Joint Polar Satellite System Common Ground System (JPSS CGS) VIIRS Improvements over MODIS

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The 36 channel Moderate Resolution Imaging Spectroradiometer (MODIS) has been a benchmark for high resolution visible and infrared environmental imagery since the first instrument was launched on December 18, 1999. Its successor, the Visible Infrared Imager Radiometer Suite (VIIRS) was launched on the Suomi National Polar-orbiting Partnership (S-NPP), the first of the JPSS constellation, on October 28, 2011. Starting with Suomi NPP, VIIRS replaces — and improves upon —three different legacy sensors with a single instrument: AVHRR onboard EUMETSAT Polar System Metop and NOAA POES, MODIS onboard NASA's Terra and Aqua, and OLS onboard DMSP. Comparisons and differences between MODIS and VIIRS, as well as the OLS Day/Night Band and VIIRS, are shown here.

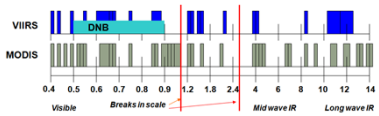

Figure 1: VIIRS and MODIS Spectral Similarities

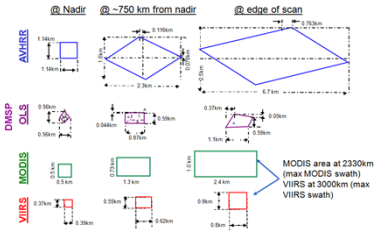

Figure 2: Sensor Scan Characteristics

	MODIS	VIIRS
Orbit	705 km polar sun-synchronous	833 km polar sun-synchronous
Swath	2330 km	>3000 km
Bands	36	22
Spectral Coverage	0.4 - 14.3 µm	0.4 to 12.5 µm
Resolution		
	Bands 1-2: 250 m	Radiometric: 0742 km nadir; 1.6 km EOS
	Bands 3-7: 500 m	Imaging: 0.371 km nadir; 0.8 km EOS
	Bands 8 - 36: 1 km	Day/Night Band: 0.742 constant
Mass	220 kg	270 kg
Power	163 W	170 W

Figure 3: VIIRS and MODIS Sensor Characteristics

Figure 4: VIIRS resolution improvements over MODIS

VIIRS improves and extends MODIS fire detection (1 km pixel size) with earlier detection of small fires and 375m resolution

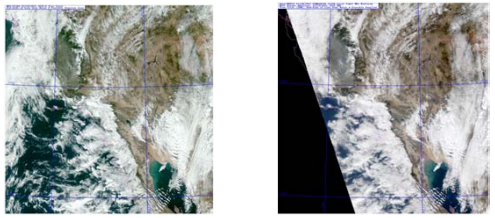

Figure 5: VIIRS scan edge improvements over MODIS

At 1500 km from nadir, VIIRS pixels are 2.25 km^2, whereas MODIS pixels are 9.7 km^2 at 1165 km from nadir

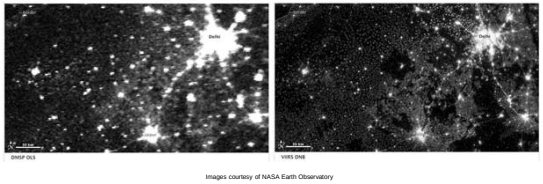

Figure 6: VIIRS Day Night Band improvements over OLS

VIIRS DNB at 750 m as compared to the Defense Meteorological Satellite Program Operational Linescan System at 3 km

The addition of a day/night band (DNB) to VIIRS allows for the detection of phenomena previously difficult or impossible to detect with MODIS, as shown in Figures 7 – 9 below:

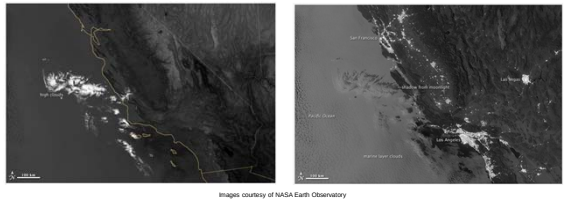

Figure7: Low clouds at night

Night time detection of low clouds is difficult in thermal IR (left). VIIRS DNB easily detects marine layer (right)

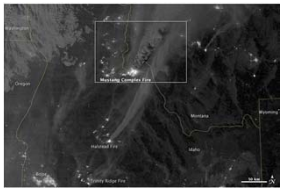

Figure8: DNB Wildfires

VIIRS can detect fires, smoke plumes, and city lights at night, giving fire fighters vital overnight coverage

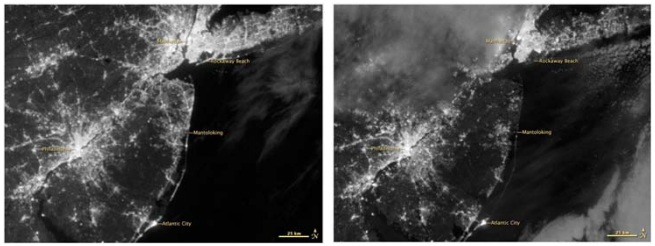

Figure9: DNB Blackouts

Before and after images from VIIRS DNB illustrates regions of power blackouts