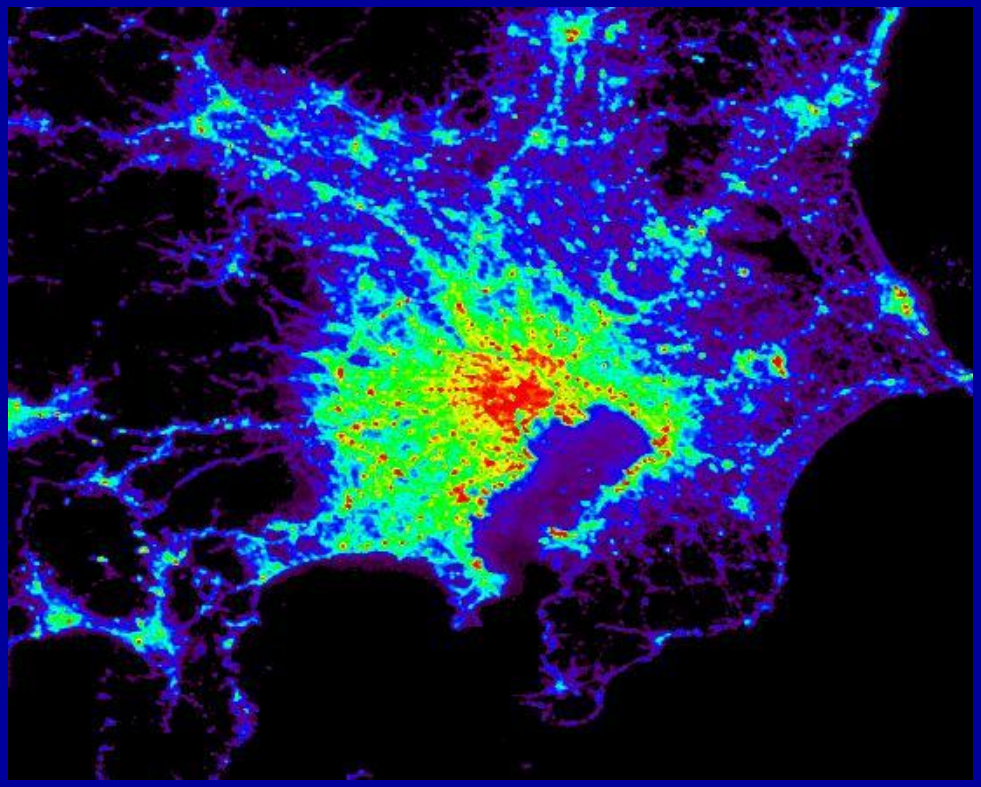

Nighttime VIIRS data and applications

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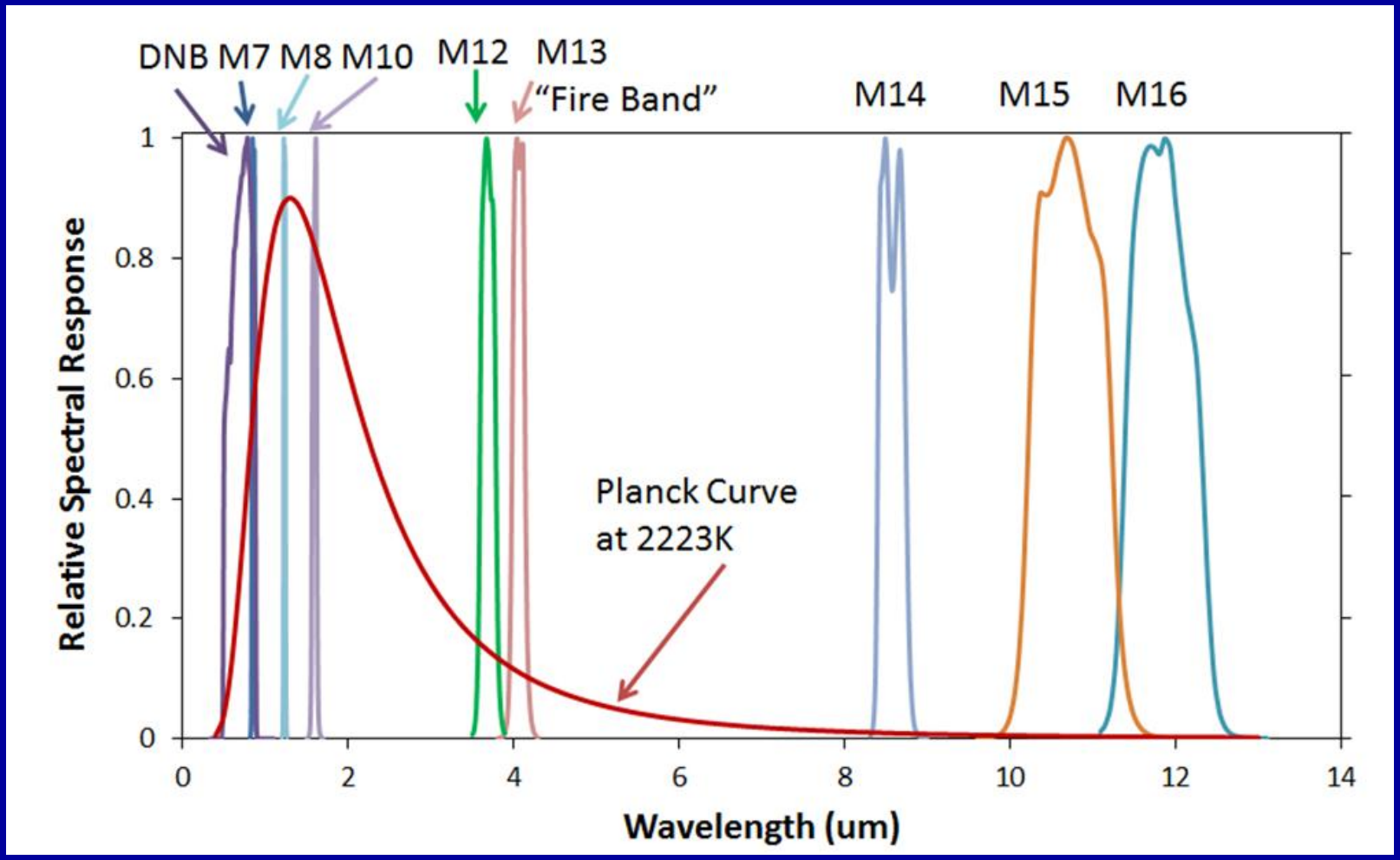
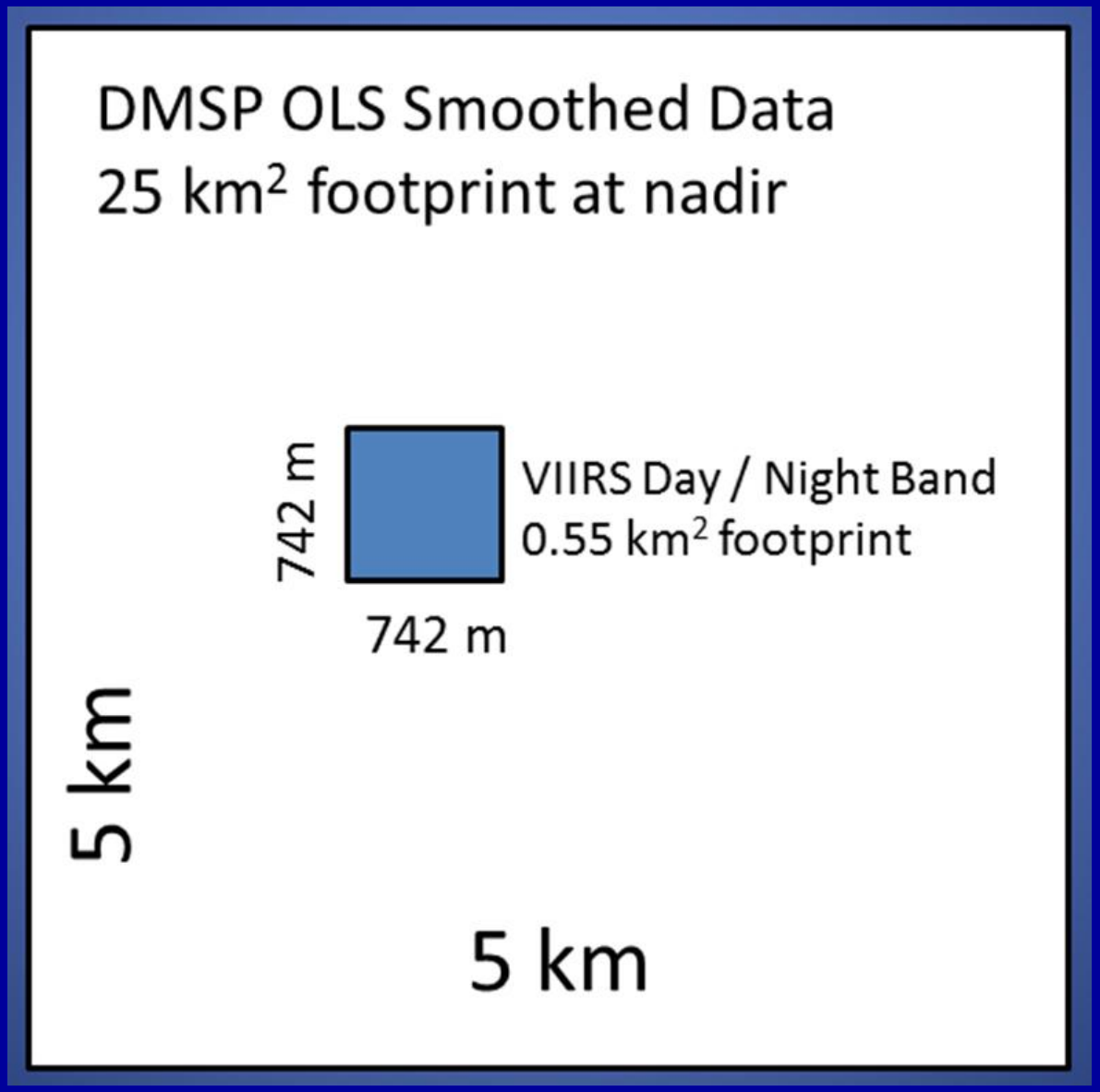
June 27, 2013

VIIRS Collects Nighttime Data in Visible, NIR and SWIR





The DNB ground footprint is 45 times smaller than the DMSP-OLS.

VIIRS Nighttime Lights

- NGDC is developing nightly mosaics, monthly and annual composites. We are currently working on
  - Filtering to reduce stray light. When the spacecraft is in sunlight there is a leak the gets to the DNB focal plane. We have a filter that is being tuned for optimal removal of stray light.
  - Separation of combustion source and electric light components using Nightfire data.
  - Fuzzy light filtering. The VIIRS cloud mask has errors that allow fuzzy lights to enter “cloud-free” composites. We are testing a fuzzy light detector for the generation of “sharp light” composites.

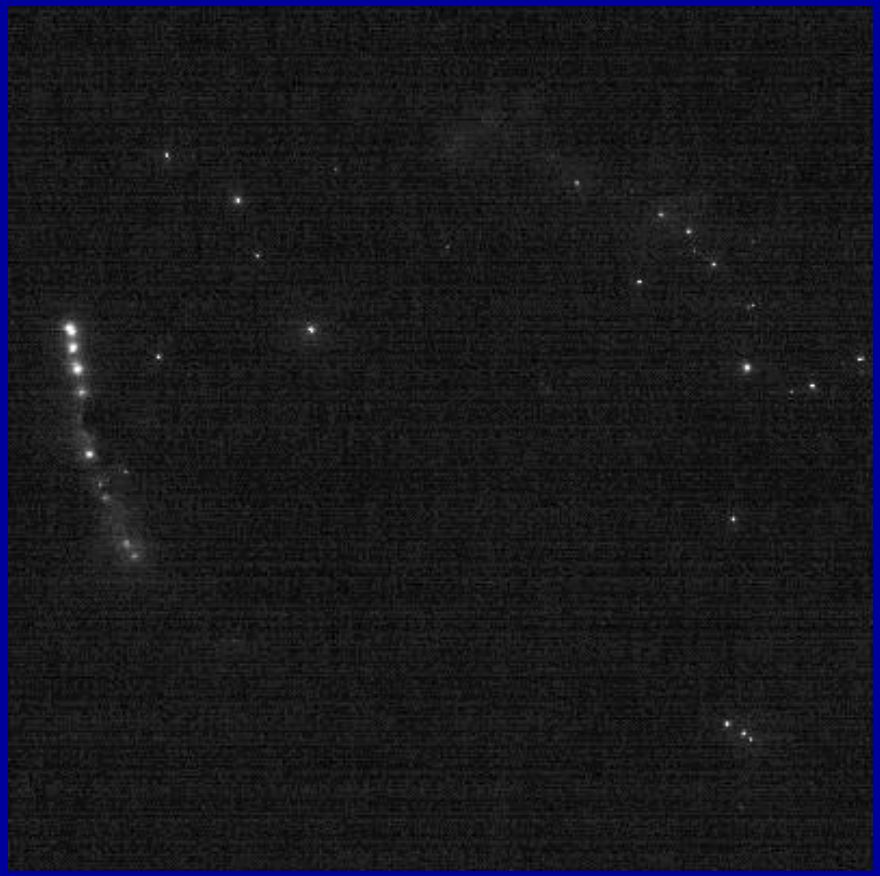
Comparison of DNB vs OLS

VIIRS Nighttime Lights

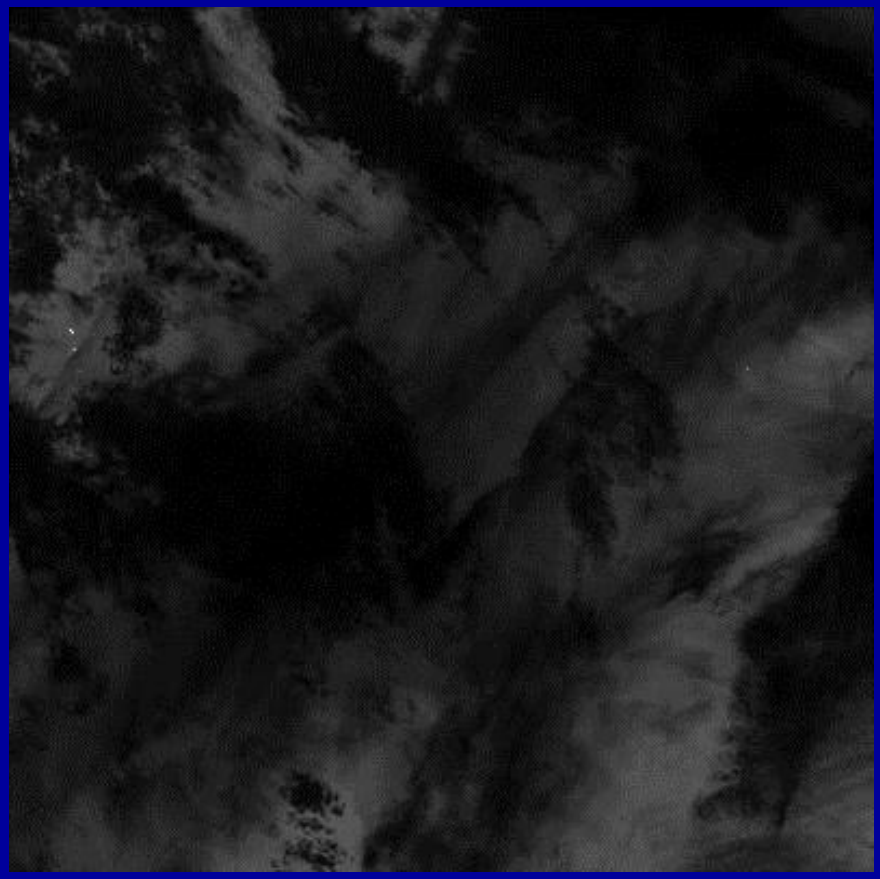
- Can be used as a spatial proxy for
  - –distributed fossil fuel emissions.
    - • CO, CO_2, N_2O
  - –Halocarbons

At night combustion sources are readily detected in the M10 image data

M10 at 1.61 um



M13 at 4.0 um



Detection of Combustion Sources Basra, Iraq Region at Night

VIIRS Nightfire

- Funded FY12-15 by the JPSS Proving Grounds Program.
- Runs on VIIRS data as they arrive at NGDC for archive.
- Detection of hot pixels in M10. Noise is filtered by requiring detection in at least one additional band.
- Atmospheric correction using temperature and H2O profiles from CrIS/ATMS sensor data collected on SNPP.
- Planck curve fitting of blackbody emission yields temperature , source size and radiant heat.
- Output on 24 hour increments available at: http://ngdc.noaa.gov/eog/viirs/download_viirs_fire.html
- Kmz output for local maxima. Csv has data on all hot pixels.

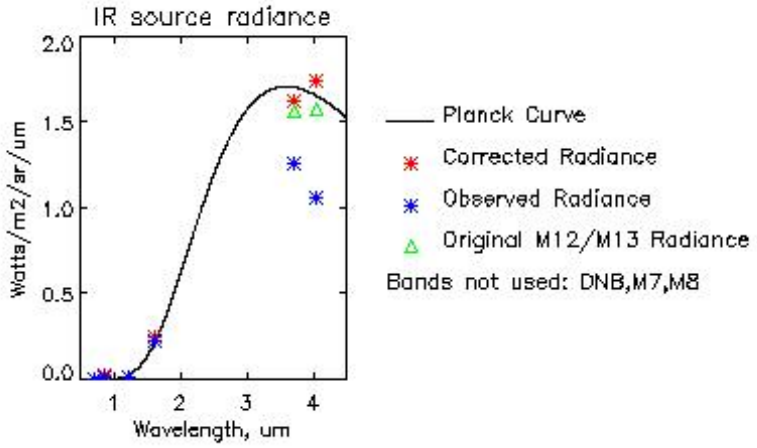
With temperature it is possible to distinguish gas flares from biomass burning

Nightfire Comparison

Biomass Burning

Combustion Parameters

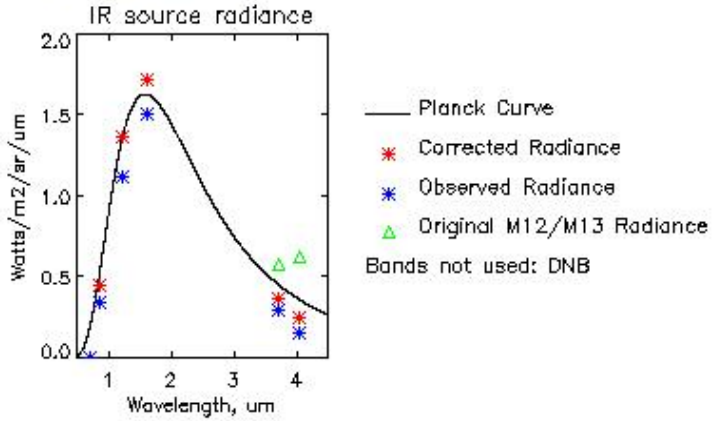
SVM10_npp_d20130623_t1907503_e1913289_b08575*
Time=23-Jun-2013 19:12:06
Detection ID=10666
Lat=0.189457deg. Lon=102.370239 deg.
Radiant Heat Intensity=29.29 W/m2
Radiant Heat=26.93 MW
Pixel Footprint=0.919 km2
Source Size=1127.282 m2
Temperature=805 deg. K
Cloud Status=Clear
Emission Scaling Factor=1.2260E-03



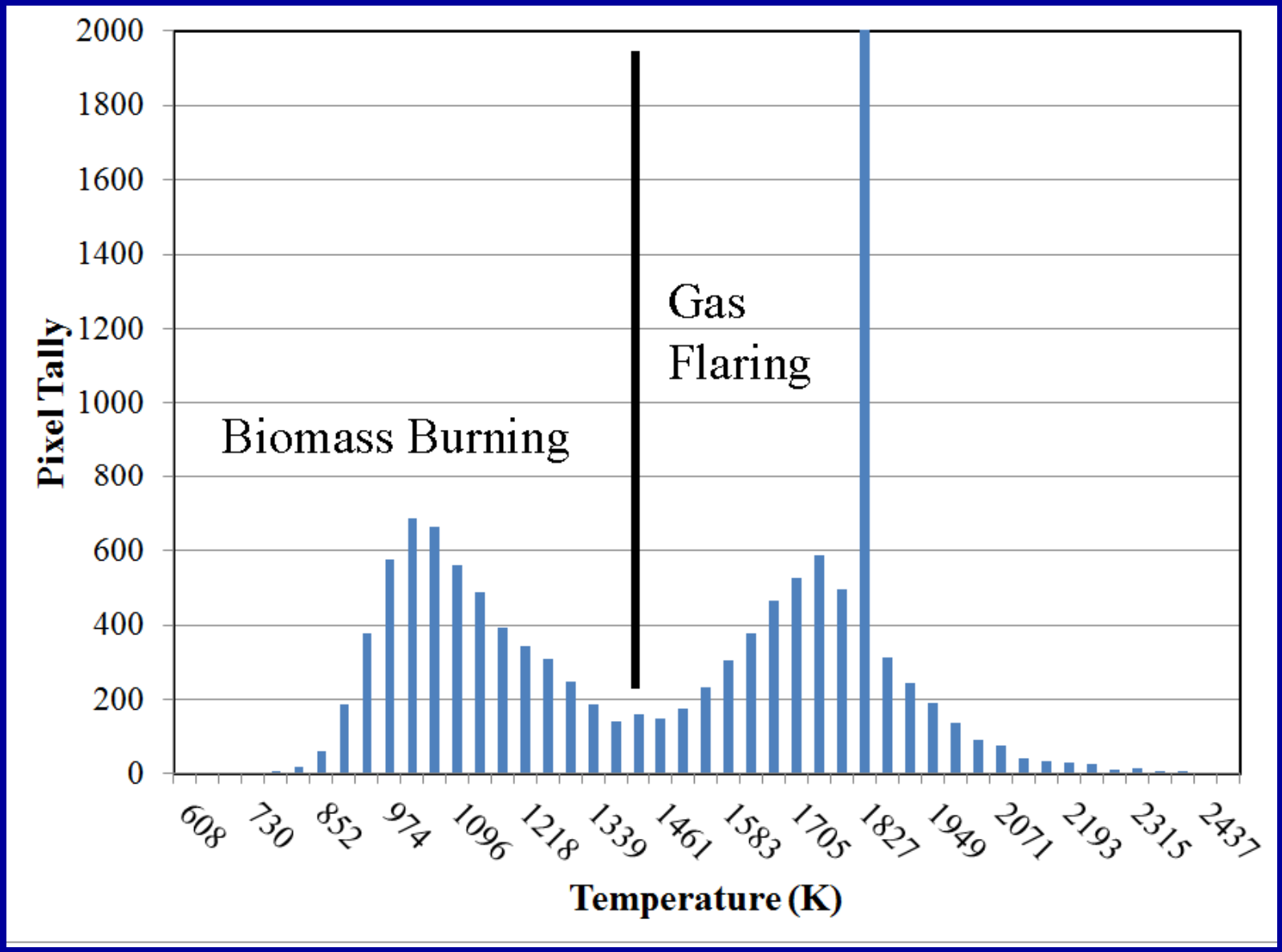
Gas Flare

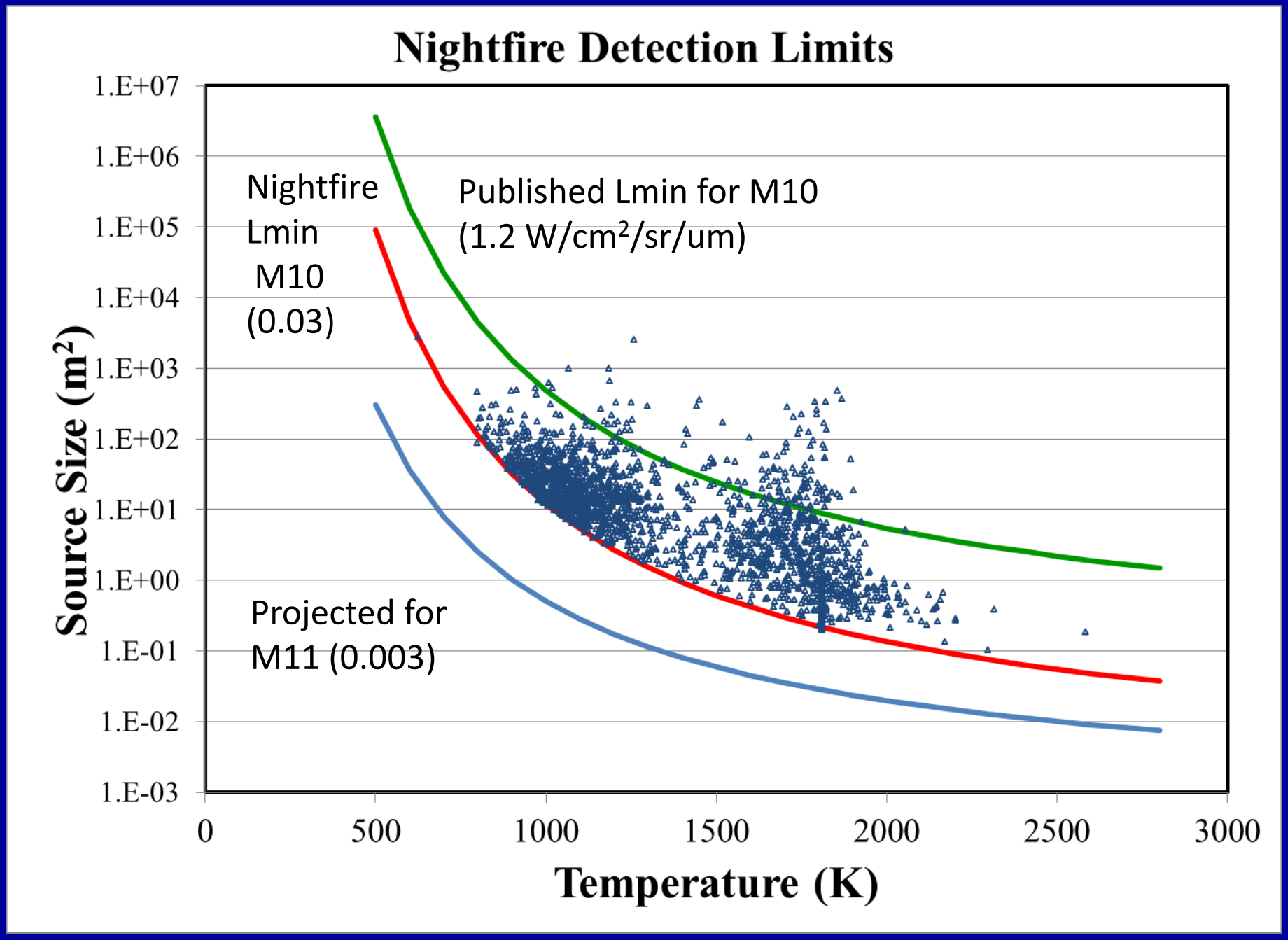
Combustion Parameters

SVM10_npp_d20130623_t1907503_e1913289_b08575*
Time=23-Jun-2013 19:12:41
Detection ID=10758
Lat=-2.102762deg. Lon=103.799110 deg.
Radiant Heat Intensity=12.34 W/m2
Radiant Heat=17.59 MW
Pixel Footprint=1.426 km2
Source Size=28.170 m2
Temperature=1821 deg. K
Methane Equivalent=0.475 m3/s
CO2 Equivalent=86.397 g/s
Cloud Status=Clear
Emission Scaling Factor=2.0000E-05



Bimodal Temperature Distribution




Nightfire Detection Limits
Source Size (m²)
1.E+07
1.E+06
1.E+05
1.E+04
1.E+03
1.E+02
1.E+01
1.E+00
1.E-01
1.E-02
1.E-03
0
500
1000
1500
2000
2500
3000
Temperature (K)
Nightfire Lmin M10 (0.03)
Published Lmin for M10 (1.2 W/cm²/sr/um)
Projected for M11 (0.003)

Nightfire Temporal Compositing

- Monthly and annual estimates of flared gas volumes should account for observations where flares are obscured by clouds or are absent due to shutdown.
- To fill in the non-detection observations we will build monthly and annual cloud-free composites.
- The top 100 gas flares will be reported monthly.
- Estimated flared gas volumes and CO2 emissions will be reported monthly and annually.

CONCLUSION

- VIIRS nighttime lights data can be used to model urban GHG emissions
- VIIRS nightfire data can be used to model GHG emissions from gas flares and biomass burning

For discussion and possible collaborations contact chris.elvidge@noaa.gov