Joint Polar Satellite System (JPSS) Common Ground System (CGS)
Suomi National Polar-orbiting Partnership (SNPP)
Environmental Products

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The Suomi National Polar-orbiting Partnership (SNPP) and JPSS-1 constitute the first two satellites in the JPSS constellation. Both satellites will fly the same sensor suite, and will generate the data from which the JPSS CGS will produce 25 Environmental Data Records (Figure 1) from the 4 separate instruments flying on the spacecraft (VIIRS, CrIS, ATMS, and OMPS). Note that the EDRs for one instrument, CERES, are not produced by CGS. SNPP launched successfully on October 28, 2011. CGS will also provide Raw Data Records the Global Climate Observation Mission – Water (GCOM-W) launched on May 18, 2012, and produce EDRs for the Department of Defense's Weather Satellite Follow-on (WSF). GCOM-W flies one instrument, the AMSR-2 microwave imager, and WSF will fly three instruments, including the same VIIRS now flying on SNPP. The 25 products from SNPP and JPSS-1 shown here, along with their associated Sensor Data Records (SDRs) and several Intermediate Products (IPs) are delivered to several government processing centers for operational use, and, most importantly for the general research community, to NOAA's Comprehensive Large Array-data Stewardship System (CLASS). CLASS is responsible for archiving and distributing all SNPP data products to the general public. Products sent to CLASS from the CGS data processing system (known as the Interface Data Processing Segment, or IDPS) are aggregated into 5 minute granules to provide for efficient transport and archival. The information presented here will help users prepare for operational SNPP products (and ultimately, JPSS-1 products), in terms of volume, coverage, and measurement range. The geolocation products (Figure 2) may be packaged separately or combined with the delivered products, depending upon the request method. Environmental Products are grouped by sensor (Figures 3 – 5) and a description of the product itself, its anticipated use, its size based on the actual non-aggregated data granule, coverage, and measurement range is provided.

Geolocation	Granule Size (bytes)	Measurement Range
Common (all xDRs)		Start Time: μs from 1/1/1958 Latitude (positive north): -90° to 90° Longitude (positive east): -180° to 180° Solar Zenith Angle: 0° to 90° Solar Azimuth Angle: (clockwise positive from north) 0° to 360° Satellite Zenith Angle: 0° to 90° Satellite Azimuth Angle (clockwise positive from north): 0° to 180° Satellite Range: m
VIIRS Aerosol Geolocation	1,267,200	same as common, plus Mid Time: μs from 1/1/1958 Height (above MSL): m S/C Position: m S/C velocity: m/s S/C Attitude: arcsec S/C Solar Zenith Angle : 0° to 90° S/C Solar Azimuth Angle: (counterclockwise from X) 0° to 360°
VIIRS Cloud Geolocation	1,220,400	
VIIRS Net Heat Flux Geolocation	405,268	
VIIRS NCC GTM Geolocation	144,653,340	same as common, plus Height (Ellipsoid-Geoid separation): m Moon Illumination Fraction: unitless Lunar Zenith Angle: 0° to 90° Lunar Azimuth Angle: (clockwise positive from north) 0° to 360°
VIIRS I-band GTM Geolocation	475,683,000	same as common, plus Height (Ellipsoid-Geoid separation): m
VIIRS M-band GTM Geolocation	118,938,300	same as common, plus Height (Ellipsoid-Geoid separation): m
CrIMSS Geolocation	4,055	Same as common, plus Mid Time: μs from 1/1/1958 Height (above MSL): m S/C Position: m S/C velocity: m/s S/C Attitude: arcsec
OMPS Geolocation	4,055	Same as common, plus Mid Time: μs from 1/1/1958 Latitude Corners (each IFOV Corner): -90° to 90° Longitude Corners (each IFOV Corner): -180° to 180° Relative Azimuth Angle (solar – satellite): degrees Height (Ellipsoid-Geoid separation): m Moon Vector (Lunar position in S/C Coord @ MidTime): m Sun Vector (Solar position in S/C Coord @ MidTime): m S/C Position: m S/C Velocity: m/s S/C Attitude: arcsec

Figure 2 – Geolocation Products

CrIS - 2200 km swath 4 scan, 32 s granule ATMS - 2500 km swath 12 scan, 32 s granule NPP: 1 Field of Regard	Description	Usage	Granule Size (bytes)	Horizontal Cell Size (km)	Measurement Range
Atmospheric Vertical Moisture Profile	A set of estimates of average mixing ratio (ratio of the mass of water vapor in the sample to the mass of dry air) in three-dimensional cells centered on specified points along a local vertical	Weather Prediction, Long Term Climatology		14 (clear) 46 (cloudy)	0 - 30 g/kg
Atmospheric Vertical Temperature Profile	A set of estimates of the average atmospheric temperature in three-dimensional cells centered on specified points along a local vertical	Weather Prediction, Long Term Climatology	52,234	14 (clear) 46 (cloudy)	180K - 330K
Atmospheric Vertical Pressure Profile	A set of estimates of the atmospheric pressure at specified altitudes above the earth's surface	Weather Prediction, Long Term Climatology		46	10 - 1050 mb
IR Ozone Profile			55,613	14	ppmv

Figure 3 – CrIMSS Products

OMPS TC: 5 scan, 38 second granule NP: 1 scan, 38 s granule LP: 1 scan, 38 s granule	Description	Usage	Granule Size (bytes)	Horizontal Cell Size (km)	Measurement Range
Ozone Total Column	The amount of ozone in a column of the atmosphere, along the line of sight of the sensor, measured in Dobson Units (milli-atm-cm).	Used by Parties to the "Montreal Protocol on Substances that Deplete the Ozone Layer" to track progress on elimination of these substances. Used to improve numerical weather prediction and support requirements for depiction of the upper atmosphere	128,819	≤ 46.47 km @ Nadir	50 - 650 milli-atm-cm
Ozone Nadir Profile	Profiles: Solution profile individual ozone amounts (matm-cm) in 12 SBUV layers (SBUV layer 1 first). Volume mixing ratio(from spline interpolation) of ozone at 19 pressure levels in order of increasing atmospheric pressure (0.3 mb to 100 mb)		763	250 km	profile: milli-atm-cm mixing ratio: ppmv

Figure 4 – OMPS Products

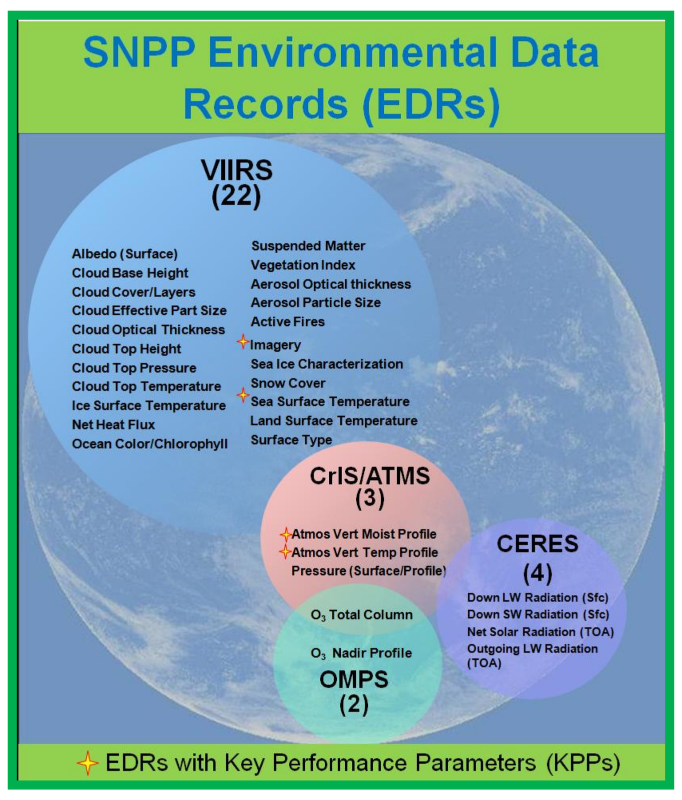

Figure 1 – SNPP Environmental Data Records

VIIRS - 3000 km swath 48 scan 85.75 s granule	Description	Usage	Granule Size (bytes)	Horizontal Cell Size (km)	Measurement Range
Cloud Mask IP	Classifies pixels as Confidently Clear, Confidently Cloudy, Probably Clear, and Probably Cloudy. A Binary Cloud Map is included as a subset of the product, comprising only those pixels that are Confidently Cloudy or Confidently Clear	Identifying pixels as either cloudy or clear is essential for the performance of all other VIIRS EDRs	14,745,664	6 ± 1 km; binary map 0.8 km (nadir)	0 - 1.0 HCS area; Binary map - Cloudy, Not Cloudy
Active Fires ARP	Provides latitude and longitude of VIIRS pixels with active fires	Operationally important for emergency response. Contributor to climate change factors.	2,457,600	0.75 km (nadir) to 1.6 km (edge)	Latitude (positive north): 0° - 90° Longitude (positive east): 0° - 180°
Albedo	The total amount of solar radiation in the 0.4 to 4.0 micron band reflected by the Earth's surface into an upward hemisphere (sky dome), including both diffuse and direct components, divided by the total amount incident from this hemisphere, including both direct and diffuse components	Key component of surface energy budget, crucial for evaluation of climate change	12,289,311	0.75 km (nadir) to 1.6 km (edge)	0 - 1.0 Units of Albedo
Cloud Base Height	The height above sea level where cloud bases occur	Valuable to U.S. war-fighting capability, e.g. cloud-free line-of-sight forecasts. Needed to model atmospheric radiation budget & understand role of clouds in climate change studies	1,072,896	6 ± 1 km	0 - 20 km
Cloud Cover Layers	Classifies pixels into as many as four layers, and determines the cloud type for each layer	Valuable to aviation applications	1,267,968	6 ± 1 km	Height: unitless - low, medium, high, > high threshold Types: unitless- stratus, altocumulus, cumulus, cirrus, cumulus/cirrus
Cloud Effective Particle Size	The ratio of the third moment of the drop size distribution to the second moment, averaged over a layer of air within a cloud	Needed to model atmospheric radiation budget & understand role of clouds in climate change studies	1,072,896	6 ± 1 km	0-50 micrometer
Cloud Optical Thickness	The extinction (scattering + absorption) vertical optical thickness of each and every distinguishable cloud layer in a vertical column of the atmosphere as well as the total optical thickness of all layers in aggregate	Valuable to U.S. war-fighting capability, e.g. cloud-free line-of-sight forecasts. Needed to model atmospheric radiation budget & understand role of clouds in climate change studies	1,072,896	6 ± 1 km	0.1 to 30 (Tau units)
Cloud Top Height	The set of heights of the tops of the cloud layers overlying each cloud-covered earth location	CTH is derived from the CTT and is a crucial parameter used to aggregate clouds into the Cloud Cover/Layers EDR. Valuable to U.S. war-fighting capability, e.g. cloud-free line-of-sight forecasts	1,072,896	6 ± 1 km	0 - 20 km
Cloud Top Pressure	The set of atmospheric pressures at the tops of the cloud layers overlying each cloud-covered earth location	Needed to model atmospheric radiation budget & understand role of clouds in climate change studies	1,072,896	6 ± 1 km	50 to 1050 mb
Cloud Top Temperature	The set of atmospheric temperatures at the tops of the cloud layers overlying each cloud-covered earth location	CTT is a crucial parameter used to aggregate clouds into the Cloud Cover/Layers EDR. It is needed to model atmospheric radiation budget & understand role of clouds in climate change studies	1,072,896	6 ± 1 km	180 to 310 K
Land Surface Temperature	The skin temperature of the uppermost layer of the land surface	Important for crop monitoring, indicator of greenhouse effect & energy flux between atmosphere & ground. Key component of the earth radiation budget	12,288,032	0.75 km (nadir) to 1.6 km (edge)	213 K - 343 K
Surface Type	One of the seventeen International Geosphere Biosphere Program (IGBP) classes	Important for land management & monitoring, implementation of policies related to climate change & most importantly inputs into biogeochemical and hydrological models. Also used to support decision aids for precision guided munitions.	12,288,016	1 km	Type: 17 distinct types Coverage: 0 - 100%
Net Heat Flux	Net surface flux (long-wave and short-wave radiation, latent heat flux and sensible heat flux) over oceans ;][;[kkpk)	Climate change research efforts and estimation of energy flux at air-sea boundary crucial to El Nino Southern Oscillation (ENSO) modeling efforts	694,944	20 km	-2000 to +2000 W/m^2
Ocean Color Chlorophyll	Ocean color is defined as the spectrum of normalized water-leaving radiances (nLw). All geophysical quantities of interest, e.g., the concentration of phytoplankton pigment chlorophyll a (chlorophyll-a) and the inherent optical properties of absorption and scattering of surface waters (ocean optical properties), are derived from these nLw values	Provide operational data for quantification of the ocean's role in the global carbon cycle and other biogeochemical cycles, to acquire global data on marine optical properties with emphasis on frontal zones and eddies, and to To identify bioluminescence potential in different ocean areas	174,489,644	0.75 km (nadir) to 1.6 km (edge)	Ocean color: 0.1 - 40 W m^{-2} $micrometer^{-1}$ sr^{-1} Optical properties, absorbtion: 0.01 - 10 m^{-1} Optical properties, scattering: 0.01 - 50 m^{-1} Optical properties, chlorophyll: 0.05 - 50 mg/m^3
Suspended Matter	Report of the presence of suspended matter such as dust, sand, volcanic ash, SO2, or smoke at any altitude	Provides information that will improve detection of population hazards (volcanic ash, smoke etc.), reducing risk to military operations and human life. Climate change research	14,742,979	1.6 km	Detection: Flag cells where atmosphere contains suspended matter Type: Dust, sand, volcanic ash, sea salt, smoke, SO2 Concentration: 0 - 1000 $microgram/m^3$ for smoke
Vegetation Index	Normalized difference vegetation index (Top of the Atmosphere) is most directly related to absorption of photosynthetically active radiation, but is often correlated with biomass or primary productivity. This product also contains a Top of the Canopy Enhanced Vegetation Index	To provide global database of VI. Inputs into studies regarding spatial and temporal variability of vegetation. TOA NDVI will provide continuity with the AVHRR heritage product. TOC EVI will provide continuity with the MODIS heritage product	68,812,870	0.375 km (nadir) to 0.8 km (edge)	NDVI units: -1 to + 1 EVI units: -1 to +1
Aerosol Optical Thickness	The extinction (scattering + absorption) optical thickness of the vertical column above the geolocation of the horizontal cell in a narrow band about the specified wavelength	Indicator of the amount of direct aerosol radiative forcing on the climate, input to radiative transfer models used to calculate this forcing, critical for military operations. Planning tools for target visibility, and a required input to atmospheric correction algorithms	1,152,048	6 km (nadir) to 12.8 km (edge)	0 .0 to 2.0 units of Tau
Aerosol Particle Size	Aerosol particle size is characterized by the Ångström wavelength exponent defined by: α = - (ln t(λ1) – ln t(λ2))/(ln λ1 – ln λ2)	Indicator of the amount of direct aerosol radiative forcing on the climate, input to radiative transfer models used to calculate this forcing, critical for military operations planning tools, and a required input to atmospheric correction algorithms		6 km (nadir) to 12.8 km (edge)	-1 to +3 alpha units
Ice Surface Temperature	The skin temperature of the uppermost layer of sea ice	Long term data set of IST can be used to assess greenhouse effect and climate changes in polar regions	12,288,032	0.8 km (nadir) to 1.6 km (edge)	213 K - 275 K
Imagery	A two-dimensional array of locally averaged absolute in-band radiances at the top of the atmosphere measured in the direction of the viewing sensor, and the corresponding array of Equivalent Black Body Temperatures (EBBTs) if the band is primarily emissive, or the corresponding array Top-Of-the-Atmosphere (TOA) reflectances if the band is primarily reflective during daytime.	Essential to creation of manually generated (or semi-automated) application related products: Cloud Cover & Cloud Type, Ice Edge Location & Concentration, and military applications	NCC (DNB): 9,643,148 M Band: 12,857,520 I Band: 63,543,707	Imagery bands < 0.4 km (nadir) to < 0.8 km (edge); DNB: 0.82 km	DNB (Day & Night): $3x10^{-5}$ - 176 $W/(m^2 sr)$ I1 Band (Day Only): 5.0 - 707 $W/(m^2 sr)$ I2 Band (Day Only): 12.4 - 345 $W/(m^2 sr)$ I3 Band (Day Only): 1.5 (TBD) - 68 $W/(m^2 sr)$ I4 Band (Day & Night): 210(TBD) - 498 K I5 Band (Day & Night): 190(TBD) - 459 K
Sea Ice Characterization	The time that has passed since the formation of the surface layer of an ice covered region of the ocean	Long term trends in extent of polar sea ice serves as valuable indicator of global climate change. Accurate General Circulation Models (GCM) in the polar regions depends on correct distinction between multi year and newly formed ice. Important for commercial and military operations in polar regions	19,660,800	2.4 km	Ice-free, New/Young ice, All other ice
Snow Cover Depth	The horizontal and vertical extent of snow cover. In addition, a binary product will give a snow/no snow flag	Important in calculating earth radiation budget. General Circulation Models (GCM) do not simulate arctic climate well, driving need for improved measurements of global snow cover	Map: 39,321,604 Fraction: 14,745,622	0.8 km (nadir) to 1.6 km (edge) (clear sky)	0 - 100% of HCS
Sea Surface Temperature	A measurement of the temperature of the surface boundary layer (skin) and upper 1 meter (bulk) of ocean water	Initialize weather prediction models, military applications, climate change research, etc.	19,660,848	0.75 km (nadir) to 1.3 km (edge) (clear sky)	271 K - 313 K

Figure 5 – VIIRS Products