Suomi National Polar-orbiting Partnership (SNPP)
NASA VIIRS Level-1 Algorithm/Software Development

Fred Patt

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Background

• The SNPP ROSES AO (November 2013) stated that “NASA… is arranging for the NASA Level-1 Suomi NPP product algorithm development…”

• The SNPP Project Scientist, Dr. James Gleason chartered the formation of a working group with representation from the existing VIIRS PEATEs.
  – Goal: provide a fast efficient, easy-to-maintain, VIIRS Level-1 algorithm that provides diagnostic insight and that can be adapted for time-dependent changes in the instrument.
  – Fred Patt was asked to coordinate the WG.

• Kick-off meeting was held on December 12, 2013, and meetings have continued every 2 to 3 weeks.
L1ASWG Membership

- Fred Patt (Ocean lead and overall coordinator)
- Vincent Chiang (VCST lead)
- Liam Gumley (Atmosphere lead)
- Gary Lin (Geolocation lead)
- Ed Masuoka (Land lead)
- Sam Anderson (VCST)
- Sean Bailey (Ocean)
- Carol Davidson (Land)
- Hongda Chen (VCST)
- Sadashiva Devadiga (Land)
- Steve Dutcher (Atmosphere)
- Gene Eplee (Ocean)
- Gene Feldman (Ocean)
- Gwyn Fireman (Ocean)
- Bruce Flynn (Atmosphere)
- Bryan Franz (Ocean)
- Alfreda Hall (ESDIS)
- James Kuyper (Geolocation)
- Ning Lei (VCST)

- Chengbo Sun (VCST)
- Bin Tan (Geolocation)
- Kevin Turpie (Ocean)
- Jack Xiong (VCST)
- Robert Wolfe (Geolocation/Land)
- Zhangshi Yin (Geolocation)
Primary Objectives Defined by L1ASWG

- VIIRS Level-1 processing starting from EDOS Level-0 data feed.
- Modular, well-documented, efficient, robust, portable software, owned and maintained by NASA.
- Straightforward implementation of instrument calibration equations and support for calibration updates.
- Data product formats developed and maintained by NASA. Level-1B and Geolocation will be the standard final products.
- Separate executables and products for Level-1A, Geolocation and Level-1B.
- Reasonable granule length chosen by NASA.
  - Granule length specified at runtime.
  - 6 minutes was requested by the Atmosphere team for standard products and agreed to by other teams.
- Reduce number of calibrated data files (i.e., eliminate separate files for each VIIRS band).
  - One file per resolution (M-band, I-band, DNB).
  - Currently IDPS generates over 22,000 SDRs per day.
Further Objectives

• Product formats compatible with both NetCDF4 and HDF5
  – Serve the largest possible user community

• Modular calibration and geolocation software
  – Run standalone or link with existing software

• Rapid-prototyping development methodology
  – Schedule and resource constraints

• Re-use of existing software

• Compliance with metadata standards (ISO, CF)

• Public release of software
Accomplishments

• ATBD updates submitted in July 2014.
• Authorization to proceed from J. Gleason in October 2014.
• NASA data product formats developed.
  – NetCDF 4 with internal compression, HDF5 compatible
• EDOS testing started in November 2014, routine data deliveries in August 2015.
• V1.0 software completed October 2015.
  – Full L1 processing chain and critical algorithm improvements
• V2.0 software completed June 2016.
  – Additional functionality and algorithm enhancements
  – Public release of software in progress
VIIRS Level-1 Processing Flow
Features that Support Direct Readout

- Variable granule length specified at runtime
  - Support an entire DR scene as a single file
- Scan-by-scan processing
  - Reduced memory usage
- Internal data object compression
  - Reduced file size by ~50%
  - Chunking defined to optimize I/O
- L1B and geolocation products can be generated for a single resolution if desired
  - Reduced execution time
- Land/water mask and terrain correction* are optional
  - Reduced execution time and eliminate need for large static files.

*Future feature to be implemented
Band M7/I2 Replacement

- VIIRS Band M7 was removed from the SNPP DR data stream on December 10, 2014 to provide downlink bandwidth for CrIS full spectral operations.
- The GSFC DRL implemented a capability to substitute aggregated I2 data for M7 in SDRs to support downstream applications that require M7 data.
- The DRL will implement an equivalent capability for the NASA L1B products prior to the release of the NASA L1 software.
  - The substitution will be independently verified by the L1ASWG.
The Level-1 source code has been configured in a Git repository developed and maintained by the Ocean SIPS.

Individual development team members create local branches for source code modifications.

Modified source files are merged into the master branch upon acceptance.

The repository will be made publicly accessible after the software release has been approved by NASA.

– The Open Source Software Request has been submitted.
– Our plan is to release the software ASAP, pending NASA approval.

VCST maintains a separate FTP site for delivery of the dynamic radiometric calibration LUTs.
Sample Products and Formats

Product formats (NetCDF CDL) and sample files can be found at:

ftp://samoa.gsfc.nasa.gov/pub/VIIRSL1/
QUESTIONS?
Responsibilities

• Ocean SIPS
  – L0-to-1A and OBC file processing software
  – Data product formats
  – Calibration ATBD support

• Geolocation Team
  – Geolocation ATBD updates
  – L1A-to-Geolocation processing software

• VCST
  – Calibration ATBD updates
  – L1A-to-L1B processing software

• Land SIPS
  – Data product formats
  – Software development and testing support

• Atmosphere SIPS
  – Data product formats
  – Software development and testing support