NASA's Land-Cover/Land Use Change Program: Sentinel-2 Component

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Sentinel-2 Preparatory Component

- ESA Sentinel-2 launch planned for June 2015
- NASA is investing in preparation for processing Sentinel-2 data
  - Sentinel-2 Data Use Preparation projects
- Sentinel-2 data are to be used synergistically with Landsat to develop higher level LCLUC products
  - Joint NASA-CNES/CESBIO project
  - Multi-Source Land Imaging Science Team
- Core funding for inter-calibration
  - Land Cover Project Office (Jeff)

Project Scientist
for Landsat-Sentinel2 work
Jeff Masek, NASA
Landsat-9 Project Scientist

Making Full Use of Sentinel-2 Data

(1) User access to S2 L1C Data (USGS)

(2) MSI Characterization & cross-calibration with Landsat-8 (NASA, USGS)

- Prelaunch comparison of integrating spheres (GSFC/Astrium/UAz)
- Planning for coincident imaging & vicarious campaigns

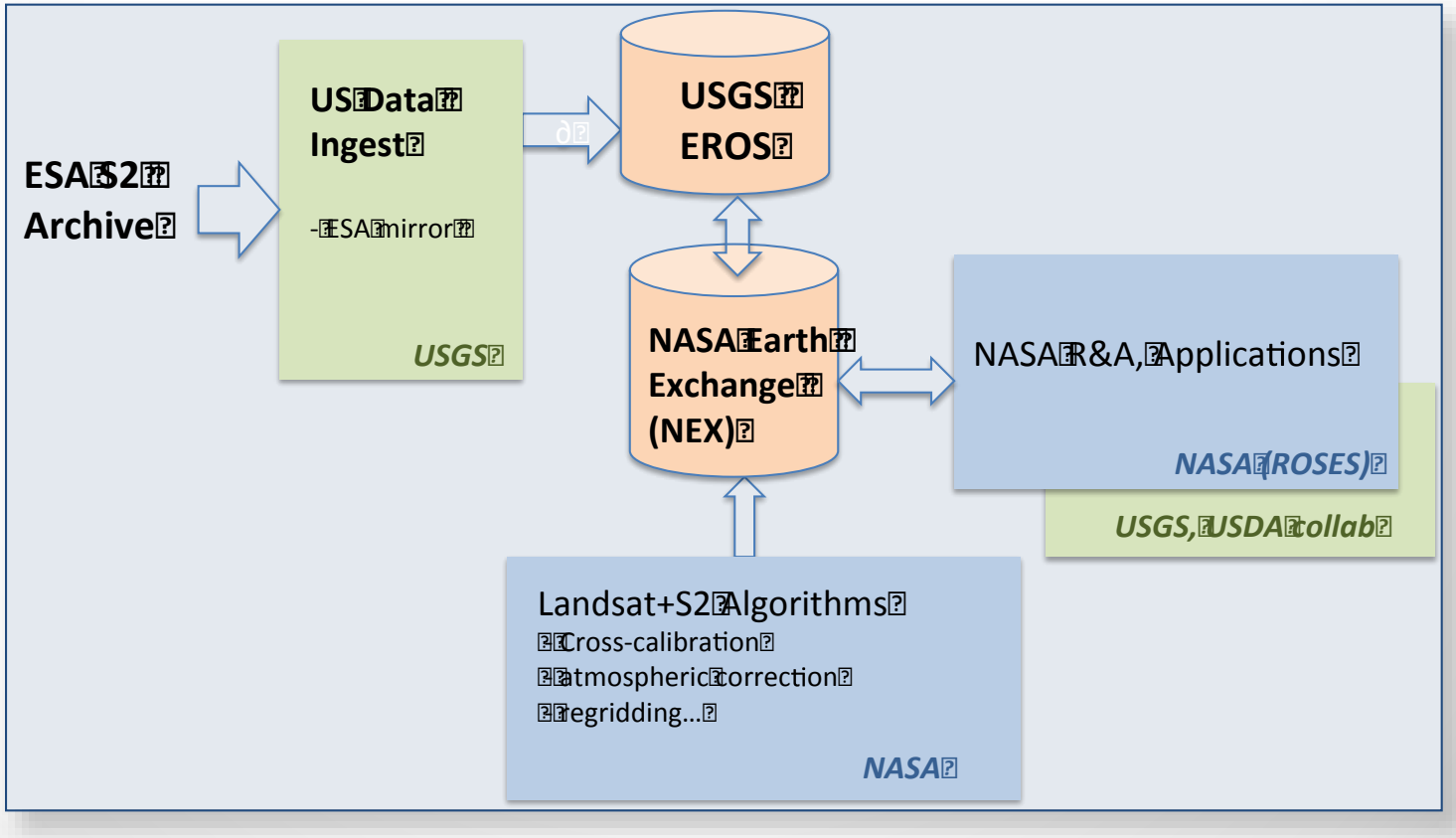
(3) Higher-level Products (NASA)

- Sensor reflectance products
  - L8 and S2 surface reflectance algorithms available
- Merged Landsat + S2 reflectance product
  - Object: a seamless, sensor-independent reflectance record at high spatial, and high-temporal resolution to support land science
  - Compatible atmospheric correction & cloud/shadow detection
  - Corrections for BRDF (solar, view angle), band pass differences
  - Adjustment to common frame, resolution (~30m), compositing period (~5 day)
- Higher-level land cover & biophysical products

Proposed Sentinel-2 / Landsat Architecture

Architecture to support:

- L1C data distribution via USGS EROS
- creation of higher level products (including merged products) via NEX



Sentinel-2 Data Use Preparation (S2DUP) Projects

- **Sentinel-2 Data Characterization**
  - Create joint S2/L8 post-launch calibration plan.
    - Plan detailed tasks and schedule for joint calibration activities, including joint acquisitions, calibration data sharing, vicarious campaigns, and coordination of calibration updates
    - Use CEOS WGCV guidelines, and complement existing mission-specific calibration plans
  - Assess theoretical MSI performance using DIRSIG
  - Investigate alternate approaches to cross-calibrate push-broom sensors
- **Higher-Level and Merged Products**
  - Evaluate current ESA/Copernicus strategy on higher-level products
  - Use DIRSIG-simulated data to assess ability of MSI to contribute to generate L8 compatible and combined higher-level products
  - Develop algorithms for preprocessing of a merged S2/L8 data stream
  - Develop reprojection/regridding tools
  - Test pre-processing algorithms on existing international data sources
  - Implement processing algorithms on NEX

NASA S2DUP Team

Team	Investigation
Helder	Improved use of PICS sites including BRDF modeling & characterization; Improved use of vegetated calibration sites; Relative gain estimation via lifetime averaging
Czapla-Myers	BRDF measurements of US PICS/calibration sites; Analysis of Sentinel-2 prelaunch calibration data
Markham	Support for analysis of MSI performance data; coordination of Cal Team
Schott	DIRSIG simulations of Sentinel-2 + Landsat time series, including BRDF variability; testing BRDF corrections
Vermote/Claverie	Atmospheric correction approach for MSI (accelerates effort, initial funding currently from LcPSO)
Justice/Claverie	Prioritization of higher-level products for NASA Land Science
Schaaf	BRDF corrections for MSI
Woodcock	Assessment of Coperinicus Higher-Level Products strategy; MSI cloud cover algorithm
Roy	Regridding/Projection approach for MSI & merged products; compositing approaches
Ganguly/Dungan	Biophysical algorithm approaches for MSI; NEX programming & systems support

- ***Period of performance: ~April 2014 - April 2015***

S2DUP Deliverables

- Detailed plans for MSI/OLI cross-calibration and product gridding/projection
- A white paper on radiometric uncertainty assessment for MSI and merged MSI/OLI product, and theoretical error budget for radiometry & biophysical variables from merged products
- A white paper on prototype algorithms for atmospheric corrections, cloud/cloud shadow detection, band pass adjustment and BRDF correction
- A white paper on potential higher order products from OLI and MSI
- Examples of pre-MSI launch prototype combined products
- Prototype algorithms implemented on NEX using L8 and synthetic MSI data
- Summaries of the S2DUP findings and links to documentation will be a special S2DUP page under LCLUC website

NASA Earth Exchange (NEX) portal

- NEX provides resources (core data sets, software/workflows, and computing) for data- and compute-intensive, NASA-supported Earth science grand challenges
- Vision: To engage and enable the Earth science community to address global environmental challenges
- Goal: To improve efficiency and expand the scope of NASA Earth science technology, research and applications programs

- All LCLUC projects are listed on the NEX site -- PI's are encouraged to register

https://nex.nasa.gov

Multi-Source Land Imaging Science Team

- ROSES-2014
  - *7 selected out of 41 proposals*
  - *PI, Co-Is and international collaborators total ~40*
    - Optical data (L8,S2) alone: 3
    - Optical (L8, S2)+Radar (S1, PALSAR, SRTM): 4

MSLI Science Team: 40+ members

PI and CO-Is

Salas , Applied Geosolutions Torbick, AG
Lang, U Maryland Jones, USGS Huang, UMD
Small, Columbia U. Nghiem, JPL Greg Yetman, Columbia U.
Friedl, Boston U. Gray, BU Melaas, BU
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Landcover Project Science Office

Masek, NASA, MSLI Project Scientist
Markham, NASA, calibration team Helder, SDSU Czapla-Myers (U. Az)
Schott, RIT DIRSIG model, LST
Vermote, NASA GSFC Atm. Corr. Team Claverie, U. MD
Woodcock, Boston U., clouds (USPI +1)
Dungan, NASA Ames, NEX Ganguly, NASA Ames, NEX

Relevant Forthcoming Meetings

- MSLI 1-day PI meeting (Aug-Sep, DC area)
- Mapping Urban Areas from Space (ESA/ESRIN, 4-5 Nov 2015)
- First international MSLI Science Team meeting in conjunction with the 20th anniversary LCLUC ST meeting (Apr 2016, DC area)

Special thanks to the organizers of this meeting