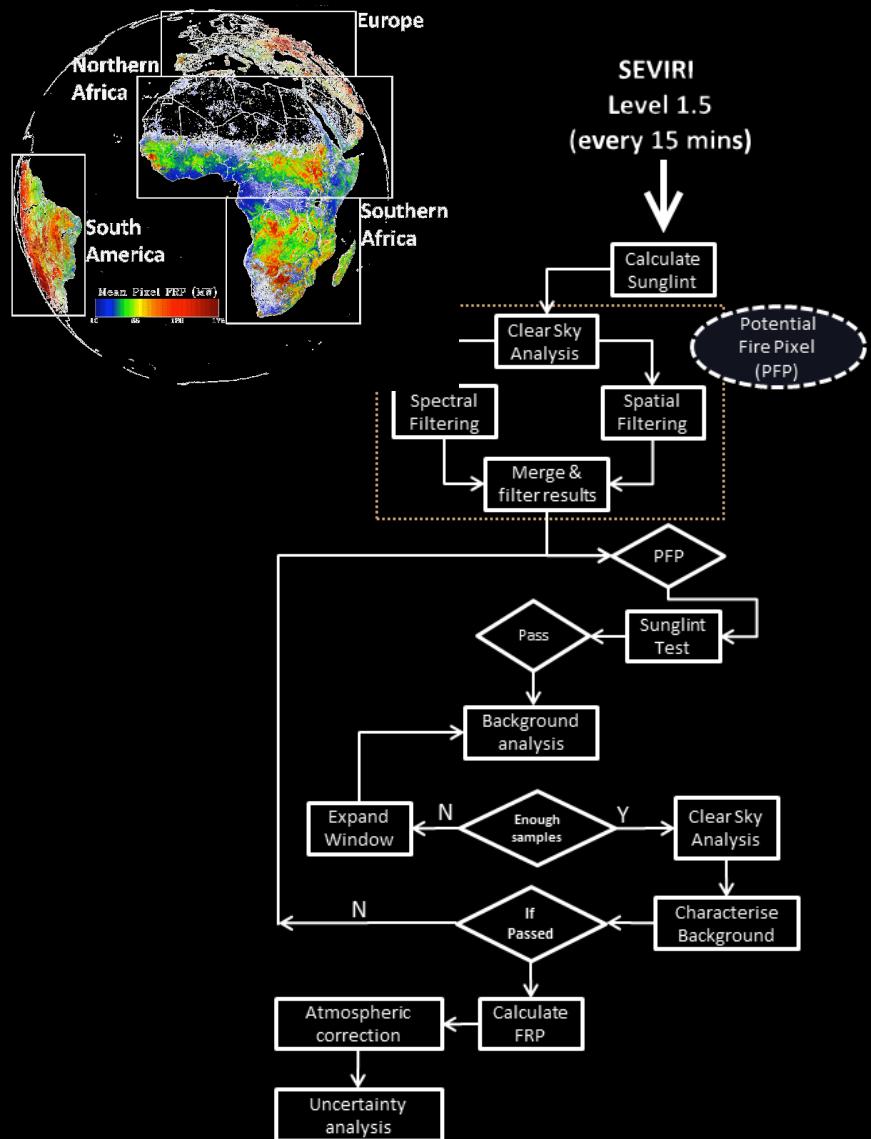
- Biomass burning a major air pollution source ($\text{PM}_{2.5}$, VOCs, tropospheric O_3 , CO..).
- Respiratory effects.
- SE Asia + 200 days/yr⁻¹ > WHO AQ targets.



Radiative Transfer of Active Fire Detection

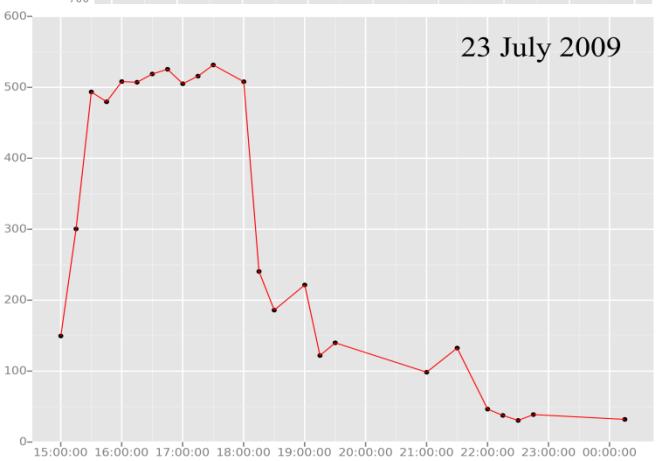


Operational SEVIRI FRP-PIXEL Product



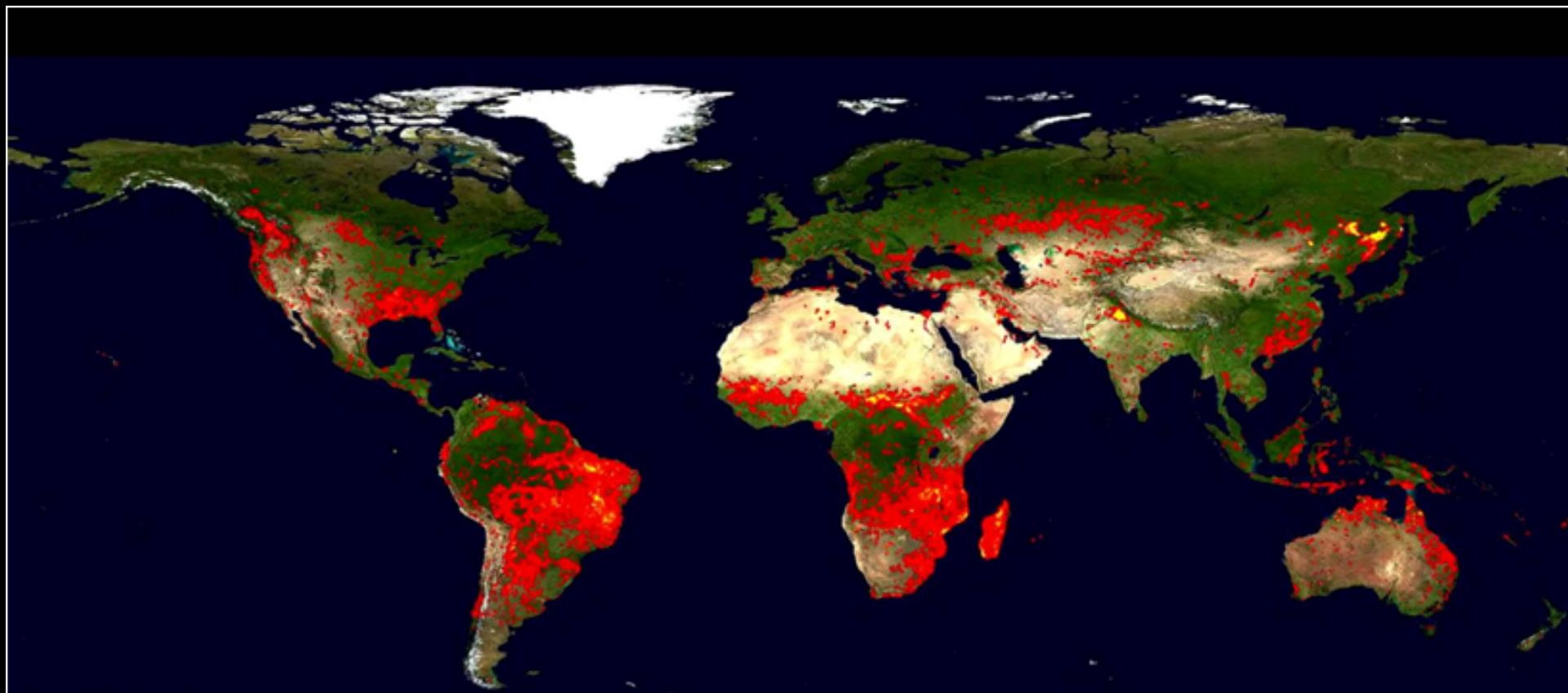
Delivered operationally to all as part of
EUMETSAT Land Surface Analysis
Satellite Applications Facility (LSA SAF)
Landsaf.meteo.pt/

Example Wildfire - July '09 Spain



- Fire expanded & burned initially exactly matching News reports.
- Fire flared again on 23rd July, as illustrated in FRP-PIXEL product.

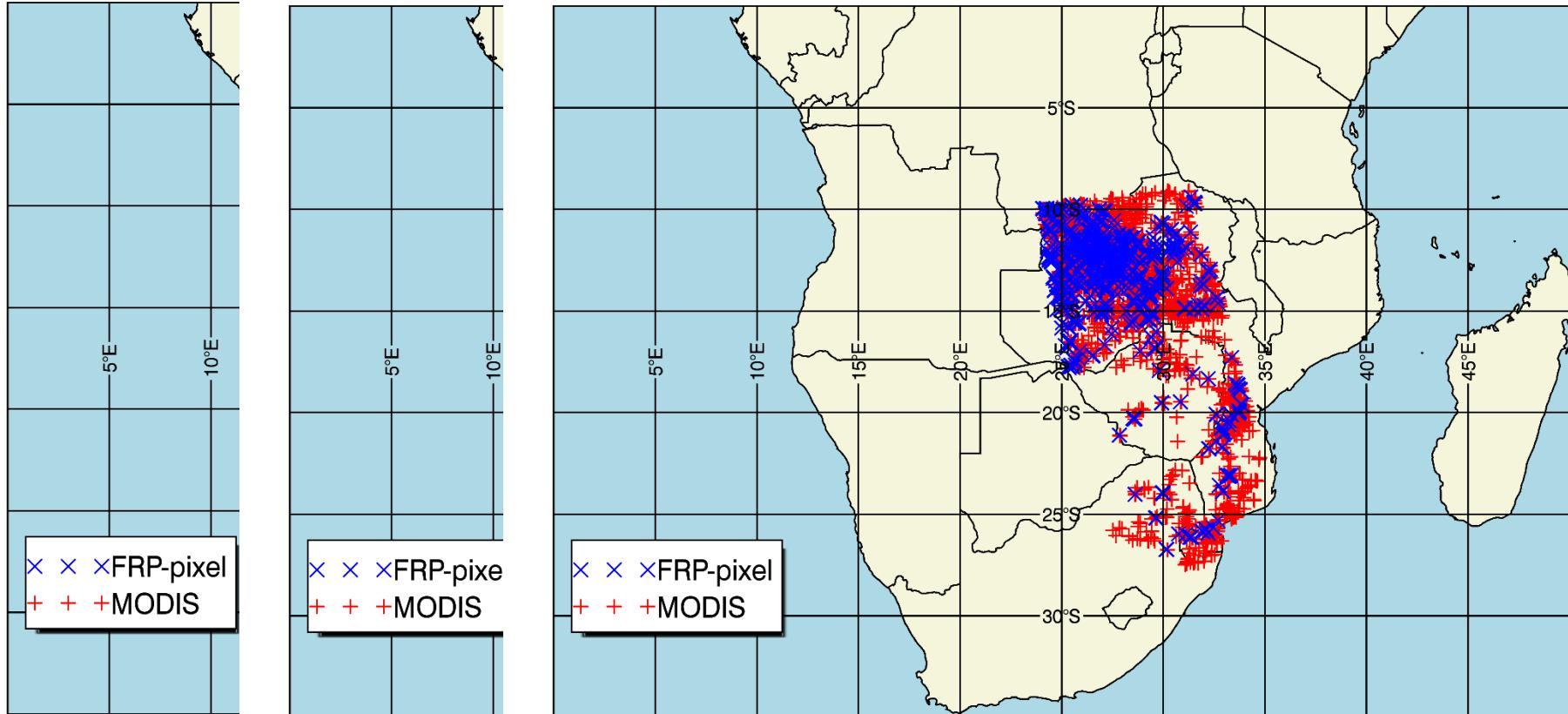
Global Fires from MODIS



- 1 km resolution – very sensitive to fires - but ONLY 4 passes per day.
- Global database – useful for evaluation of other products.
- Fires temporally variable - diurnal cycle - so geostationary very useful.

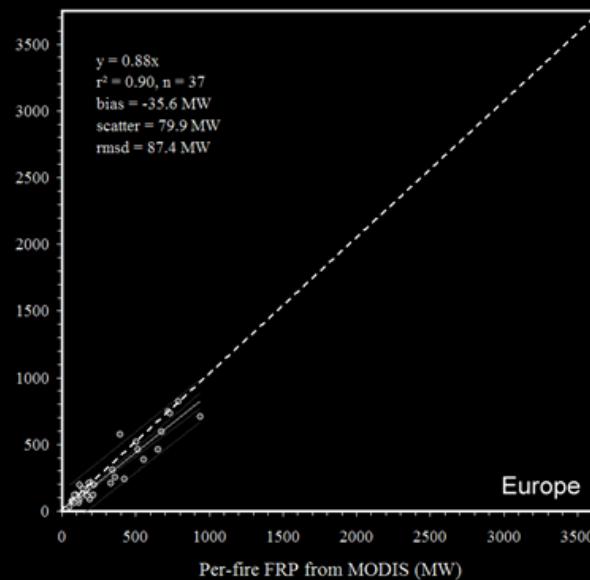
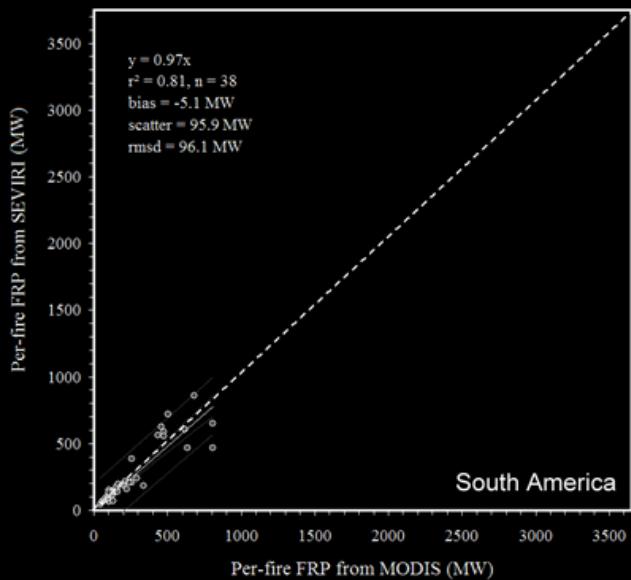
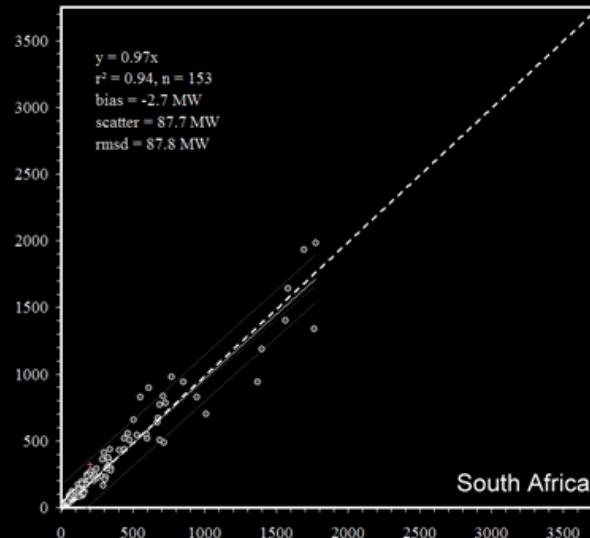
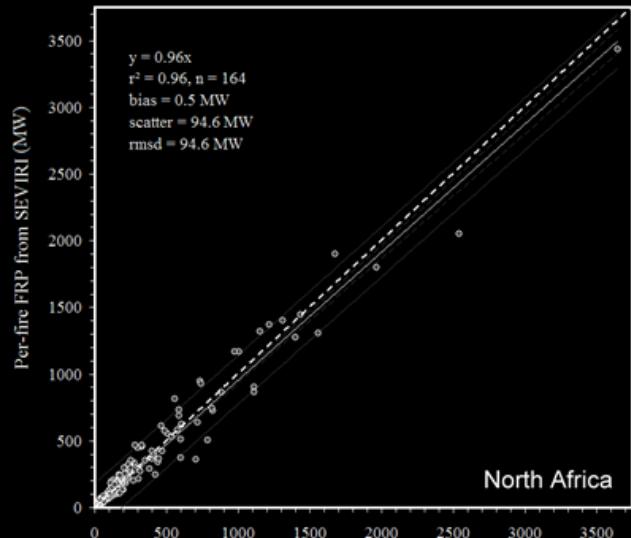
Active Fire Pixel Comparison: FRP-PIXEL & MODIS

KCL VS MODIS: 0.91



- +
- MODIS Active Fire Pixels in MODIS Swath
- ×
- SEVIRI FRP-PIXEL Detections at Same Time & Within Same “Swath”

Fire Pixel “Cluster” FRP Comparison (FRP-PIXEL vs. MODIS)

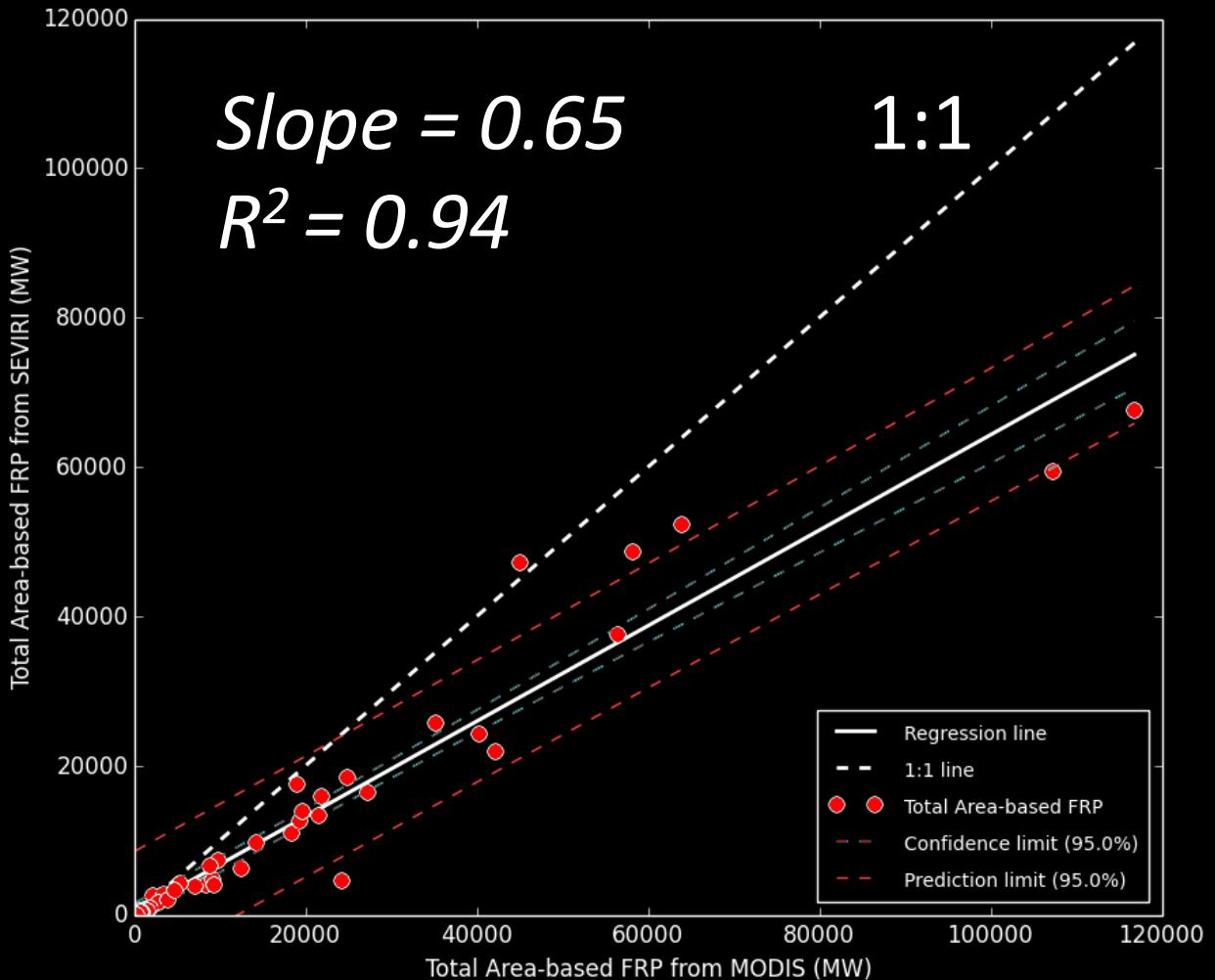


Slopes: 0.88-0.97
 r^2 : 0.81-0.96
Scatter: 79.9-95.9
RMSD : 87.4-96.1

Conclusion

When SEVIRI and MODIS detect the same fires, the retrieved FRP shows excellent agreement in all four LSA SAF regions.

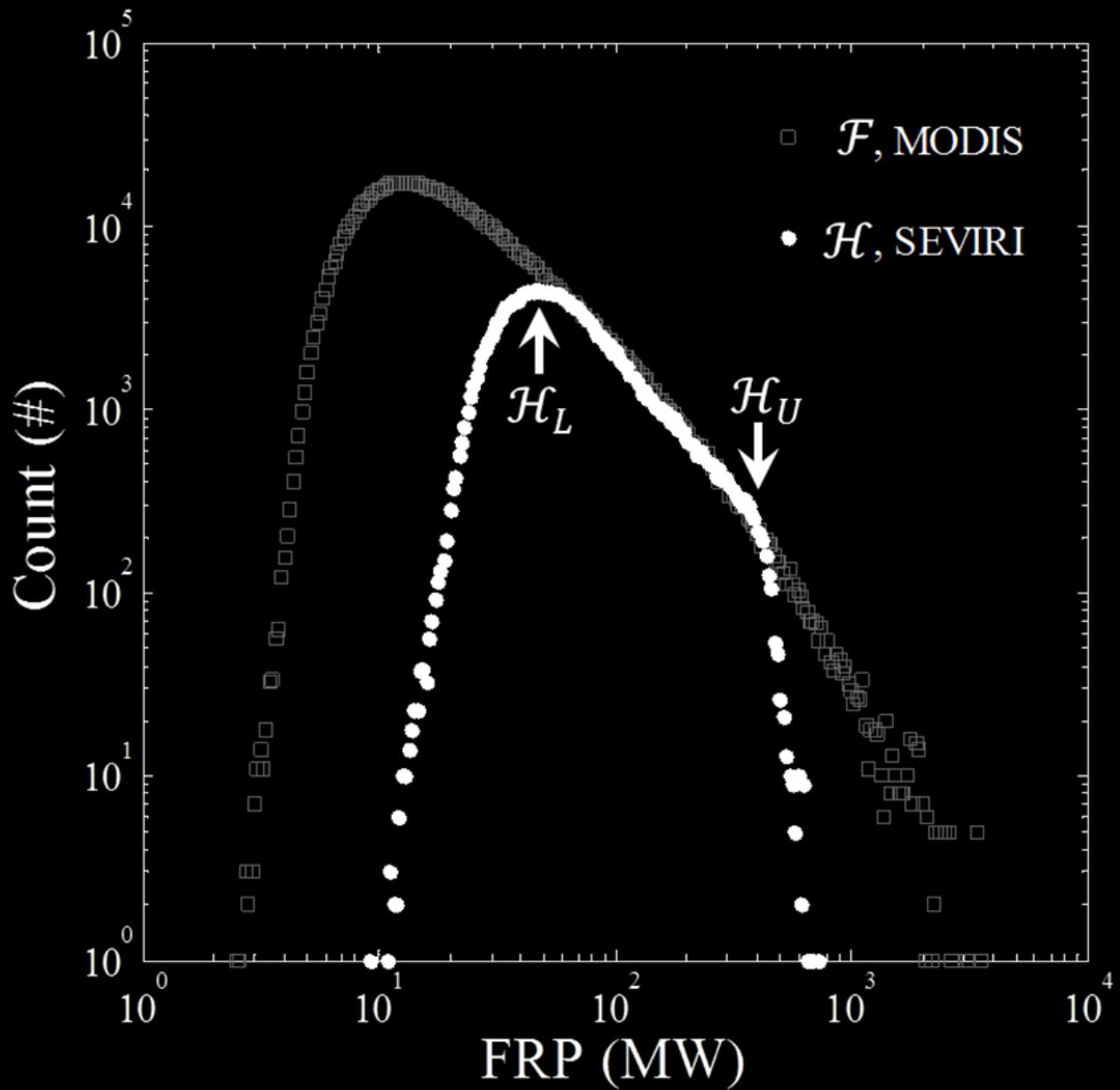
Regional Scale FRP Comparison (FRP-PIXEL vs. MODIS)



Conclusion

When SEVIRI and MODIS observe the same region, the FRP-PIXEL product tends to underestimate total regional-scale FRP, due to missing “small fire” which can be detected by MODIS.

FRP Frequency Distribution

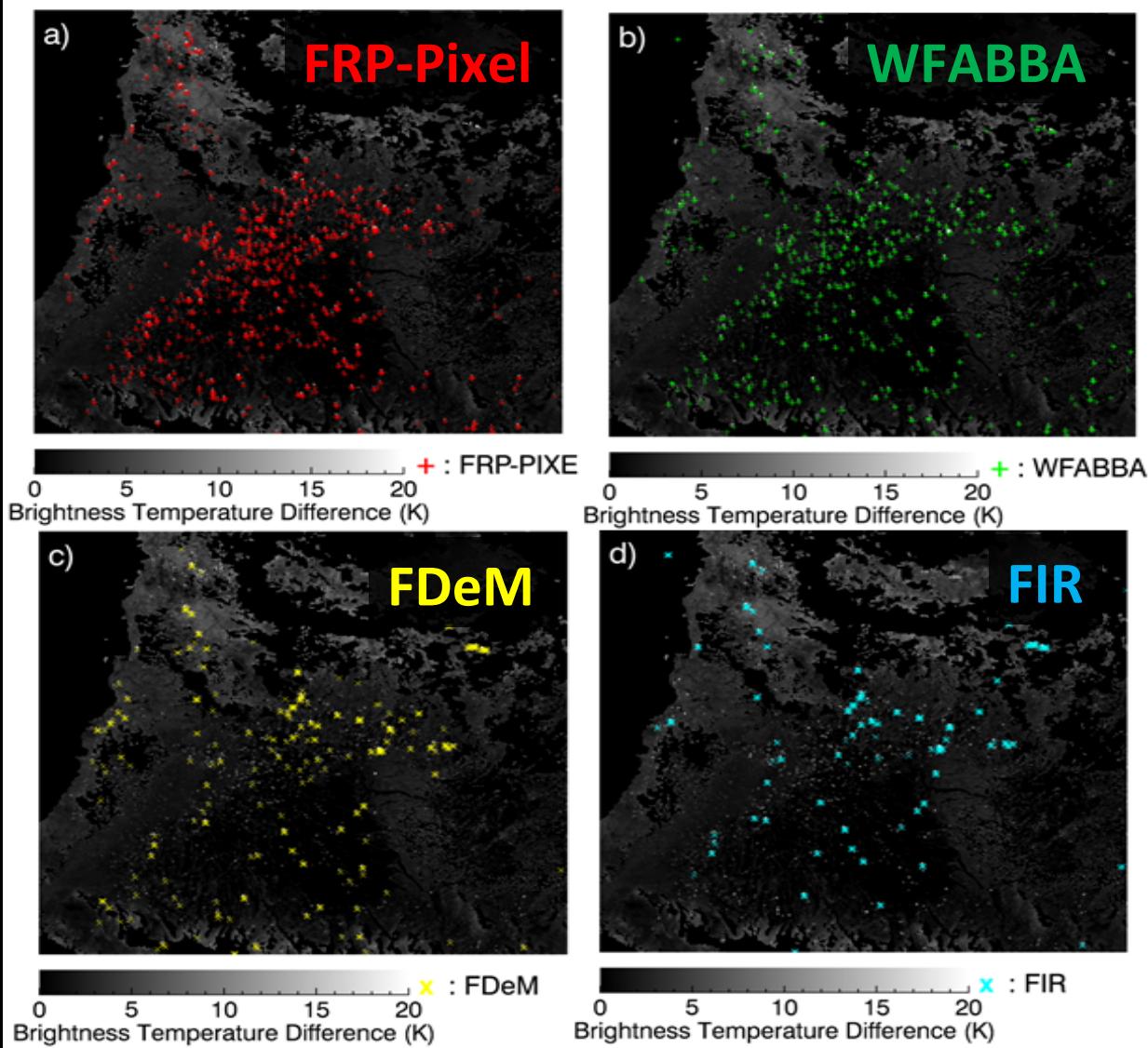


"Rollover" Thresholds

MODIS: ~ 10 MW

SEVIRI: ~ 40 MW

FRP-Pixel: Comparison to Alternative SEVIRI Active Fire Products – 21 Aug 2014



Active Fire
Pixel Counts

FRP-PIXEL : 1249

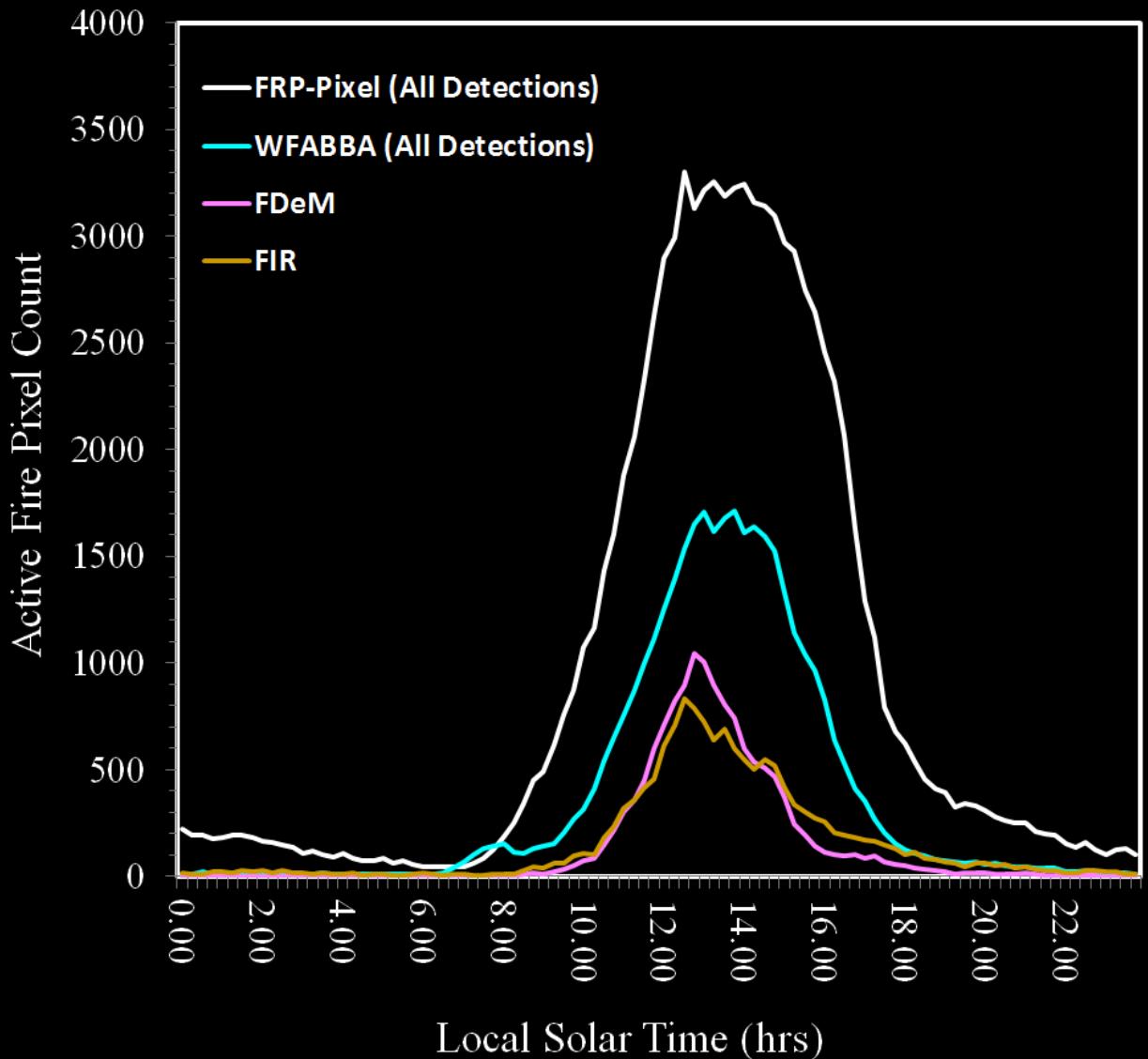
WFABBA : 686

FDeM : 346

FIR : 312

All @ 13:15 UTC

Fire Diurnal Cycle of SEVIRI Active Fire Products



Daily Active Fire Pixel Count

FRP-PIXEL : 89,781
WFABBA : 35,759
FDeM : 13,477
FIR : 14,645

All on 30 Aug 2014

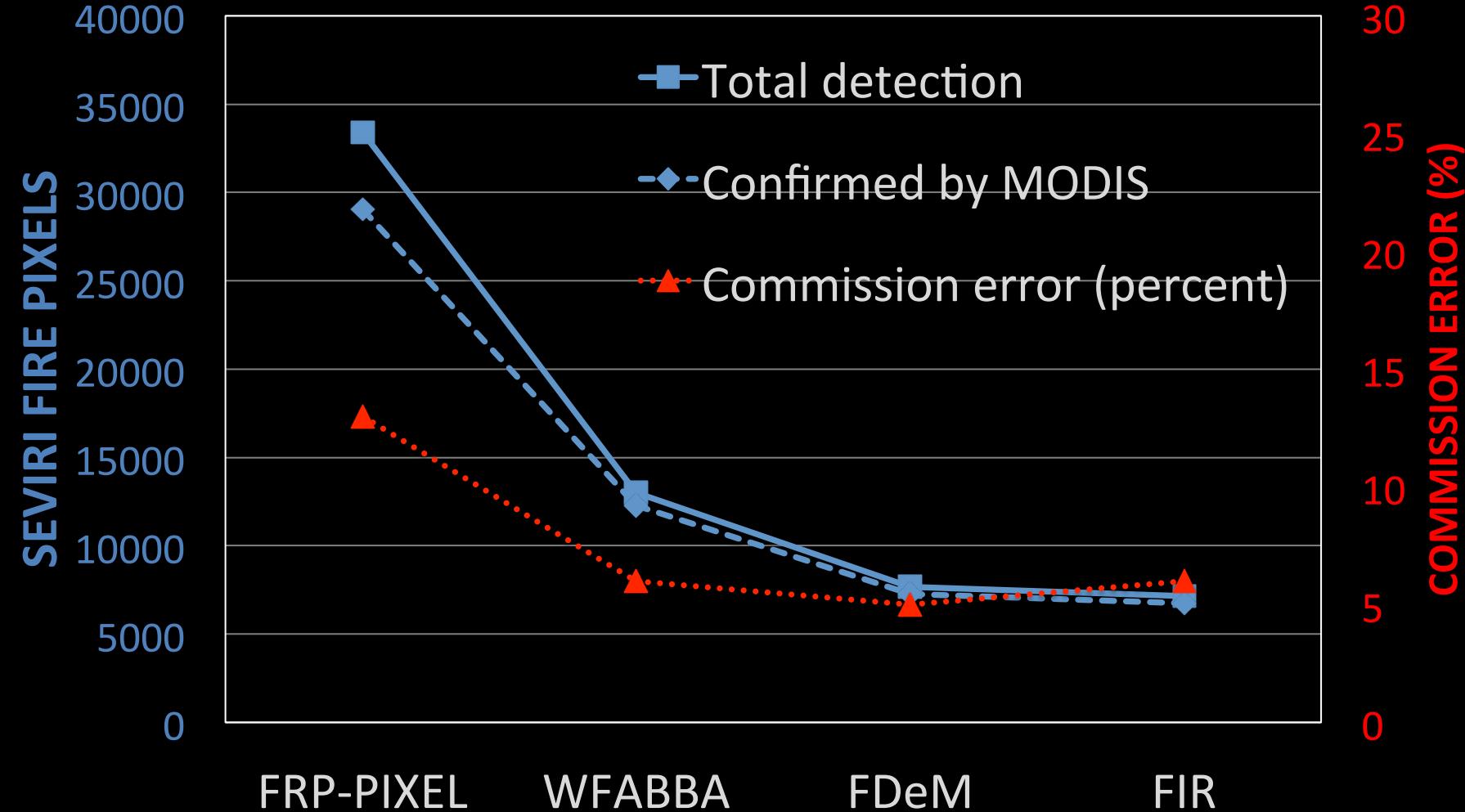
Active Fire Detection Performance : SEVIRI Fire Products vs. MODIS

1 Month Active Fire Error of Omission



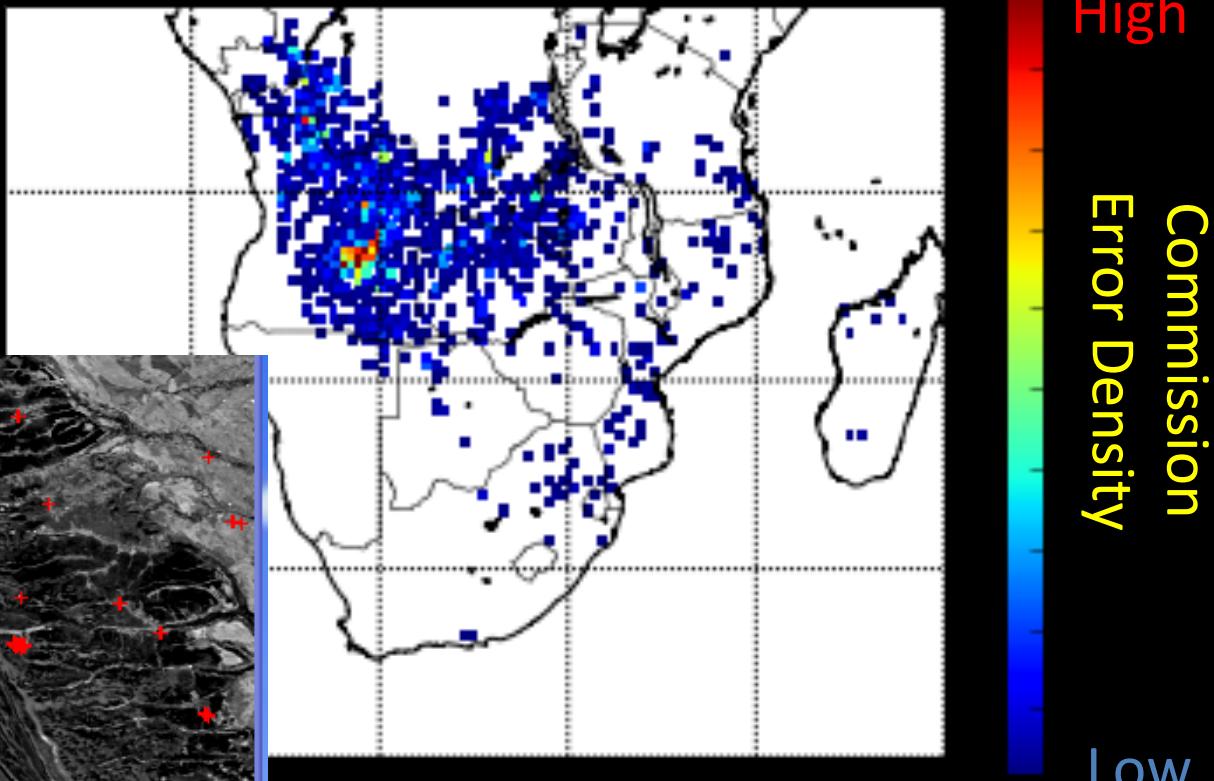
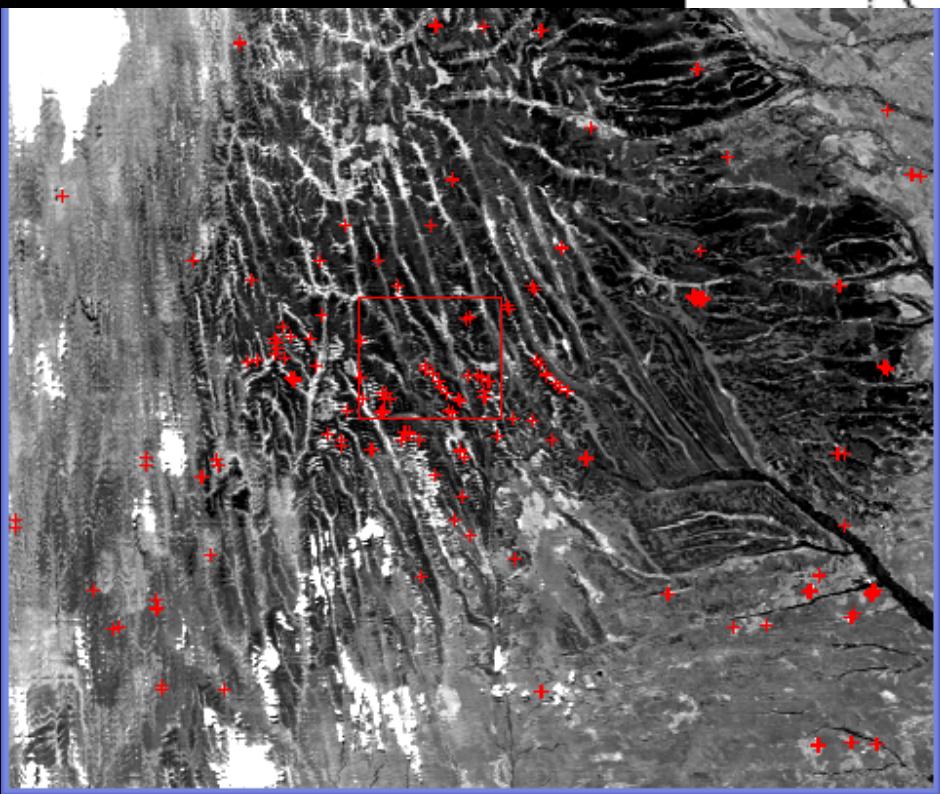
Active Fire Detection Performance : SEVIRI Fire Products vs. MODIS

1 Month Active Fire Error of Commission



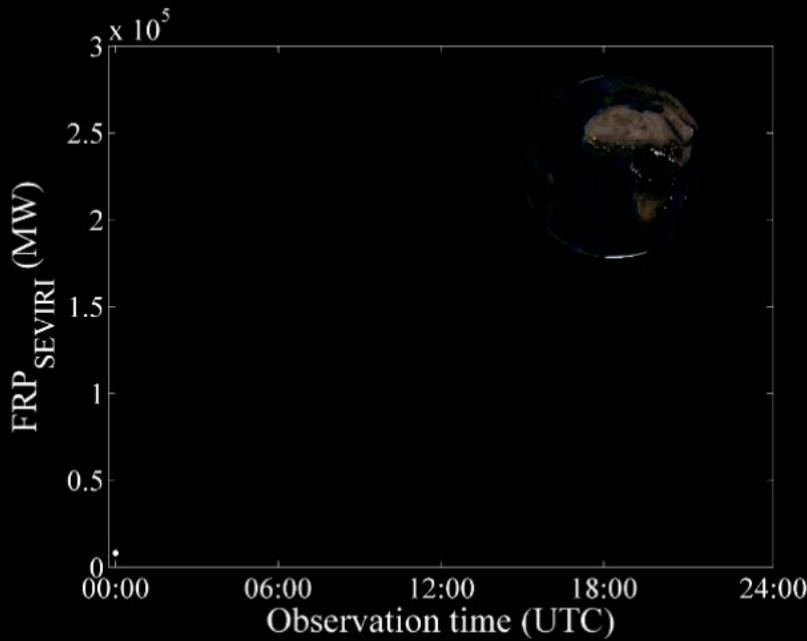
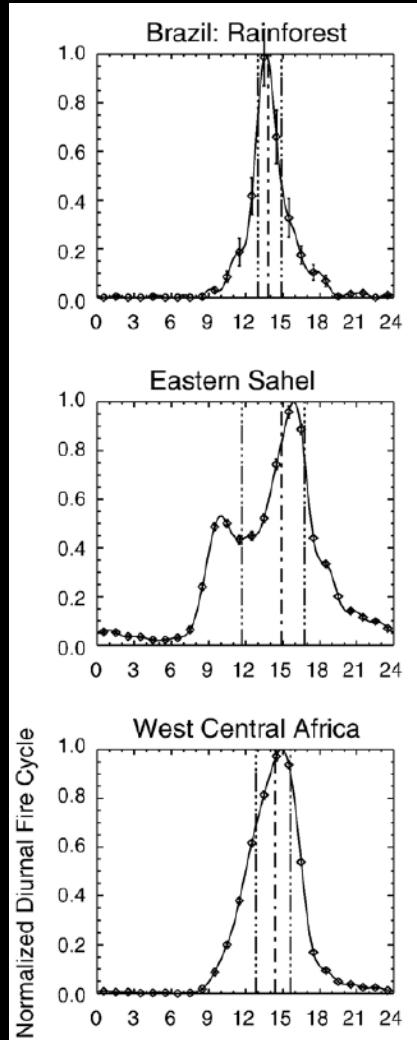
Active Fire Detection Commission Error Mapping

~28% (1247 of 4415 pixels) of false detections in FRP-Pixel Product from “solar heated warm slopes” in Angola.



- Caused by Alg. “Spatial filter” using static minimum threshold to save processing time.
- Reduces to < 10% using dynamic spatial filter (mean of all clear pixels).

SEVIRI - Fire Diurnal Cycle

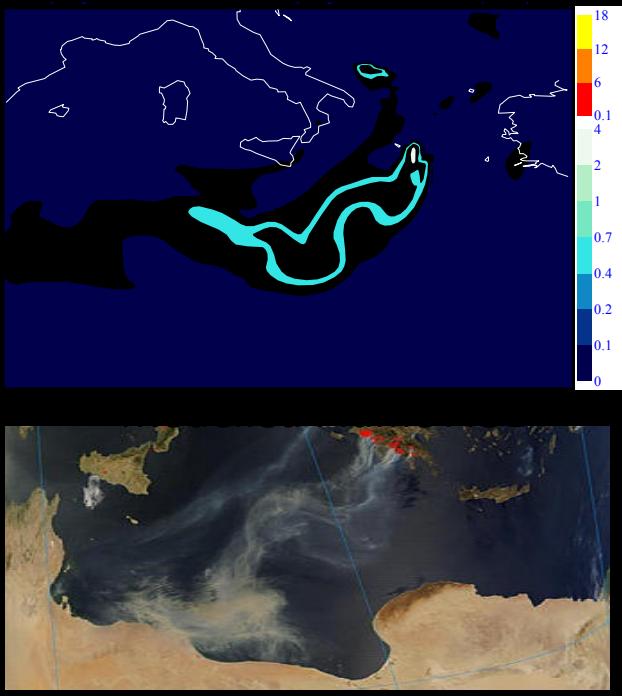


August 2007 Greek Fires

Copernicus Atmosphere Service



Aerosol Optical
Depth (Modelled)



Modeling performed under EU MACC Project

Courtesy by Morcrette, J., Jones, L, Benedetti, A. and Kaiser, J.

Future Developments

- Full disk FRP-pixel product
- Daily product ?
- Gas flare product ?
- Fire emissions product
- Spatial filter enhancement
- Cloud edge enhancement
- Water edge enhancement

