Community Satellite Processing Package (CSPP): Current Status and Support for JPSS-1

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The Community Satellite Processing Package (CSPP) is a collection of freely available software for processing data from LEO and GEO meteorological satellites.

CSPP supports the creation of calibrated observational data, geophysical derived products, and mapped images from visible, infrared, and microwave sensors.

The CSPP project is based at the Space Science and Engineering Center at the University of Wisconsin-Madison and is funded by NOAA JPSS Program Office. CSPP LEO supports processing of data from these satellites in low earth orbit:

Suomi NPP, Metop-A/B, NOAA-18/19, Terra, Aqua, GCOM-W1, and FY-3B/C.

Data source is usually Direct Broadcast (DB) from the spacecraft. However, archived data are also supported (e.g., NOAA CLASS, NASA DAAC).

Typical LEO Receiving Equipment



2.4-m X/L-band Antenna Honolulu Community College, Hawaii





- The CSPP software:
- Is freely available,
 - Includes up-to-date algorithms,
 - Is pre-compiled for 64-bit Intel Linux (CentOS),
 - Is easy to install and operate,
 - Includes test data for verification,
 - Runs efficiently on modest hardware,
 - Has prompt expert user support.

CSPP runs on CentOS 64-bit Linux



Typical host computer is a server with

- 2 x quad-core Intel Xeon CPUs @ 2.5 GHZ
- 64 GB RAM
- 4 x 2 TB SATA hard drives
- Internet connection at 1 Mbit/sec (to download ancillary data)

CSPP LEO Supported Sensors



CSPP Software	Suomi NPP	Metop-A/B	NOAA-18/19	Terra	Aqua
1. SDR	VIIRS, CrIS, ATMS	Provided by AAPP	Provided by AAPP	Provided by SeaDAS	Provided by SeaDAS
2. VIIRS EDR	VIIRS	N/A	N/A	N/A	N/A
3. HSRTV	CrIS	IASI	N/A	N/A	AIRS
4. Polar2Grid	VIIRS, CrIS, IASI	AVHRR	AVHRR	MODIS	MODIS, AIRS
5. Hydra	VIIRS, CrIS, ATMS	AVHRR, IASI	AVHRR	MODIS	MODIS, AIRS
6. MIRS	ATMS	AMSU, MHS	AMSU, MHS	N/A	N/A
7. CLAVR-x	VIIRS	AVHRR	AVHRR	MODIS	MODIS
8. NUCAPS	CrIS, ATMS	In progress	N/A	N/A	Future version
9. IAPP	N/A	HIRS, AMSU, MHS	HIRS, AMSU, MHS	N/A	N/A
10. ACSPO	VIIRS	AVHRR	AVHRR	MODIS	MODIS
11. Sounder Quicklook	CrIS, ATMS	IASI, AMSU, MHS	AMSU, MHS	N/A	AIRS

Geophysical Products (VIIRS EDR)



SNPP VIIRS 2015/04/05 18:26 UTC



Temperature/Moisture (HSRTV)



Atmospheric Temperature 500 hPa



SNPP CrIS 2015/04/02 19:25 UTC

Water vapor Mixing ratio 500 hPa







Metop-B IASI 2015/04/02 16:35 UTC

Atmospheric Temperature 500 hPa



Metop-B IASI 2015/04/02 16:35 UTC

Water vapor Mixing ratio 500 hPa

VIIRS Imagery (Polar2Grid)



SNPP VIIRS Day/Night Band, 2016/11/23



VIIRS on ABC World News Tonight



October 6/7, 2016 VIIRS Day/Night Band from SSEC direct broadcast Hurricane Matthew aftermath: lights out along east coast of Florida



ABC World News Tonight averaged 8 million viewers per night in October, 2016

MODIS Imagery (Polar2Grid)



Terra MODIS True Color, 2015/01/30



Cloud Products (CLAVR-x)



SNPP VIIRS 0.87 micron

Terra MODIS 0.87 micron



2015/10/26 VIIRS Cloud Mask



MODIS Cloud Mask



VIIRS Cloud Top Pressure



MODIS Cloud Top Pressure



Sea Surface Temperature (ACSPO)



2015/04/02

SNPP VIIRS 17:44 UTC

METOP AVHRR 18:31 UTC





Algorithm developed by Sanmei Li at George Mason University

- Daytime algorithm using VIIRS I-bands at 375 meter resolution.
- Includes built-in tests for detecting clouds, snow, ice, and shadows from clouds and terrain.
- Uses static global water database to identify "normal water".
- Will be released by the end of July, 2017.

VIIRS flood detection





SNPP VIIRS False Color January 1, 2016

VIIRS flood detection





SNPP VIIRS Flood Map January 1, 2016



New version of RT-STPS is required

- RT-STPS v5.9 (released Dec 2016) from NASA DRL supports creation of Raw Data Record (RDR) files in HDF5 format for JPSS-1.
- RT-STPS v5.9 has been tested successfully with SNPP DB data.
- RT-STPS v5.9 has been tested with JPSS-1 spacecraft level test data.



Overview

- CSPP Sensor Data Record (SDR) version 3.0 supports ATMS, CrIS, and VIIRS SDR processing for SNPP and JPSS-1 (one package supports both satellites).
- CSPP SDR v3.0 is based on ADL Block 2.0 MX3.
- CentOS 6.9 x86_64 is the primary supported operating system for the initial release.
- Computer hardware and memory requirements are the same as for CSPP SDR v2.2.



Implementation Details

- Multiple versions of ADL Block 2.0 SDR software have been built and tested at SSEC since spring 2016.
- Beta version of CSPP SDR 3.0 was released in spring 2017 to allow DBNet users to stay in sync with ATMS calibration changes introduced into the global data.
- CSPP SDR 3.0 driver scripts have the same runtime flags and options as CSPP SDR 2.2.
- Product files for JPSS-1 are stored in HDF5 with the same format and naming conventions as SNPP files.



Current Status

- CSPP SDR 3.0 (based on ADL Block 2.0 MX3) has been built and tested at SSEC using SNPP DB data (VIIRS, CrIS, ATMS) and SDRs have been created successfully (including FSR CrIS).
- CSPP SDR 3.0 is now in routine DB production at SSEC (for SNPP).
- Testing, verification, and documentation work is continuing. Aiming for a public release of CSPP SDR 3.0 by the end of July, 2017.



Feature set

- CSPP SDR 3.0 supports multi-core processing for reduced runtimes (e.g., 13-minute pass processed in 8 minutes using 8 cores).
- CrIS can be processed at Normal Spectral Resolution (NSR) or Full Spectral Resolution (FSR).
 Default processing mode for SNPP CrIS is NSR.
 Default processing mode for JPSS-1 CrIS is FSR.
- CSPP SDR 3.0 supports offline downloads of required ancillary data and calibration lookup tables.



- CSPP continues to support the creation a range of calibrated sensor observations, geophysical products, and imagery from LEO polar satellite data.
- JPSS-1 support will be available soon.
- The University of Wisconsin-Madison acknowledges the support of NOAA JPSS Program Scientist Mitch Goldberg in the development of CSPP LEO.

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VIIRS true color 27 June 2017





Backup charts



CSPP LEO Software



CSPP Software	Product Description
1. SDR	VIIRS, CrIS, and ATMS geolocated and calibrated earth observations.
2. VIIRS EDR	VIIRS imager cloud mask, active fires, surface reflectance, vegetation indices, sea surface temperature, and aerosol optical depth.
3. HSRTV	Hyperspectral infrared sounder retrievals of temperature and moisture profiles, cloud properties, total ozone, and surface properties.
4. Polar2grid	Reprojected imagery (single and multi-band) in GeoTIFF and AWIPS formats.
5. Hydra	Interactive visualization and interrogation of multispectral imagery and hyper spectral soundings.
6. MIRS	Microwave sounder retrievals of temperature and moisture profiles; surface properties; snow and ice cover; rain rate; and cloud/rain water paths.
7. CLAVR-x	Multispectral imager retrievals of cloud properties; aerosol optical depth; surface properties; ocean properties.
8. NUCAPS	Combined hyperspectral infrared sounder and microwave sounder retrievals of temperature and moisture profiles, cloud cleared radiances, and trace gases.
9. IAPP	Combined infrared sounder and microwave sounder retrievals of temperature and moisture profiles, water vapor, total ozone, and cloud properties.
10. ACSPO	Multispectral imager retrievals of sea surface temperature.
11. Sounder Quicklook	Projected 2D maps of temperature and water vapor retrievals, and Skew-T profiles for individual atmospheric profiles.
12. VIIRS Imagery EDR	VIIRS imagery in Ground Track Mercator projection from I-bands and Day/Night Band Near Constant Contract

CSPP updates since April 2015



04/27/2017: Polar2Grid Reprojection Software Version 2.1 03/03/2017: International ATOVS Processing Package (IAPP) Software Version 1.1 02/08/2017: Advanced Clear-Sky Processor for Oceans (ACSPO) Software Patch Version 1.1.2 06/02/2016: Suomi NPP CrIS, VIIRS and ATMS SDR Software Version 2.2 Patch 04/07/2016: CLAVRx VIIRS, MODIS and AVHRR Cloud Retrieval Software Version 2.0 04/01/2016: Suomi NPP CrIS, VIIRS and ATMS SDR Software Version 2.2 02/24/2016: Advanced Clear-Sky Processor for Oceans (ACSPO) Software Version 1.1 02/22/2016: Suomi NPP HYDRA2 Multispectral Data Analysis Toolkit Version 2.0 12/14/2015: NUCAPS CrIS/ATMS EDR Retrieval Software Version 1.1 10/12/2015: Polar2Grid Reprojection Software Version 2.0 10/09/2015: Microwave Integrated Retrieval System (MIRS) Software Version 2.0 09/29/2015: Suomi NPP CrIS, VIIRS and ATMS SDR Software Version 2.1.1 Patch 07/16/2015: Sounder Quicklook Software Version 1.0