



Landsat Update

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Landsat – 8



Agenda



- Landsat-8 Update
- Sustainable Land Imaging
- Landsat/Sentinel-2 Collaboration

1. Landsat-8 Overview



- Landsat-8 launched in February 2013
- Data products available from USGS EROS beginning May 30, 2013
- Landsat-8 carries two instruments
 - Operational Land Imager (OLI) covers reflective bands
 - *9 bands covering 0.44 – 2.2 micron*
 - *30 meter spatial resolution*
 - *Improved SNR & dynamic range compared to ETM+*
 - *New spectral bands for Coastal/Aerosol, Cirrus detection*
 - Thermal Infrared Sensor (TIRS)
 - *2 bands covering 10-12 micron*
 - *100 meter spatial resolution*
- L1T data products contain both resampled OLI & TIRS data
 - Metadata includes coefficients for radiance and TOA reflectance
 - New band designations compared to TM/ETM+
 - Note impact of narrower NIR band

Landsat-8 Status

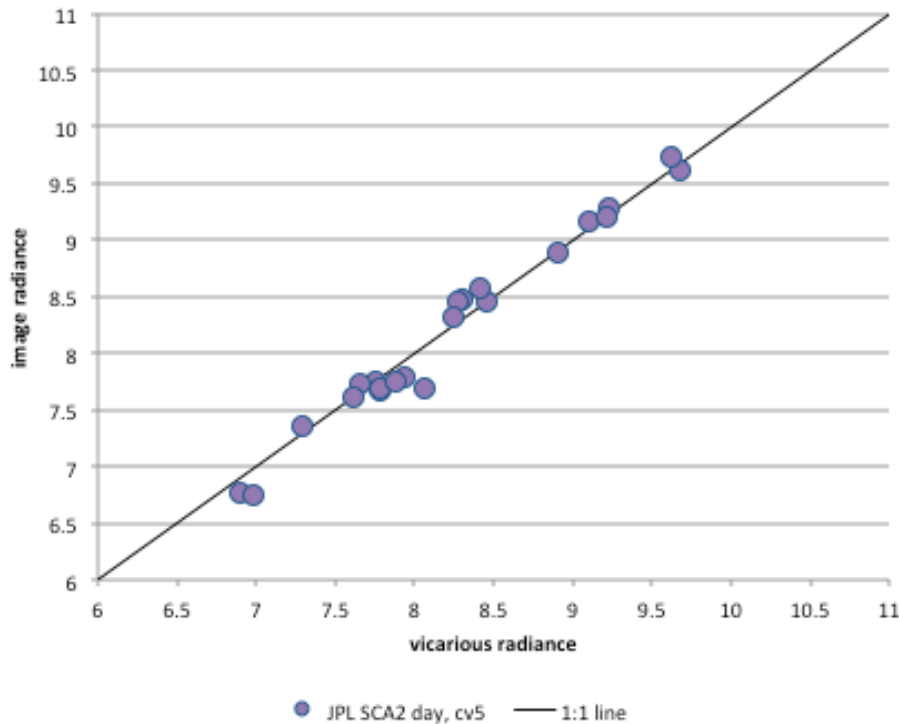


- Landsat-8 continues to perform well
 - OLI performance meets or exceeds all radiometric & geometric performance requirements
 - TIRS meeting most requirements
 - *TIRS Band 11 stray light issue (next slide)*
 - *Users discouraged from using Band 11 for now*
- All Landsat products cleared and reprocessed starting Feb 3, 2014 to accommodate calibration changes (http://landsat.usgs.gov/calibration_notices.php)
- Landsat-8 currently acquiring ~550 scenes/day (out of possible ~850 land scenes/day)

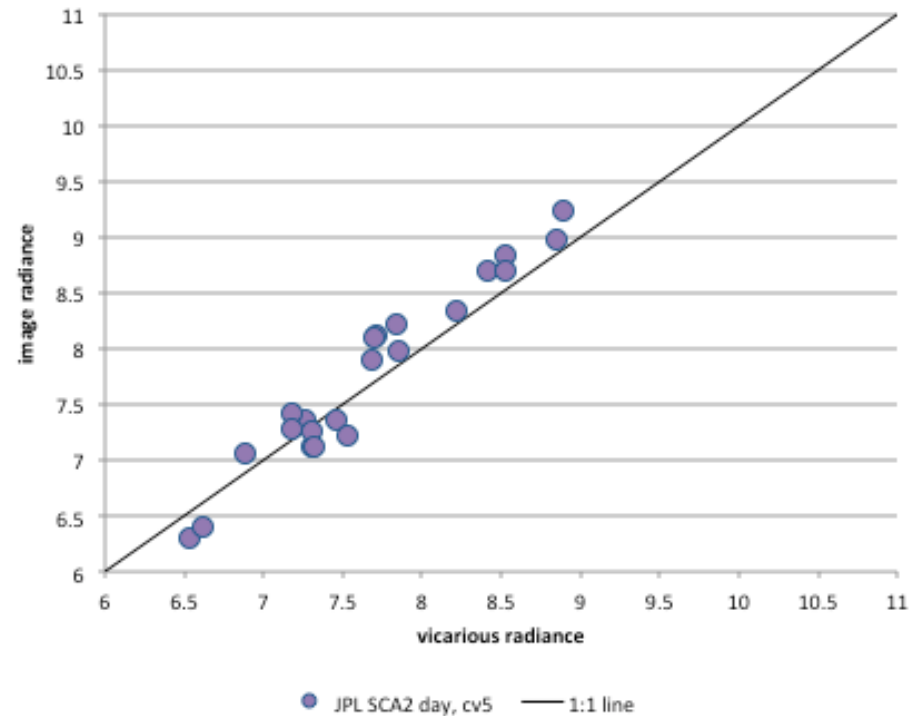
TIRS Absolute Calibration



TIRS10 Calibration Results



TIRS11 Calibration Results



TIRS bias correction implemented on 2-Feb-14 but the correction does not address the significant variability in results, particularly in band 11 (12 micron band).

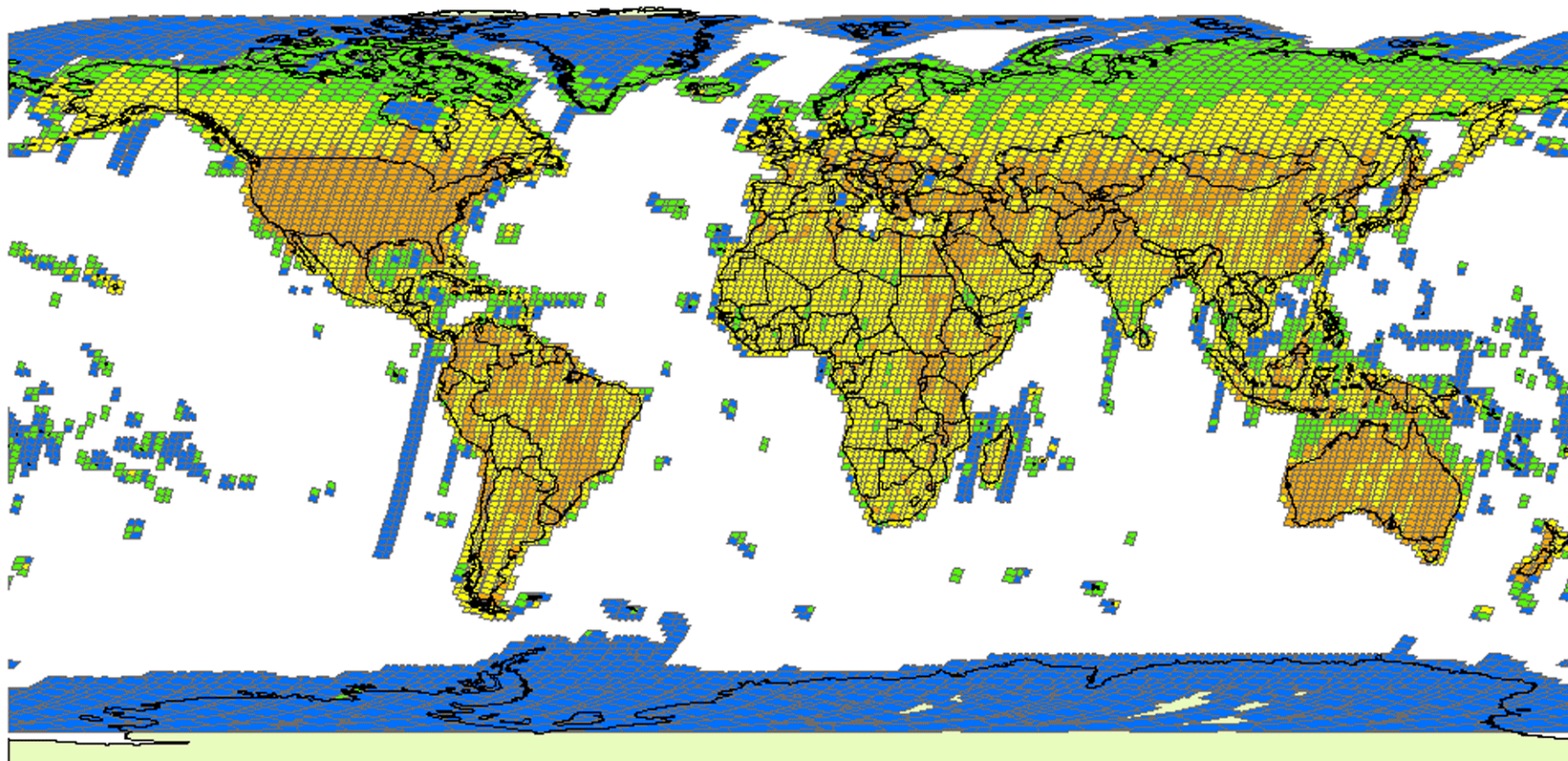
Source of error appears to be extra signal reaching detectors from outside the field of view – ghosting. Studies are ongoing to model the stray light effect.

FY13 Acquisitions

15 = 16 day coverage
30 = 8 day coverage



FY13/FY14 L8 OLI & TIRS / L7 ETM+ Acquisitions



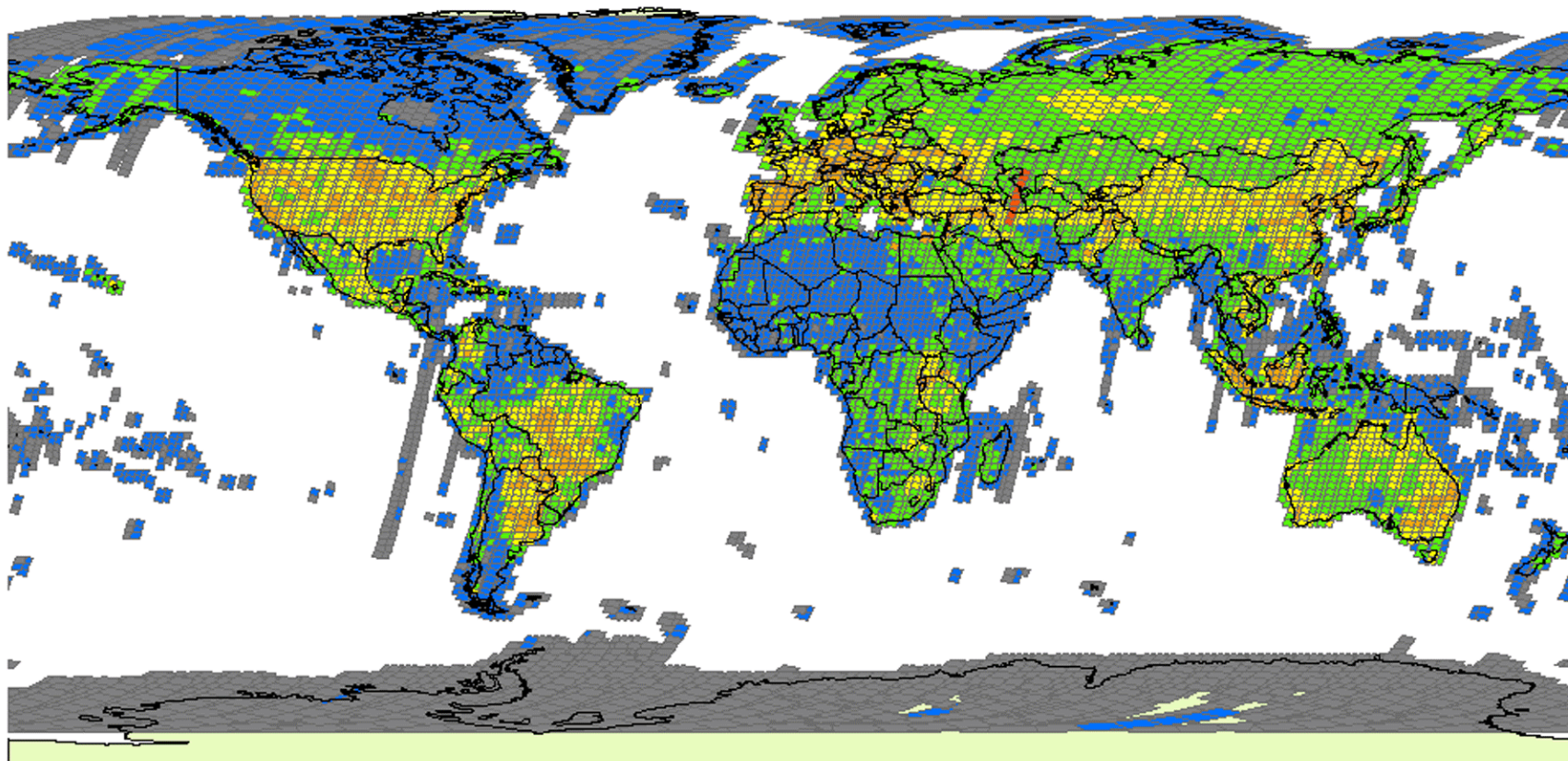
L8 OLI & TIRS / L7 ETM+ Acquired Scenes
June 01, 2013 through January 31, 2014
220,216 Total Scenes
13,443 Unique Locations

1 - 9 10 - 18 19 - 27 28 - 37 38 - 46

FY13 Downloads



FY13/FY14 L8 OLI & TIRS / L7 ETM+ Downloads



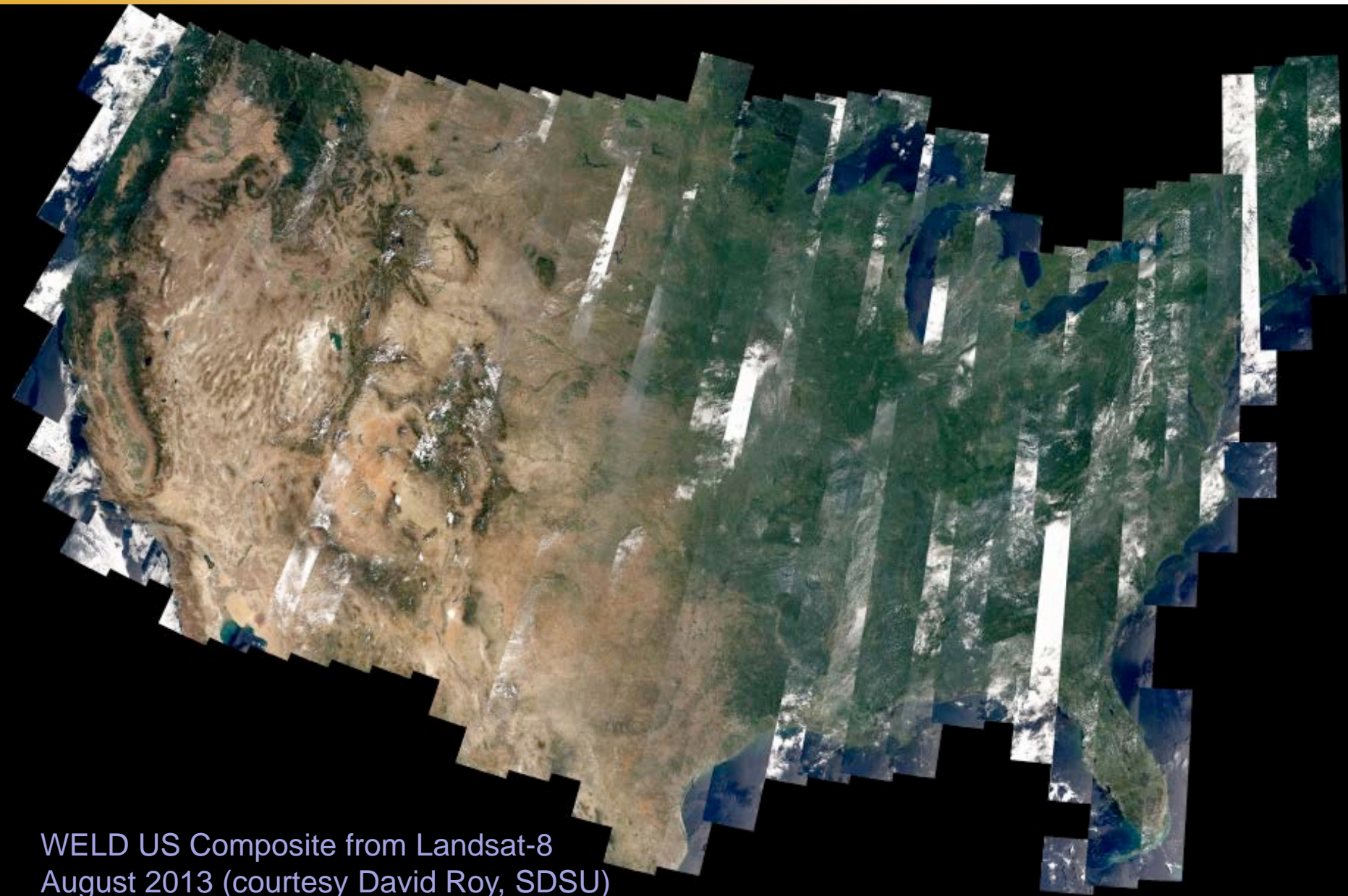
L8 OLI & TIRS / L7 ETM+ Downloaded Scenes

June 01, 2013 through January 31, 2014

245,503 Total Scenes

13,443 Unique Locations

Legend: No Downloads (Grey), 1 - 13 (Blue), 14 - 37 (Green), 38 - 74 (Yellow), 75 - 306 (Orange), 307 - 996 (Red)



WELD US Composite from Landsat-8
August 2013 (courtesy David Roy, SDSU)

2. Sustainable Land Imaging



- President's FY14 budget called for a NASA-led, USGS-supported Sustainable Land Imaging (SLI) program to secure Landsat continuity for 2018-2038
 - *NASA responsible for system design, implementation, and launch*
 - *USGS responsible for ground system and operations*
- Initial focus on study phase by Architecture Study Team (AST) to recommend one or more 20-year architectures for US Land Imaging (Report due to OSTP/OMB August 2014)
- The President's FY 2014 Budget Submittal for NASA's Sustainable Land Imaging activities, released in April 2013

\$K	FY 14	FY 15	FY 16	FY 17	FY 18	FY 19
Land Imaging	30,000	84,000	94,800	117,900	117,900	-

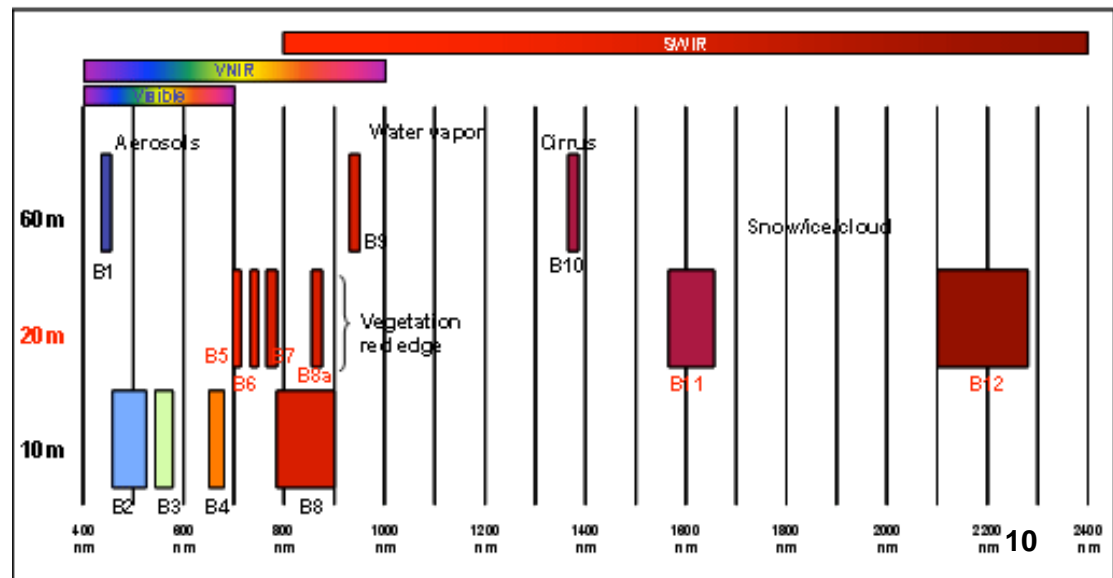
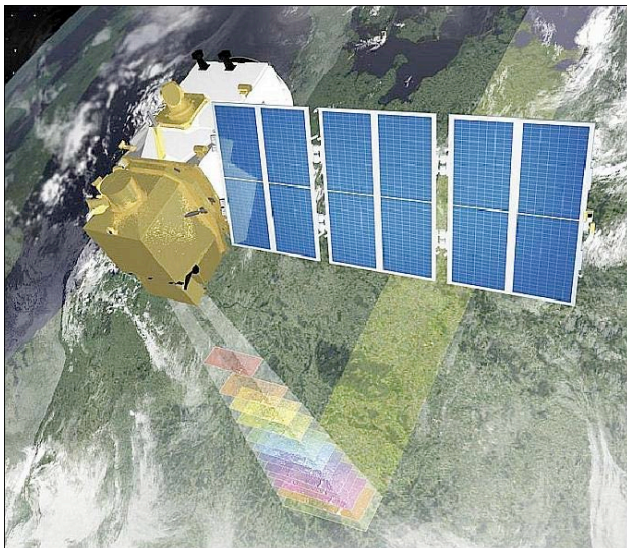
For more information visit:

<http://espd.gsfc.nasa.gov/landimagingstudy/index.html>

3. USGS & NASA Plans for Sentinel-2



- ESA Sentinel-2 mission is a “Landsat-like” component of the European Copernicus environmental security program
 - S2a launch currently 2Q 2015; S2b 2016
 - *Global coverage about 1 year after launch*
 - Each satellite provides 10-day global revisit
 - 2 Sentinels + Landsat-8 provides ~2-3 day global repeat
 - *Qualitative advance for land science – if users can be empowered to use the data set*
- Sentinel “Free and Open” data policy now ratified by EU

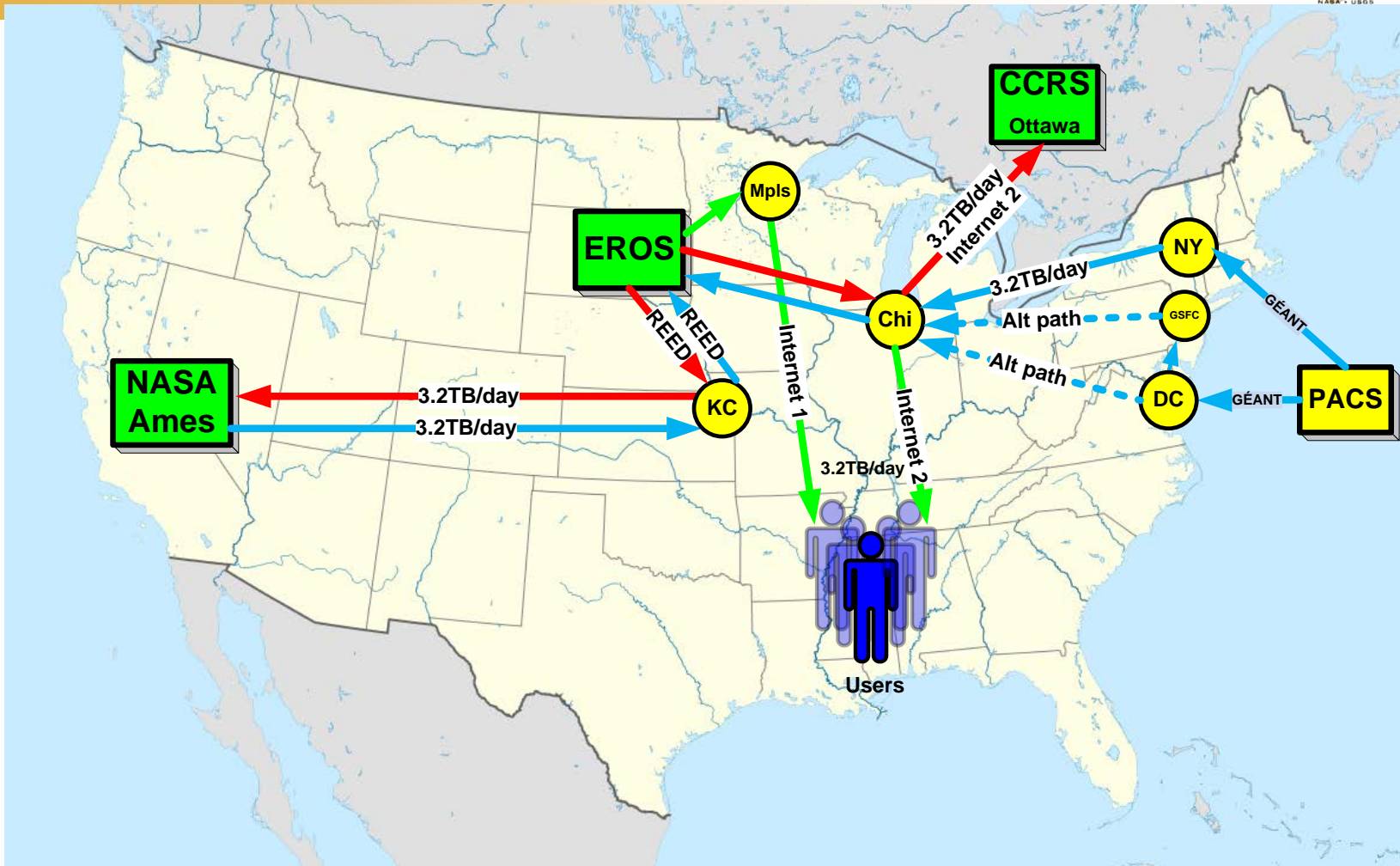


Preparations for Sentinel-2 (NASA/USGS)



- Cross-Calibration & Data Characterization (NASA/USGS)
 - Pre-launch comparison (integrating spheres, diffusers)
 - Post-launch planning (joint vicarious campaigns)
- “Mirroring” Sentinel-2 L1C Archive (USGS)
- Higher-Level Products from merged Landsat/S2 stream (NASA)

Network Connectivity and Sentinel-2 Data Flow

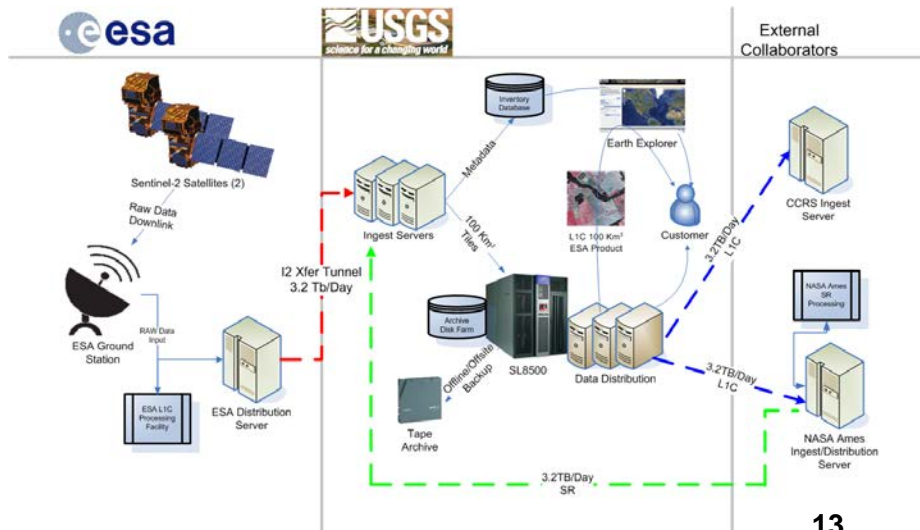


CCRS – Canada Center for Remote Sensing
EROS – Earth Resources Observation and Science
PACS – Processing and Archive Centers

USGS Concept of Operations



- The Sentinel-2 MSI Level-1C (L1C) product is analogous to Landsat Level-1T (L1T). Approximately 800- 900GB of raw data to be downlinked per day will be processed to L1C by ESA.
- L1C products are orthorectified Top of Atmosphere (TOA) reflectance provided as 100x100km² tiles of 500MB each in UTM projection. L1C products are 16-bit with radiometric conversion coefficients and a QA band.
- USGS will pull L1C products from PACs for distribution to NASA Ames, Canada Center for Remote Sensing (CCRS), and the general public at no cost.
- NASA Ames to process L1C data to surface reflectance that will be pulled back to EROS for archive and distribution.
- USGS estimates for the data archive and distribution of Sentinel-2 L1C and surface reflectance (SR) products assume daily ingest volume of 1.6GB per satellite.
- Total data archive 6.4TB per day
 - L1C data archive of 3.2TB per day
 - SR data archive of 3.2TB per day
- Level-1C reprocessed data will be replaced – no concurrent versions



NASA Activities: Higher Level Products



- NASA investing in approaches to harness Sentinel-2 and Landsat for Land Science
 - Joint activities with CESBIO (SPOT-4 “Take 5” prototype)
 - Initial support in FY14 for planning & algorithm prototyping
 - Potential support for future Land Imaging Science Team

- Object 1: Harmonized surface reflectance product from S2 and Landsat
 - Calibration/radiometric normalization
 - Atmospheric correction
 - BRDF (solar, view angle) and band pass adjustments
 - Cloud/shadow screening & cirrus masking
 - Common gridding, compositing approach

- Object 2: Higher-Level Land Cover and Biophysical products from merged moderate-resolution record
 - GTOS ECV's
 - QA & Validation components
 - Implementation using ARC NEX processing system (bring algorithms to the data)
 - Assessment of Copernicus strategy for higher-level products & algorithms



Thank You

