

# VIIRS M-Band Active Fire Products

Louis Giglio<sup>1</sup>, Wilfrid Schroeder<sup>1</sup>, Evan Ellicott<sup>1</sup>,  
Ivan Csiszar<sup>2</sup>, William Walsh<sup>1</sup>, Christopher Justice<sup>1</sup>

<sup>1</sup>University of Maryland

<sup>2</sup>NOAA NESDIS

GOFC Fire IT Meeting, July 2014

# VIIRS Fire Monitoring: Big Picture

- Sensor is mostly great
- Operational ground system remains problematic
- Operational fire product has some problems but is quite useable
- Research/CDR-quality fire data not yet available

# VIIRS Active Fire Products

- 750-m IDPS Product
  - C4 MODIS detection algorithm
  - No fire mask, no FRP, minimal QA
    - Product is simply a list of fire locations
  - No higher level fire products
  - HDF5

# VIIRS Active Fire Products

- 750-m NASA “Replacement” Product
  - Based on C6 MODIS detection algorithm
  - Fire mask, FRP, extensive QA, fire pixel attributes
  - Permits production of higher level fire products
  - Produced within the LPEATE
  - HDF4
  - Eventually port to the IDPS\*
  - Stand-alone code available for Direct Broadcast

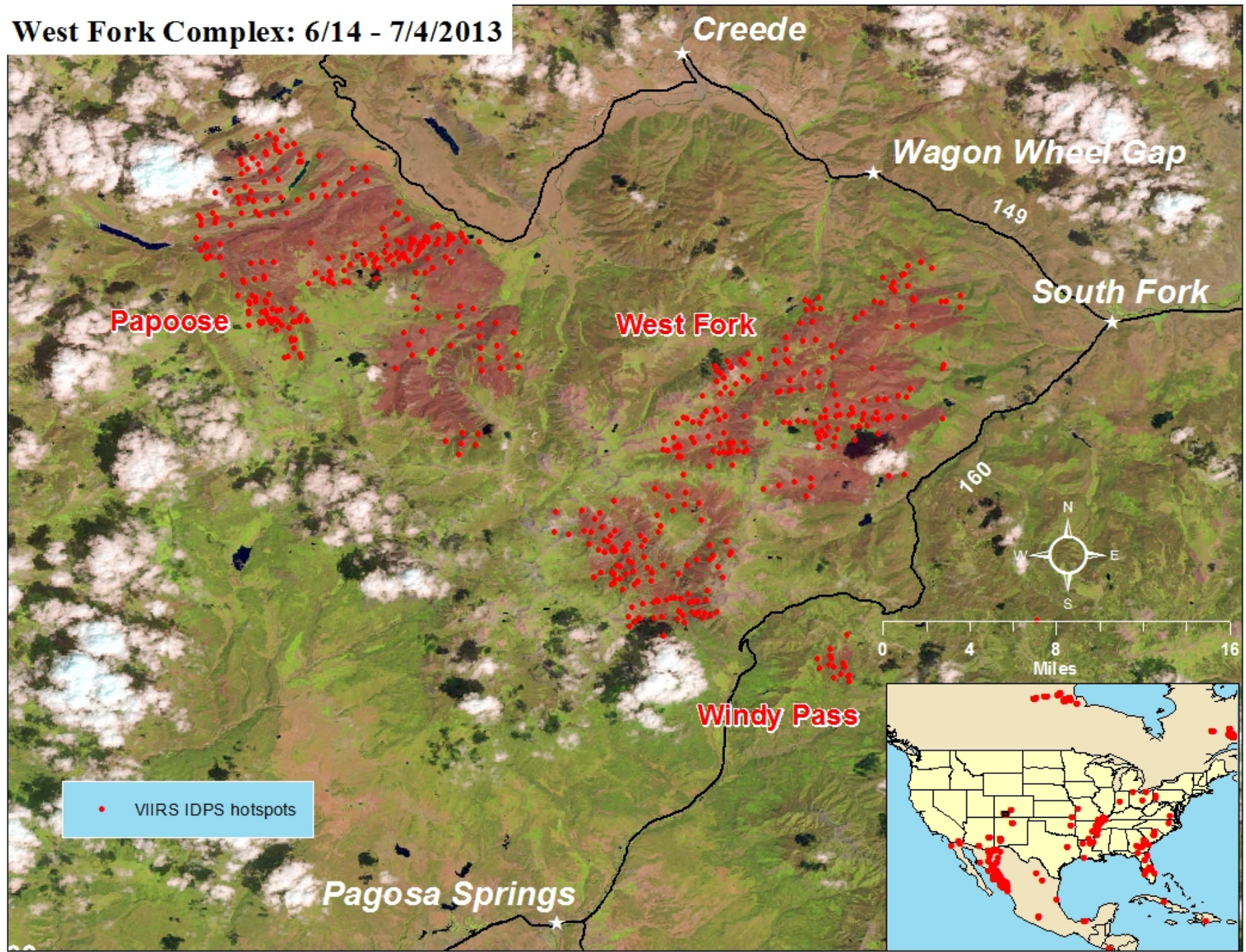
# VIIRS Active Fire Products

- 375-m I-Band Product
  - Next talk!

# IDPS Product Status

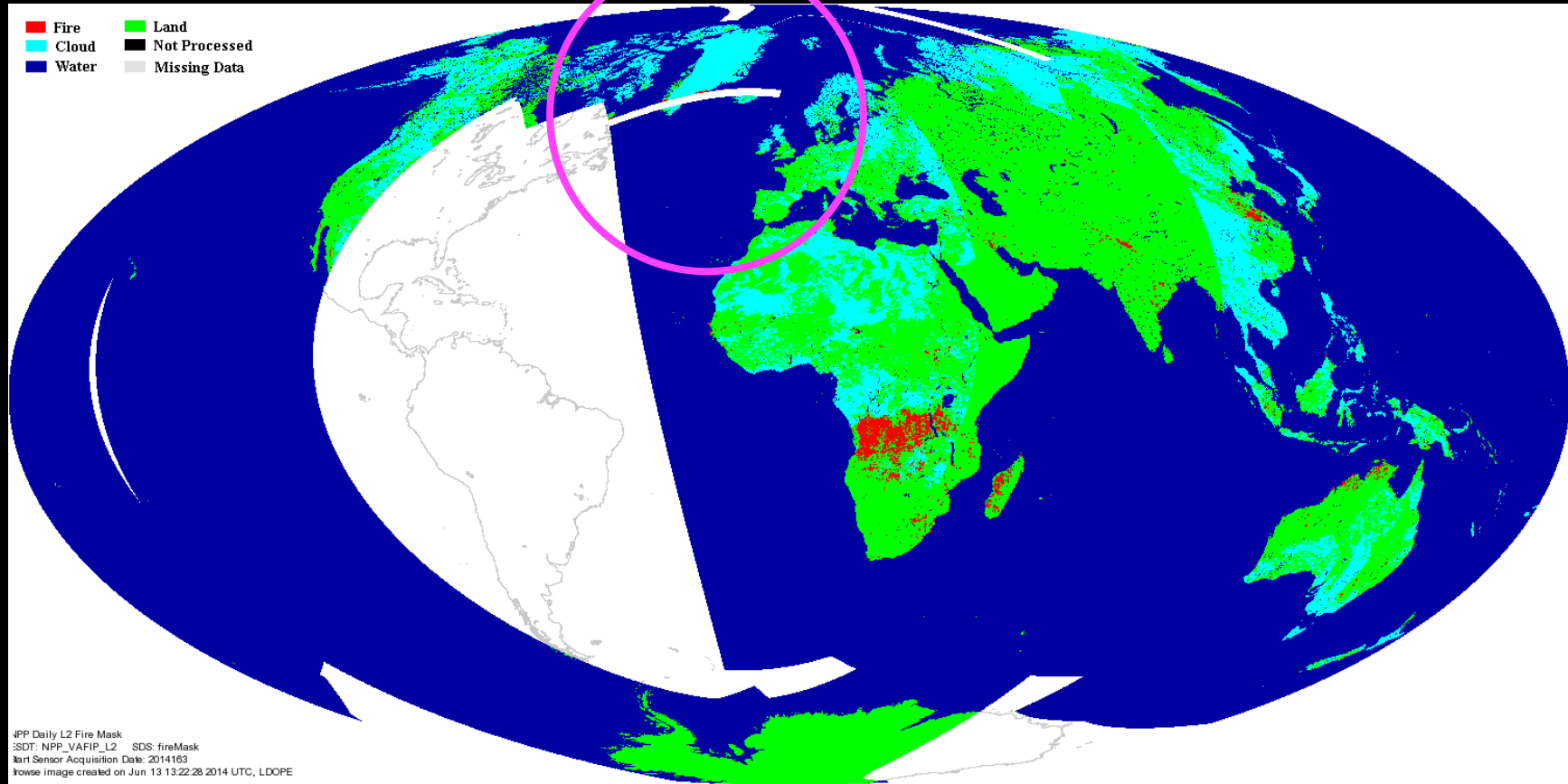
- 84-second granules (1028 per day)
- HDF5
- Ignores SDR (input data) quality flags
- Operational
- No provision for reprocessing
- Not adequate for research or long-term monitoring

**West Fork Complex: 6/14 - 7/4/2013**

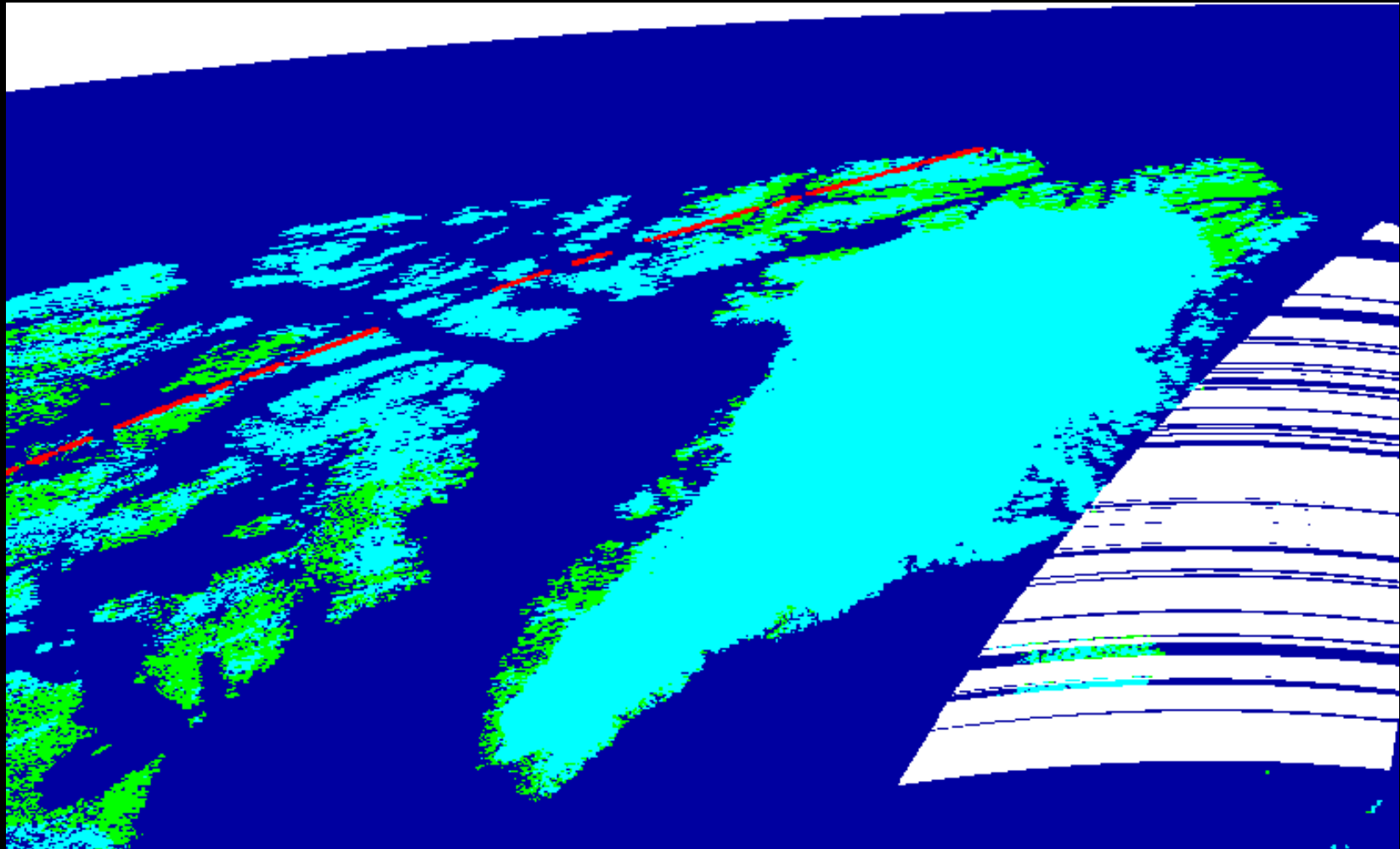


• VIIRS IDPS hotspots

# VIIRS IDPS Fire Product, Mx8.4, 15 July 2014



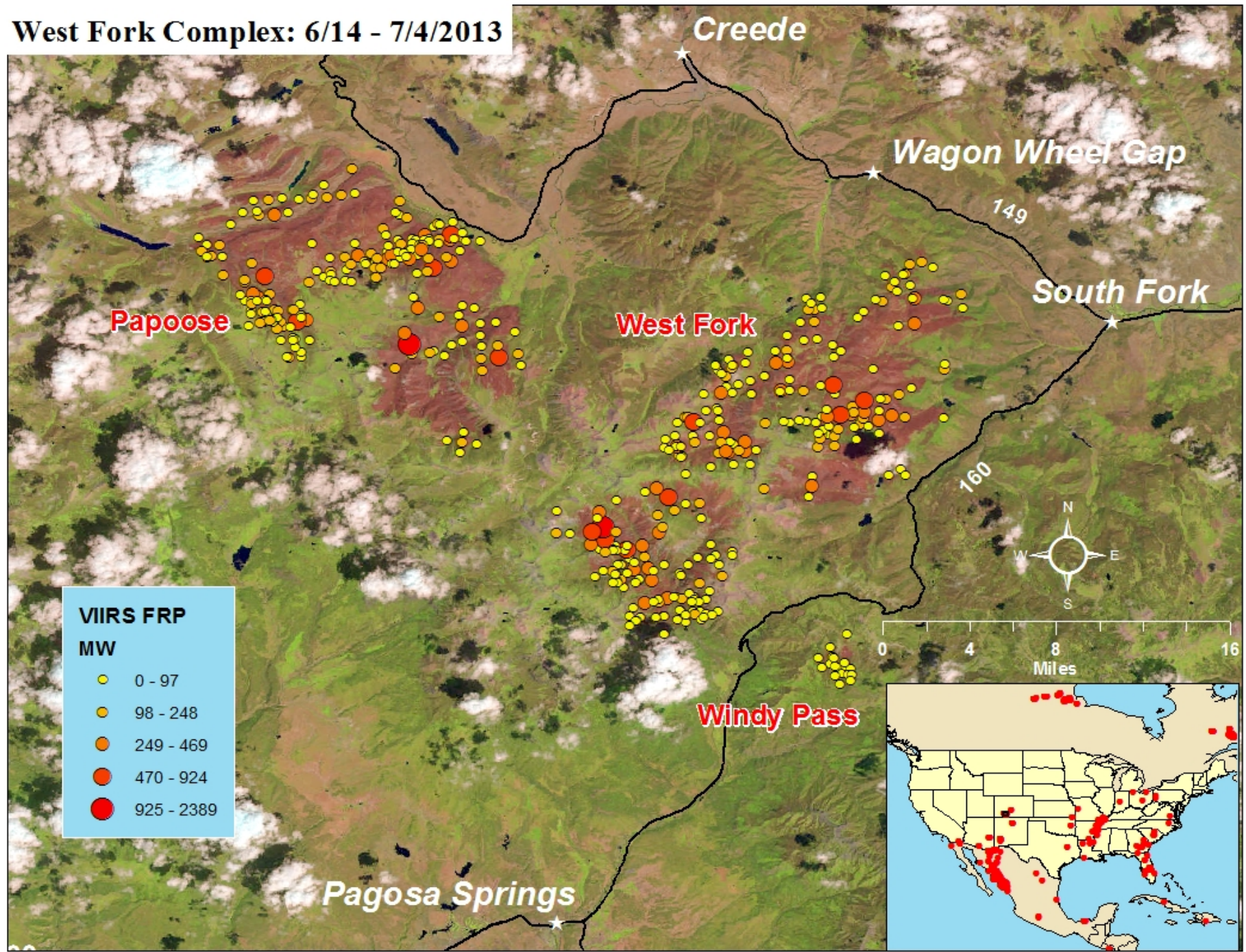
# VIIRS IDPS Fire Product, Mx8.4, 15 July 2014



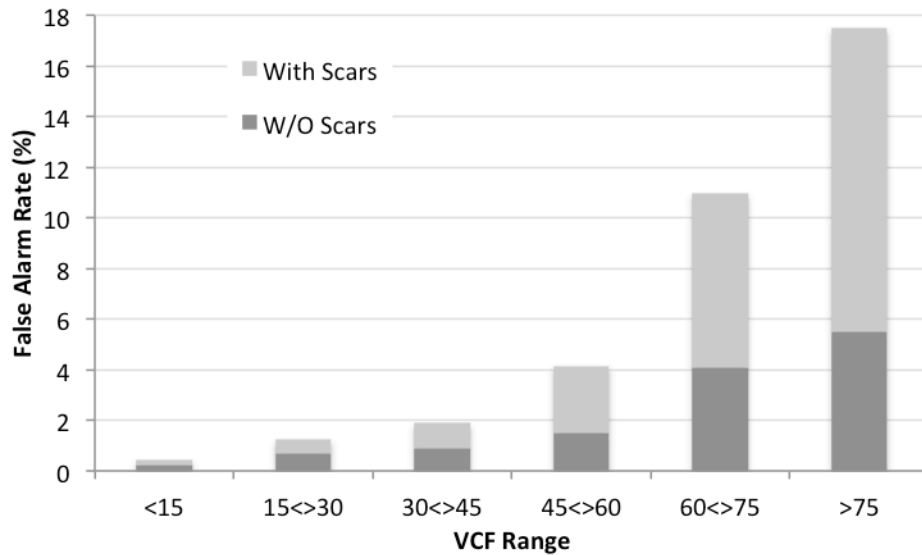
# Replacement Product Status

- 5-minute granules (288 per day)
- HDF4, MODIS-like
- Includes all C6 MODIS fire refinements
- Interrogates SDR quality flags
- Wobbly until SDRs (input data) settle down
- Focus on achieving stable and correct SDRs
  - Late August 2014 in IDPS (we hope)
  - Migrate into LPEATE by late 2014

# West Fork Complex: 6/14 - 7/4/2013



# VIIRS 750m Fire Algorithm Update/Refinement: Implementation of MODIS Collection 6 Equivalent

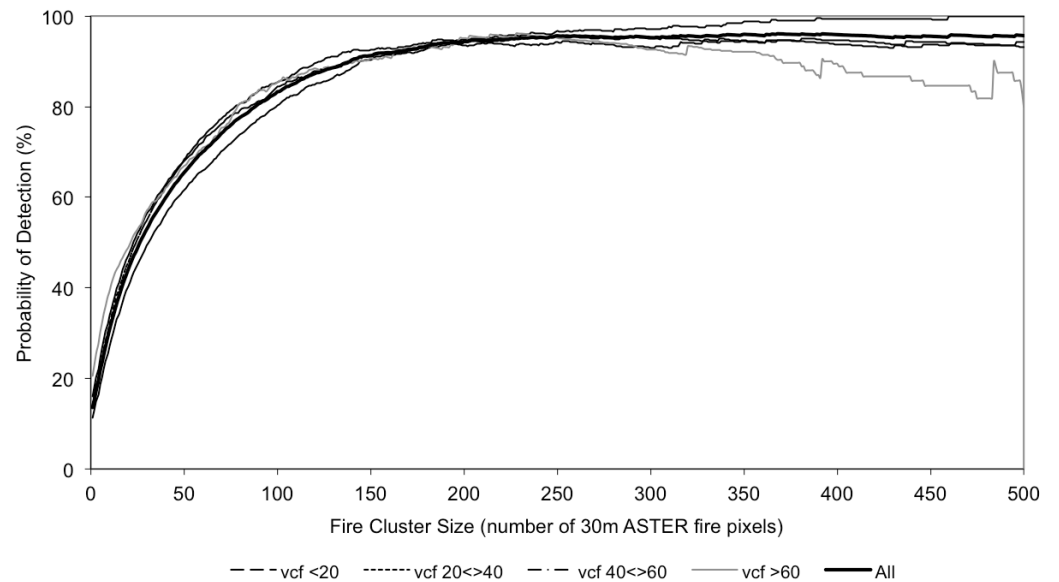


False alarm rates as a function of tree cover

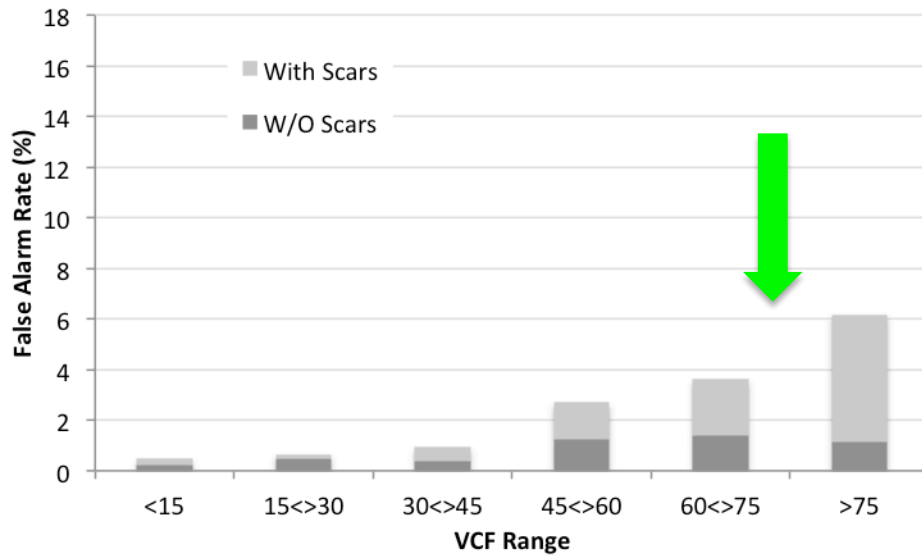
C5

*MODIS results based on +2,300 reference ASTER scenes*

Probability of detection as a function of tree cover



# VIIRS 750m Fire Algorithm Update/Refinement: Implementation of MODIS Collection 6 Equivalent

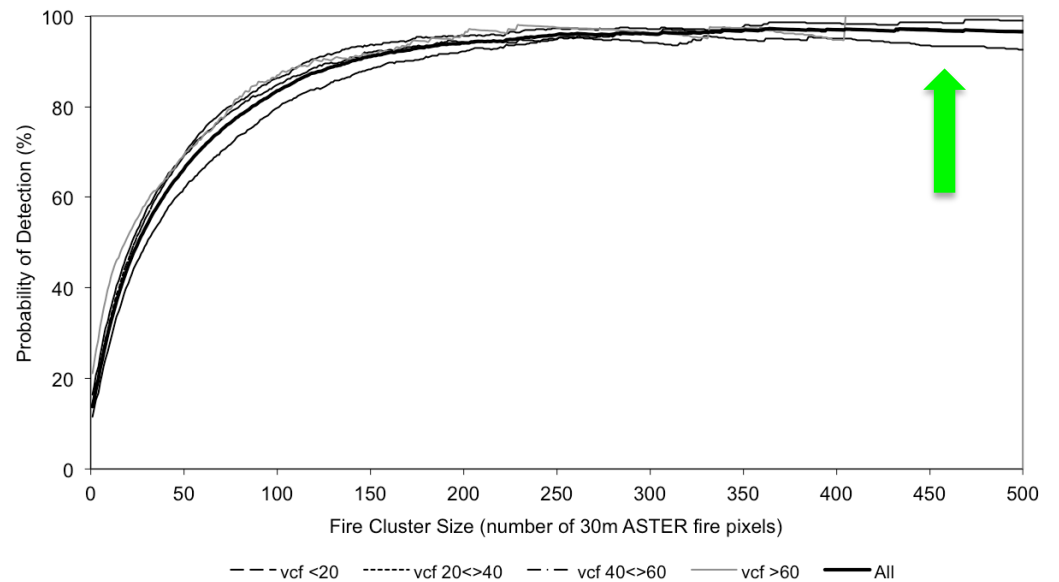


False alarm rates as a function of tree cover

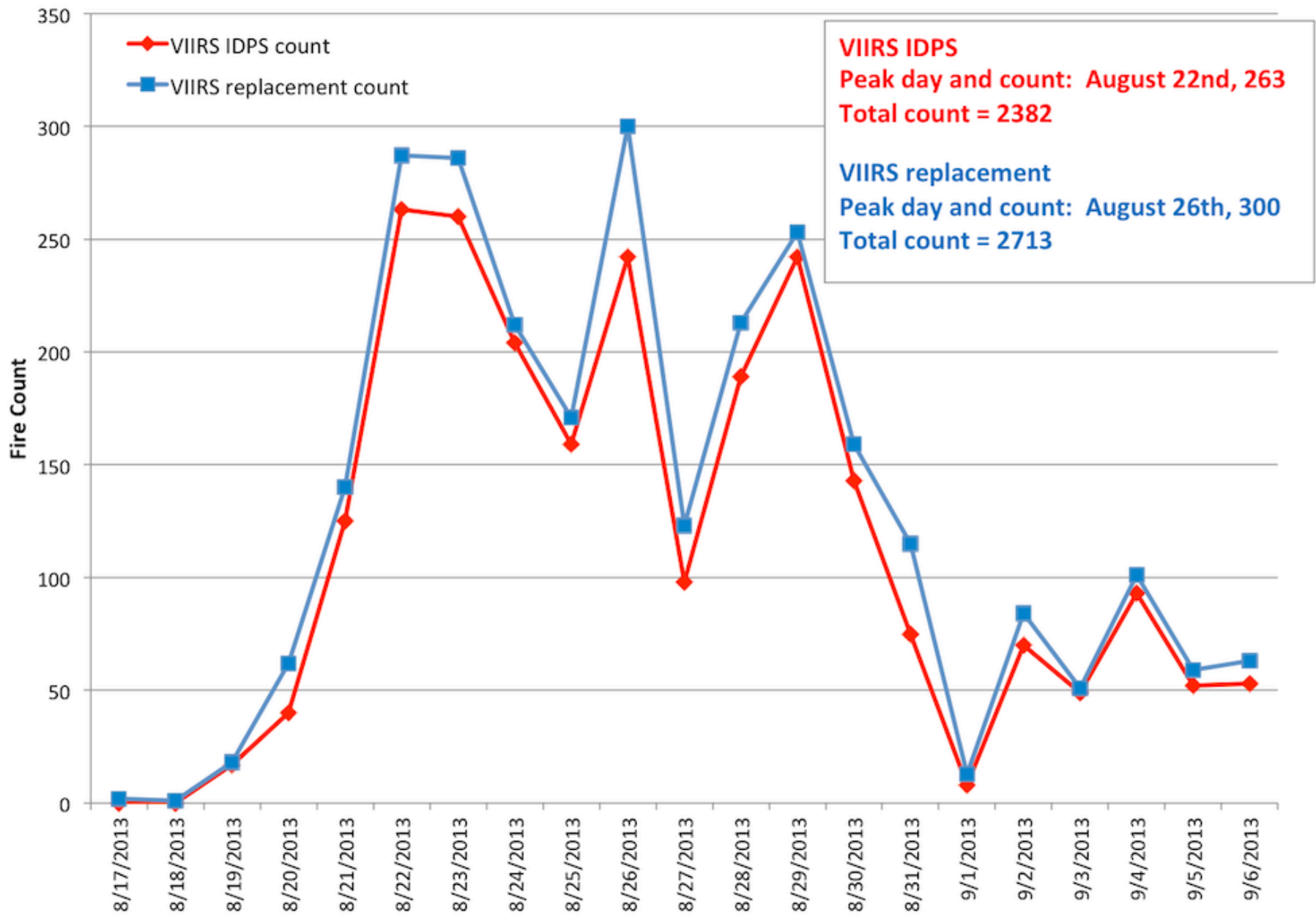
C6

*MODIS results based on +2,300 reference ASTER scenes*

Probability of detection as a function of tree cover



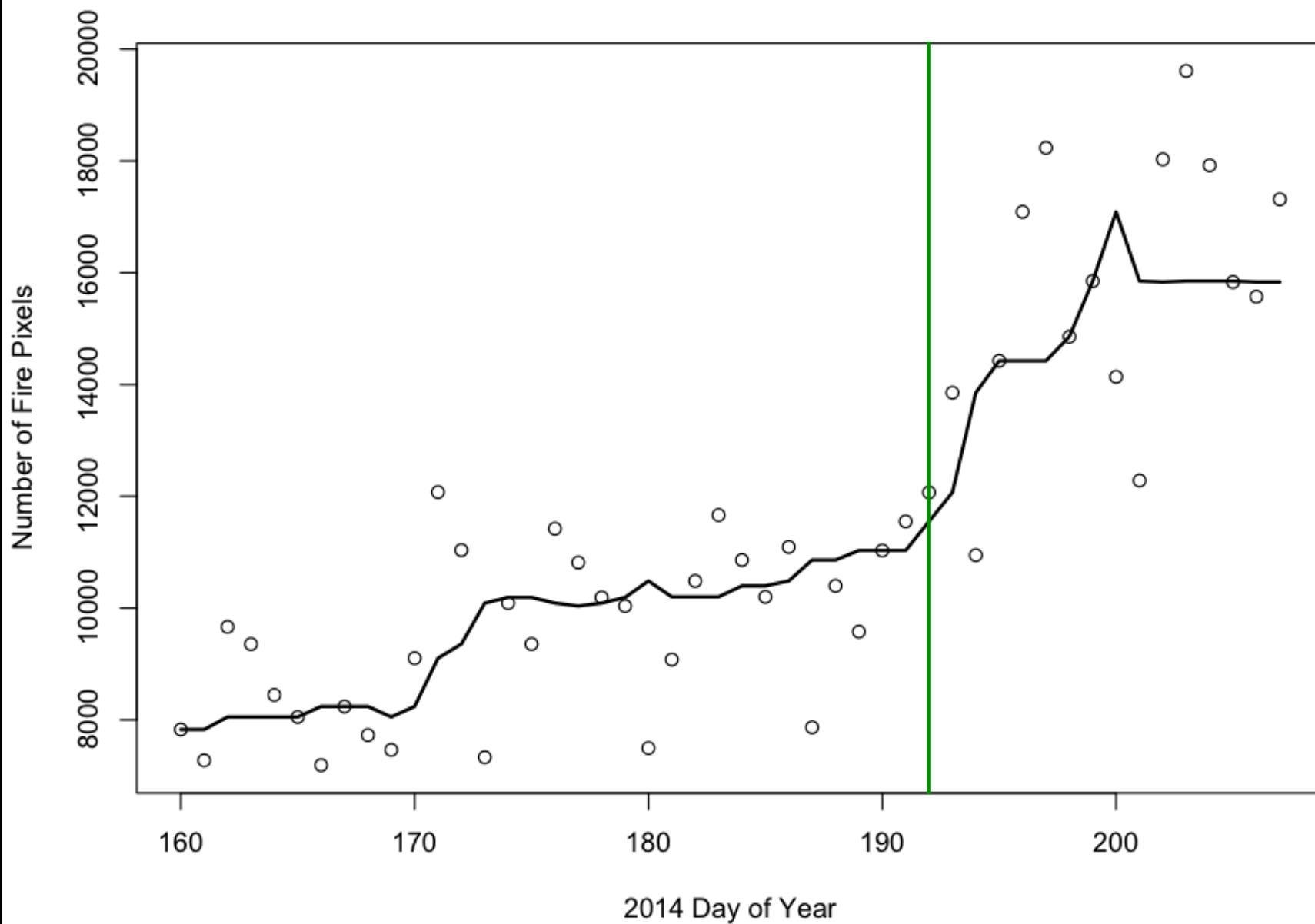
### Rim fire, CA: Aug. 17th - Sept. 6th



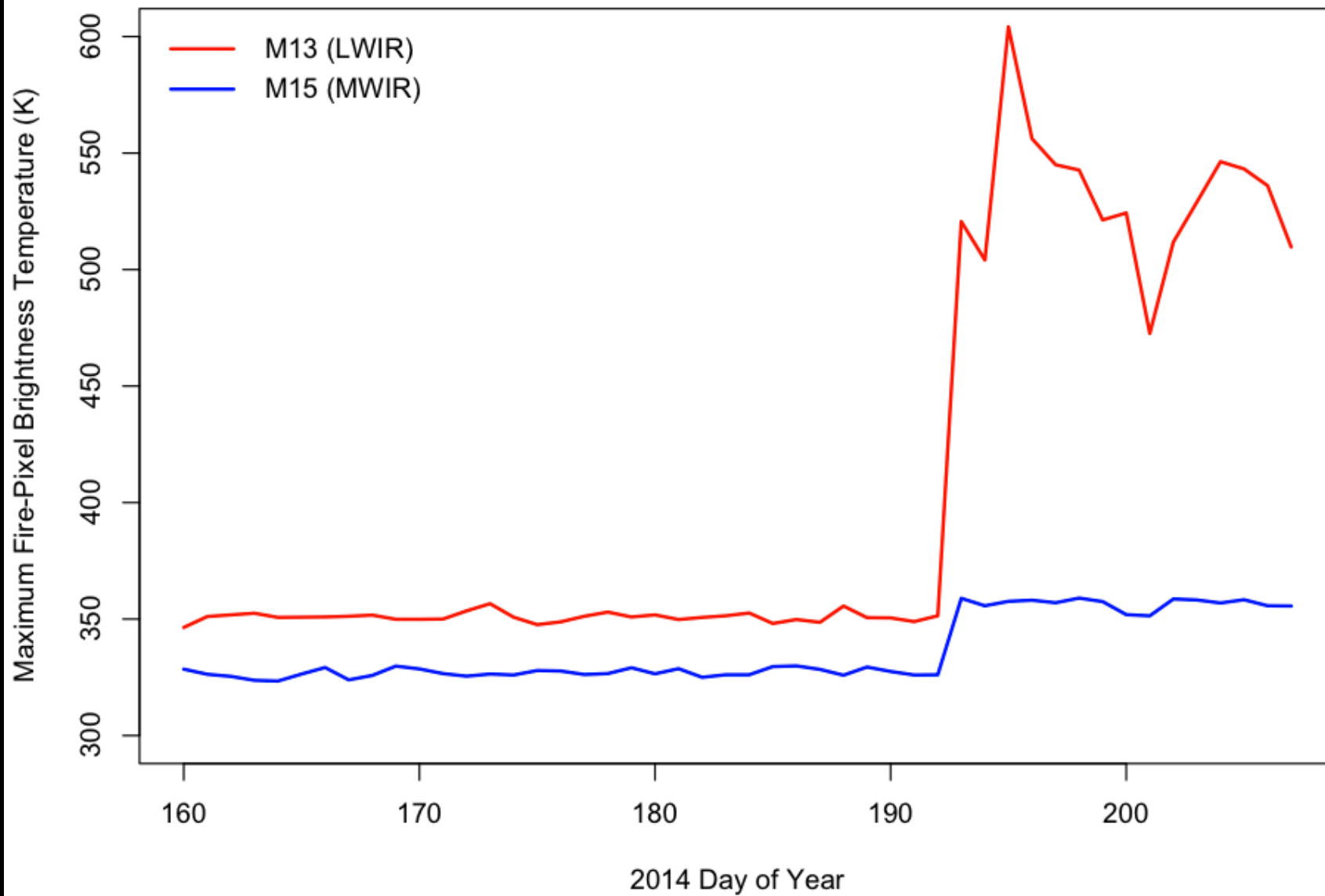
# SDR Problems

- Non-unique mapping of radiance to brightness temperature near saturation
- Confusion between sensor specification and actual sensor capabilities in SDR software
- QF1 data quality bits often set haphazardly
- “Folded” radiance values due to saturation not flagged as invalid
- Disproportionally affect the VIIRS fire product

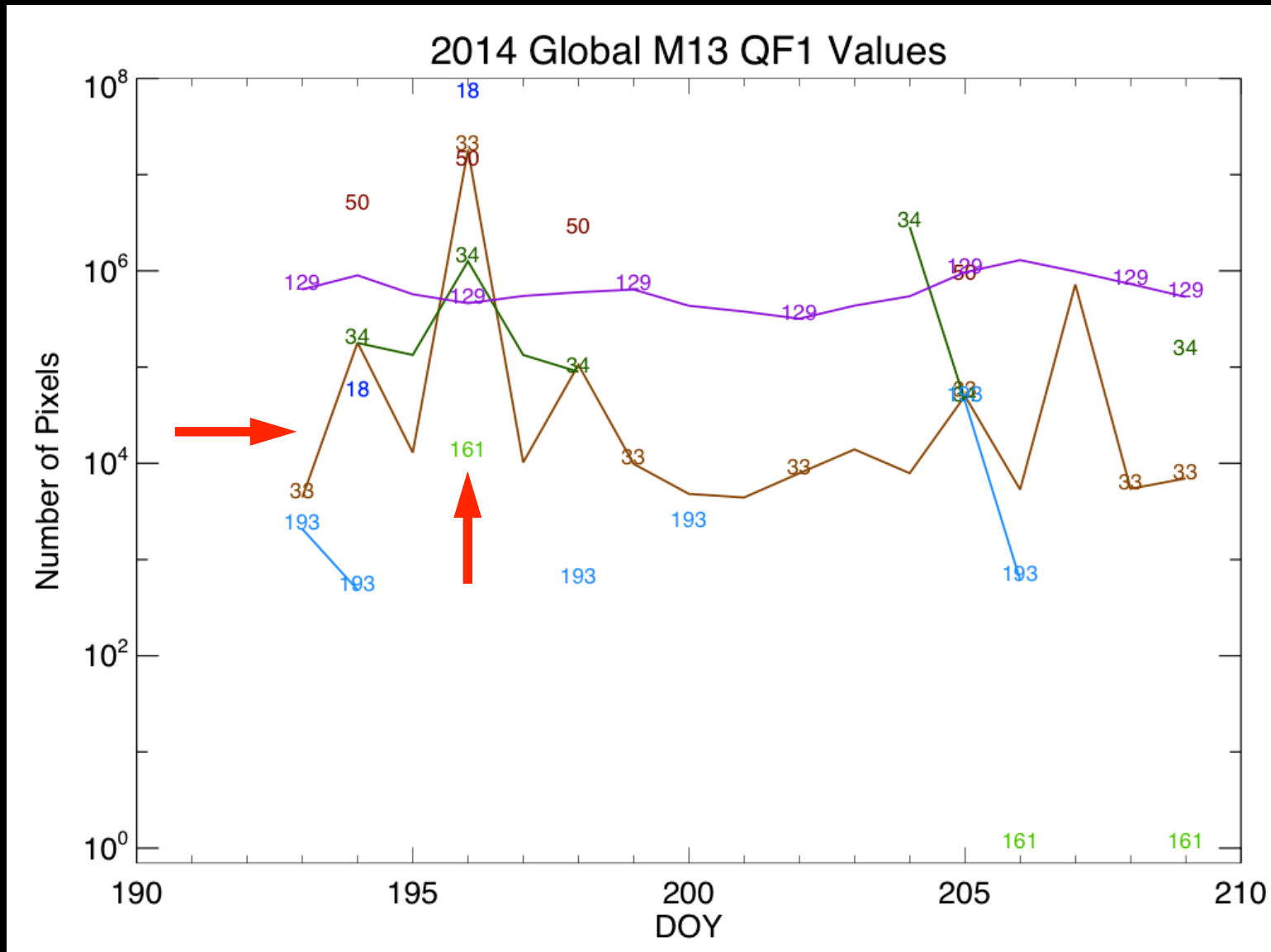
### VIIRS Replacement Active Fire Product



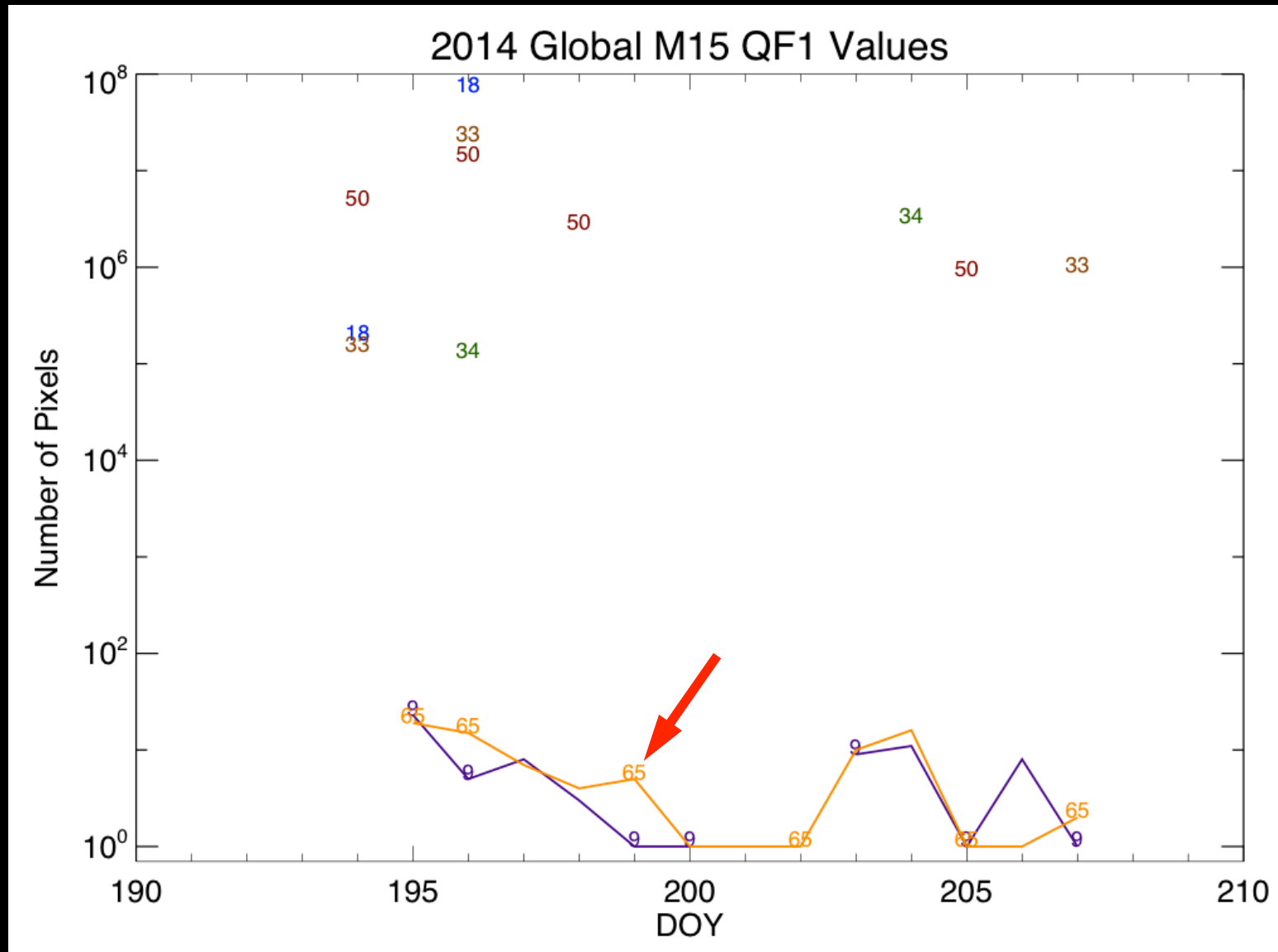
### VIIRS Replacement Active Fire Product



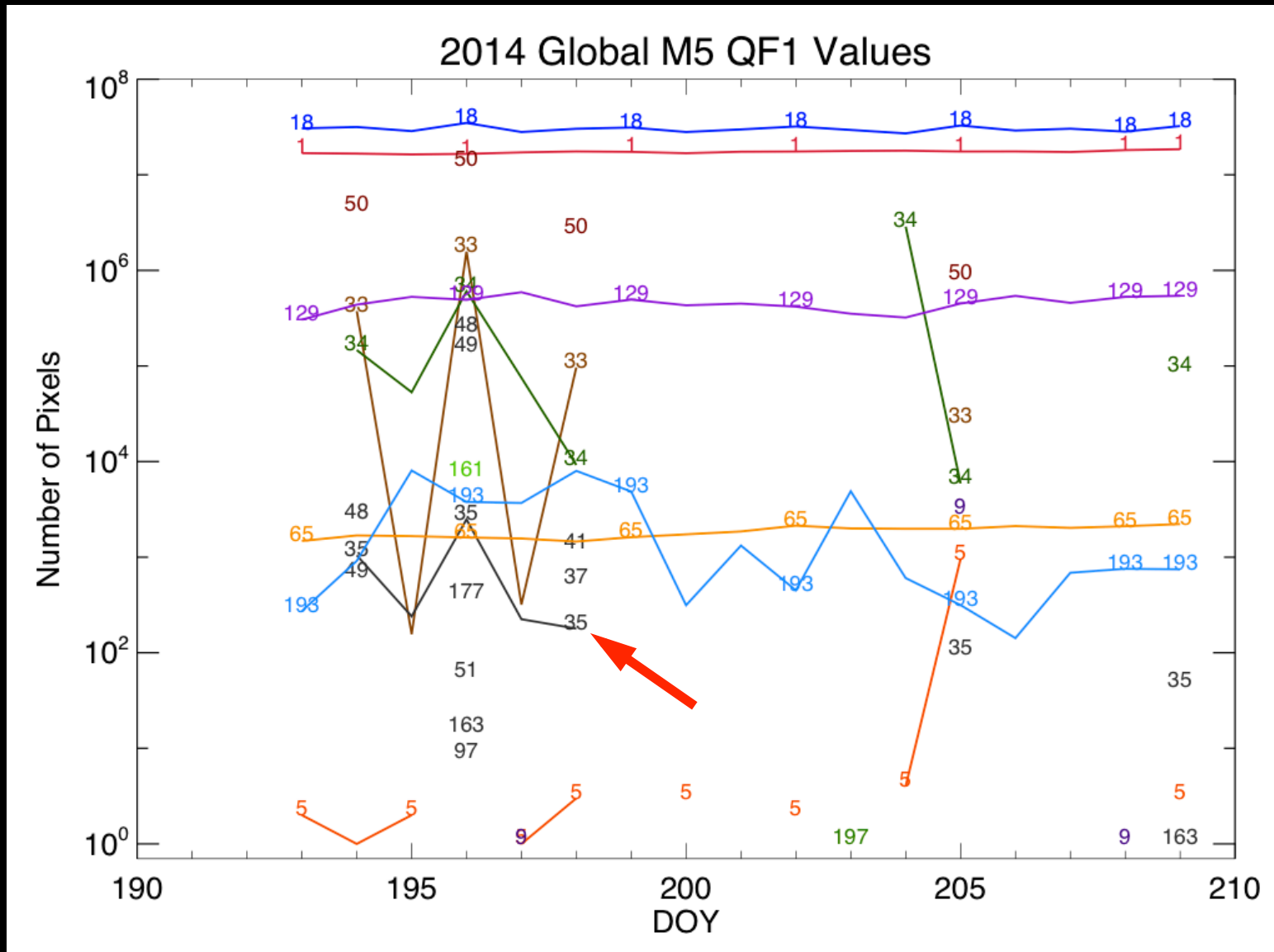
# MWIR Primary Fire Band



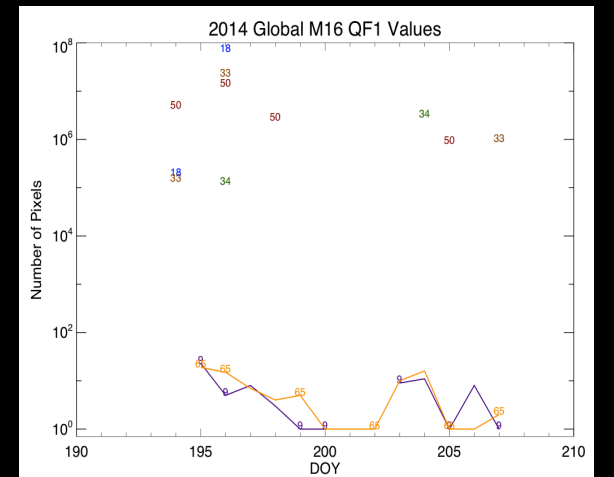
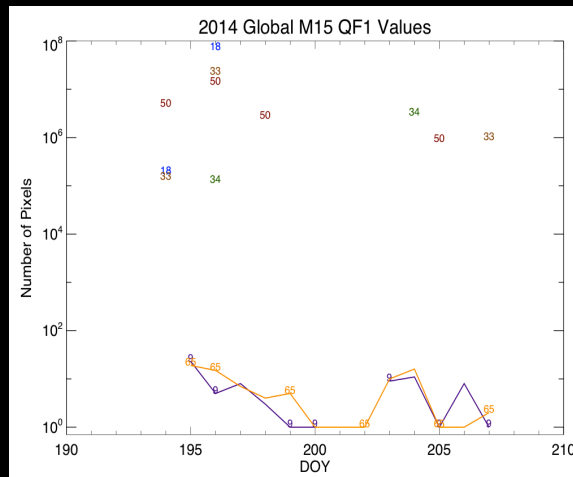
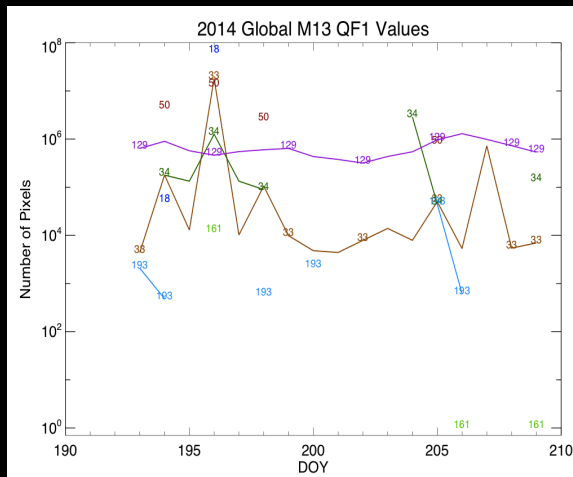
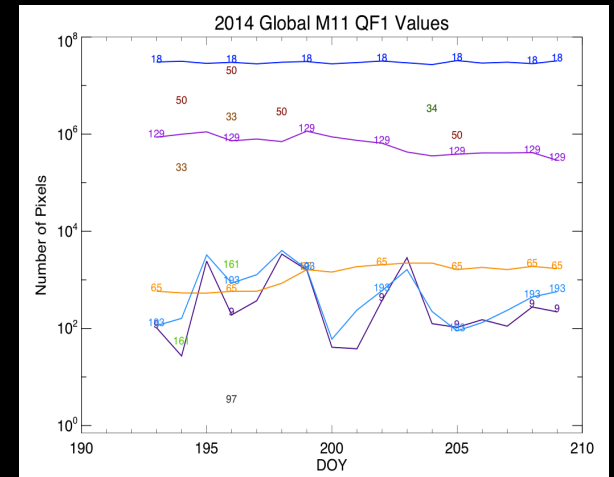
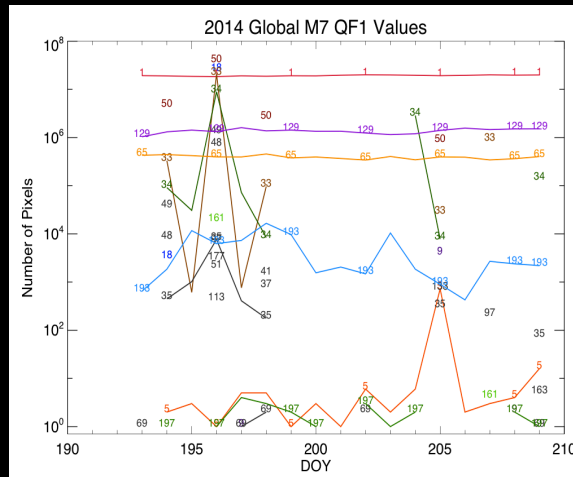
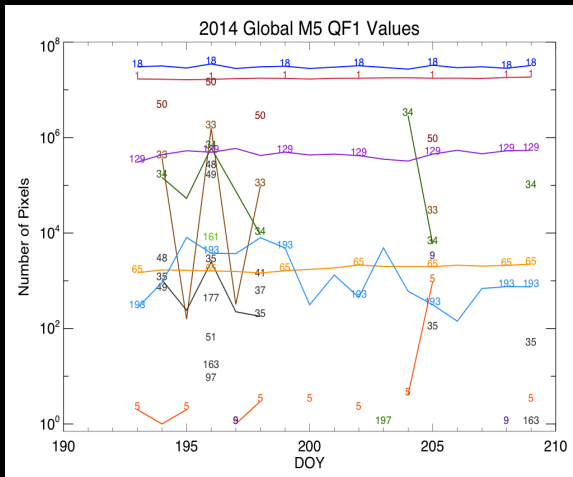
# LWIR



# Red



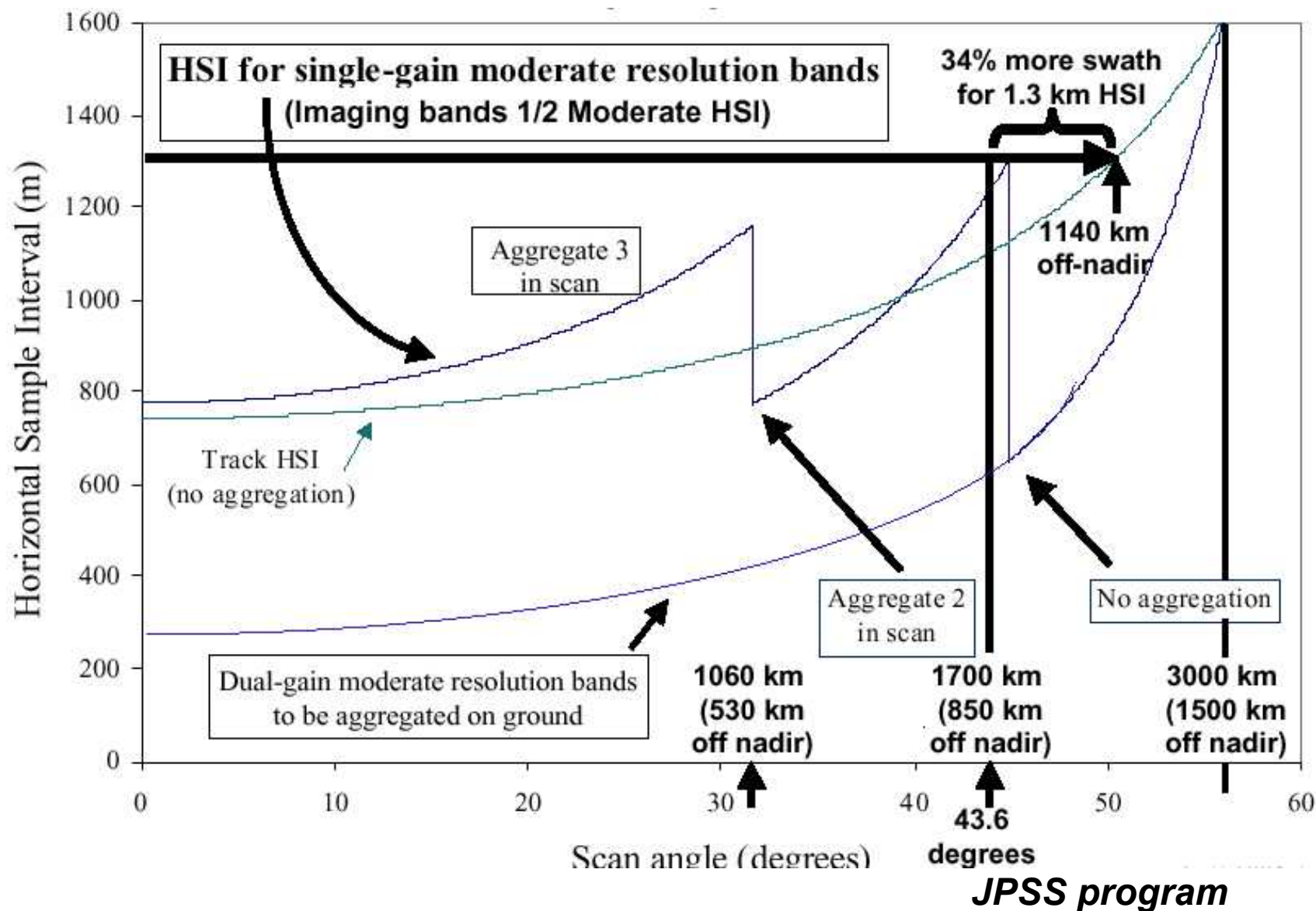
# Fire code checks quality flags of all six input bands + geolocation.



# SDR Problems (Cont.)

- On-board aggregation bug
  - Affects all non-dual gain bands
  - No reliable method to detect corrupt radiance values arising as a result of this bug

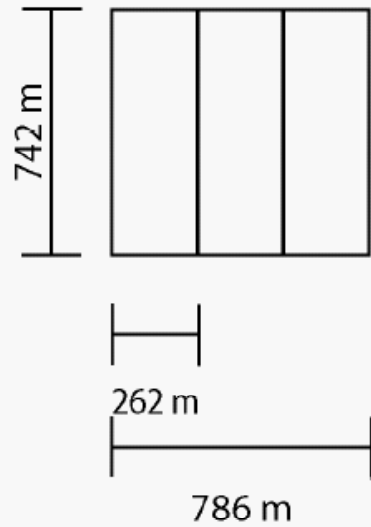
# VIIRS Detector Aggregation Scheme



# VIIRS Detector Aggregation Scheme

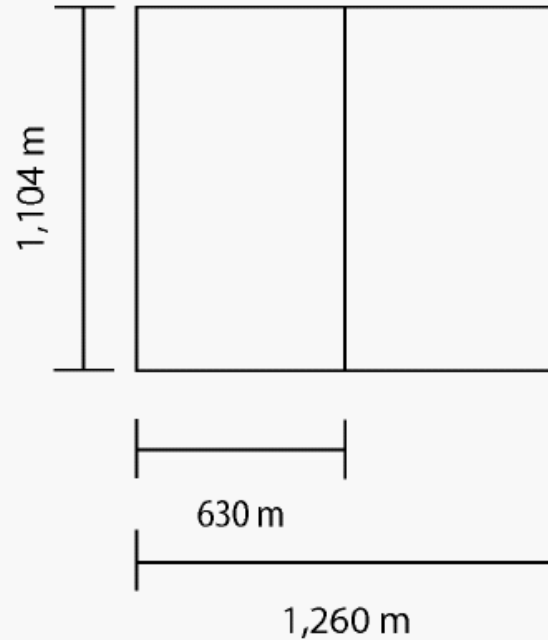
## Nadir

Aggregate 3 Samples  
SNR  $\sim\sqrt{3}$  X Baseline



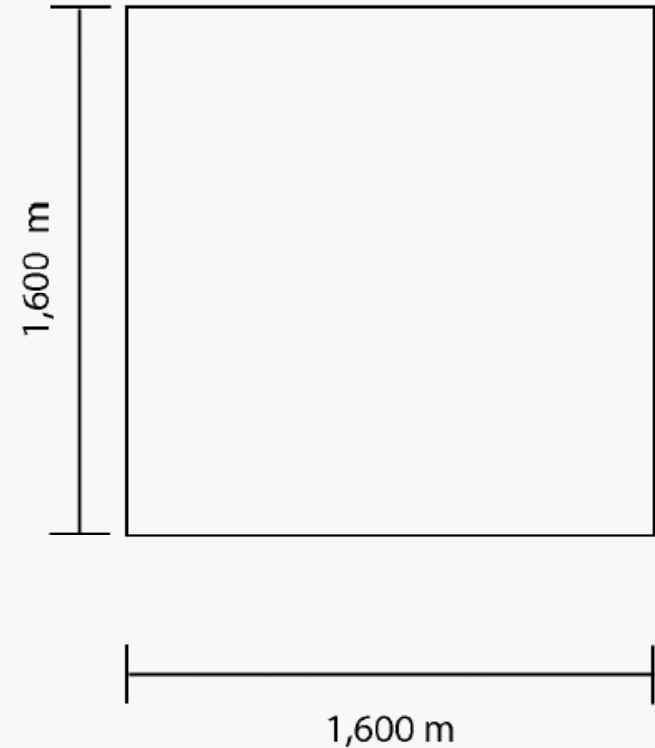
## $\pm 850$ Km

Aggregate 2 Samples  
SNR  $\sim\sqrt{2}$  X Baseline



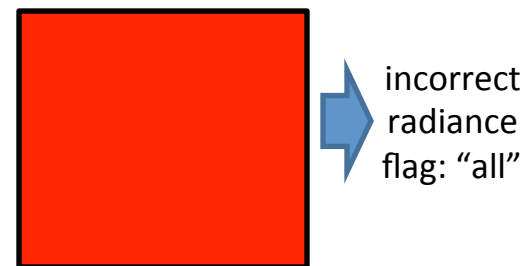
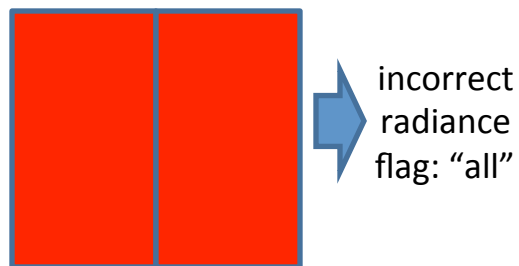
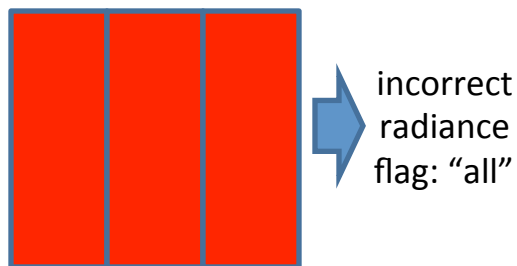
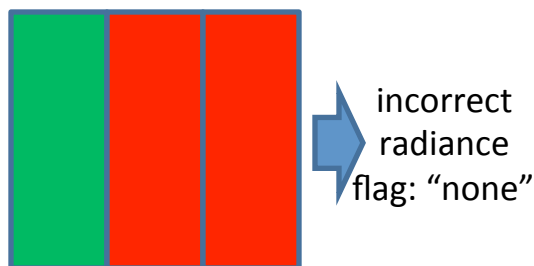
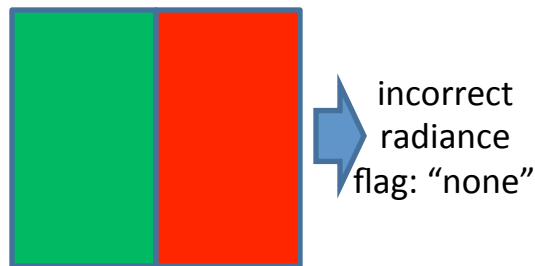
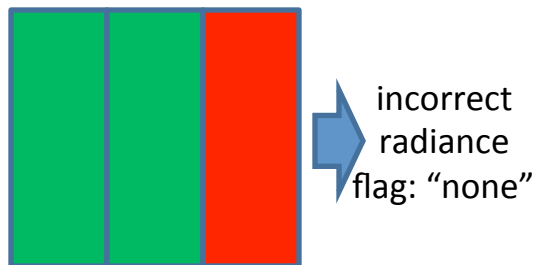
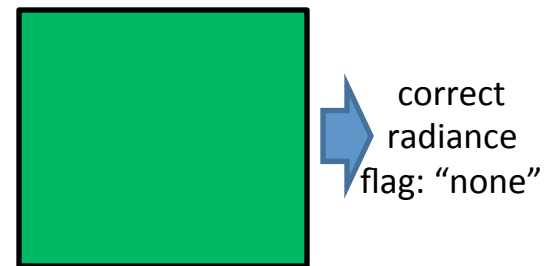
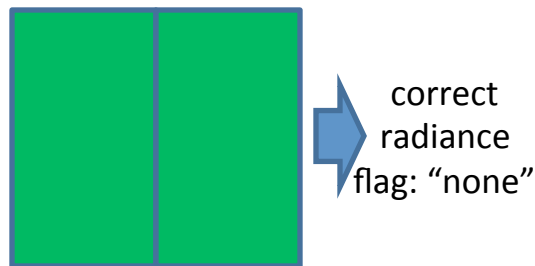
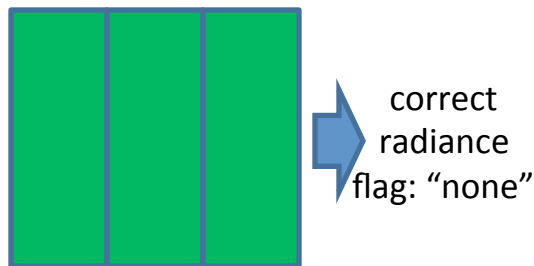
## $\pm 1,500$ Km

No Aggregation  
SNR = Baseline



*JPSS program*

# Possible saturation scenarios for number of native pixels within the nominal pixel



# Challenges

- SDR quality
  - Lack of stability
  - Time series is not continuous
  - Research-grade product (i.e., CDR) not yet available
- Higher level fire products not yet available
  - Will be produced by NASA

# Challenges

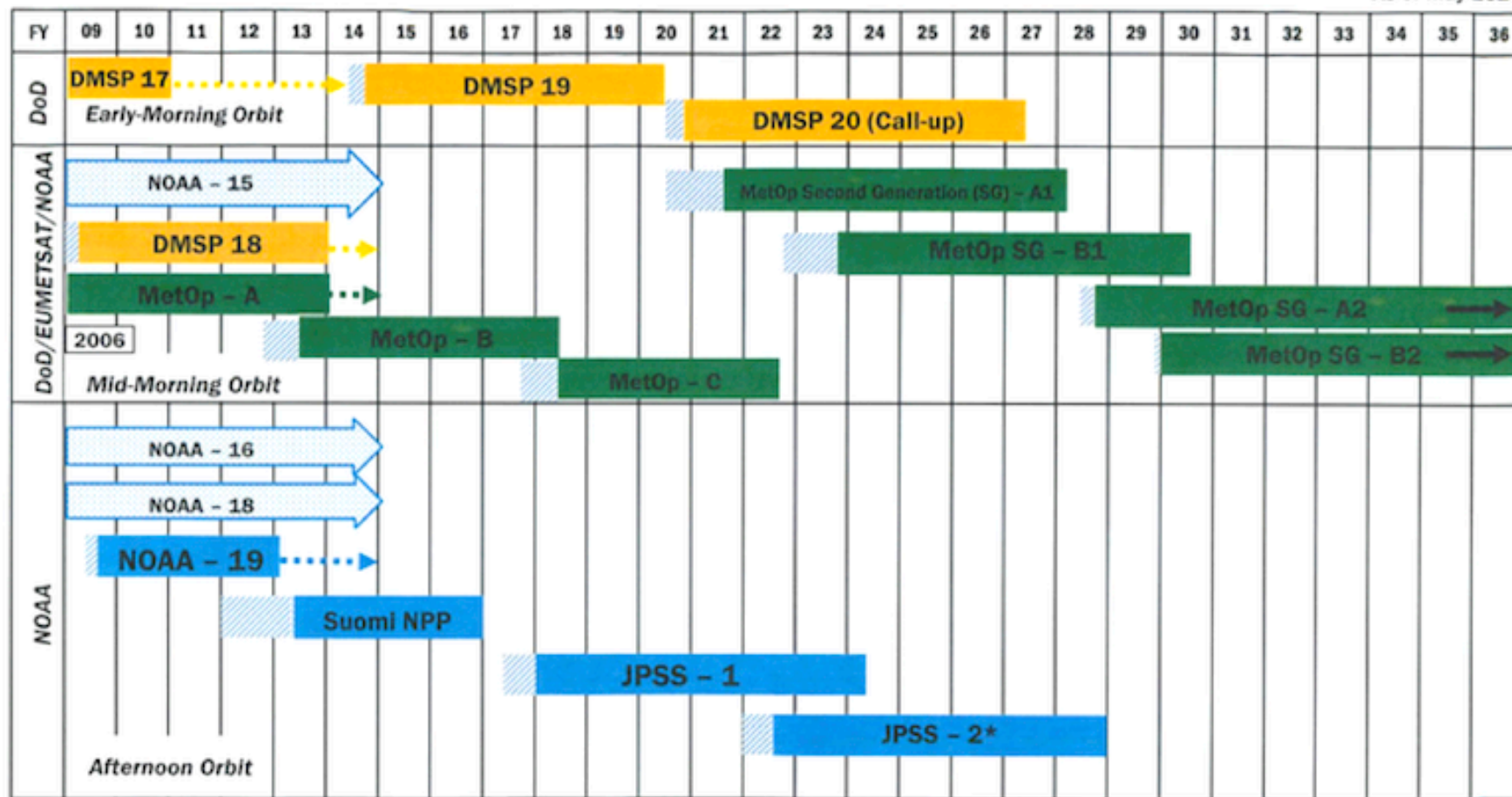
- Data continuity
  - S-NPP VIIRS (2011) – 13:25 overpass
  - JPSS-1 VIIRS (2017) – 13:30 overpass
  - JPSS-2 VIIRS (2022) – 13:30 overpass
  - Post-MODIS data record will most likely require mix of VIIRS, SLSTR, etc.



# Continuity of NOAA's Polar (Primary) Operational Weather Satellite Programs



As of May 2014



Approved: *Mary E. Kelly*  
 Assistant Administrator for Satellite and Information Services

\* Program funding provided through FY2025. The follow-on Program will provide funding for operations post 2025.

DMSP: Defense Meteorological Satellite Program  
 JPSS: Joint Polar Satellite Program  
 Suomi NPP: Suomi National Polar Partnership

- Post Launch Test
- Operational based on design life
- Secondary
- Operational beyond FY 2036
- In Extended Mission

Note: Extended operations are reflected through the current FY, based on current operating health.

# Further Information

- <http://viirsfire.geog.umd.edu/>