CrIS L1B Project Status

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Project Overview

- NASA-funded effort to write software to generate a climate quality CrIS L1B product
- Equivalent to IDPS SDR but some differences in algorithms and underlying science
  - Different software from IDPS
- Some team members are also involved in CrIS Cal/Val effort headed by NOAA STAR
  - Applying lessons learned from Cal/Val
- One year in to a 5-year project

Project Overview (2)

- Software will be improved, new versions will be released
  - Want feedback from users on products
- Source code and documentation will be publicly available
- With each new software release will reprocess mission dataset
- Plan to eventually release both normal spectral resolution (NSR) and full spectral resolution (FSR) datasets
  - Planned start of NSR dataset: Apr 2012
  - Start date of FSR is TBD

First Year Progress

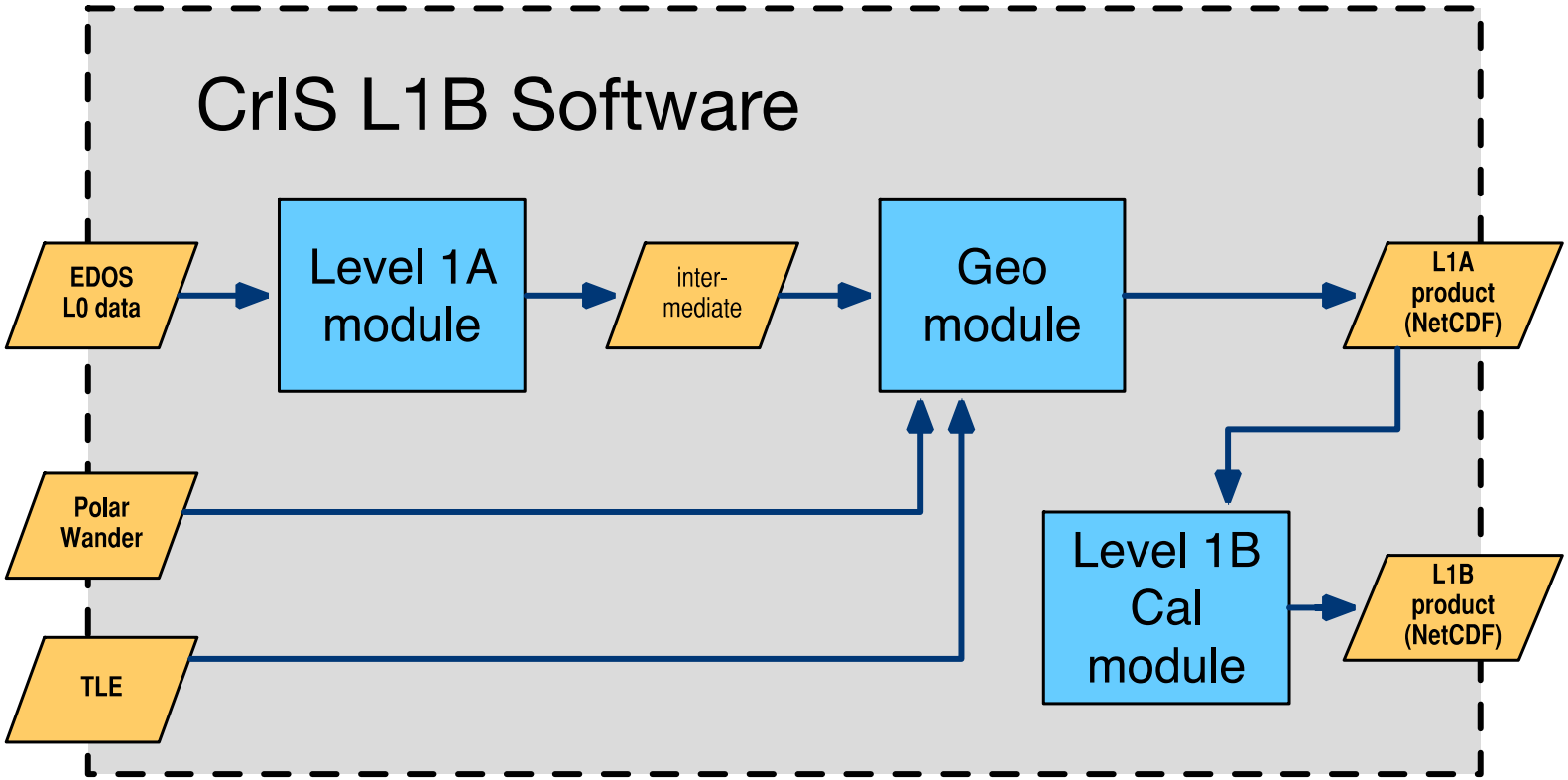
- Science
  - Identified high priority algorithm improvements
  - Algorithm development and testing
- Data formats
  - Developed common CrIS / ATMS L1B file format in collaboration with JPL
  - Determined L1B granulation scheme
  - Participated in EDOS L0 format definition and testing
- Software
  - Developed new Level 1A and Geo software
  - Adapted CCAST software as Calibration module
- Sample data
  - Released to Sounder Science teams

Future Software Deliveries

- Version 1.0 beta, target date Nov 18, 2015
  - Will be delivered to the Sounder SIPS
  - They will integrate to the DAAC
- Version 1.0 beta2?
- Version 1.0 final, early 2016
  - NSR mission product will be generated and made available
- Periodic software releases thereafter

Software Design

- Modular components connected by glue code
- Want to minimize expense of research to operations
  - Calibration module: leverage existing code and compiled Matlab
- New modules and glue code written in Python
- First correctness, then performance optimization
  - Initially files as internal interfaces
- Command-line callable, CentOS-6 compatible

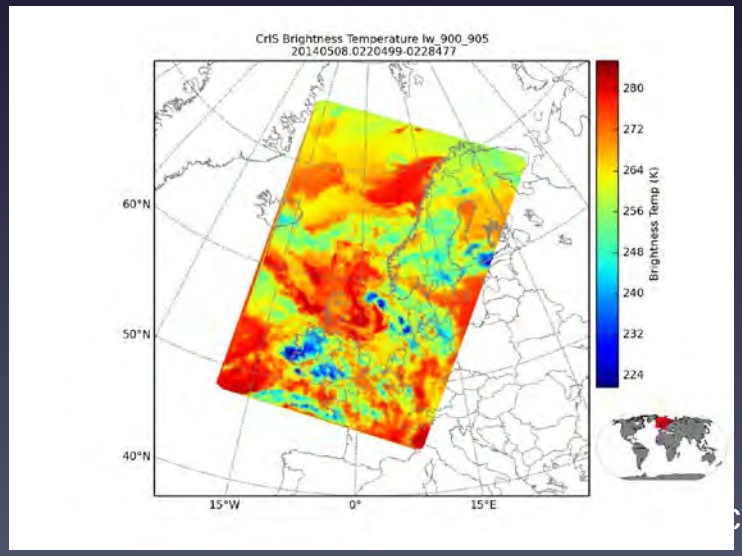


- Inputs are EDOS L0 data and ancil files needed for Geo
- Outputs are L1A and L1B granules in NetCDF format

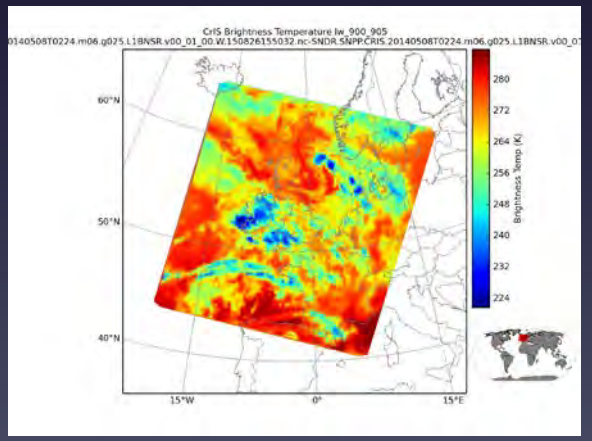
Granulation Comparison

	IDPS	L1B
granule size	31.997 seconds	6 minutes
granules / day	about 2700	exactly 240
scans/granule	usually 4, sometimes 3	45
granules/file	15 (aggregated)	1
granulation type	instrument-based	UTC-based

IDPS SDR file
(15 granules)



L1B file
(1 granule)



Data Product

- L1A and L1B data product files are NetCDF4
- Geo is in both the L1A and L1B file
  - Initially same Geo fields as SDRs, later version will add information derived from static databases, e.g. mean elevation, land fraction, sun glint distance
  - Later version will include terrain correction
- L1B File format was designed in collaboration with JPL and is common with ATMS
- Quality flags are TBD, will be somewhat different from IDPS

Metadata

- Metadata is compliant with CF and ACDD standards where possible
- Fill values and units are described in metadata

Example: Long wave radiance

Variable "rad_lw"

```
float rad_lw(atrack=45, xtrack=30, fov=9, chan_lw=717);
  :units = "mW/(m2 sr cm-1)";
  :long_name = "longwave real spectral radiance";
  :standard_name = "toa_outgoing_radiance_per_unit_wavenumber";
  :coordinates = "lon lat";
  :description = "longwave real spectral radiance";
  :_FillValue = 9.96921E36f; // float
  :coverage_content_type = "physicalMeasurement";
```

Accessing L1B data

- Many desktop data inspection and visualization tools support NetCDF4 (e.g. Panoply, HDFView)
- NetCDF4 libraries exist for most languages (Python, Fortran, C, Matlab, IDL)
- Libraries come with command line tools for inspecting and manipulating NetCDF

Example: opening a file and reading a variable in Python

```
import netCDF4 as nc4
ncf = nc4.Dataset(filename, 'r')
rad_lw = ncf.variables['rad_lw']
atrack, xtrack, fov = 0, 0, 0
spectrum = rad_lw[atrack, xtrack, fov, :].squeeze()
```

Key Products in the L1B file

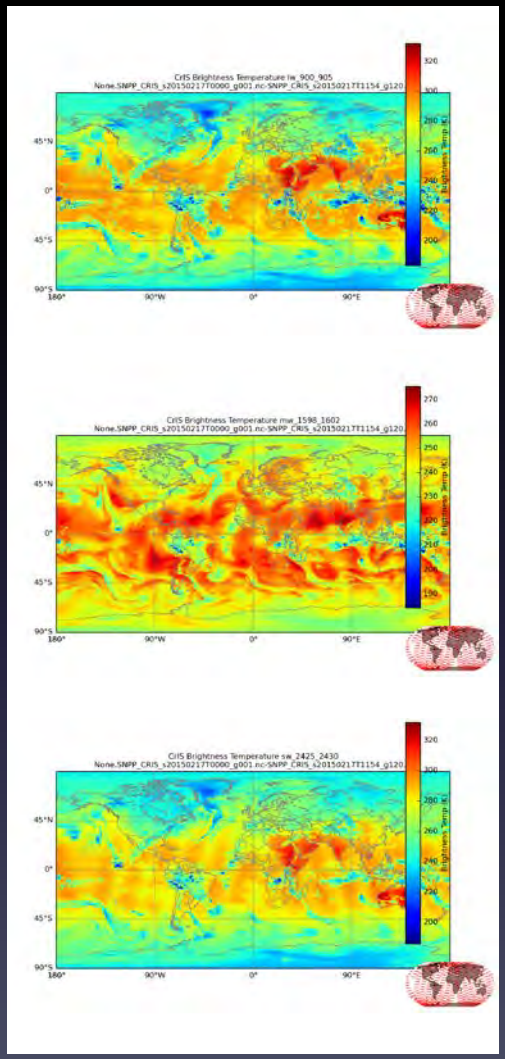
- Radiance spectra
- Geo products
- Wavelengths associated with each band
- NeDN
- Observation times in both UTC and TAI format
- Auxiliary outputs including imaginary spectra are located in a separate group

Comparison of SDR and L1B files

	IDPS	L1B
File type	HDF5	NetCDF4
Geolocation	in a separate file	included in the same file
Terrain-corrected Geo?	no	will be added after version 1.0
Wavelengths included?	no	yes
Missing data representation	Multiple values in -999.x range	Single value near data max or min

Sample data

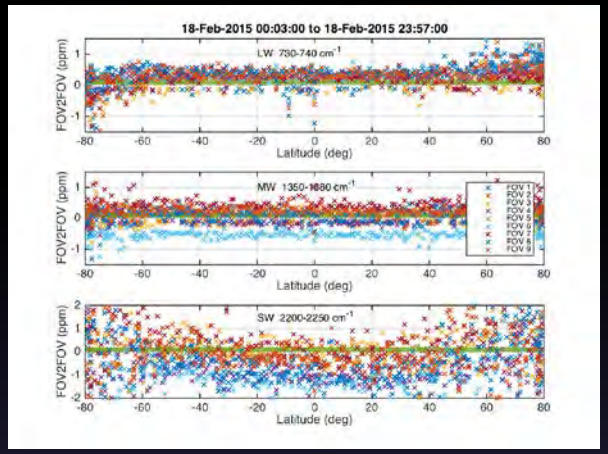
- Released sample L1b datasets
  - Two days of Normal spectra resolution data and 3 days of full spectral resolution
  - NSR: May 7-8, 2014
  - FSR: February 17-19, 2015
- Data was generated with a pre-release software prototype
- Wanted to give users some data to work with before the first release, and get feedback
- Data was distributed to science teams, but can be made available to other users.
  - Contact cris.l1b.support@ssec.wisc.edu.
- Sample Data Users' Guide



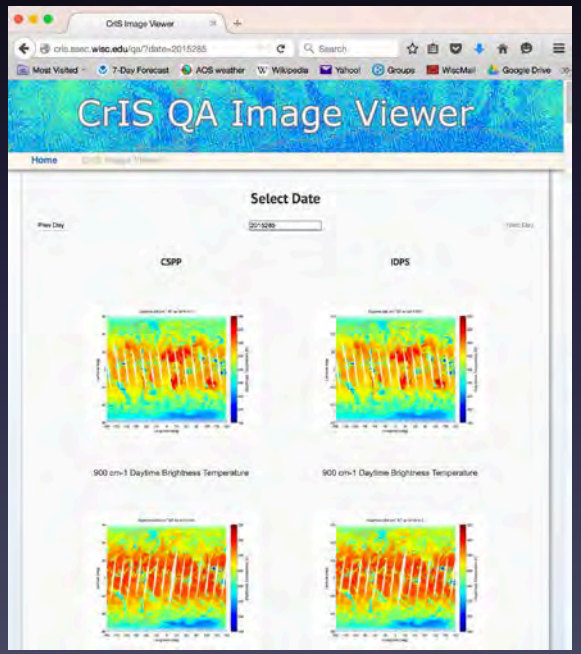
Science and ATBD

- Plan to release a delta ATBD with software describing differences compared to IDPS software
- Science changes will include
  - New calibration equation
  - Spectral ringing correction
  - Polarization correction
  - Shortwave nonlinearity correction (possible)
  - Low responsivity calibration
  - Self-apodization corrections
  - Spectral calibration and neon lamp tracking
  - Radiometric uncertainty estimates
  - Geolocation

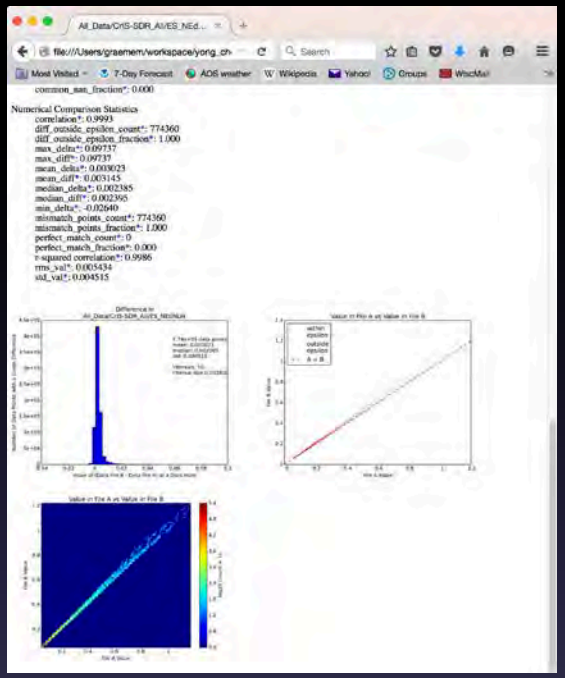
Product Evaluation and Monitoring



Inter-FOV comparison



CrIS QA Monitoring tool



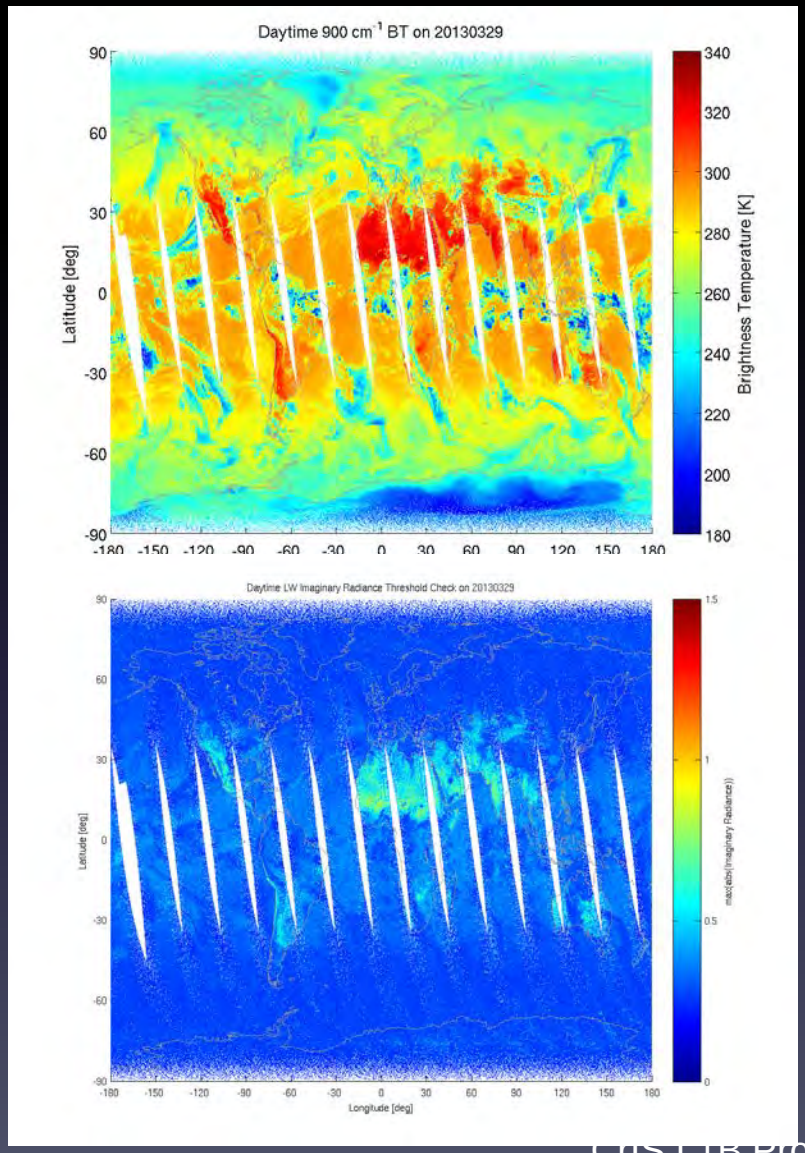
Glance: a general purpose dataset comparison tool

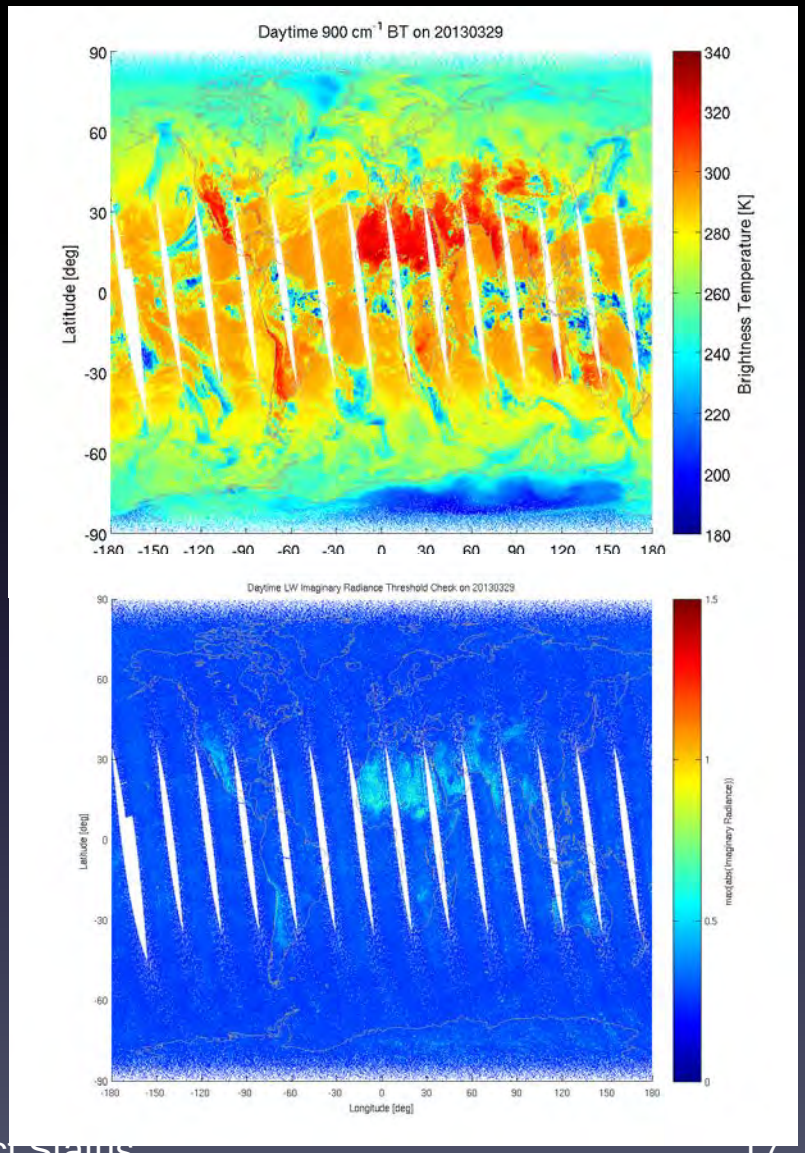
SDRs from IDPS

L1B sample data

real

imaginary





Img module

- Indices of VIIRS pixels collocated within CrIS footprint
- Statistics derived from VIIRS L1 and L2 products
- Useful for interpreting CrIS data
- Provides continuity with similar AIRS and IASI products
- Year 3 activity

CrISXBCAL module

- Produces CrIS calibration subset files, to be used for
  - Long-term validation / trending
  - Neon lamp calibration
- Includes
  - Clear scenes
  - Small random subset
  - Data over specific ground sites (e.g. ARM)
  - Deep convective clouds
- Year 3 activity

Thank you!

Contact: cris.l1b.support@ssec.wisc.edu