CSPP Geo Overview, Status & Plans

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GOES ReBroadcast (GRB)

- GOES-R will have a Direct Broadcast stream, similar to current GOES, called GRB
- Will include data from all GOES-R instruments
  - Advanced Baseline Imager (ABI)
  - Geostationary Lightning Mapper (GLM)
  - Extreme Ultra Violet X-Ray Irradiance Sensor (EXIS)
  - Magnetometer (MAG)
  - Space Environmental In-Situ Suite (SEISS)
  - Solar Ultra Violet Imager (SUVI)
- Level 2 data for GLM, Level 1 for all other instruments
- Data flow
  - Mission data received at Wallops
  - Processed to L1 or L2
  - Packed into CCSDS packets
  - GRB stream is bounced off GOES-R satellite
  - Received at DB stations
- GRB can be received by anyone with the right hardware who can see GOES-R
- More information on the NOAA GRB web site
  - http://www.goes-r.gov/users/grb.html

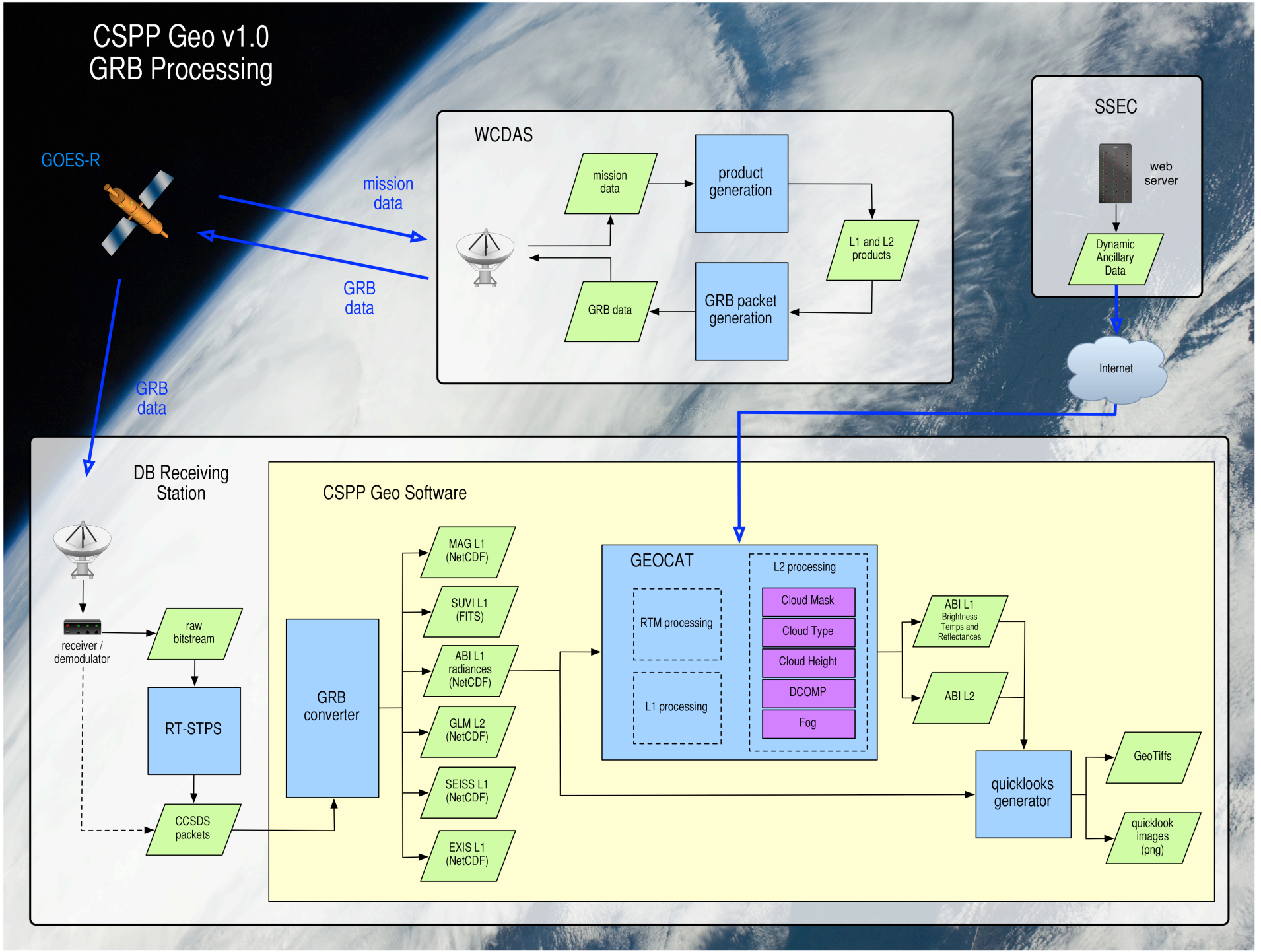
CSPP Geo

NOAA has funded the CSPP Geo project to develop a software package that will allow DB users to process GRB data received on their antennas

- Two main tasks
  - Unpack GRB data and reconstruct L1 or L2 (GLM) datasets for *all* GOES-R instruments
  - Process L1 *ABI* data to produce L2 geophysical products
- Will also support
  - Current GOES
  - Himawari AHI
- Software development on all three tracks (GRB, current GOES, AHI) will occur in parallel
- Will coordinate with vendors of GRB receiving systems on upstream data interface
- CSPP / IMAPP model of software development & distribution
  - User-centric approach
  - Easy to install and run
  - Should run on relatively modest hardware
  - Free to use
  - Re-use or adapt existing software where possible
- Software will be distributed as pre-built binaries for Linux (CentOS 6, 64-bit)
  - Source will be included if possible

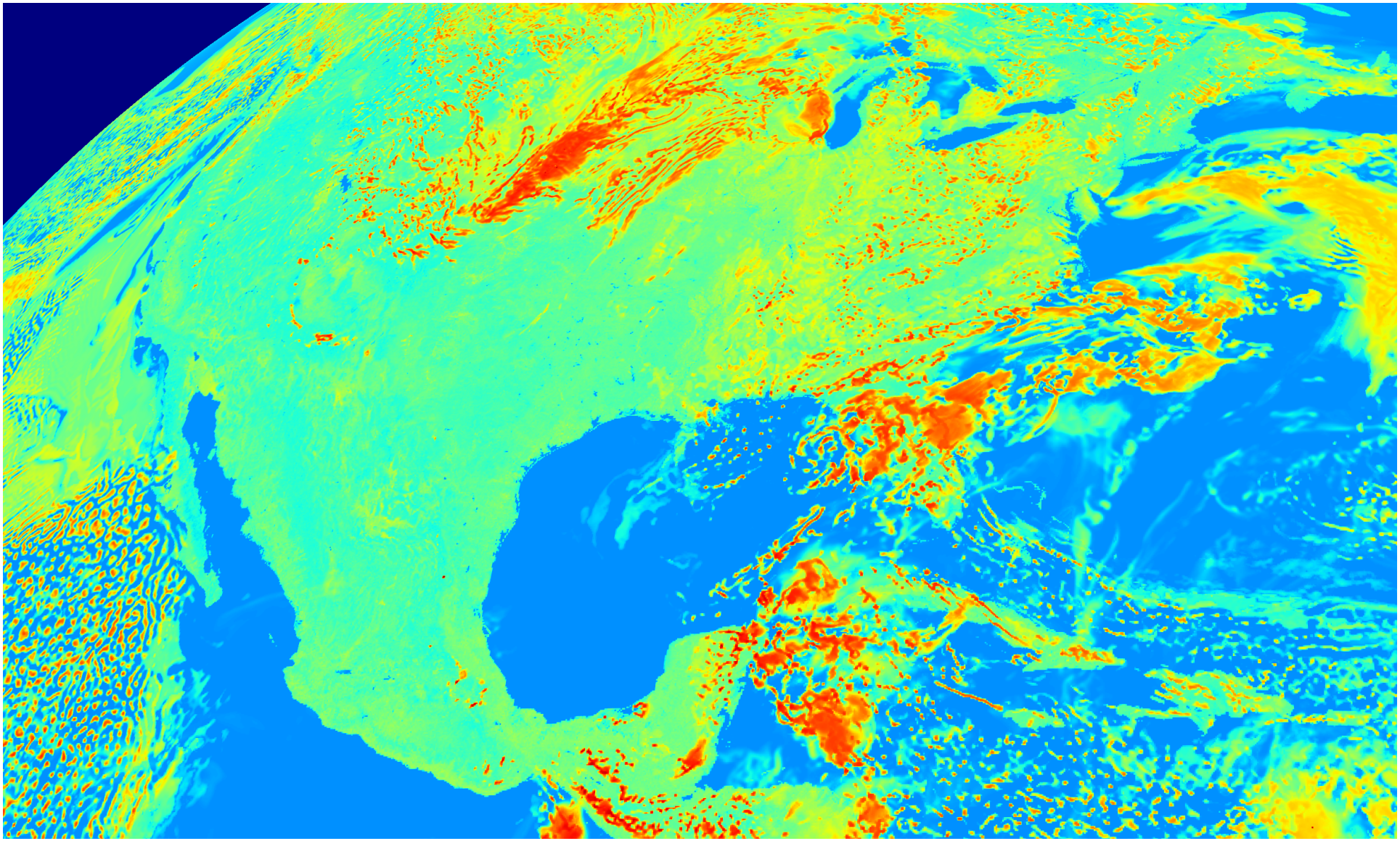
GRB ingest and reconstruction

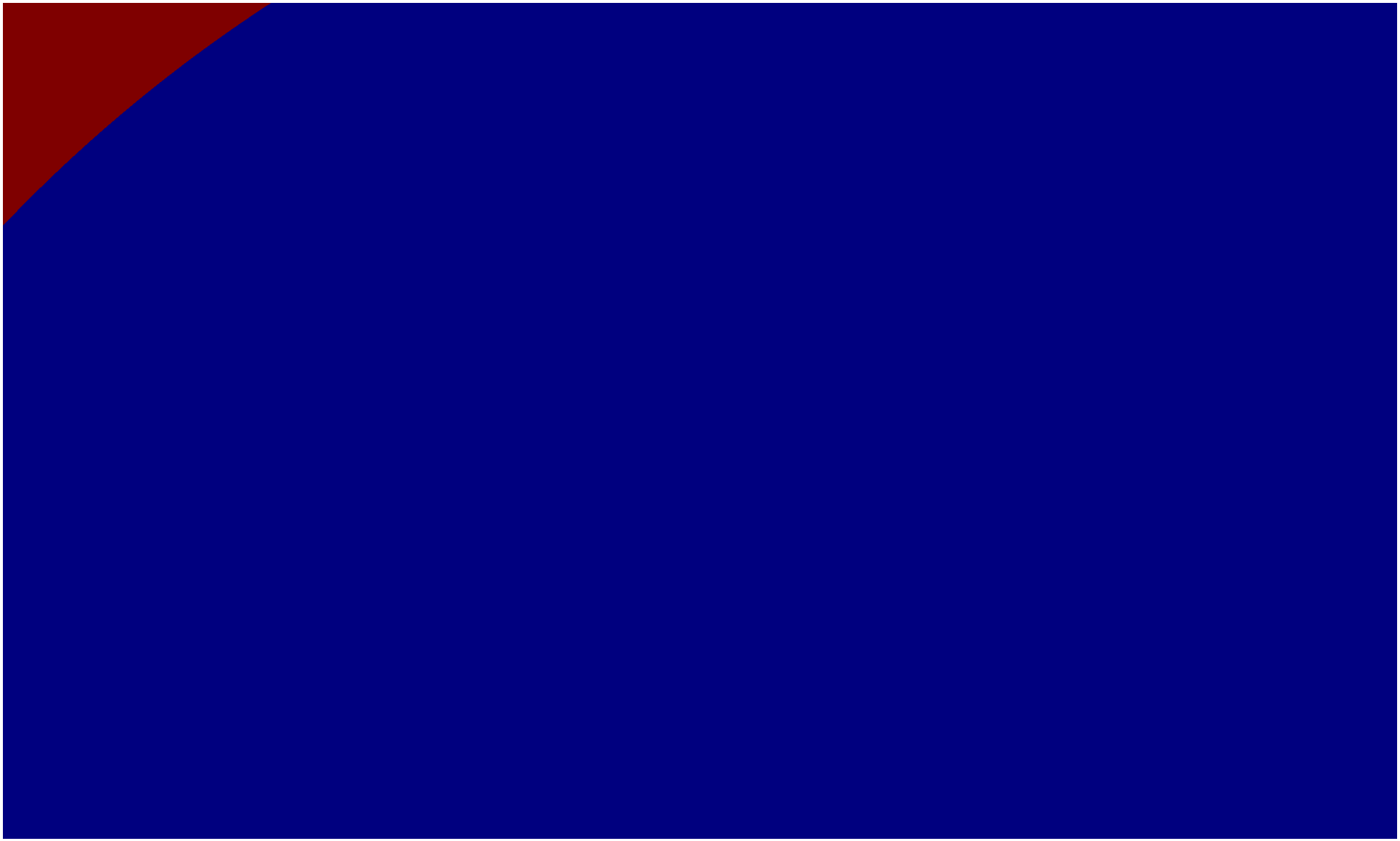
- Raw bitstream may be handled by RT-STPS software (NASA)
  - Output will be files containing CCSDS packets
  - Vendors may want to use their own software
- Developing new software to reconstruct the GRB data and metadata
  - Parse CCSDS packets and recover payloads
  - Reconstruct data fragments
  - Decompress
  - Piece together
  - Write output
- Format of GRB data and unpacking procedure is described in the PUG
  - Data specification for each instrument
  - Time granulation of point datasets
  - Nominal schedule / refresh rate
  - File formats / NCML
- Output will be mission-standard NetCDF files, except SUVI will be FITS
- Parallelization will likely be required
- Have simulated GRB data obtained from GRB simulator
  - Includes ABI data from proxy team and other datasets


CSPP Geo v1.0
GRB Processing
GOES-R
mission data
GRB data
WCDAS
mission data
product generation
L1 and L2 products
GRB packet generation
GRB data
SSEC
web server
Dynamic Ancillary Data
Internet
GRB data
DB Receiving Station
receiver / demodulator
raw bitstream
RT-STPS
CCSDS packets
CSPP Geo Software
GRB converter
MAG L1 (NetCDF)
SUVI L1 (FITS)
ABI L1 radiances (NetCDF)
GLM L2 (NetCDF)
SEISS L1 (NetCDF)
EXIS L1 (NetCDF)
GEOCAT
RTM processing
L1 processing
L2 processing
Cloud Mask
Cloud Type
Cloud Height
DCOMP
Fog
ABI L1 Brightness Temps and Reflectances
ABI L2
quicklooks generator
GeoTiffs
quicklook images (png)

Status – GRB ingest and reconstruction

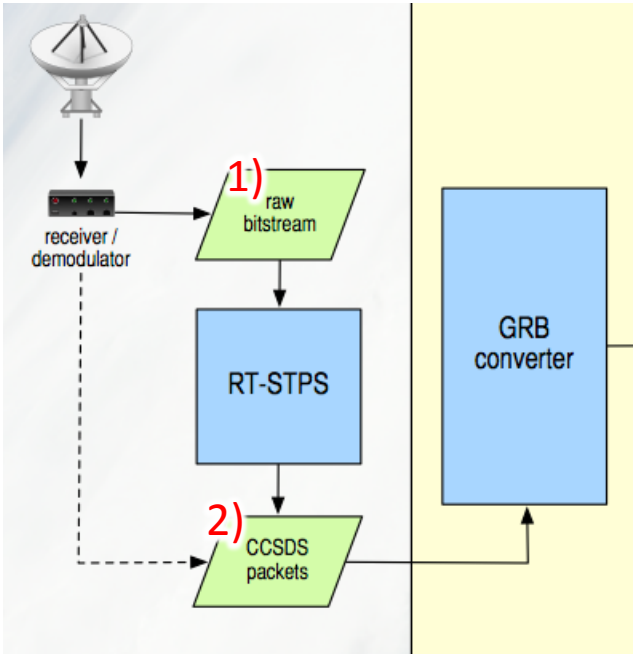
- Recovered test data from the GRB simulator
- Processed raw data files with modified version of RT-STPS
  - 32-bit frame header needed to be removed
  - Output is files containing only CCSDS packets, sorted by APID
- Reconstructed a CONUS image and DQF image from a test case
  - JPEG-2000 compression
  - All image data was in a single image fragment
  - Not consistent with the PUG in all aspects
- Will look at other test data recovered from GRB simulator
- Have requested the simulator again in Jan 2015





CSPP Geo upstream interface

- Currently being discussed but not yet decided
- Two possible interfaces, may support one or both
  1) Read raw bitstream via a socket
  2) Read data from files containing only CCSDS packets
- Bit-stream interface specification should be consistent with
  - PUG
  - GRB simulator, but simulator may be configurable, and may contradict PUG
  - Operational data stream (most important)
- File-based interface
  - Files contain only CCSDS packets, no network frames or other metadata
  - What grouping? By APID, and maybe by image block or fragment
  - Upstream software should not have to look too deeply into packets
- Plan to circulate interface specification
  - Want feedback from vendors

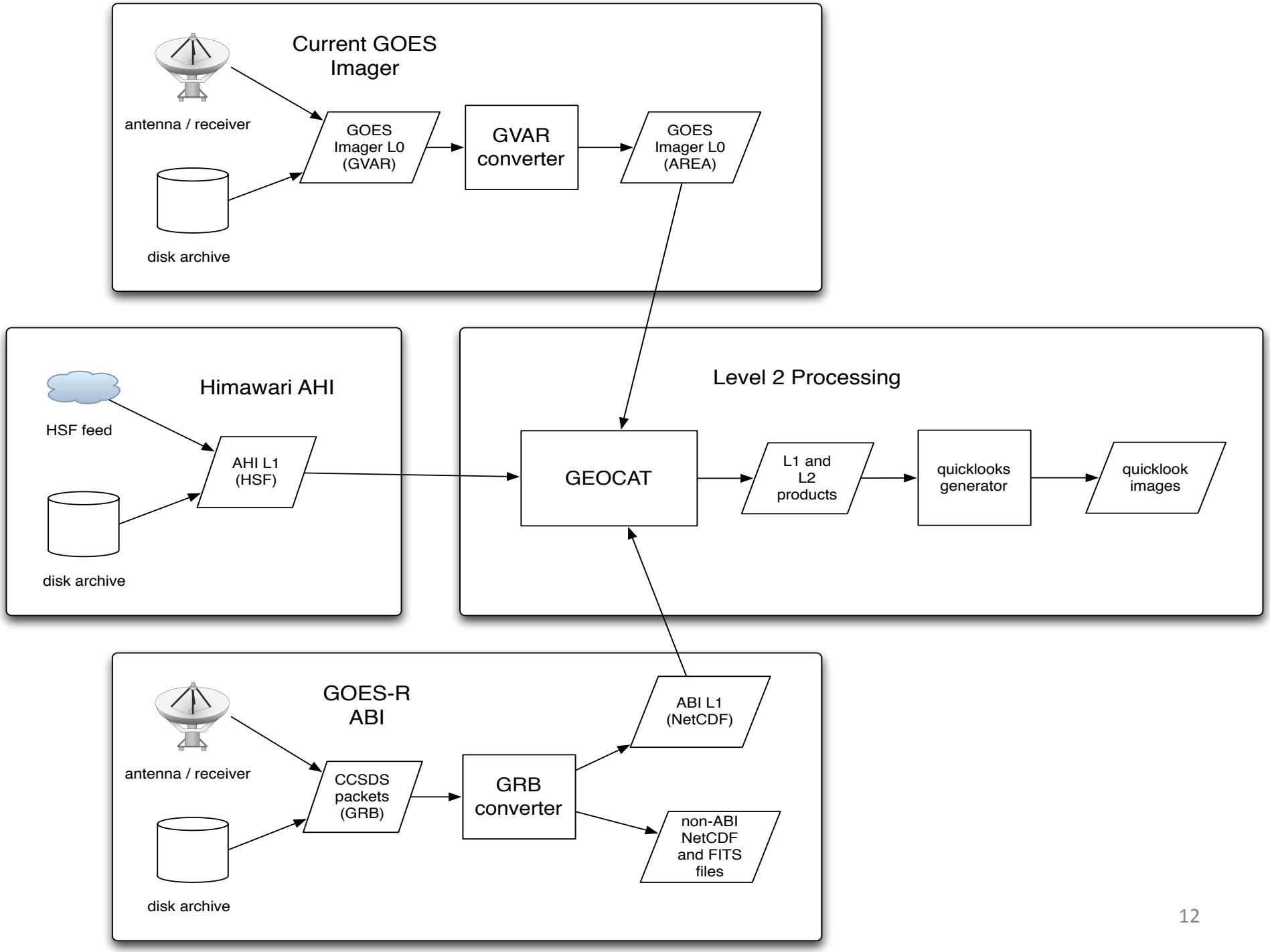


L2 processing

- Will release algorithms that are most useful to DB users
  - Users will include NWS, international DB community
- Leverage GEOstationary Cloud Algorithm Testbed (Geocat)
  - Developed jointly by NOAA / SSEC for GOES-R algorithm development
  - Research versions of many AWG algorithms run in Geocat
- Advantages of using Geocat
  - Geocat is portable and robust, well-tested
  - AWG algorithm code is high-quality and well-tested
  - Can integrate and release algorithm updates
- Version 1: Geocat with AWG cloud / fog algorithms
- Will expand to include additional algorithms:
  - Low-hanging fruit is algorithms that are in Geocat
  - May expand in later releases to include other processing systems, e.g. CLAVR-X, AIT framework, standalone programs
- Not planning or budgeted to develop new science algorithms or software
  - CSPP strategy has been to adapt or encapsulate existing software for DB use

Products currently produced

product	algorithm	maintainer
0.65 um reflectance	geocat L1	G Martin
3.9 um reflectance	geocat L1	G Martin
3.9 um brightness temperature	geocat L1	G Martin
6.7 um brightness temperature	geocat L1	G Martin
11.0 um brightness temperature	geocat L1	G Martin
13.3 um brightness temperature	geocat L1	G Martin
Cloud mask	Cloud mask	A Heidinger
Cloud phase	Cloud type	M Pavolonis
Cloud type	Cloud type	M Pavolonis
Cloud top height	Cloud height	A Heidinger
Cloud top temperature	Cloud height	A Heidinger
Cloud top pressure	Cloud height	A Heidinger
Cloud 11 um emissivity	Cloud height	A Heidinger
Cloud visible optical depth	DCOMP	A Walther
Cloud effective radius	DCOMP	A Walther
Cloud liquid water path	DCOMP	A Walther
Cloud ice water path	DCOMP	A Walther
Probability of Marginal Visual Flight Rules (MVFR)	Fog	M Pavolonis
Probability of Instrument Flight Rules (IFR)	Fog	M Pavolonis
Probability of Low Instrument Flight Rules (LIFR)	Fog	M Pavolonis
Low cloud geometric thickness	Fog	M Pavolonis


Current GOES Imager
antenna / receiver
disk archive
GOES Imager L0 (GVAR)
GVAR converter
GOES Imager L0 (AREA)
Himawari AHI
HSF feed
disk archive
AHI L1 (HSF)
Level 2 Processing
GEOCAT
L1 and L2 products
quicklooks generator
quicklook images
GOES-R ABI
antenna / receiver
disk archive
CCSDS packets (GRB)
GRB converter
ABI L1 (NetCDF)
non-ABI NetCDF and FITS files

Current GOES - beta release

- Beta release for current GOES processing
  - Released May 2014
  - Runs on a canned GOES-15 GVAR dataset only, from SSEC ingestor
  - Includes standalone software to convert GVAR to AREA files, developed by Scott Mindock from MCIDAS codebase
  - Cloud and low cloud / fog algorithms running in Geocat
  - Binaries only, built for 64-bit RHEL-compatible Linux
  - Package includes all required third-party software; easy to install and run

Current GOES - public release

- First public release for current GOES processing
  - Planned for Fall / Winter 2014
  - Users will be able to process data in realtime received at their antennas
  - Will run on GOES-13 and GOES-15
  - GVAR converter improvements – vendor support?
  - Intermediate AREA files
    - Remapped to common GRID
  - Dynamic ancillary data downloaded from SSEC server
  - Robust scripting infrastructure for job sequencing, ancillary download, error reporting, logging, etc.
  - Quicklooks
  - Working with science teams to integrate L2 algorithm updates and verify output
  - Plan to add Night-time Cloud Optical and Microphysical Properties (NCOMP)
  - Testing: different instruments, scan sectors, image times & sequences

Himawari AHI

- Plan to add support for AHI as a pathfinder for ABI (2015)
  - AHI offers an early opportunity to test software on an instrument that is almost identical to ABI
  - Geocat will support AHI sooner (Fall 2014)
  - Algorithms may need to be adapted for AHI, LUTs generated, etc.
    - One channel different from ABI
  - Interested in knowing algorithm developers plans or interest in processing AHI
- Data format will be HSF
  - HSF ingest library already exists (contact Ray Garcia)
  - HSF data will be obtained from JMA via STAR
  - May also support legacy HRIT for DB users if requested

Challenges

- Have to keep up with a data rate of ~31 Mbps
  - 15x current GOES rate
  - Can parallelize both GRB conversion and L2 processing
- L2 system design and parallelization is complicated by:
  - Inter-algorithm dependencies
  - Spatial dependencies (algs that require surrounding pixels)
  - Temporal dependencies (algs that require products from previous or subsequent timesteps)
- Some users have limited bandwidth for ancillary downloads
  - Requires balancing algorithm needs vs user needs
- Want to support "streaming" processing mode
  - E.g. allow image segment to be served via ADDE as they become available
- Will operational data look like simulator data?
- PUG is a work in progress and contains TBDs

Current Best-Estimate Schedule

- Fall / Winter 2014: Initial public release with support for GOES-13 and GOES-15
  - Produces L2 cloud and fog products
- Spring 2014: add support for GRB
  - Level 1 ABI and Level 2 GLM
  - Produces L2 cloud and fog products
- Summer 2015: add support for Himawari-8
- Summer / Fall 2015: add support for remaining GOES-R instruments
- Late 2015 and onward: add L2 science products

Questions?