Earth Observation of Active Fires & Biomass Burning in Europe

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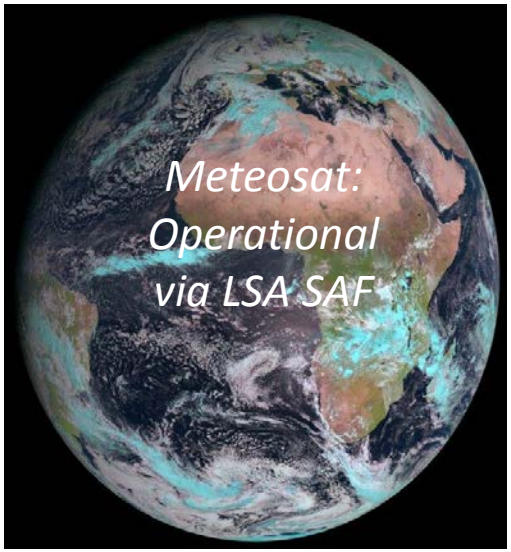
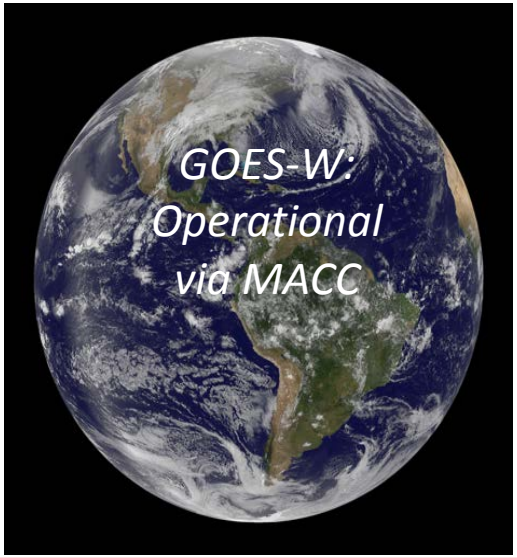
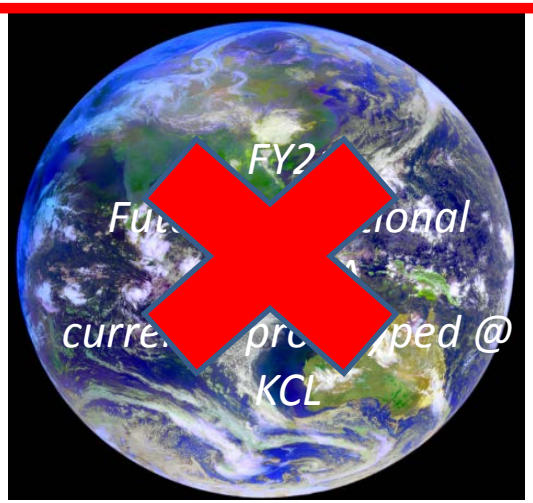
NERC National Centre for Earth Observation (NCEO)

European Geostationary Active Fire Products

Global Geostationary System (via Europe)

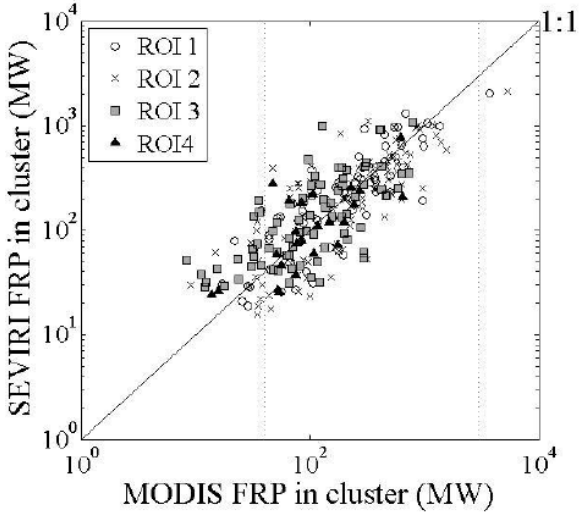






Non-Optimum 3.9 µm channel data quality

Non-Optimum 3.9 µm channel dynamic range



SEVIRI FRP-Pixel: Quality Product

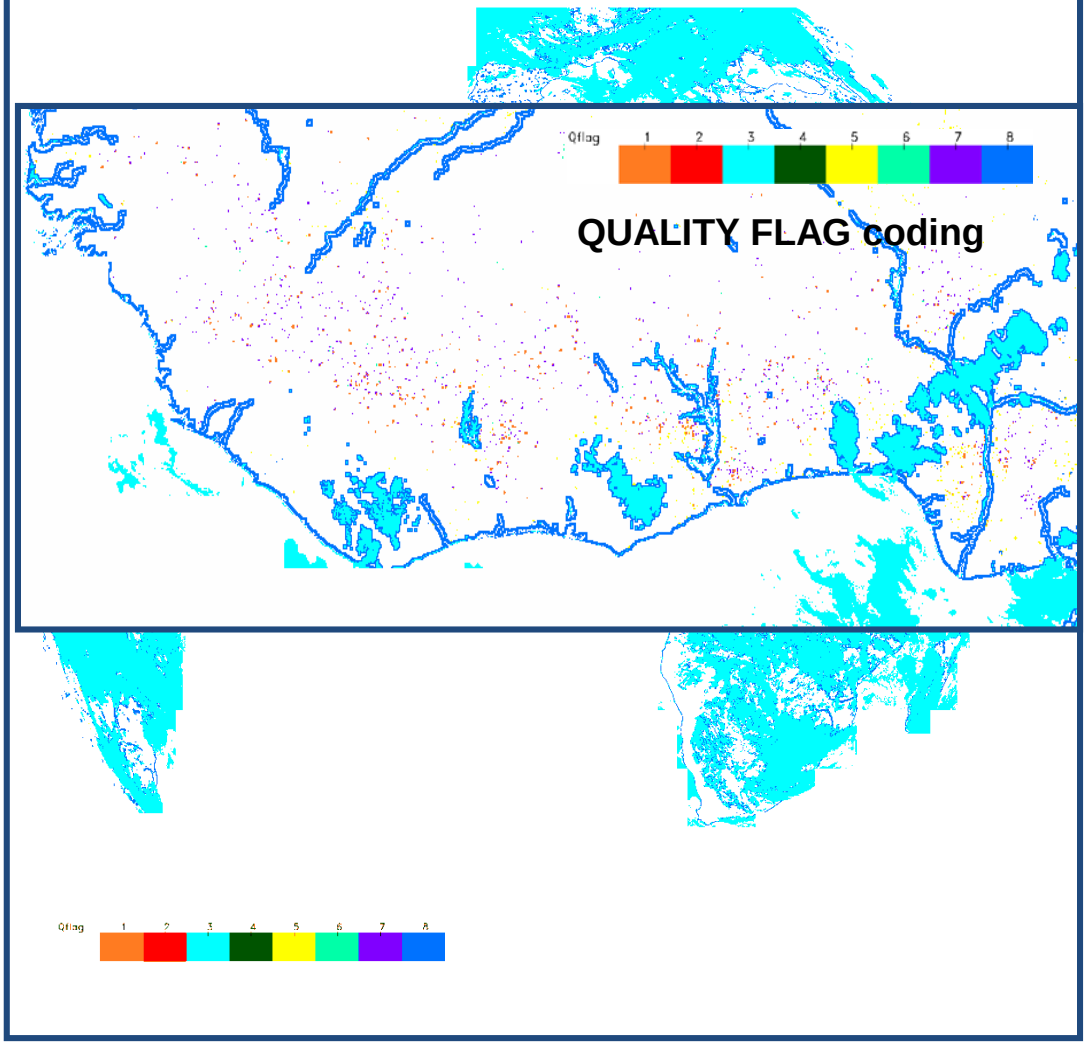
Two HDF files for each slot

- "List Product"- Fire Data only

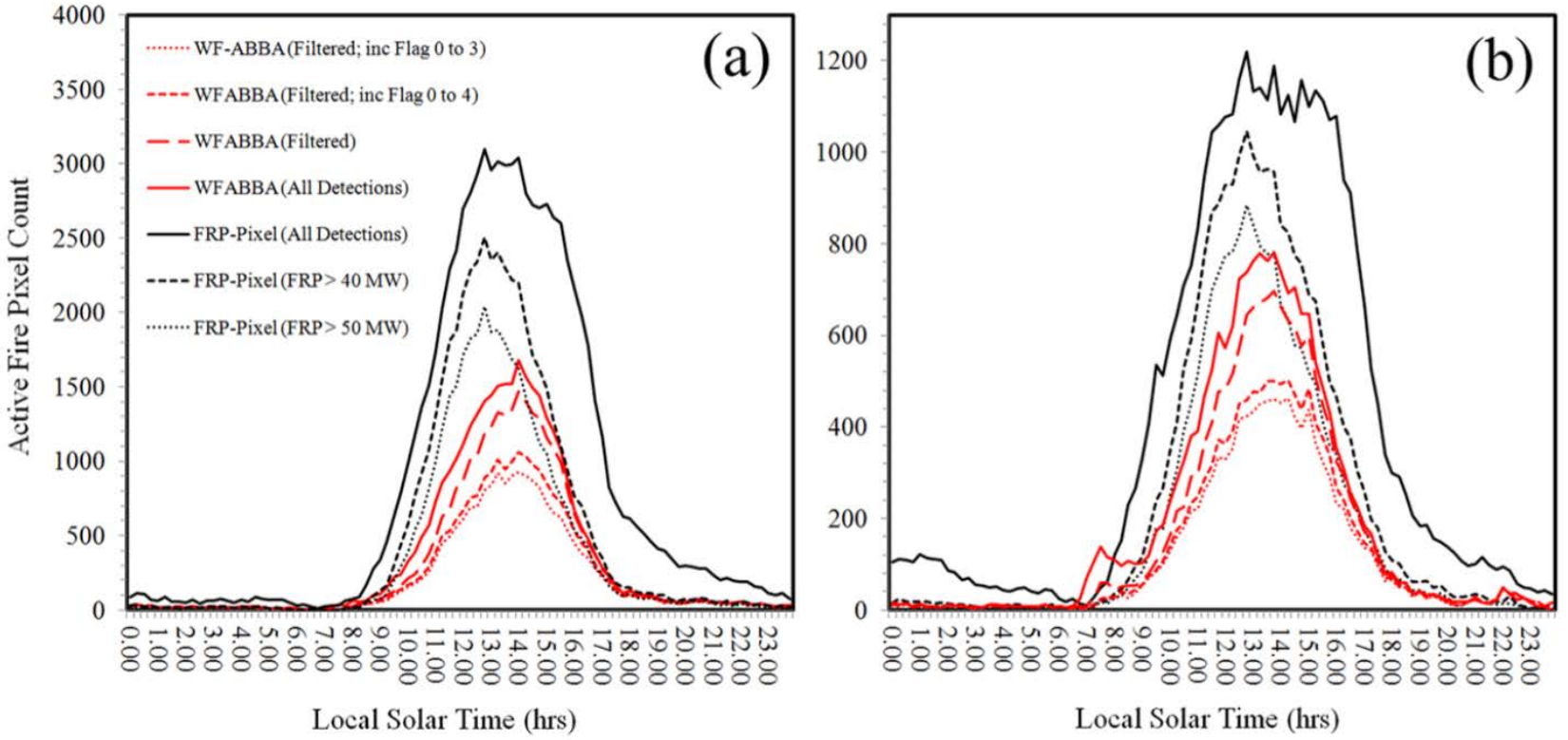
VALUE	MEANING
0	NOT POT FIRE
1	FRP OK
2	FRP SAT
3	CLOUDY
4	SUN GLINT
5	SUN GLINT RATIO
6	NO BCK
7	BAD BCK
8	CLOUD EDGE
254	NOT PROCESSED

LSA SAF Meteosat FRP products-Part 1 : Algorithms, product contents, and analysis. / Wooster, M. J.; Roberts, G.; Freeborn, P. H.; Xu, W.; et al. In: Atmospheric Chemistry and Physics, Vol. 15, No. 22, 30.11.2015, p. 13217-13239.

FRP_Pixel Quality Product File



SEVIRI FRP-Pixel – Intercomparison



LSA SAF Meteosat FRP products-Part 1 : Algorithms, product contents, and analysis. / Wooster, M. J.; Roberts, G.; Freeborn, P. H.; Xu, W.; Govaerts, Y.; Beeby, R.; He, J.; Lattanzio, A.; Fisher, D.; Mullen, R. In: Atmospheric Chemistry and Physics, Vol. 15, No. 22, 30.11.2015, p. 13217-13239.

METEOSAT LSA-SAF FRP Climate Data Record

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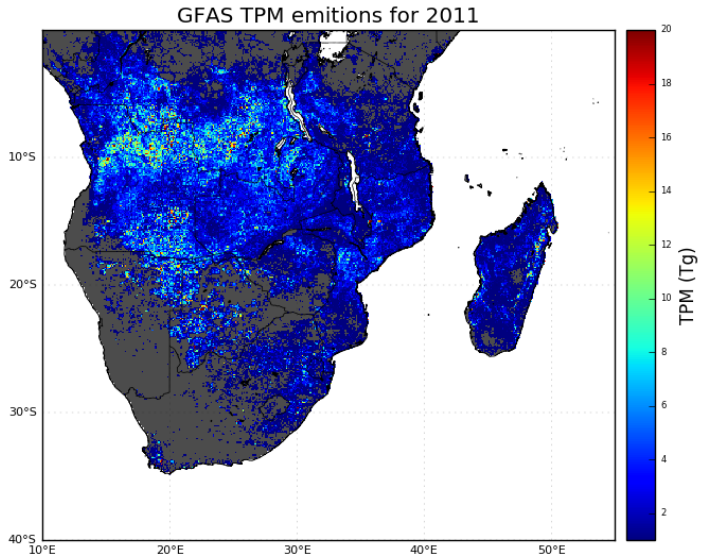
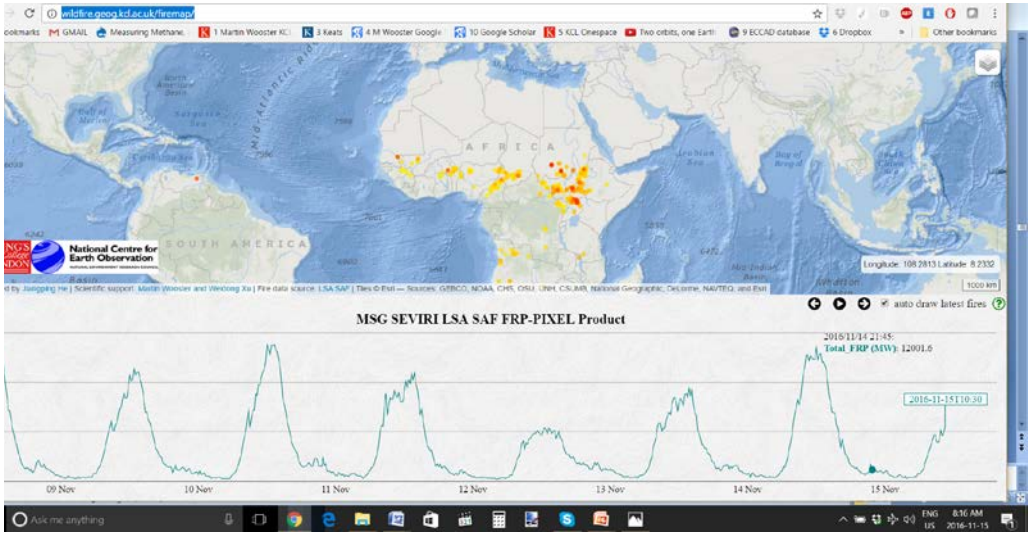
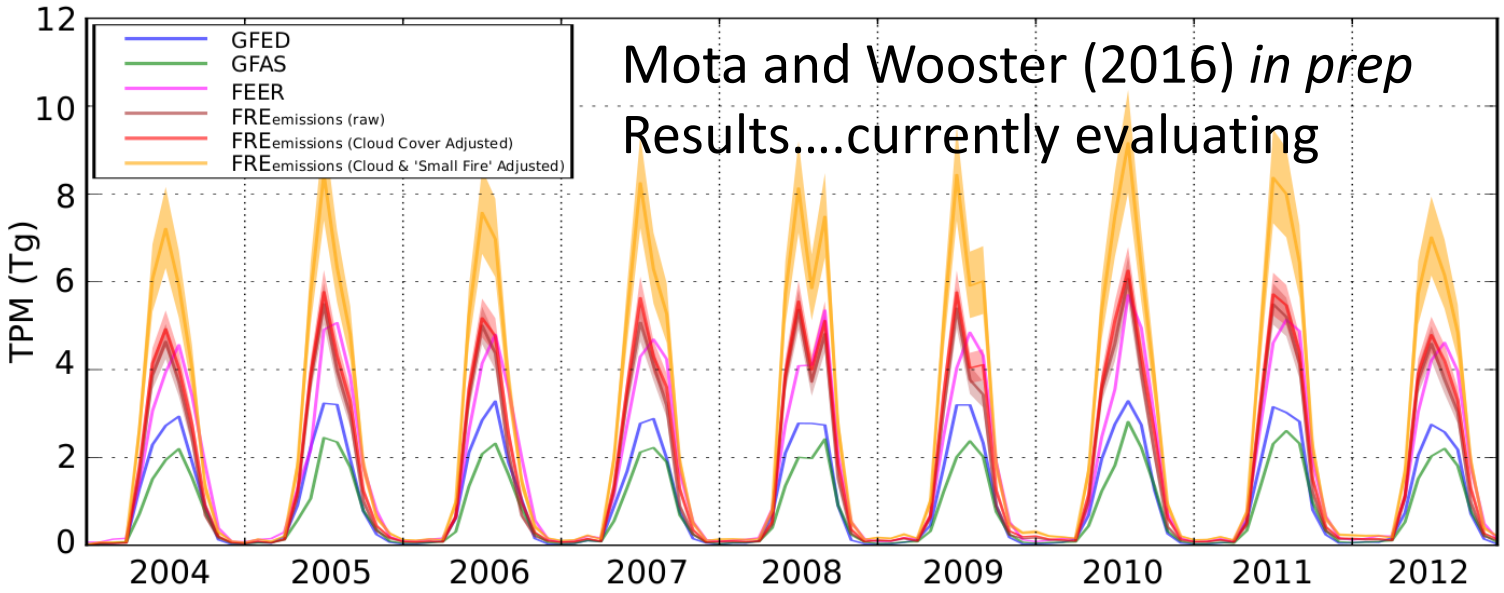


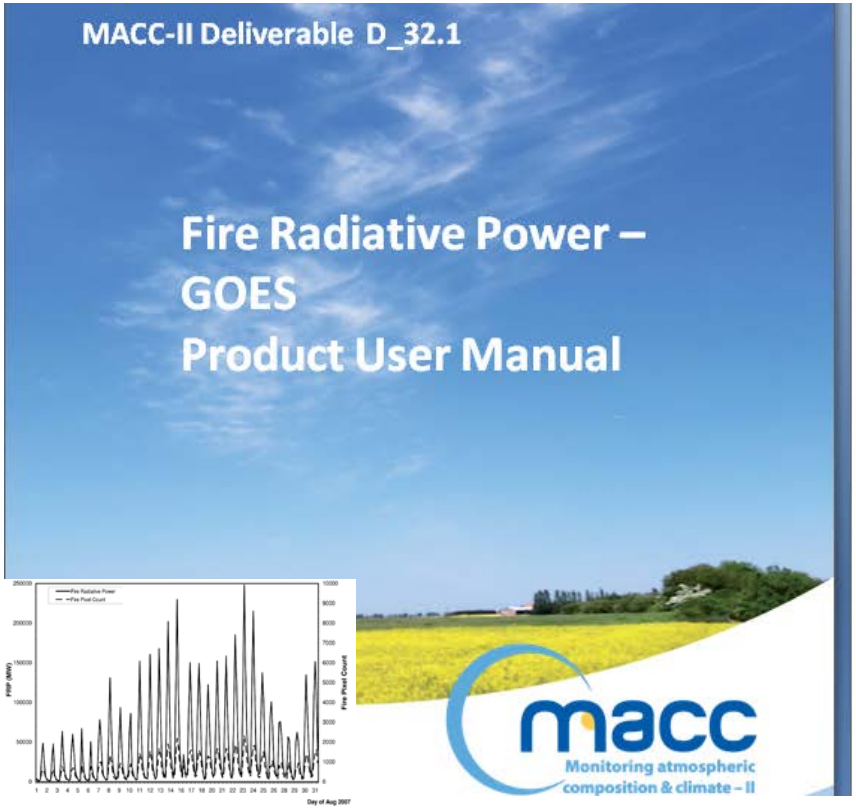


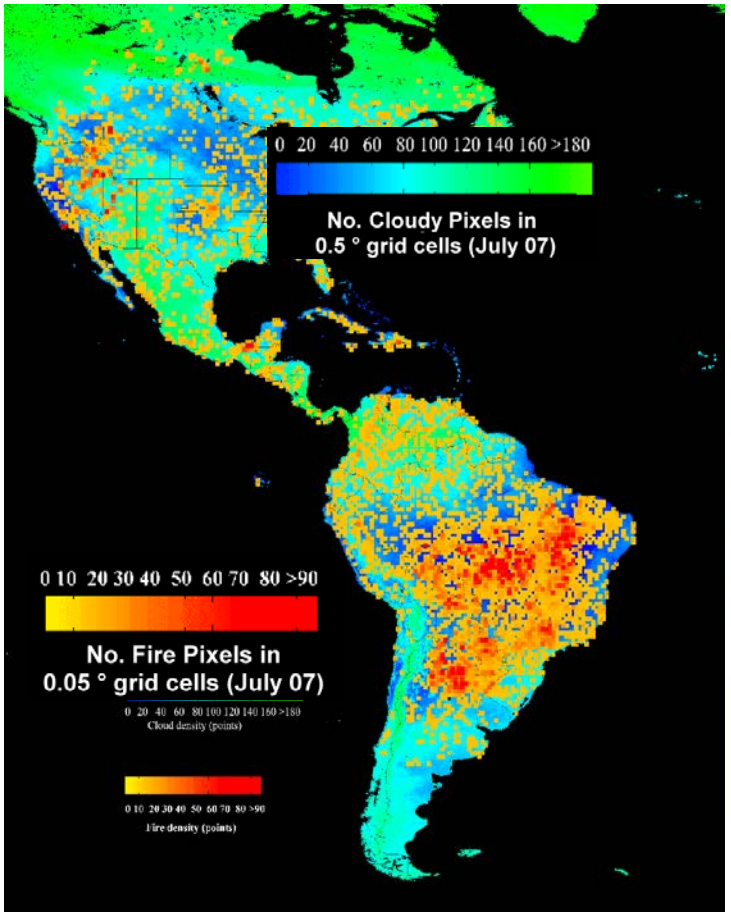


Mota and Wooster (2016) *in prep*

Results….currently evaluating

GOES FRP Product (America's)

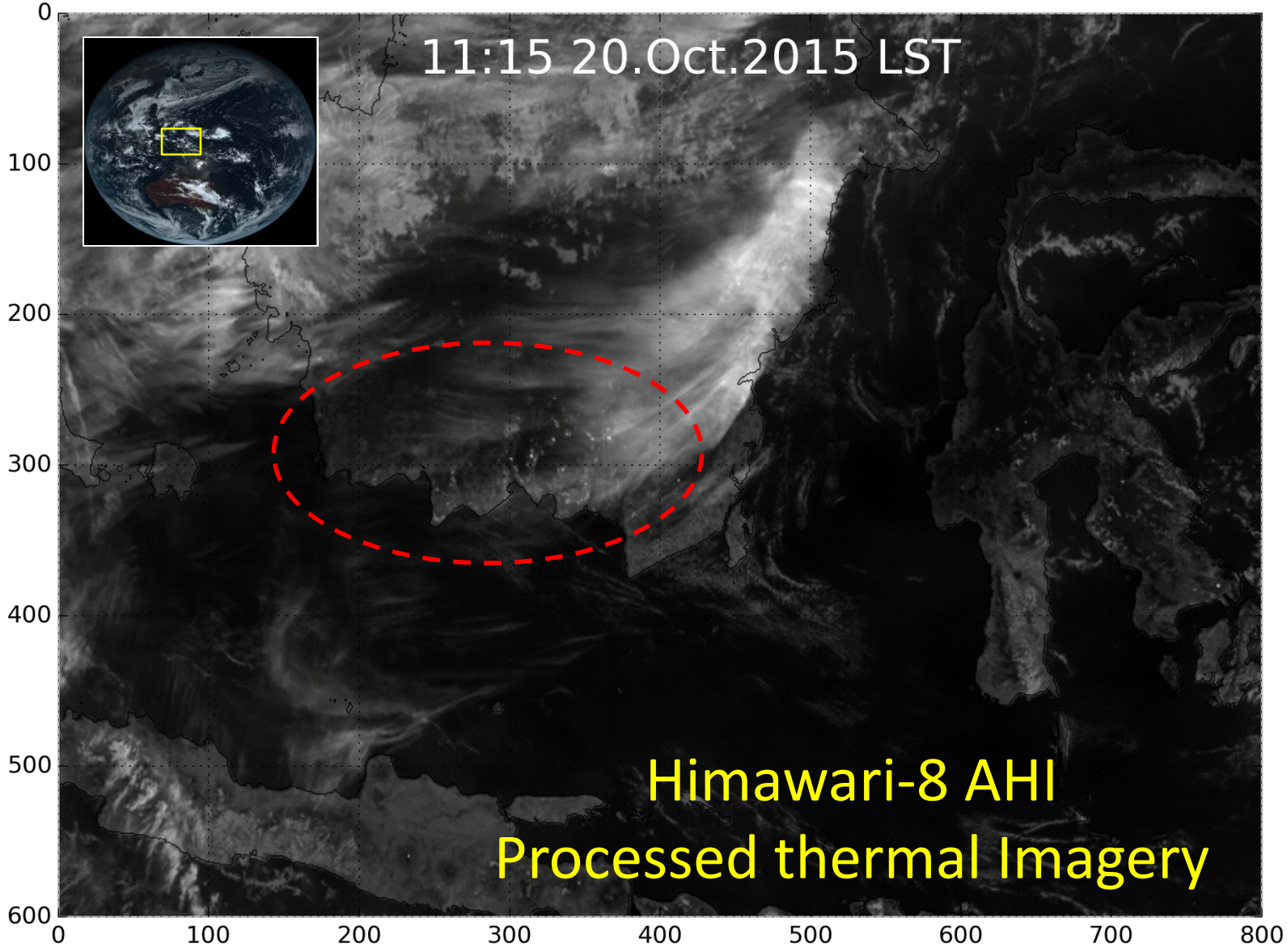




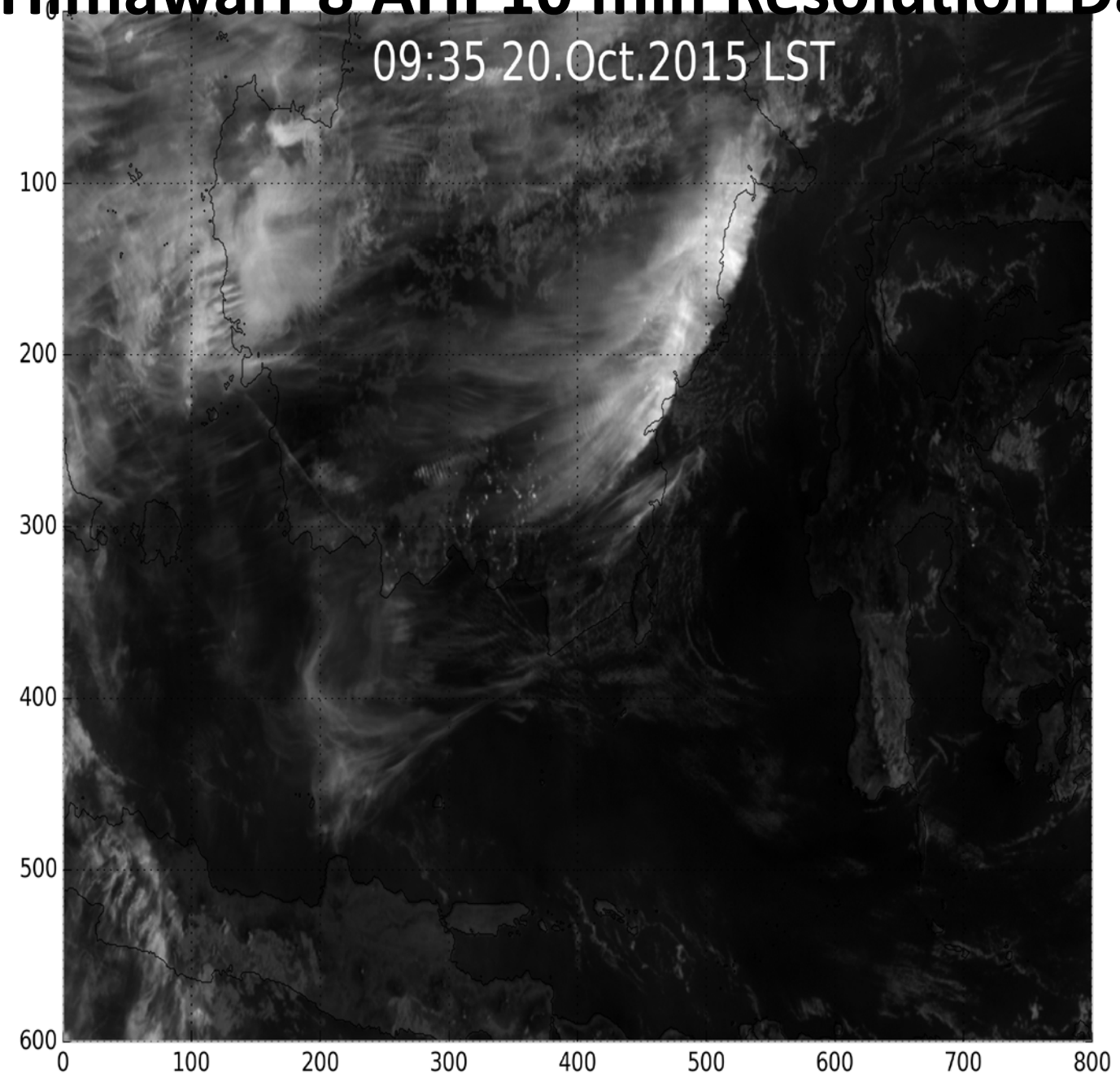
Produced using the same Fire Thermal Anomaly (FTA) as the LSA SAF Meteosat FRP

ftp://frp_public:frp@geoland2.meteo.pt

Himawari-8 AHI 10 min Resolution Data



Himawari-8 AHI 10 min Resolution Data



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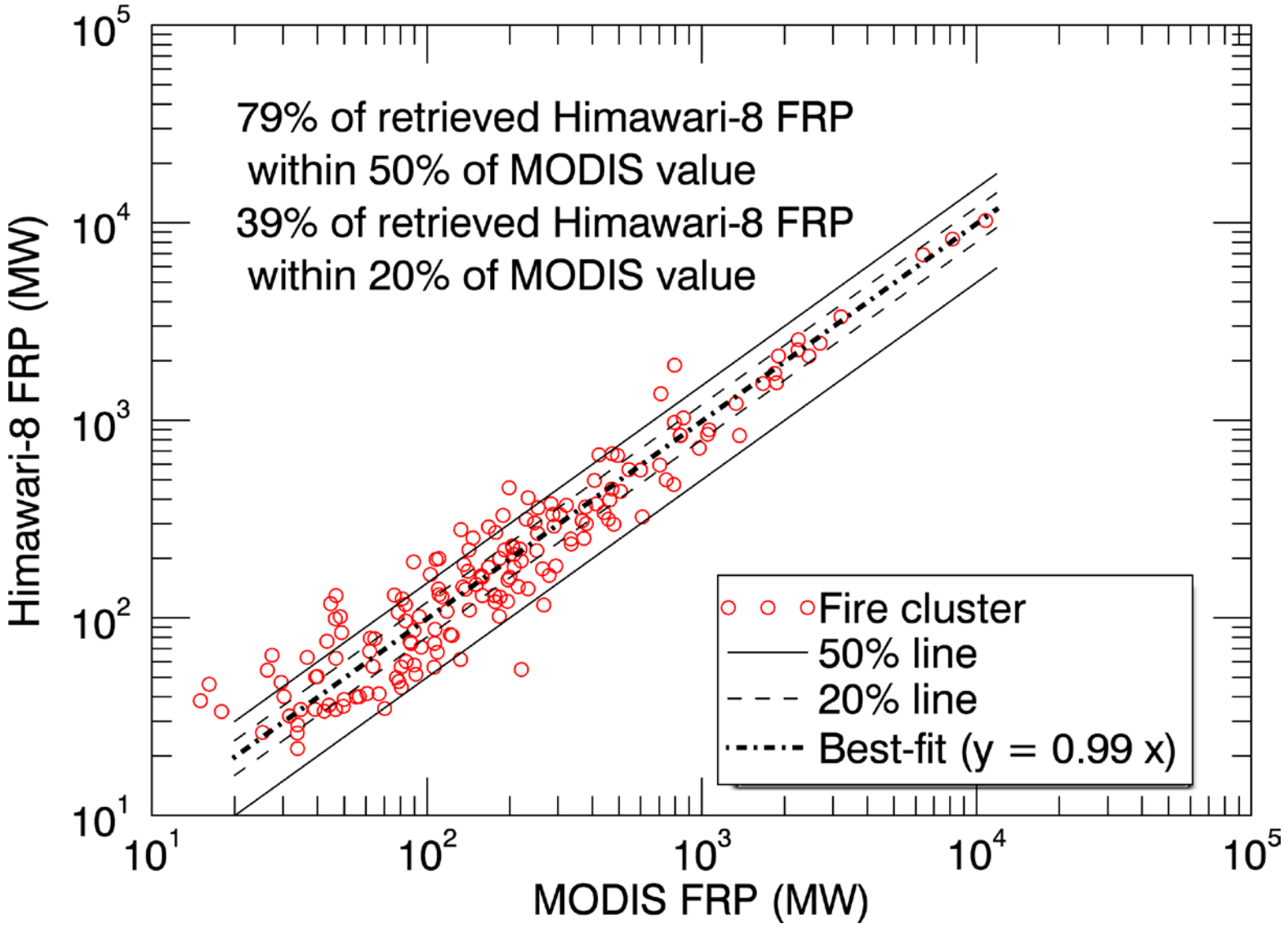
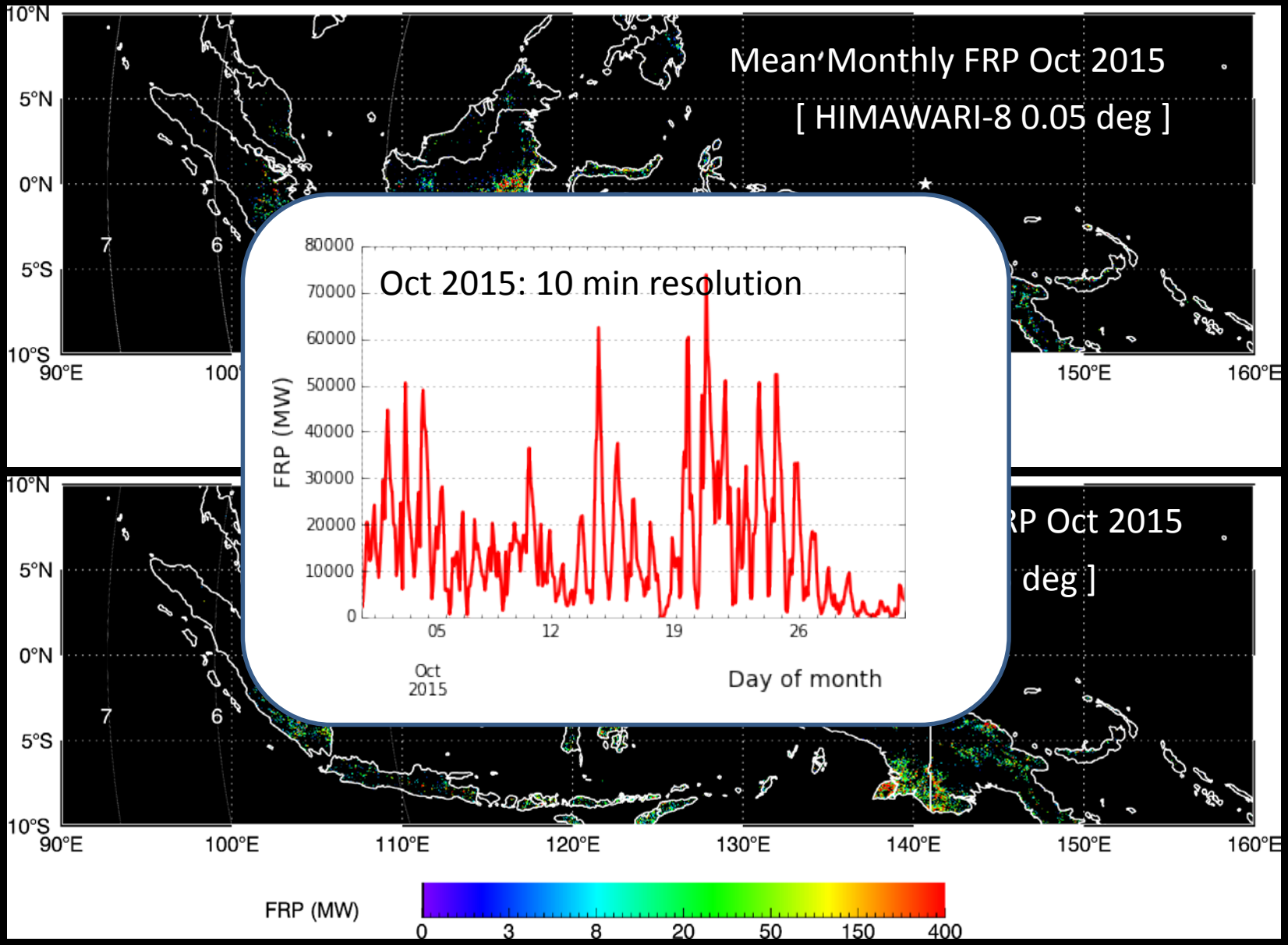
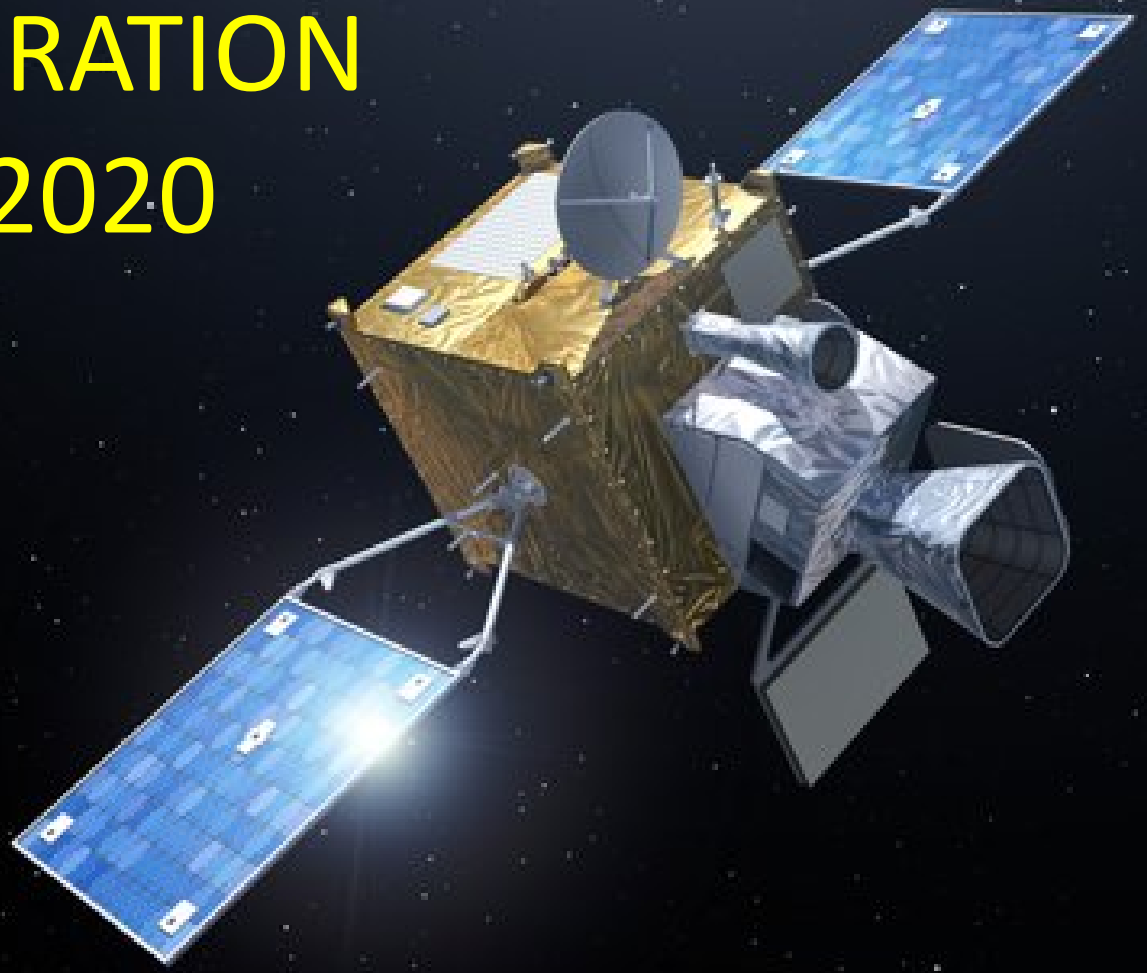
Himawari-8 AHI *vs.* MODIS Comparison



Himawari-8 *vs.* MODIS



METEOSAT 3rd GENERATION ~ 2020



COPERNICUS ATMOSPHERE MONITORING SERVICE (CAMS)

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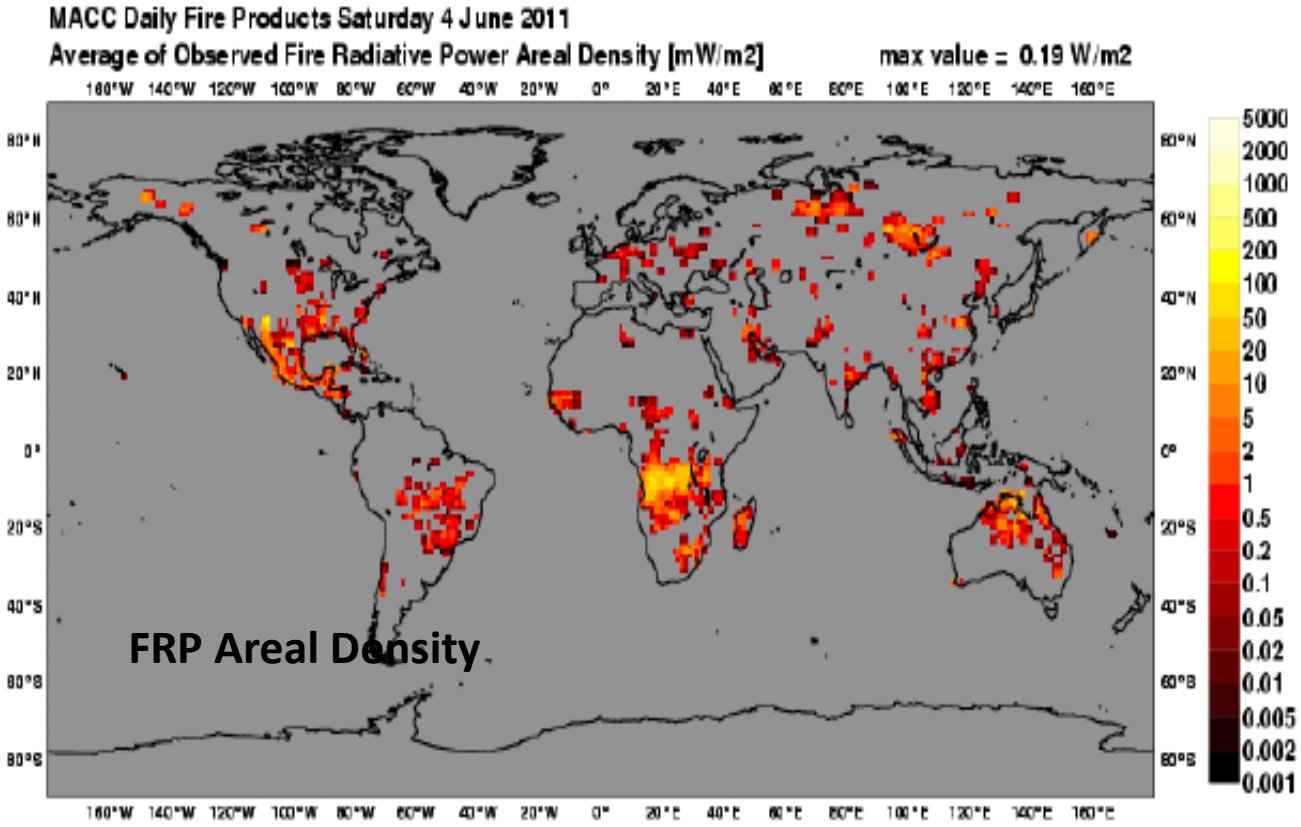
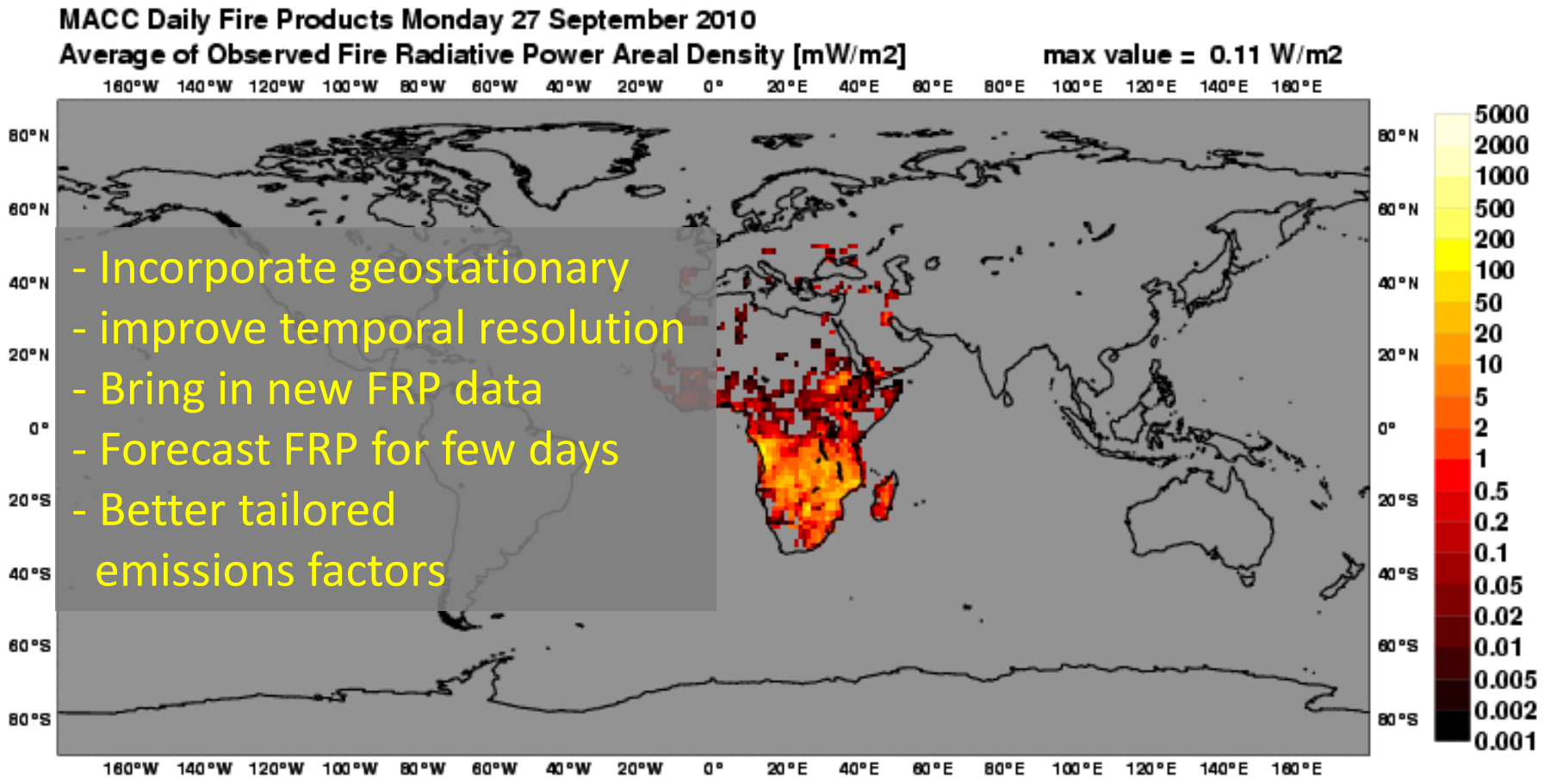
Global Fire Assimilation System (GFAS)



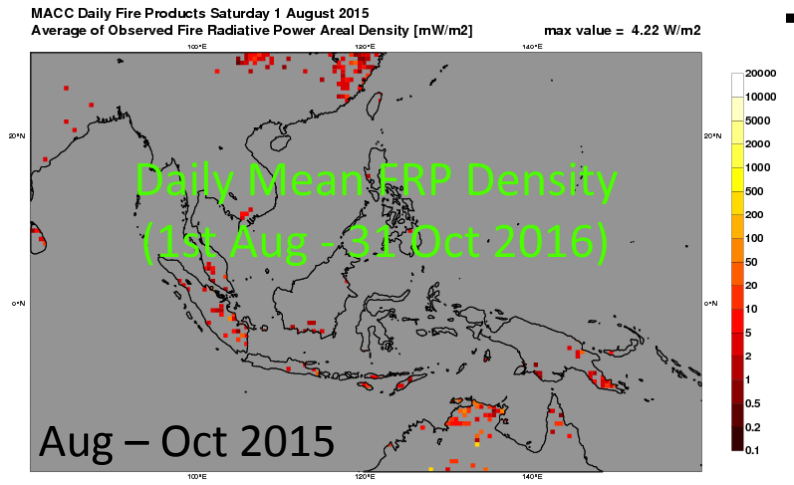
GFAS FRP Density from SEVIRI



Daily Mean FRP density [W m^{-2}] calculated from SEVIRI @ 0.5°

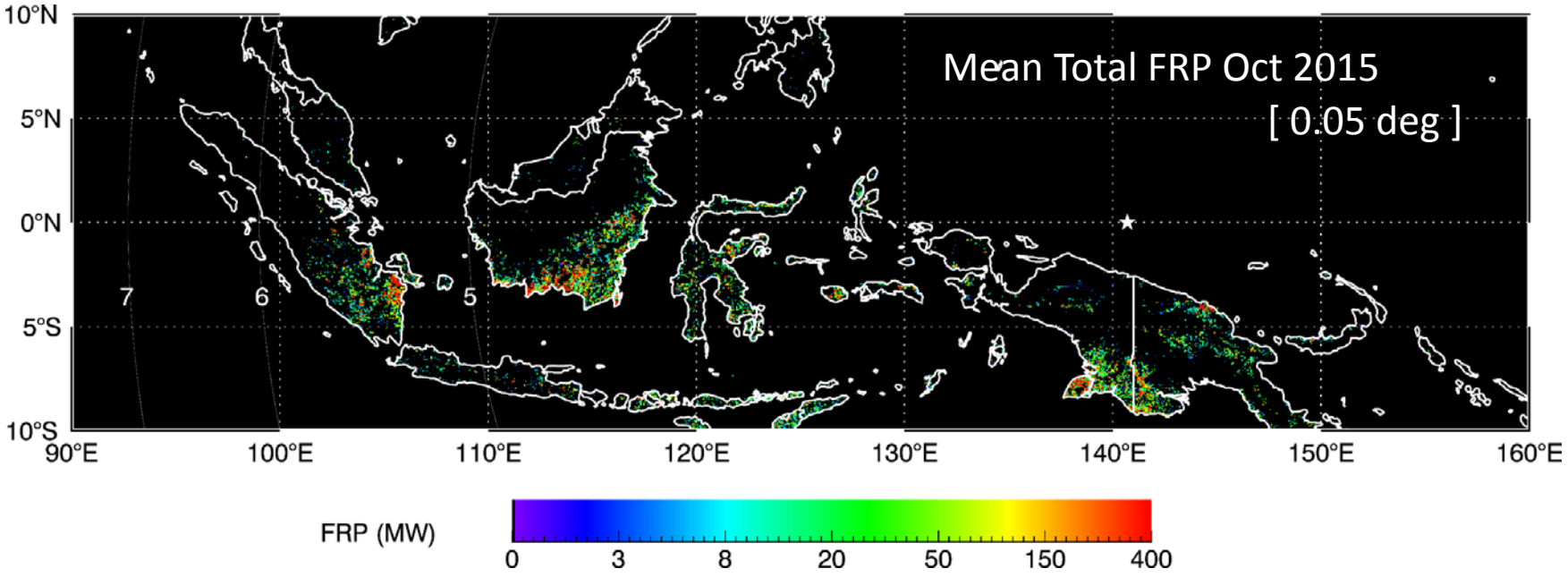
Global Fire Assimilation System developed to run part of Copernicus Atmosphere Service.

Daily FRP Mapping from MODIS

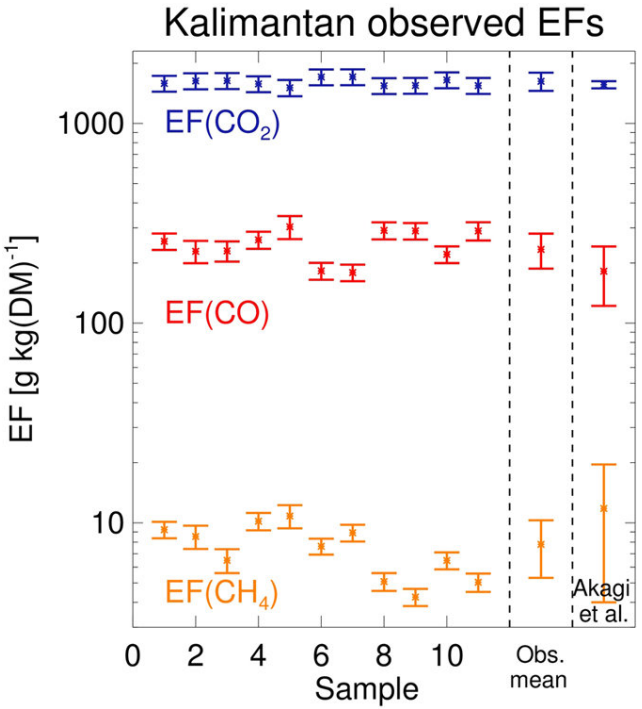


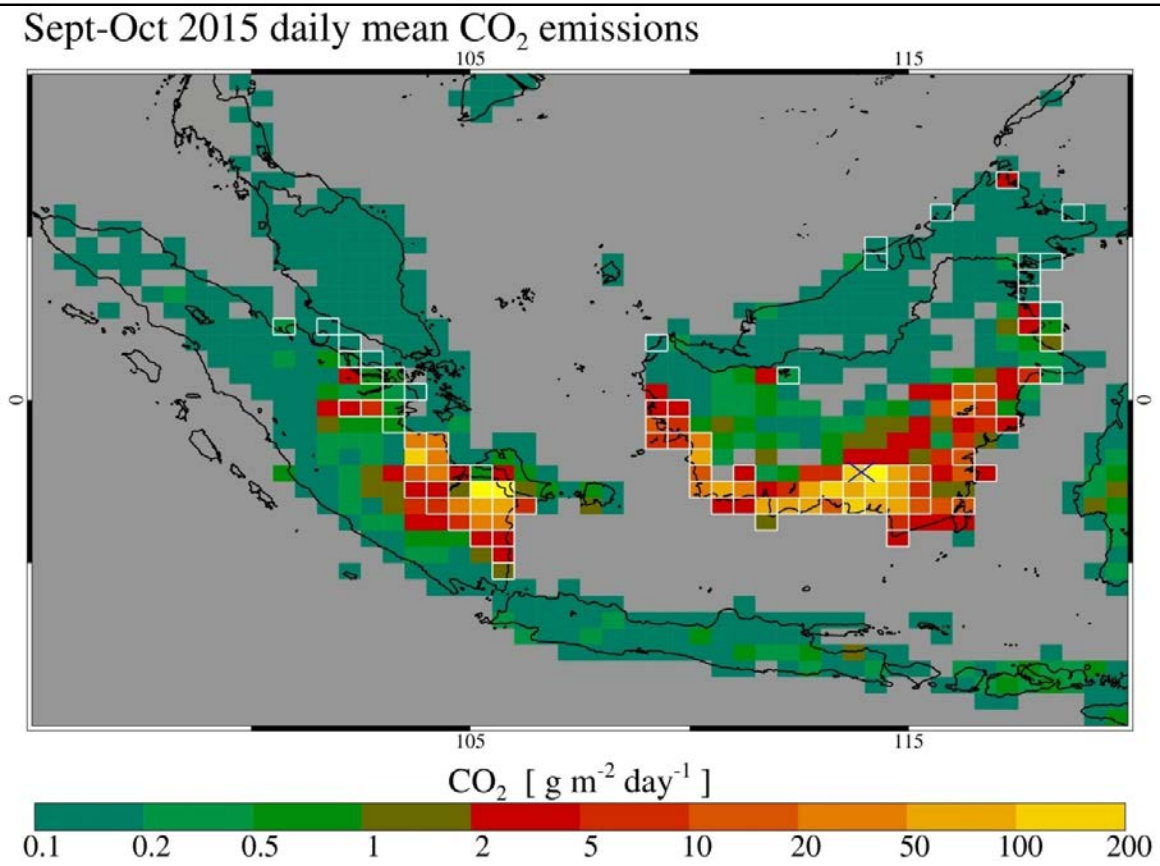
MODIS FRP measures made at locations of detected fire pixels are the basis of the Copernicus Atmosphere Service GFAS Fire Emissions – updated daily :

www.copernicus-atmosphere.eu



First 2015 Fire C Emissions Estimate

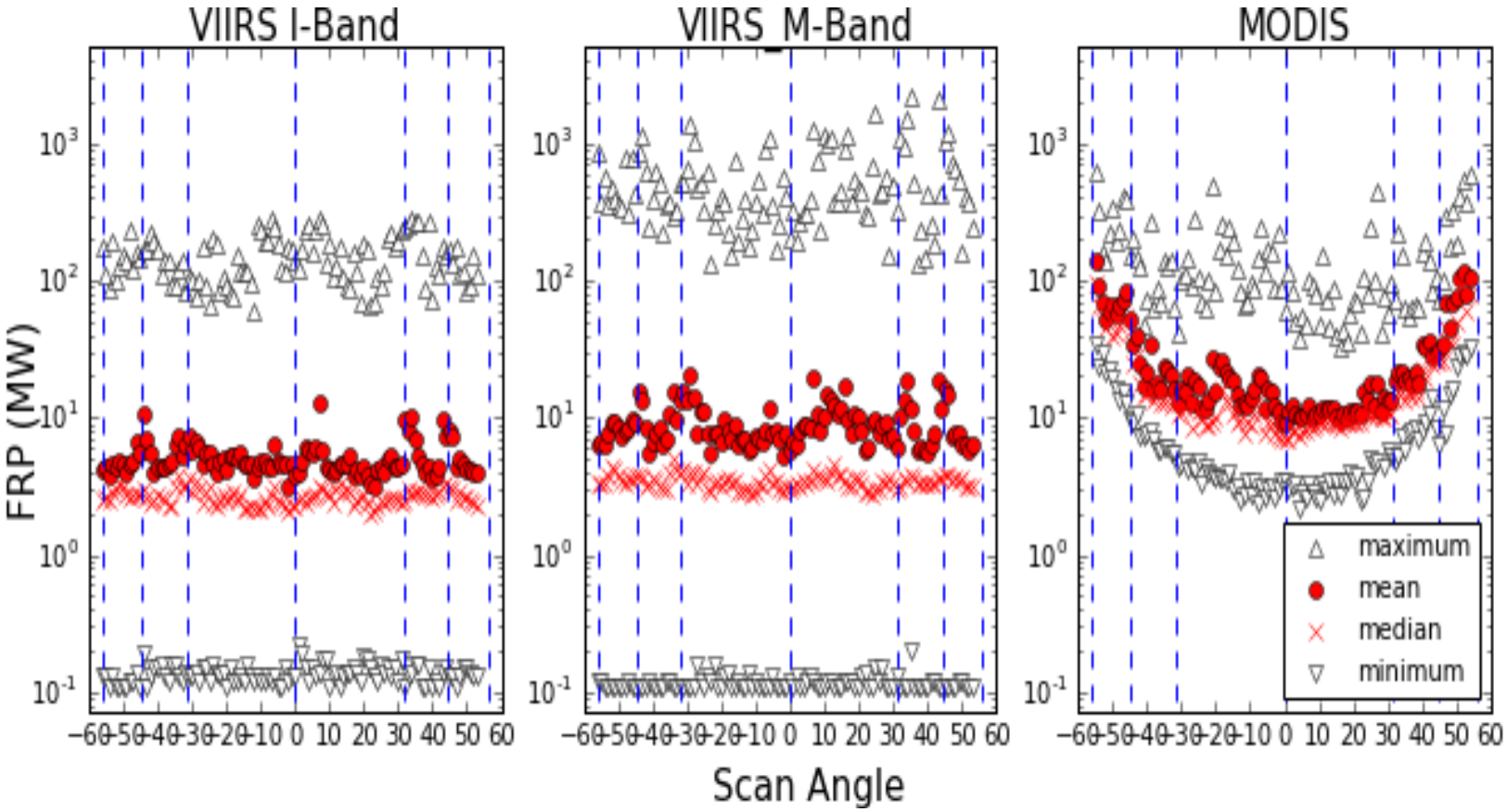




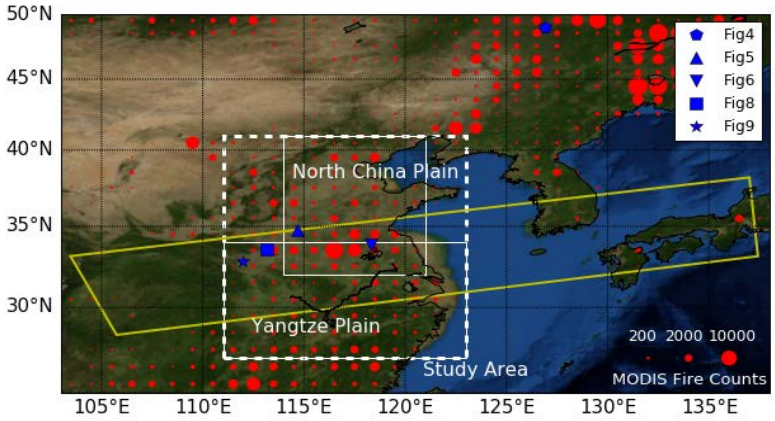
Huijnen, V., Wooster, M. J., L. A. Gaveau, D., Flemming, J., Parrington, M., Inness, A., D. Murdiyarso, Main, B. & van Weele, M. 31 May 2016 In **Fire carbon emissions over maritime southeast Asia in 2015 largest since 1997, Nature Scientific Reports**

Regional Exploitation of VIIRS

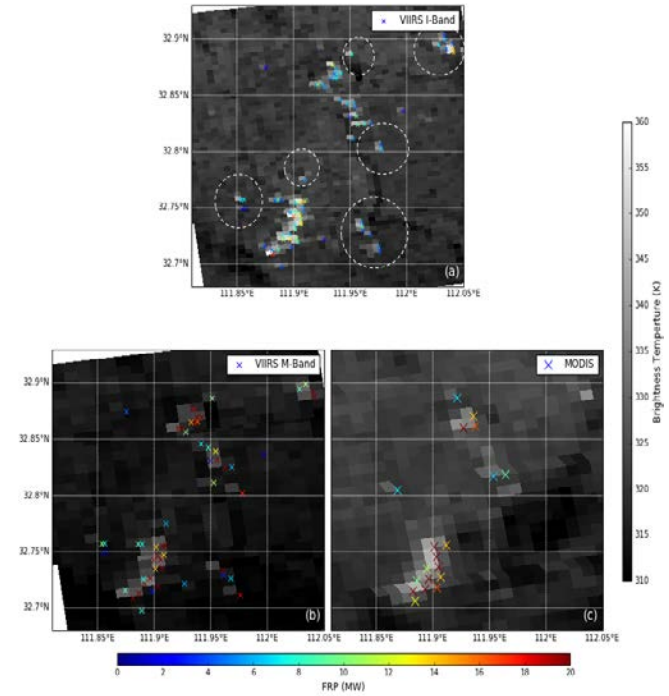
Benefits of VIIRS

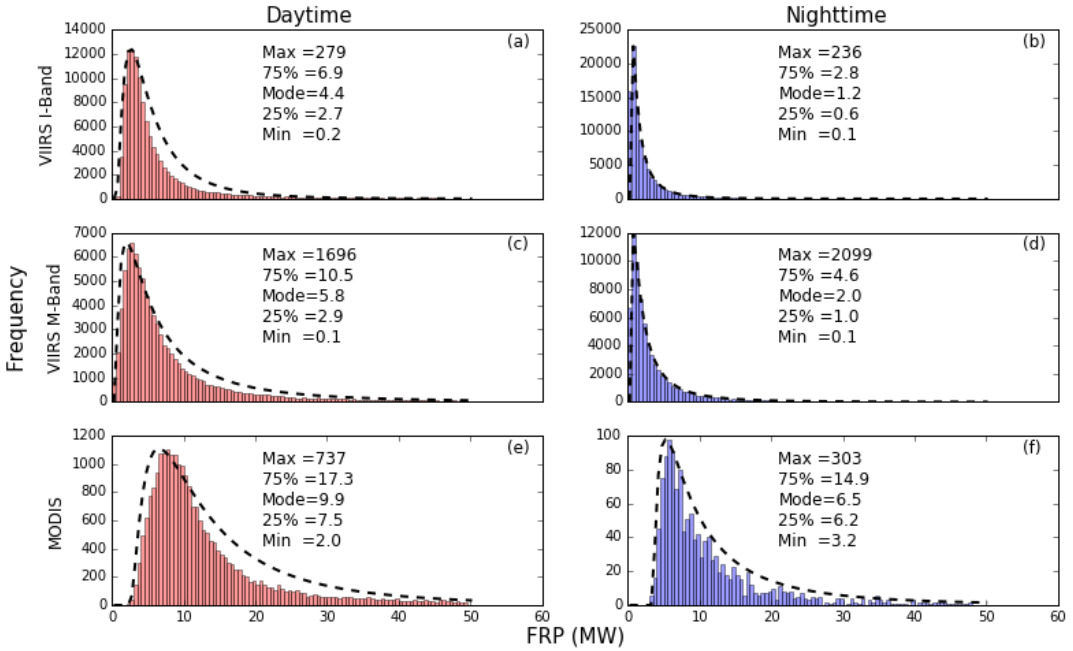


Regional Exploitation of VIIRS



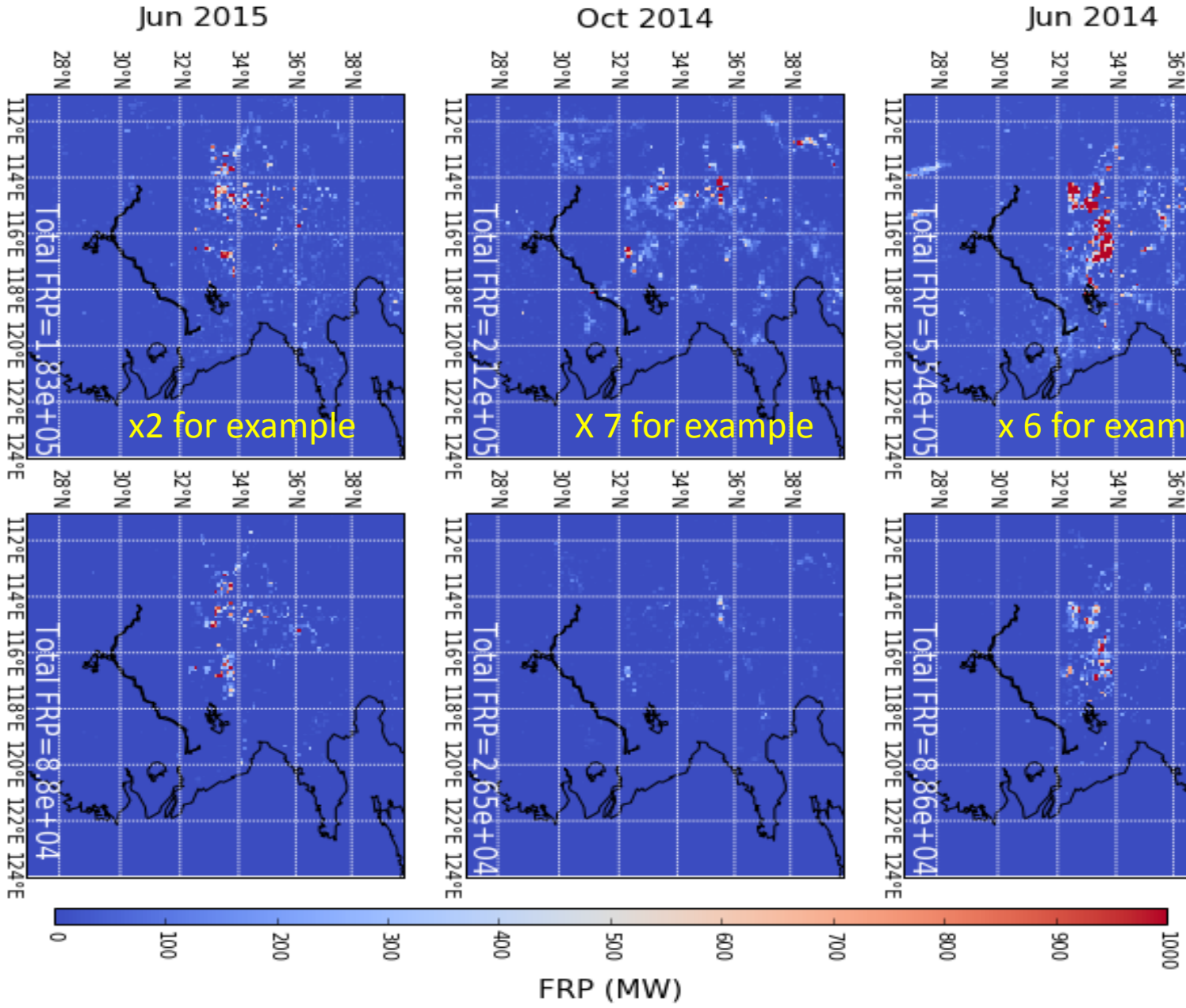
Real interest in using this to examine "small fire" importance on regional basis…GLOBAL CHALLENGE RESEARCH FUND (GCRF) in the UK.






Mo Jiaolou
(a)


(c)



Zhang, T., Wooster, M.J. and Xu, W. (submitted) Approaches for Synergistically Exploiting VIIRS I- and M-Band Data in Regional Active Fire Detection and FRP Assessment: A Demonstration in Eastern China, Remote Sensing of Environment

Sentinel 3

VERY PRELIMINAY RESULTS

(Active fire Detection Relies on Band Differencing – Check S7, S8, S9 Inter-band Registration)

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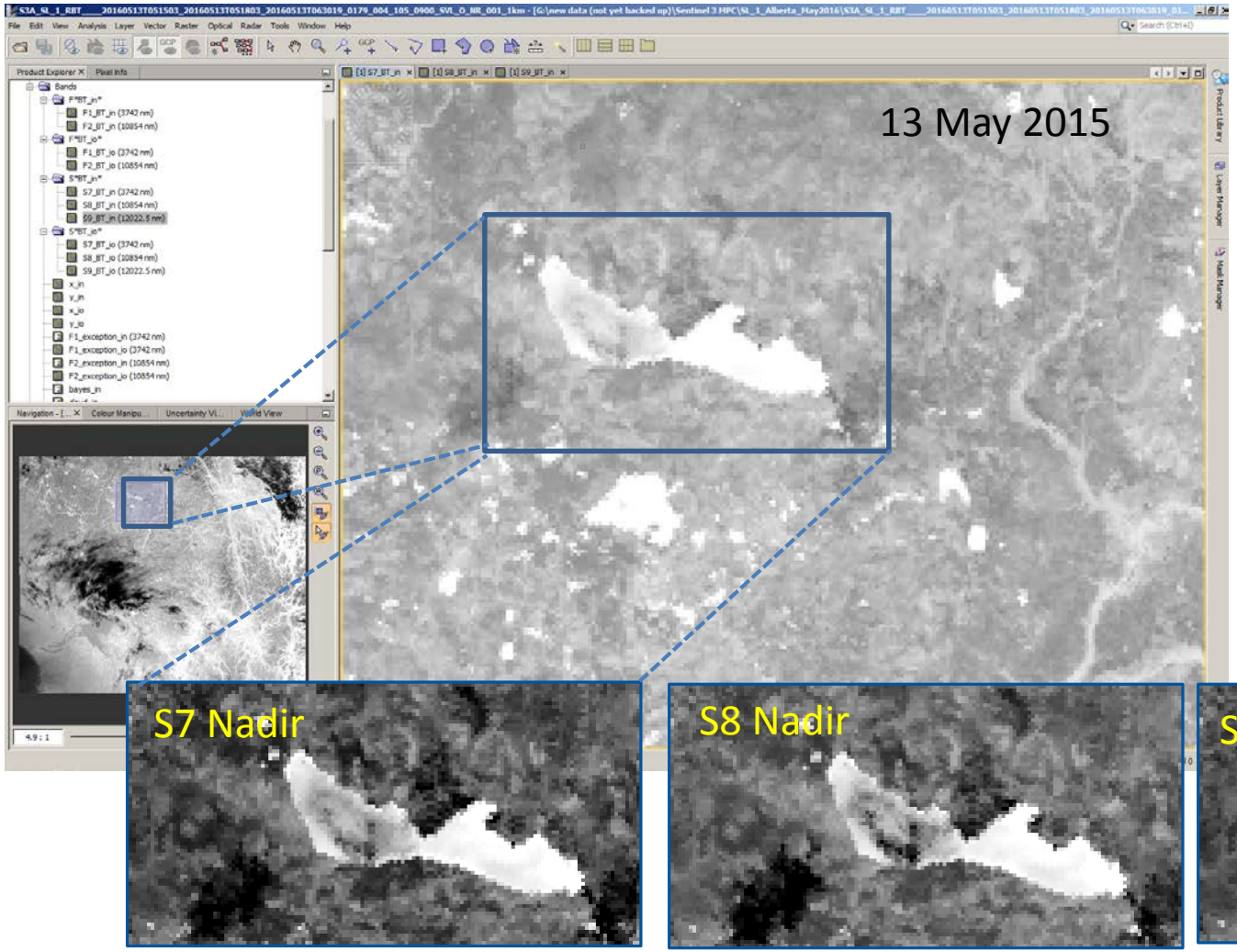

SLSTR Nadir View
Alberta Fire Scene
(night-time:- warm lakes & cold land)

SLSTR Scene:
S3A_SL_1_RBT____20160513T051503_20160513T051803_20160513T063019_0179_004_105_0900_SVL_O_NR_001.SEN3

Data obtained from S3-MPC FTP Site

PRELIMINAY RESULTS (Nadir View)

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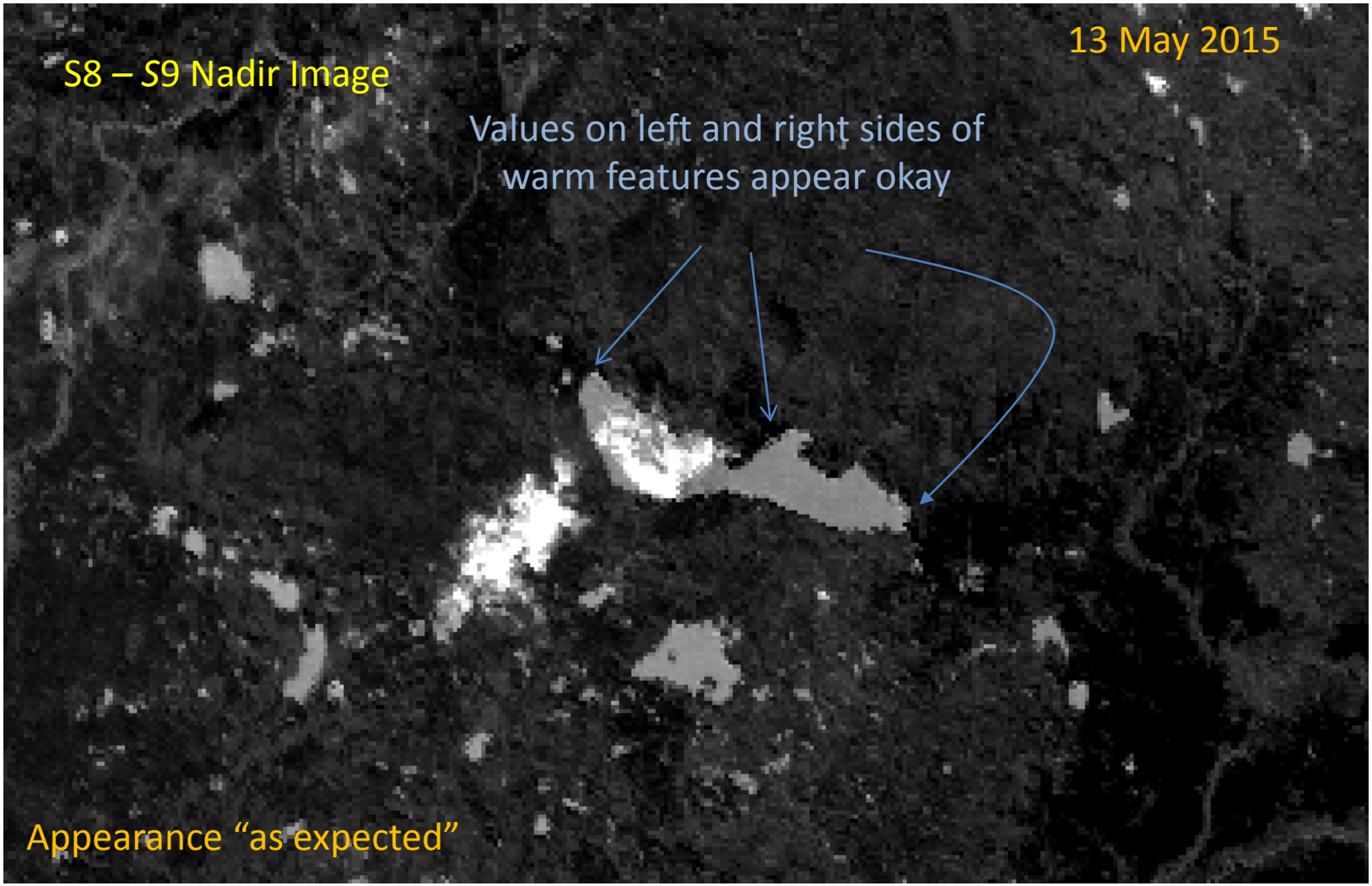
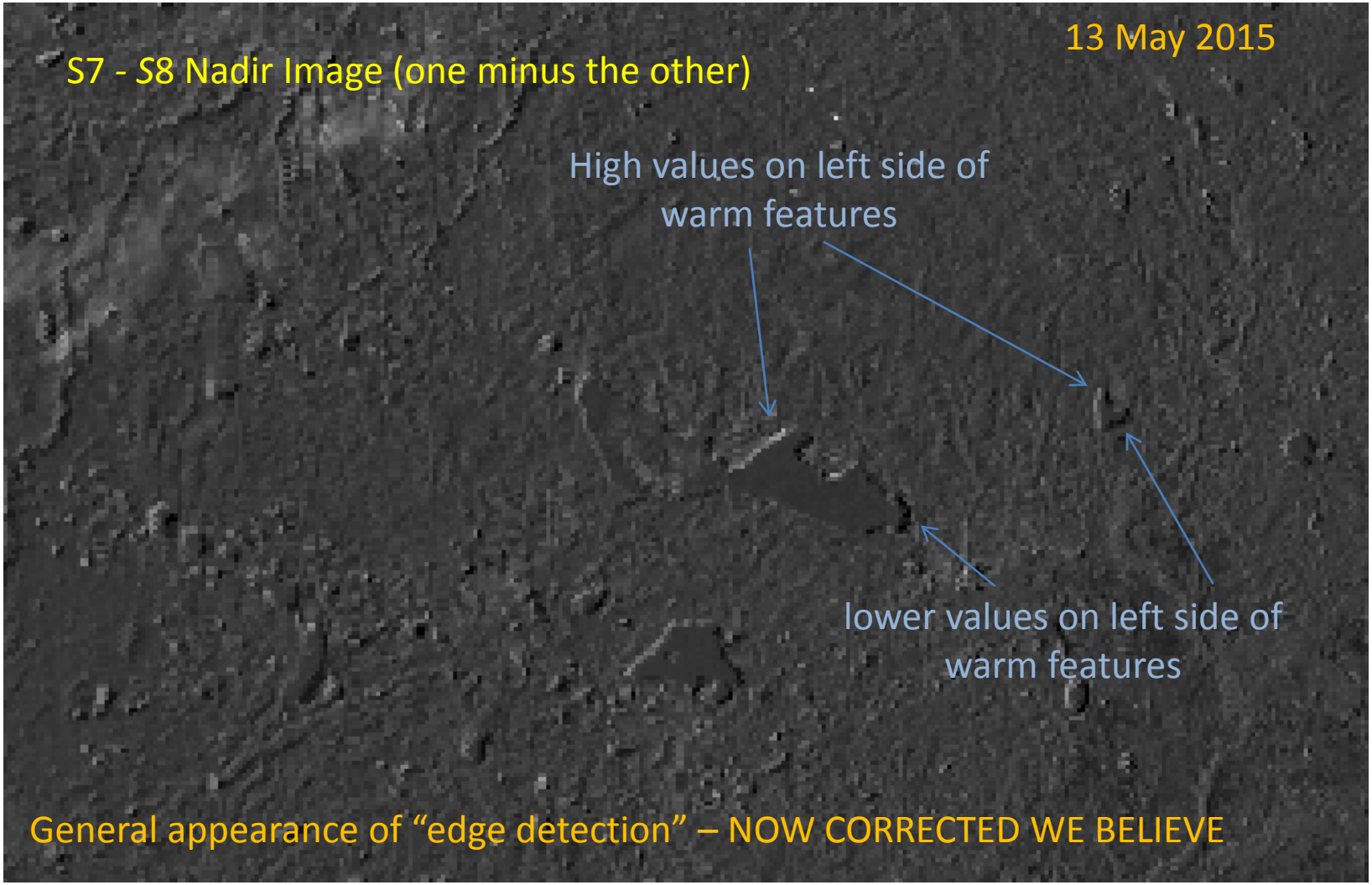


PRELIMINAY RESULTS (Nadir View)



PRELIMINAY RESULTS
Possible S7 “shift” vs S8 and S9?

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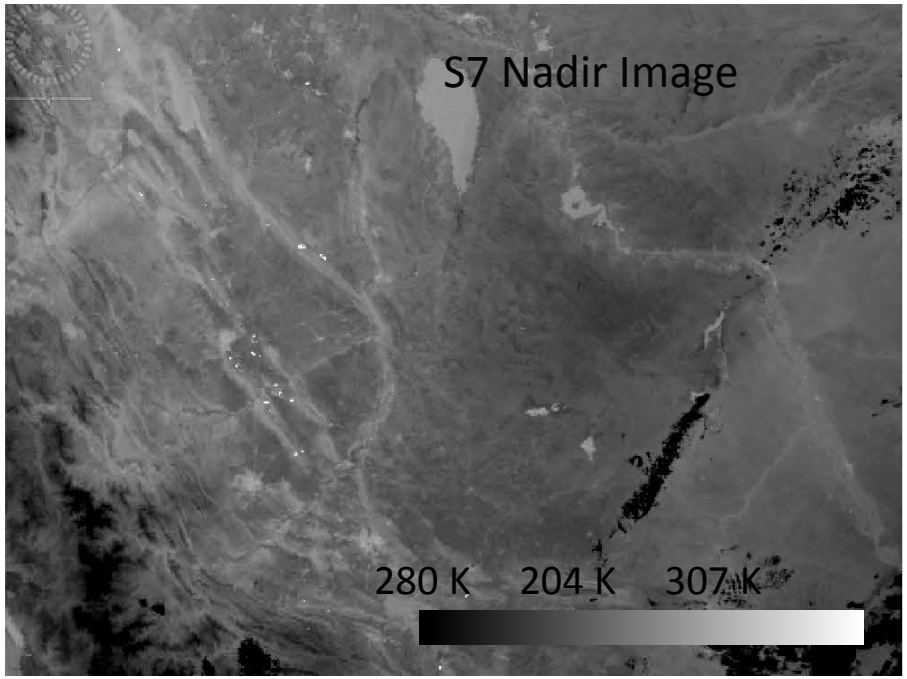
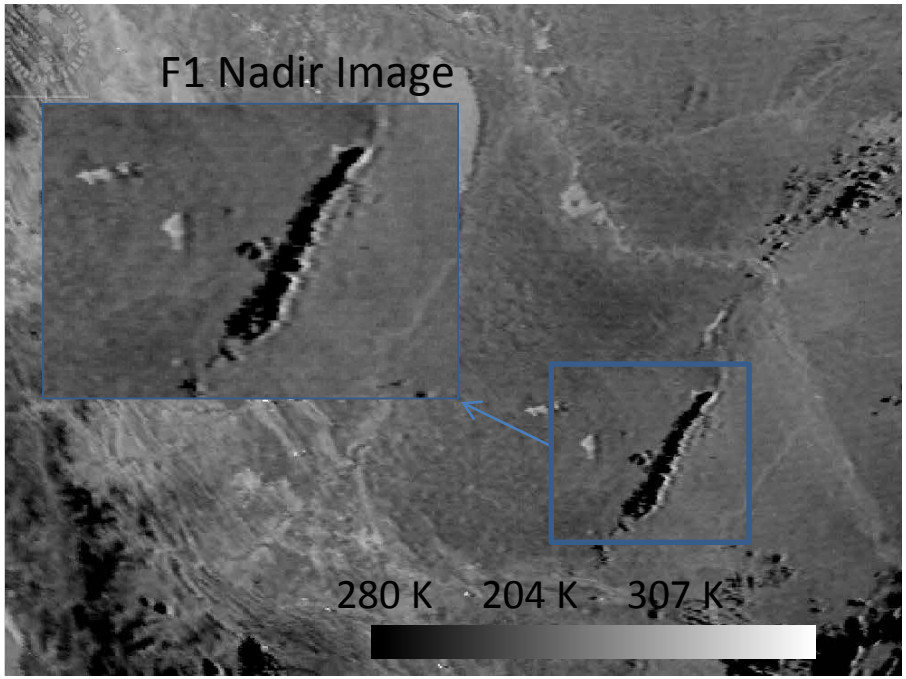
Apparent “shift” seen between S7 and S8 / S9 bands.

No apparent “shift” seen between S8 and S9 bands.

THIS HAS WE THINK BEEN CORRECTED

S7 vs. F1 Channel Noise
("Warm" ambient scene)





Warm BT scene

- F1 image still seems noisier than S7 – but less so than for prior colder scene. (expected due to NEdT being lower at higher temperatures)
- Odd "warm" BT shadow adjacent to some cold features e.g. clouds. (see zoom box above around cloud). Further examined next....

S3A_SL_1_RBT____20160528T184810_20160528T185110_20160530T151403_0180_004_327_6599_LN2_O_NT_001.SEN3

S7 vs. F1 Channel Noise
("Cold" ambient scene)

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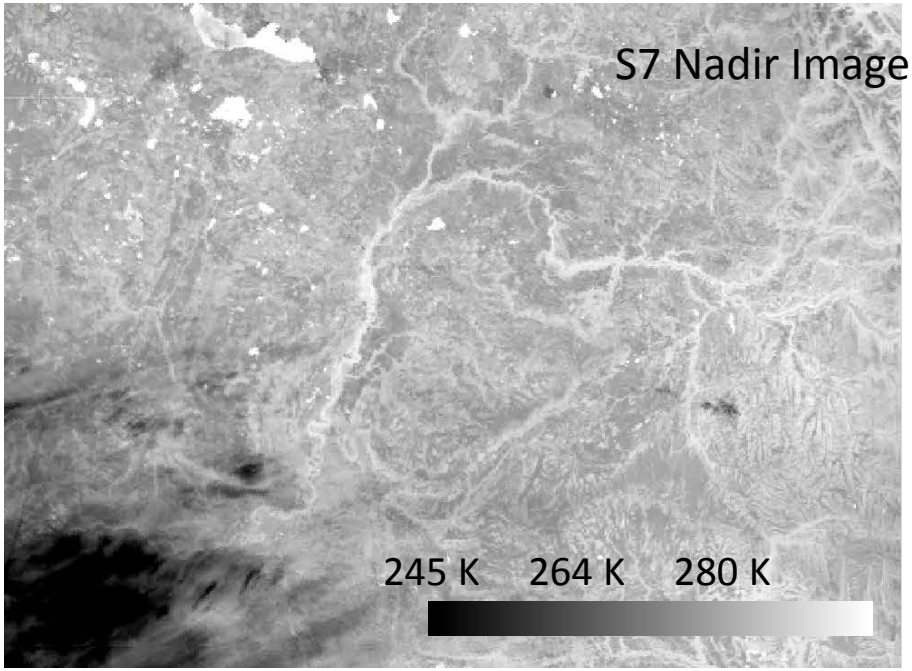
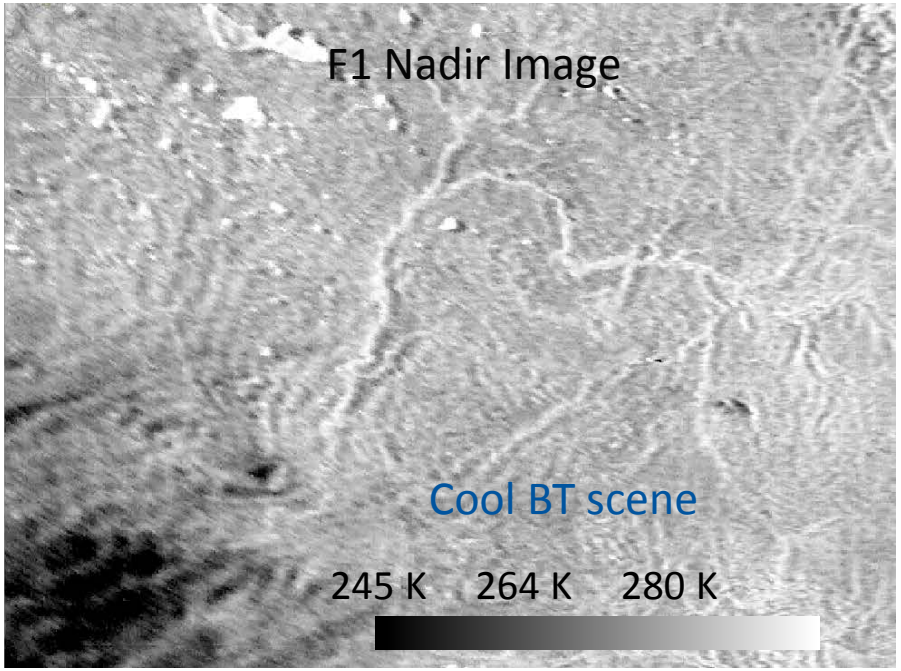
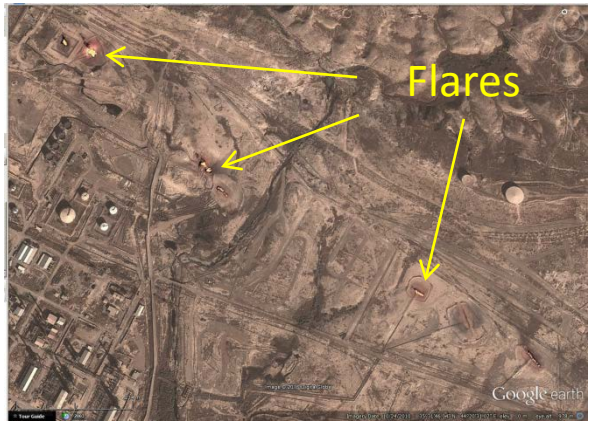


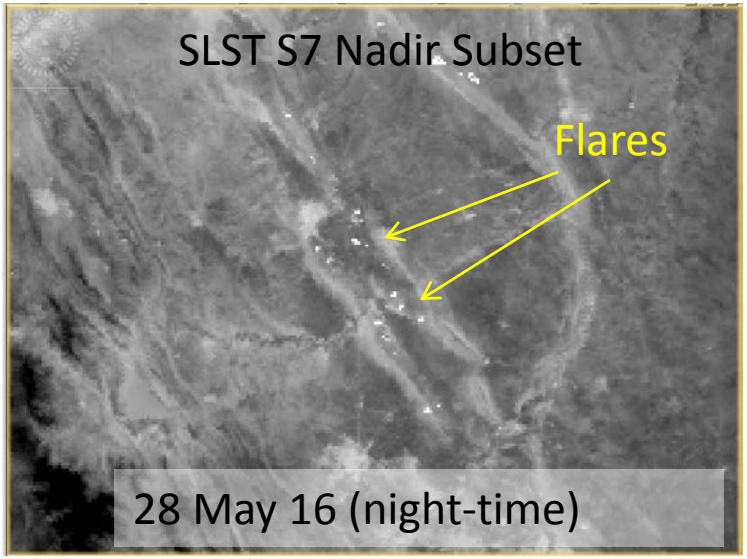


- F1 image has increased noise compared to S7 image.
  (expected due to much lower gain and wider dynamic range)
- Same type of difference not seen between F2 and S8.
- Applications should ideally use S7 for BT < 305 K and F1 > 305 K.
  (but not so easy to swap on pixel-by-pixel basis as area covered is different)

S3A_SL_1_RBT____20160513T051503_20160513T051803_20160513T063019_0179_004_105_0900_SVL_O_NR_001.SEN3

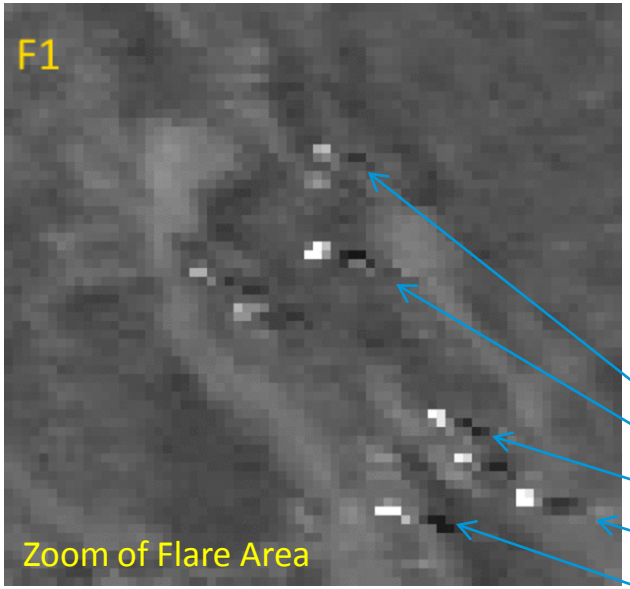
High Temperature Targets Gas Flares (Iraq)





S3A_SL_1_RBT____20160528T184810_20160528T185110_20160530T151403_0180_004_327_6599_LN2_O_NT_001.SEN3

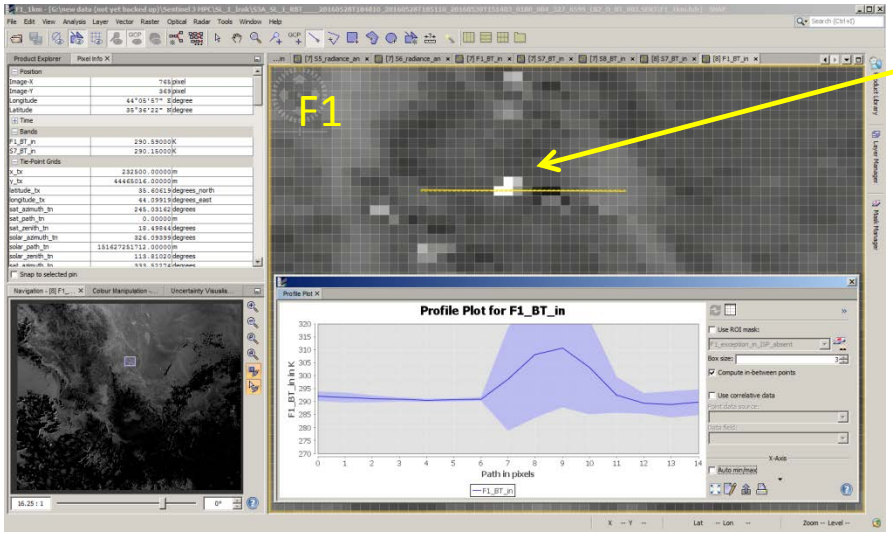
Here flares are apparent in S7 band (also seen in F1).

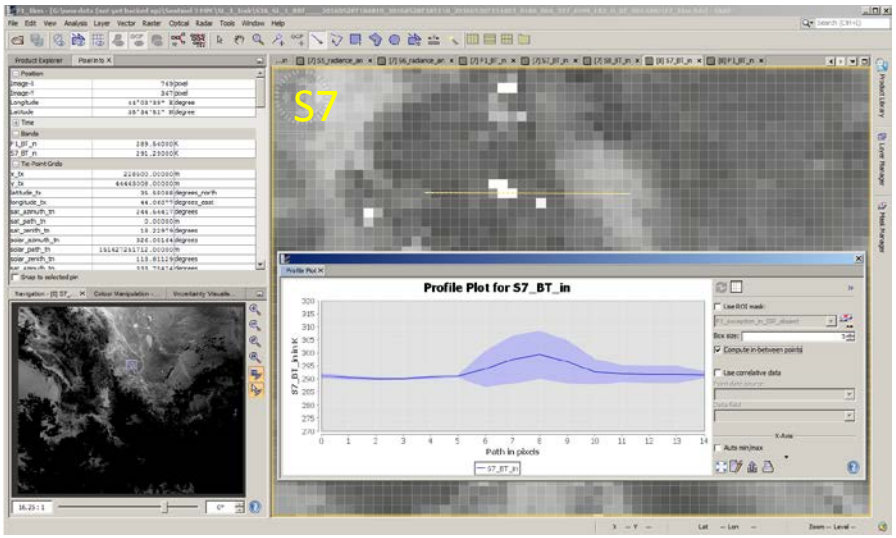


In this Zoom we see **flare pixels shift position** between S7 and F1 gridded data – which has consequence for data use in active fire detection / FRP algorithm (cannot just switch simply between S7 & F1 band in any algorithm)

Apparent low temperature "ghosting" of high BT pixels in F1 band? (effect not seen in S7 band) ?

Flare Pixel Signals Different in S7 & F1.





Example of set of "Flare Pixels"

F1 : 301, 307, 324, 342 & 351 K

S7 : 303, 306, 312, 312 K

Background Pixels ~ 290 - 292 K

- F1 enables measurement of high BT pixels and ambient background.
- S7 measures far lower max BTs. Probably saturation BUT some **S7 BT's higher than quoted saturation temperature** of 305 K?
- Apparent "ghosting" depressing F1 BT's by > 5K close to "hot pixels" …and the larger the "flare pixel" BT the greater the BT depression.
- No such depression seen in S7.

S3A_SL_1_RBT____20160528T184810_20160528T185110_20160530T151403_0180_004_327_6599_LN2_O_NT_001.SEN3

Fort McMurray Wildfire Example 24 May 2016: SLSTR and MODIS

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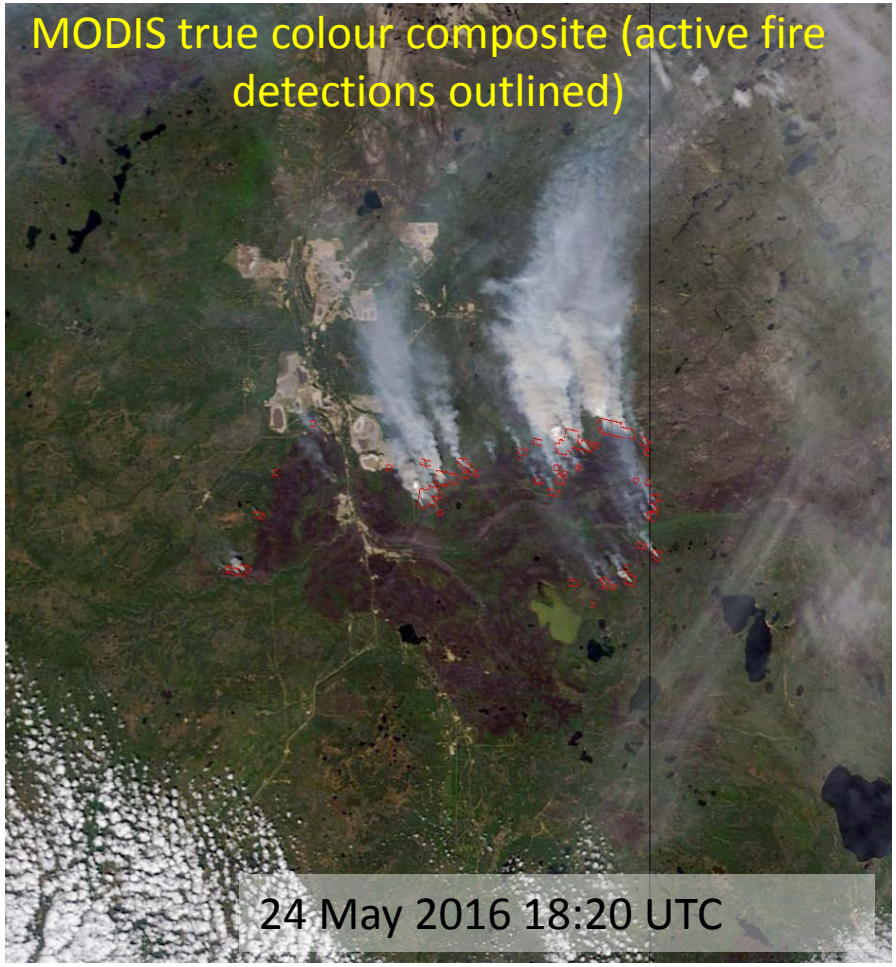

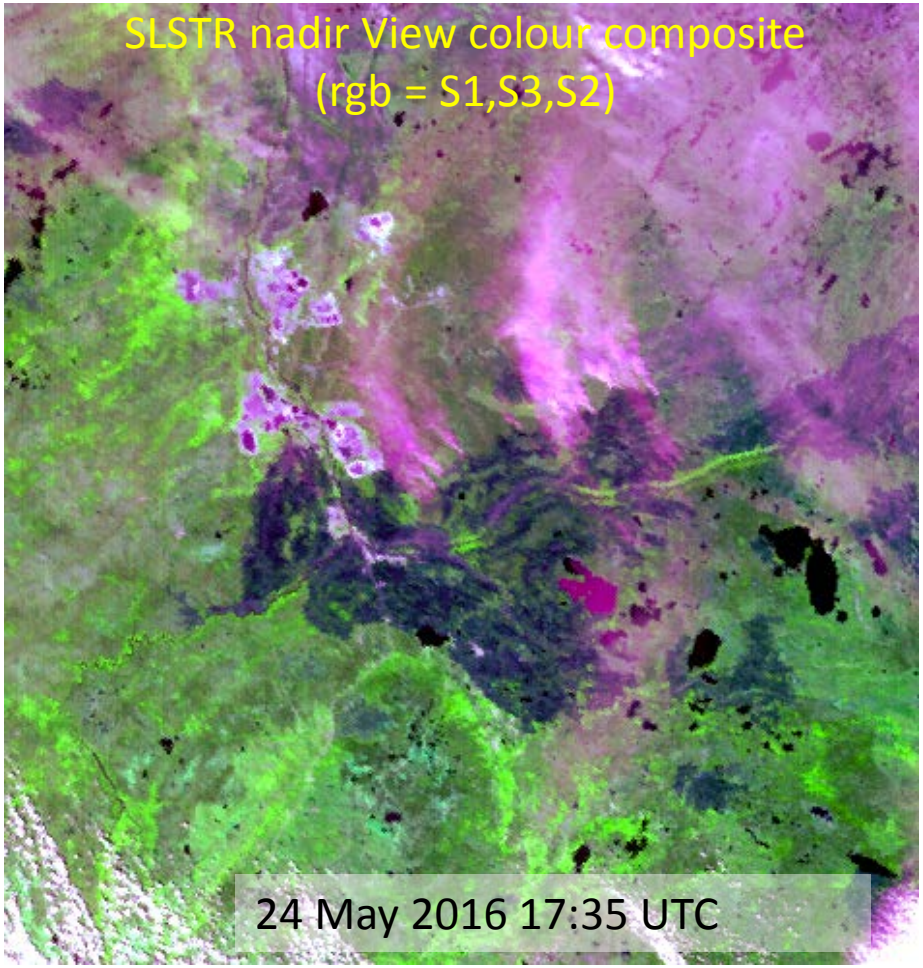

S3A_SL_1_RBT____20160524T173455_20160524T173755_20160524T193923_0179_004_269_1979_SVL_O_NR_001.SEN3

Fort McMurray Wildfire Example 24 May 2016: SLSTR and MODIS

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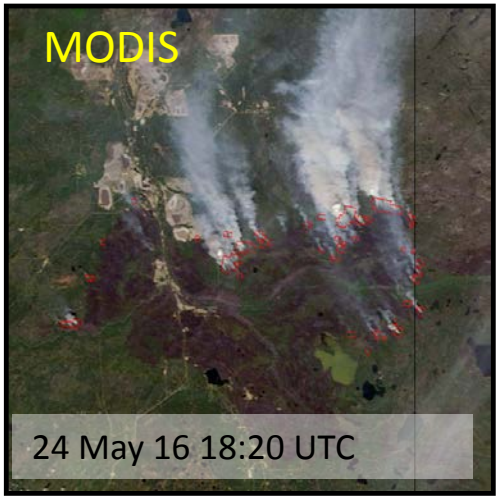
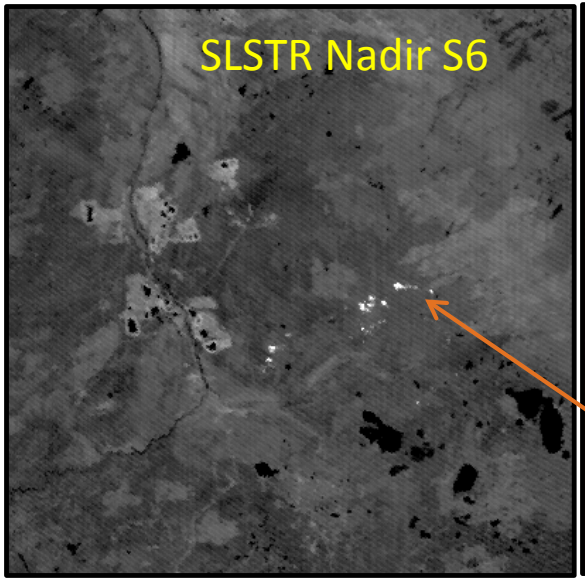
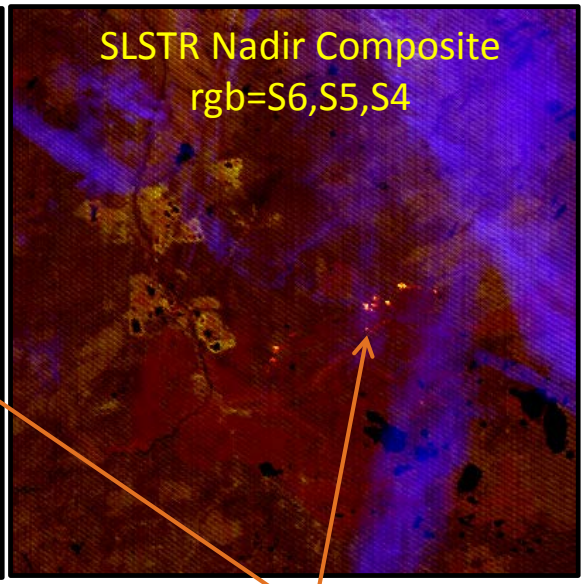
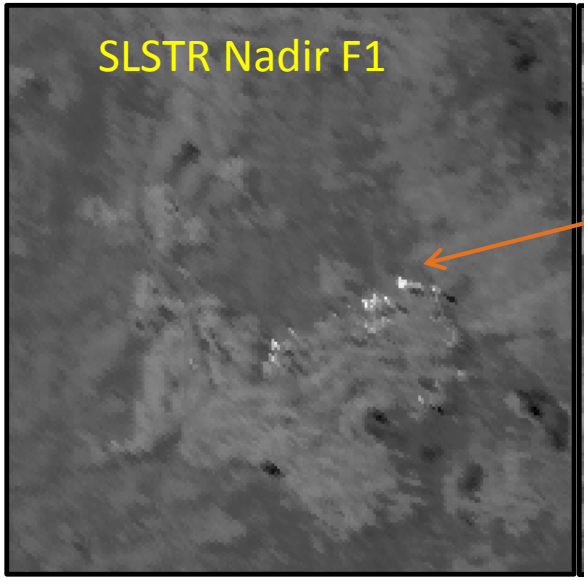
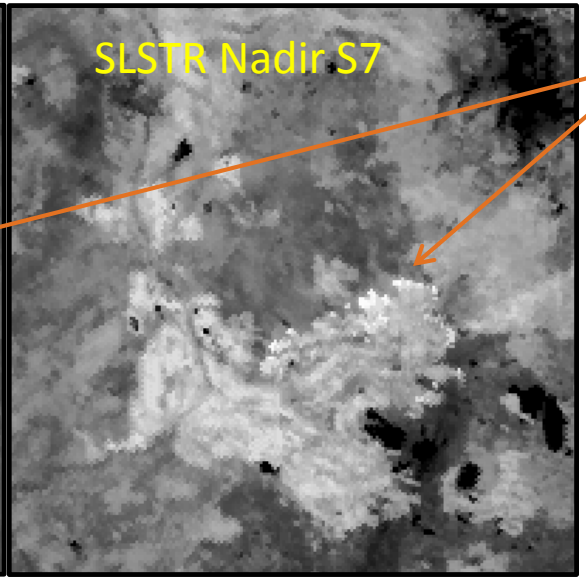




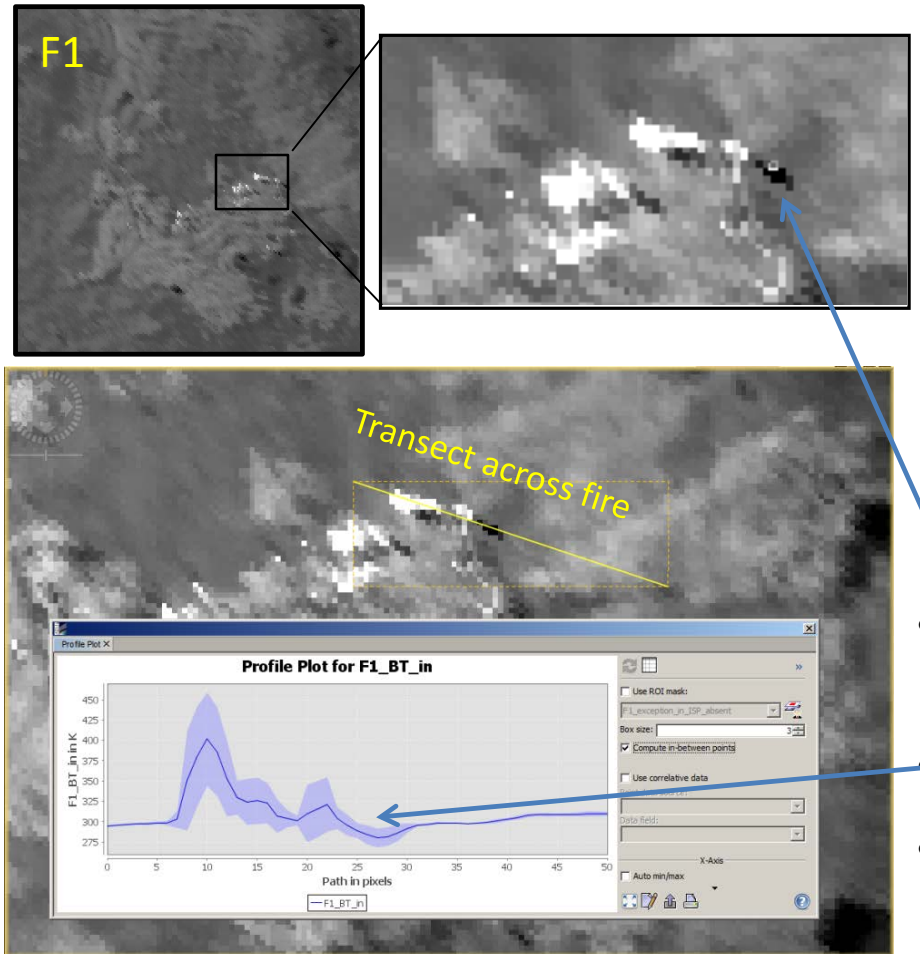






- **Fire thermal emission** strongly detectable in SWIR bands (S5 & S6)
- Also detectable in S7 and F1 (MWIR)..and at some locations in LWIR bands (F2 & S8/S9) as well.

Fort McMurray Wildfire Example 24 May 2016: SLSTR and MODIS



Example "Wildfire Pixels"

F1 : extends up to 436 K over fire

S7 : extends to 313 K (though oddly S7_exception_in.saturation flag unset)

Background Pixels ~ 290 - 292 K

F2 : extends up to 311 K

S8 : extends up to 311 K

- Apparent "ghosting" again seen in F1 close to "hot pixels.
- Depresses F1 BT's by up to ~ 30K.
- No such effect seen in S7 band (nor F2 or F8/F9).

S3A_SL_1_RBT____20160524T173455_20160524T173755_20160524T193923_0179_004_269_1979_SVL_O_NR_001.SEN3