Observations of Major 2012 Fire Events in the United States from Suomi NPP: Product Evaluation and User Readiness

Ivan Csiszar[1], Evan Ellicott[2], Wilfrid Schroeder[2], Peter Roohr[3], Brad Quayle[4], Louis Giglio[2], Christopher O. Justice[2]

[1]NOAA/NESDIS /STAR, Camp Springs, MD (ivan.csiszar@noaa.gov), [2]University of Maryland, College Park, MD, [3]National Weather Service, Silver Spring, MD, [4]USDA Forest Service Remote Sensing Applications Center

The 2012 fire season was particularly active over the Conterminous United States. Major fire events occurred in the Western US. These fire events caused major losses and gained widespread media attention. Monitoring multiple fires over such a large area is a challenge to fire management agencies. The 2012 fire season was also the first one in North America when observations from the Visible Infrared Imager Radiometer Suite (VIIRS), on the Suomi National Polar-orbiting Partnership (SNPP) satellite, were available. The standard VIIRS Active Fire Product, generated by the SNPP Interface Data Processing Segment (IDPS), processes radiometric measurements from the VIIRS 750m moderate resolution bands using a heritage algorithm from the Moderate Resolution Imaging Spectroradiometer (MODIS) on the NASA Earth Observing System (EOS) Terra and Aqua satellites. To assist product evaluation and user readiness, the Joint Polar Satellite System (JPSS) Active Fire Algorithm Development and Validation team have developed a web-based data visualization, analysis, and distribution system that provides near-real-time data and a rolling archive of all VIIRS fire observations over North America. For select cases, near-simultaneous observations from Aqua MODIS were also presented for comparison. The data were also converted into geospatial formats to assist on-site fire managers in evaluating the usefulness of the product in daily operations. The JPSS Active Fire Team was also engaged in generating imagery for select fire events derived using an experimental detection algorithm from the 375m VIIRS Imager bands. This imagery was also provided for end user evaluation and to the public through various online outlets. This presentation will provide a summary of lessons learned during the 2012 fire season through examples of major fire events and plans for improved data products, data distribution, and applications.

SUOMI NPP VIIRS ACTICE FIRE CAPABILITIES AND PRODUCT STATUS

VIIRS			MODIS Equivalent			AVHRR-3 Equivalent			OLS Equivalent		
Band	Range (um)	HSR (m)	Band	Range	HSR	Band	Range	HSR	Band	Range	HSR
DNB	0.500 - 0.900	750	NONE			Low light capabilities			HRD PMT	0.580 - 0.910 0.510 - 0.860	550 2700
M1	0.402 - 0.422	750	8	0.405 - 0.420	1000						
M2	0.436 - 0.454	750	9	0.438 - 0.448	1000						
M3	0.478 - 0.498	750	3 10	0.459 - 0.479 0.483 - 0.493	500 1000	NONE			Ocean Color, Aerosol		
M4	0.545 - 0.565	750	4 12	0.545 - 0.565 0.546 - 0.556	500 1000						
I1	0.600 - 0.680	375	1	0.620 - 0.670	250	1	0.572 - 0.703	1100	Imagery		
M5	0.662 - 0.682	750	13 14	0.662 - 0.672 0.673 - 0.683	1000 1000	1	0.572 - 0.703	1100	Ocean Color, Aerosol		
M6	0.739 - 0.754	750	15	0.743 - 0.753	1000	NONE			Atm Correction		
I2	0.846 - 0.885	375	2	0.841 - 0.876	250	2	0.720 - 1.000	1100	NDVI		
M7	0.846 - 0.885	750	16	0.862 - 0.877	1000	2	0.720 - 1.000	1100	Ocean Color, Aerosol		
M8	1.230 - 1.250	750	5	SAME	500	NONE			Cloud Particle Size		
M9	1.371 - 1.386	750	26	1.360 - 1.390	1000				Thin Cirrus		
I3	1.580 - 1.640	375	6	1.628 - 1.652	500				Snow Map		
M10	1.580 - 1.640	750	6	1.628 - 1.652	500	3a	SAME	1100	Snow Fraction		
M11	2.225 - 2.275	750	7	2.105 - 2.155	500	NONE			Cloud		
I4	3.550 - 3.930	375	20	3.660 - 3.840	1000	3b	SAME	1100	Imagery, Clouds		
M12	3.660 - 3.840	750	20	SAME	1000	3b	3.550 - 3.930	1100	SST, Fire		
M13	3.973 - 4.128	750	21 22 23	3.929 - 3.989 3.929 - 3.989 4.020 - 4.080	1000 1000 1000	NONE			SST, Fire		
M14	8.400 - 8.700	750	29	SAME	1000				Cloud Top Propoerties		
M15	10.263 - 11.263	750	31	10.780 - 11.280	1000	4	10.300 - 11.300	1100	SST, Fire		
I5	10.500 - 12.400	375	31 32	10.780 - 11.280 11.770 - 12.270	1000 1000	4 5	10.300 - 11.300 11.500 - 12.500	1100 1100	HRD	10.300 - 12.900 Cloud Imagery	550
M16	11.538 - 12.488	750	32	11.770 - 12.270	1000	5	11.500 - 12.500	1100	SST		

: M-band 750m (nadir) MIR/TIR detection and characterization (IDPS and experimental replacement products)

: I-band 375m (nadir) MIR/TIR detection (experimental product)

: DNB -band 750m (nadir) nighttime visible detection (experimental product); not discussed further in this presentation)

VIIRS Active Fire Product Development

NOAA: "real-time (NOAA) operational applications"

- Operational product generated by IDPS (Interface Data Processing Segment)
- Part of integrated processing chain
- Low latency
- Detections only
- Locations only (no fire mask)

Algorithm updates ⟷ Upstream processing updates

NASA: "science, long-term continuity + added value NRT"

- Experimental MODIS continuity product produced by LandPEATE (Product Evaluation and Test Element)
- Detections and Fire Radiative Power
- Spatially explicit fire mask
- Spatial and temporal aggregates

algorithm synchronization
end user feedback

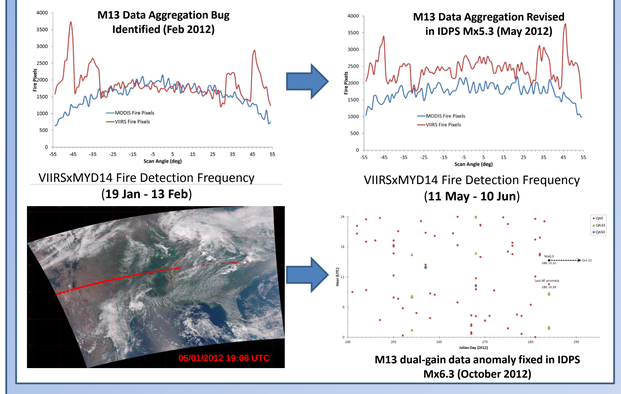
DIRECT READOUT

- Can run IDPS, NASA or locally developed code
- Stand-alone

viirsfire.geog.umd.edu

- Product information
- Evaluation portal
- User-friendly formats
- Limited data distribution

IDPS Product Evaluation and Improvements



CODE CHANGES LEADING TO THE IMPROVEMENT OF THE IDPS ACTIVE FIRES PRODUCT HAVE BEEN IMPLMENTED IN VARIOUS IDPS BUILDS

In October 2012 the SNPP Active Fires product was declared to have Beta maturity status

It is publicly available through NOAA CLASS at https://www.class.noaa.gov

The start date of the released data record is May 3, 2012 (the start of IDPS Mx 5.3)

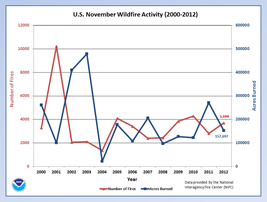
Suomi NPP Environmental Data Record (EDR) beta maturity:

- *Early release product*
- *Minimally validated*
- *May still contain significant errors*
- *Versioning not established until baseline is determined*
- *Available to allow users to gain familiarity with data formats and parameters*
- *Product is not appropriate as the basis for quantitative scientific publications, studies and applications*

EXAMPLES OF SNPP FIRE OBSERVATIONS IN 2012

Year-to-Date Wildfire Statistics*

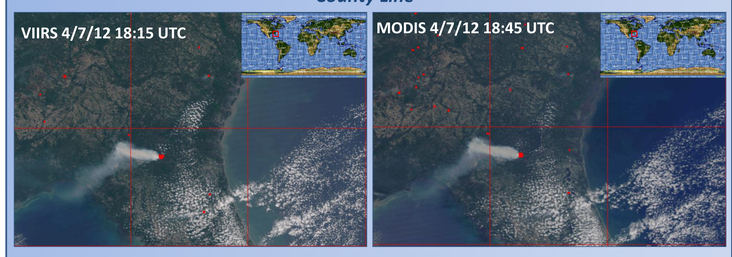
	January–November	Rank (out of 13 years)	Record Value	Record Year	10-Year Average (2001-2010)
Acres Burned	9,156,278	2nd Most	9,508,251	2006	6,346,769.6
		12th Least			
Acres Burned/Fire	165.0	Most on Record	165	2012	88.5
		13th Least			



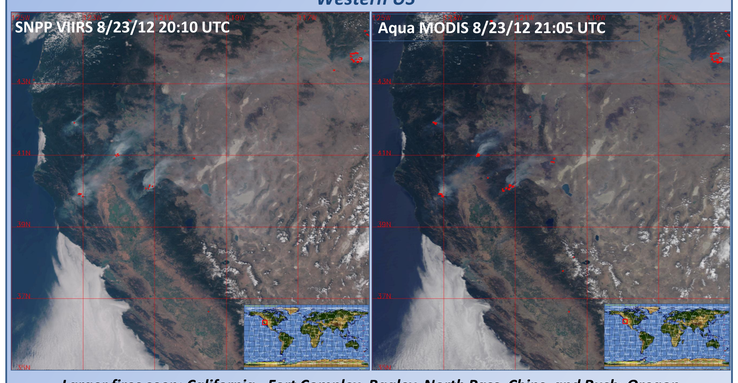
Some basic statistics of the 2012 US fire activity. (National Interagency Fire Center; www.nifc.gov)

M-band IDPS Product and Comparisons with Near-coincident Aqua MODIS

County Line

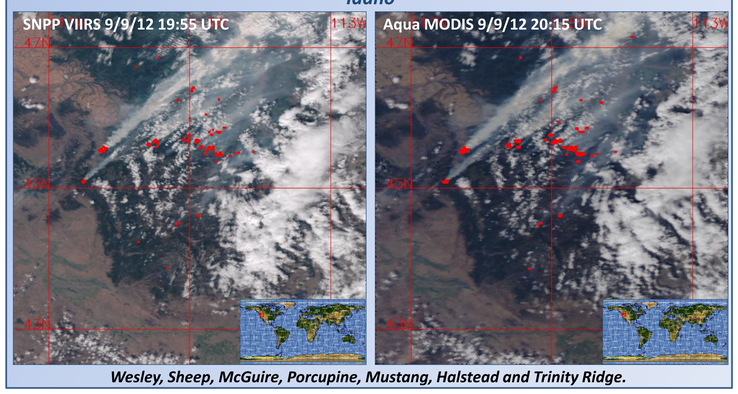


Western US



Larger fires seen: California - Fort Complex, Bagley, North Pass, Chips, and Rush; Oregon - Waterfalls 2; Idaho - Trinity Ridge, and Halstead.

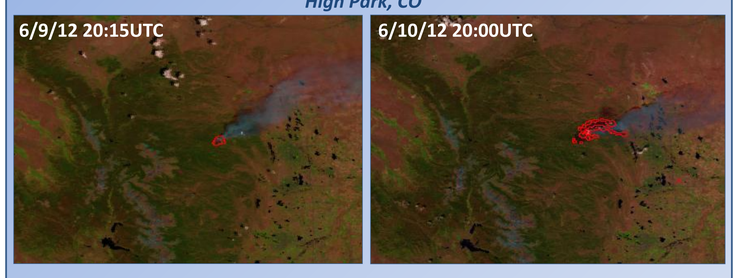
Idaho



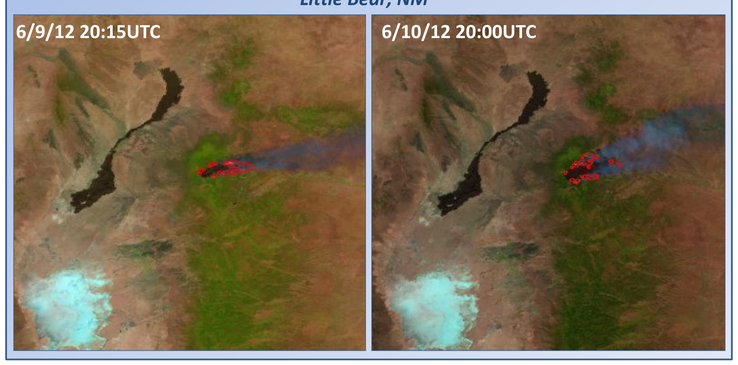
Wesley, Sheep, McGuire, Porcupine, Mustang, Halstead and Trinity Ridge.

I-band Experimental Product

High Park, CO



Little Bear, NM



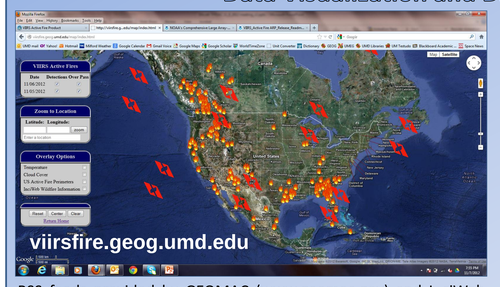
PROVING GROUND AND RISK REDUCTION

The goals of VIIRS AF data proving ground project is the development of a near-real-time enhanced VIIRS AF product delivery system to NOAA end users.

Core activities:

- Web-based near real-time data visualization, evaluation and distribution
  - Background information and VIIRS-MODIS comparisons are also included to help product evaluation
- VIIRS active fire algorithm improvement and evaluation
  - The system is also a testbed for evaluating enhanced and experimental algorithms
- Partnership with end users for enhanced data services and user outreach
  - USDA Forest Service, NWS IMETs
- International outreach through GOFC-GOLD Regional Networks
  - GOFC-GOLD: Global Observation of Forest and Landcover Dynamics; a panel of the Global Terrestrial Observing System

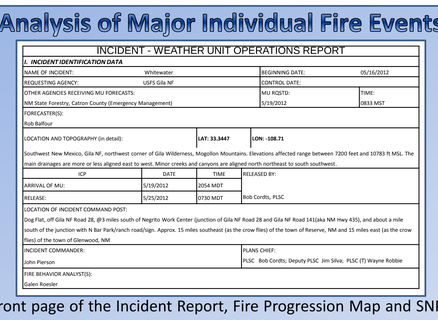
Data Visualization and Distribution



RSS feeds provided by GEOMAC (www.geomac.gov) and InciWeb (www.inciweb.org). Data are available in ASCII, GeoTIFF and KMZ formats. Note: this is an experimental, non-operational system. For the official IDPS product visit the NOAA CLASS data portal (www.class.ncdc.noaa.gov).

Timestamp	Date	Ascii	TIFF	KMZ
NPP_VIIRS_20121107_212542_213122	2012-11-07	Download	Download	Download
NPP_VIIRS_20121107_162406_162947	2012-11-07	Download	Download	Download
NPP_VIIRS_20121107_180050_180631	2012-11-07	Download	Download	Download
NPP_VIIRS_20121107_194316_194856	2012-11-07	Download	Download	Download
NPP_VIIRS_20121107_194858_195438	2012-11-07	Download	Download	Download
NPP_VIIRS_20121107_193734_194315	2012-11-07	Download	Download	Download
NPP_VIIRS_20121107_180632_181212	2012-11-07	Download	Download	Download
NPP_VIIRS_20121106_214853_215432	2012-11-06	Download	Download	Download
NPP_VIIRS_20121106_164137_164717	2012-11-06	Download	Download	Download
NPP_VIIRS_20121106_182402_182943	2012-11-06	Download	Download	Download
NPP_VIIRS_20121106_214312_214852	2012-11-06	Download	Download	Download
NPP_VIIRS_20121106_200046_200627	2012-11-06	Download	Download	Download
NPP_VIIRS_20121106_200628_201208	2012-11-06	Download	Download	Download
NPP_VIIRS_20121106_181821_182401	2012-11-06	Download	Download	Download
NPP_VIIRS_20121105_220622_221202	2012-11-05	Download	Download	Download
NPP_VIIRS_20121105_220042_220621	2012-11-05	Download	Download	Download
NPP_VIIRS_20121105_201816_202357	2012-11-05	Download	Download	Download
NPP_VIIRS_20121105_202358_202938	2012-11-05	Download	Download	Download
NPP_VIIRS_20121105_184132_184713	2012-11-05	Download	Download	Download

Analysis of Major Individual Fire Events



INCIDENT - WEATHER UNIT OPERATIONS REPORT

I. INCIDENT IDENTIFICATION DATA

NAME OF INCIDENT:	Whitewater	BEGINNING DATE:	05/16/2012
REQUESTING AGENCY:	USFS Gila NF	CONTROL DATE:	
OTHER AGENCIES RECEIVING MU FORECASTS: NM State Forestry, Catron County (Emergency Management)		MU RQSTD: 5/19/2012	TIME: 0833 MST

FORECASTER(S): Rob Balfour

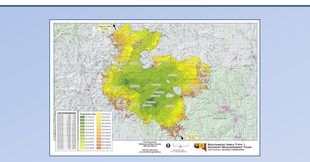
LOCATION AND TOPOGRAPHY (in detail): LAT: 33.3447 LON: -108.71

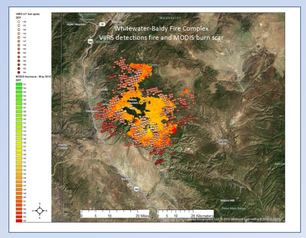
Southwest New Mexico, Gila NF, northwest corner of Gila Wilderness, Mogollon Mountains. Elevations affected range between 7200 feet and 10783 ft MSL. The main drainages are more or less aligned east to west. Minor creeks and canyons are aligned north northeast to south southwest.

	ICP	DATE	TIME	RELEASED BY:
ARRIVAL OF MU:		5/19/2012	1054 MDT	
RELEASE:		5/25/2012	0730 MDT	Bob Cordts, PLSC

LOCATION OF INCIDENT COMMAND POST: Dog Flat, off Gila NF Road 28, @3 miles south of Negrito Work Center (junction of Gila NF Road 28 and Gila NF Road 141(aka NM Hwy 435), and about a mile south of the junction with N Bar Park/ranch road/sign. Approx. 15 miles southeast (as the crow flies) of the town of Reserve, NM and 15 miles east (as the crow flies) of the town of Glenwood, NM

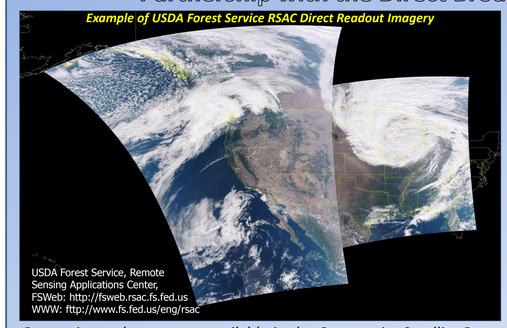
INCIDENT COMMANDER: John Pierson	PLANS CHIEF: PLSC Bob Cordts; Deputy PLSC Jim Silva; PLSC (T) Wayne Robbie
FIRE BEHAVIOR ANALYST(S): Galen Roesler	

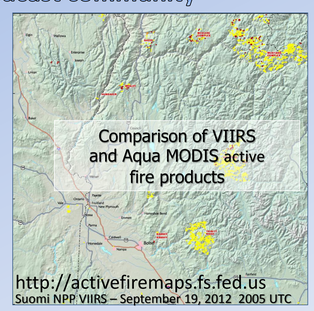




Front page of the Incident Report, Fire Progression Map and SNPP VIIRS fire detections (over a MODIS burned area map) for the Whitewater-Baldy fire event. Evaluation is ongoing to analyze the utility of VIIRS fire information to assist on-site fire management support by National Weather Service Incident Meteorologists (IMETs).

Partnership with the Direct Broadcast community





Processing codes are now available in the Community Satellite Processing Package (CSPP; University of Wisconsin) and International Polar Orbiter Processing Package (IPOPP; NASA Direct Broadcast Laboratory).The Active Fires product team works with the providers of CSPP and IPOPP to ensure that the latest algorithms are included.

Online Articles

First Fire Images from VIIRS (January 26, 2012)
http://earthobservatory.nasa.gov/IOTD/view.php?id=77025

NASA/NOAA Satellite Sees Western U.S. High Mountain Blazes (July 13, 2012)
http://www.nasa.gov/mission_pages/NPP/news/west-blazes.html

NASA Finalizes Contracts for NOAA's JPSS-1 Mission (August 10, 2012)
http://www.nasa.gov/centers/goddard/news/releases/2012/12-066.html

Complex Interactions between Wildfires and Lightning during Summer 2012 (December 12, 2012 by Scott Rudloski)
http://essic.umd.edu/joom2/index.php/outreach-main/its-severe-blog/1229-complex-interactions-between-wildfires-and-lightning-during-summer-2012

Summary and Conclusions

Assessment of the VIIRS fire product using 2012 fire observations is **encouraging**

Active Fires product has been declared **Beta maturity** and is publicly available

User Readiness and Proving Ground activities are reaching out to various users

Implementation of **Direct Readout processing systems** is underway

Acknowledgment

This work was supported by the NOAA JPSS Office (NJO) through the JPSS Proving Ground and the JPSS Algorithm Development and Validation programs.