National Aeronautics and Space Administration

Harmonized Landsat/Sentinel-2 Reflectance Products for Land Monitoring

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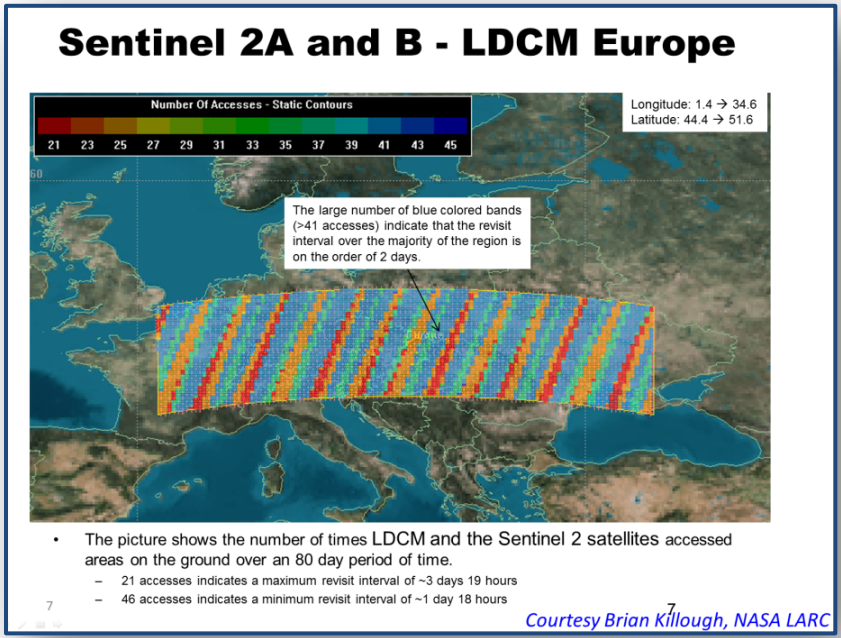
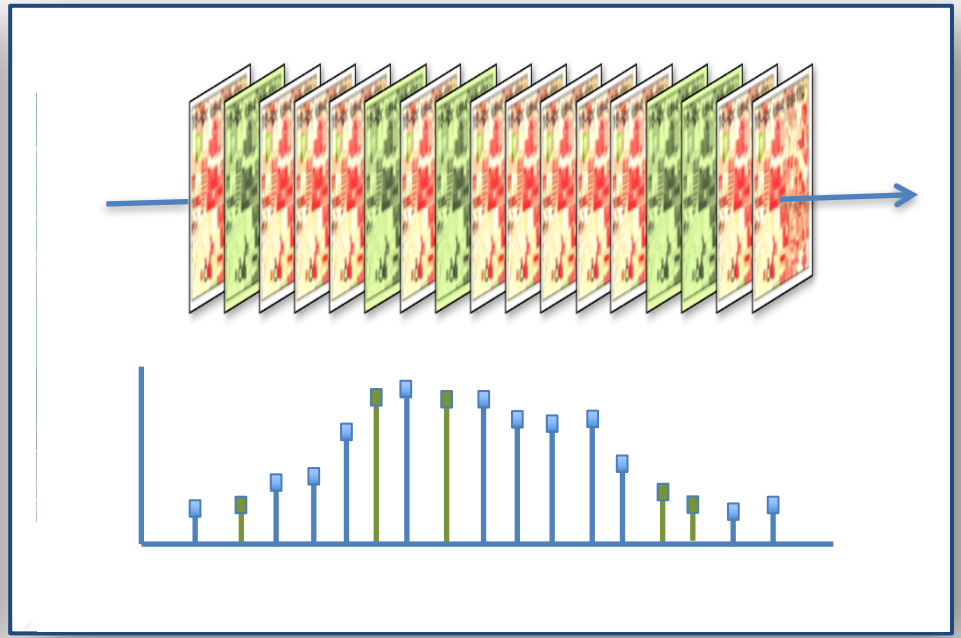
Presentation contains modified Copernicus Sentinel data (2015-17) processed by ESA

Harmonized Landsat Sentinel-2 (HLS) Project

- Merging Sentinel-2 and Landsat data streams can provide **2-3 day global coverage**
- Goal is “seamless” near-daily 30m surface reflectance record including atmospheric corrections, spectral and BRDF adjustments, regridding
- Project initiated as collaboration among GSFC, UMD, NASA Ames

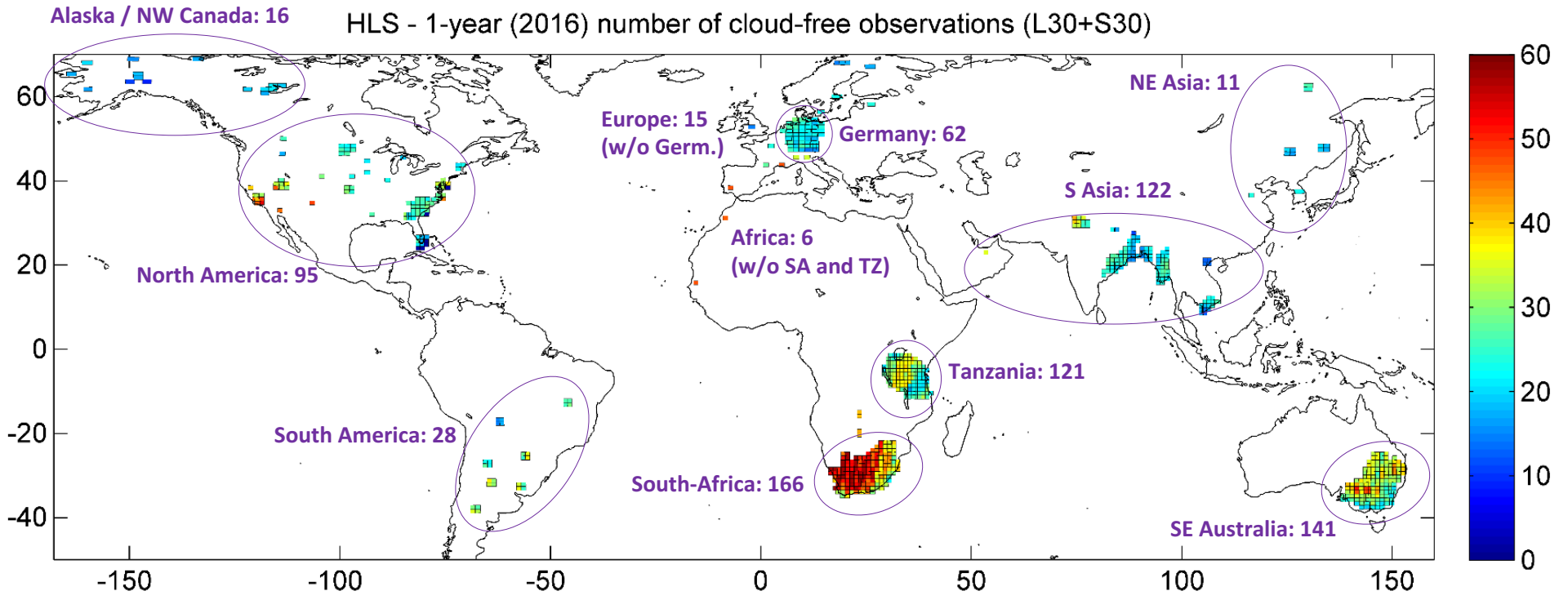




HLS Test Sites (v 1.3)

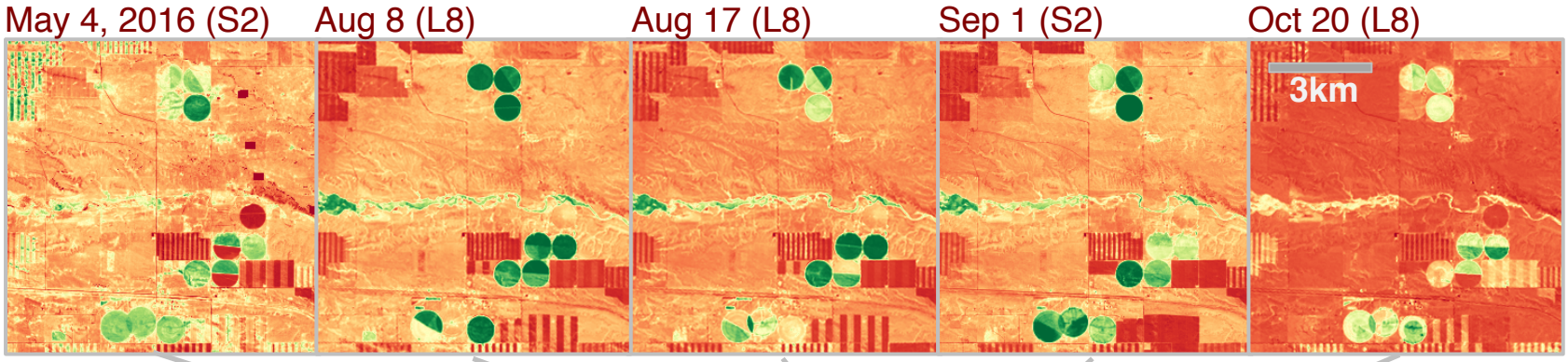
- 69 Test sites (45 from NASA MuSLI team)
- 783 MGRS tiles
- >7.5 million sq. km2

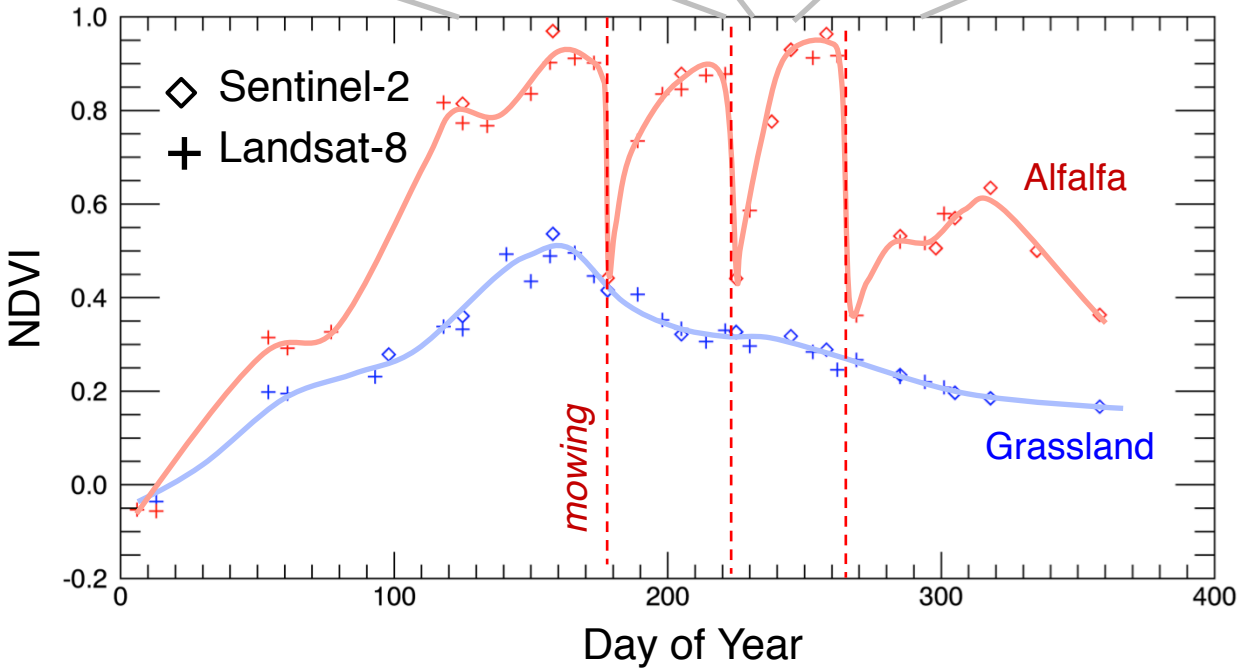
- Landsat-8 data set: 147k products
  From Mar-2013 to Sep-2017
- Sentinel-2 data set: 47k products
  From Jun-2015 to Sep-2017



Harmonized Landsat / Sentinel-2 Products

Laramie County, WY





Seasonal phenology (greening) for natural grassland (blue line) and irrigated alfalfa fields (red line) near Cheyenne, Wyoming observed from Harmonized Landsat/Sentinel-2 data products. The high temporal density of observations allows individual mowing events to be detected within alfalfa fields. HLS Products available from https://hls.gsfc.nasa.gov

Recent Work

Recent work focused on assessing product accuracy and algorithm improvements

HLS reflectance accuracy assessed via:

- *Independent validation of LaSRC atmospheric correction (e.g. WGCV ACIX)*
- *Comparison of HLS with SURFAD albedometer measurements (see next slide)*
- *Quantifying temporal stability of invariant sites (e.g. deserts)*

Algorithm improvements

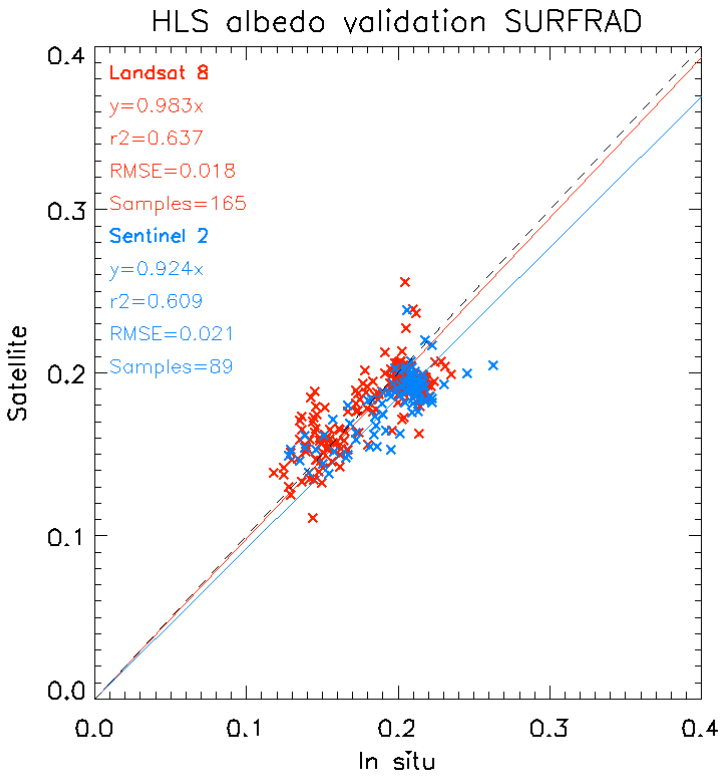
- *Cloud masking remains challenging, especially for Sentinel-2*
  - *Too conservative, and many valid points are flagged as cloud; too lenient, and time series become noisy*
  - *Current approach*
    - *L30: union of LaSRC and USGS L1 cloud masks*
    - *S30: union of LaSRC and Fmask cloud masks*
  - *Working with Boston University on intercomparison of current S2 cloud masking algorithms (see Slide 7)*
- *Current BRDF correction (Roy et al., 2016) does not work well for non-vegetated surfaces – looking for alternatives.*

Comparison of HLS with SURFRAD

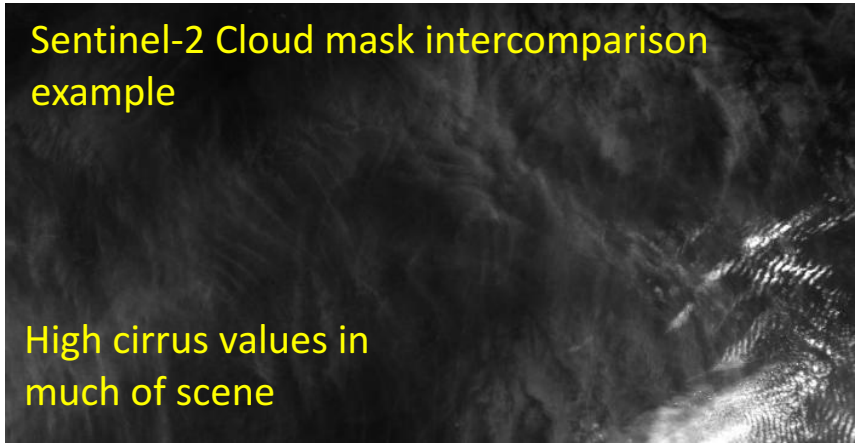
HLS albedo compared to SURFRAD albedometer measurements (B. Franch et al, AGU 2017)

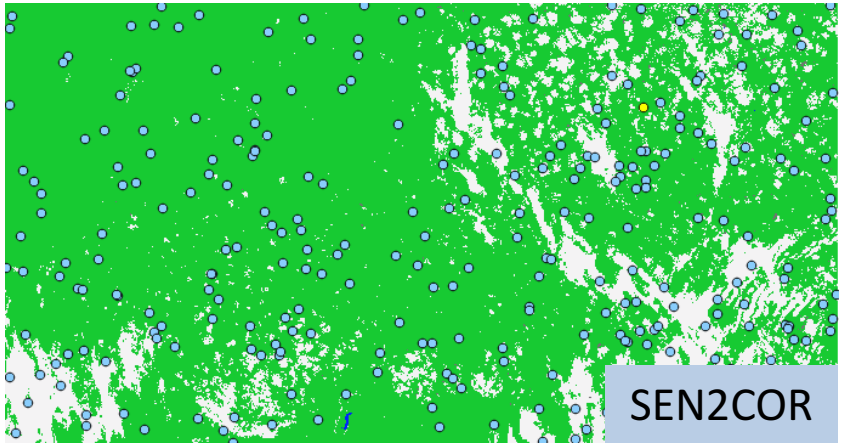
- *hemispheric integration using MCD43 BRDF*
- *narrow-to-broadband conversion using fixed coefficients (Liang et al, 2001)*
- *RMSE ~0.02 absolute*
- *For 0.2 SR targets -> ~10% relative uncertainty*

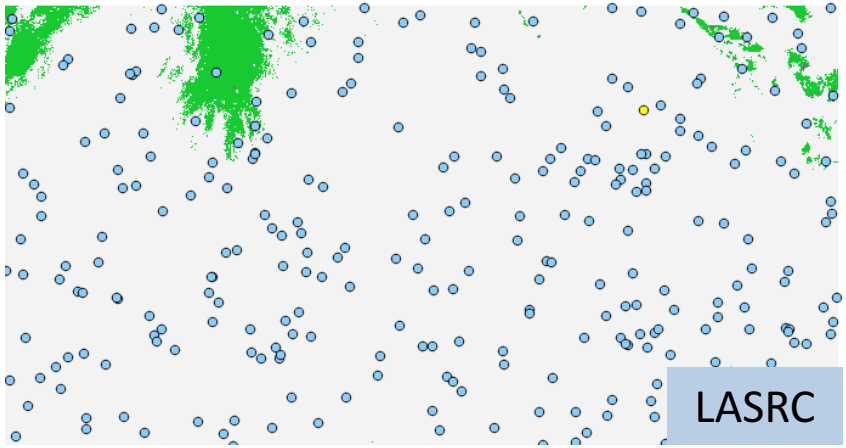
Includes errors due to (i) HLS product; (ii) conversion from NBAR to albedo; (iii) in-situ measurements

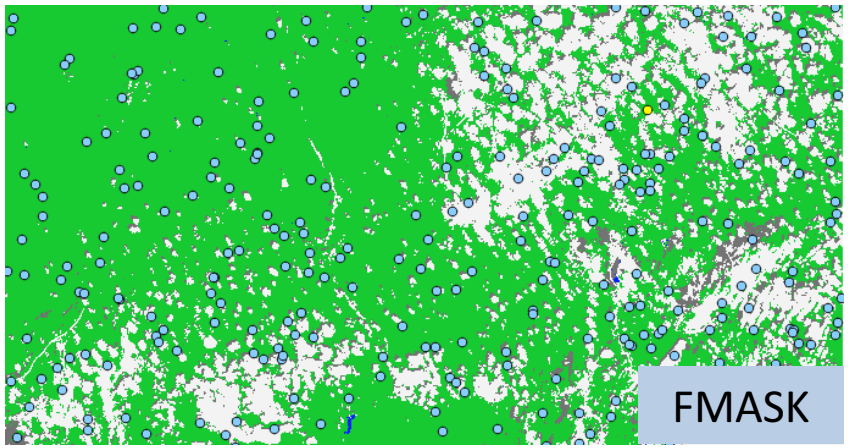


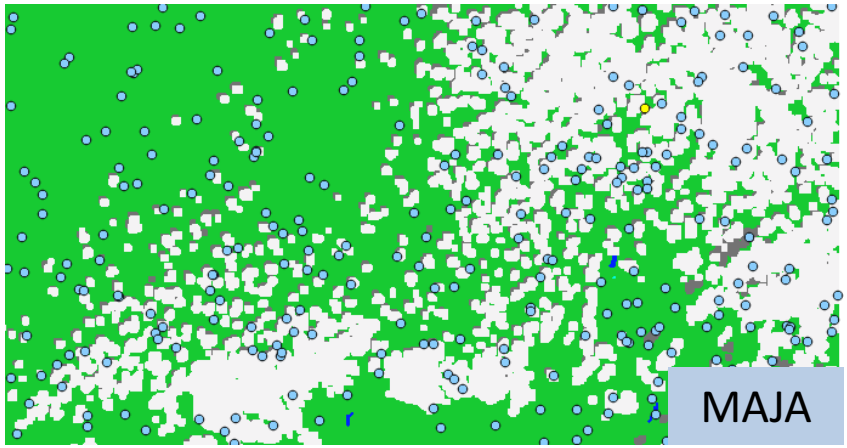
Courtesy Belen Franch, UMD

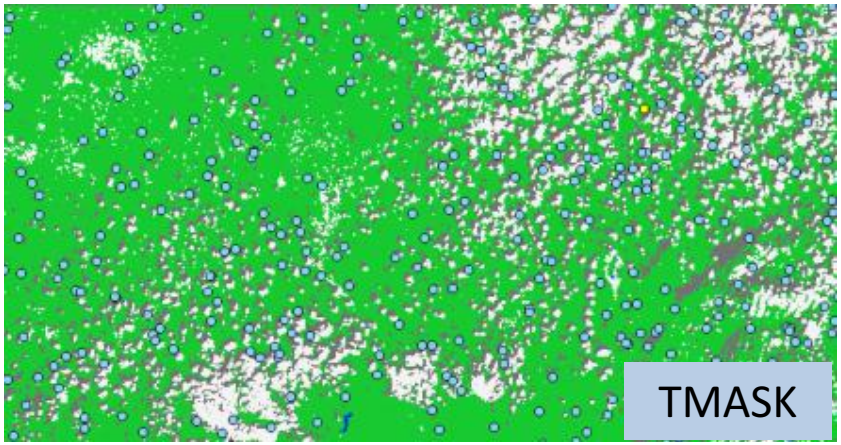












Courtesy Boston University

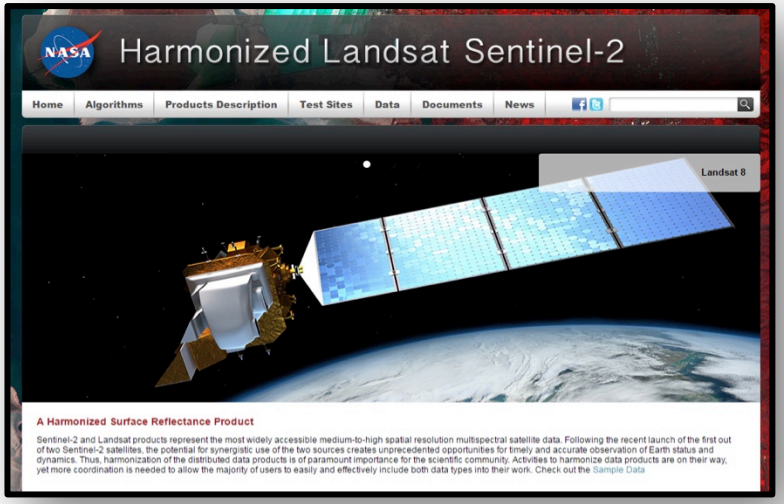
Status and Future Directions

- Version 1.3 released July 2017
  - Available for download and testing
- Version 1.4 to be released Q2 2018
  - Wall-to-wall North America + global test sites
  - Incorporates Collection 1 Landsat 8 (2013-current) and S2b data
  - < 7 day latency
  - Processing via Amazon Web Services (AWS)
- Support for new NASA MuSLI investigations (2018-20)
- Beginning dialog with NASA HQ about long-term stewardship of HLS processing

Websites and Public Interface

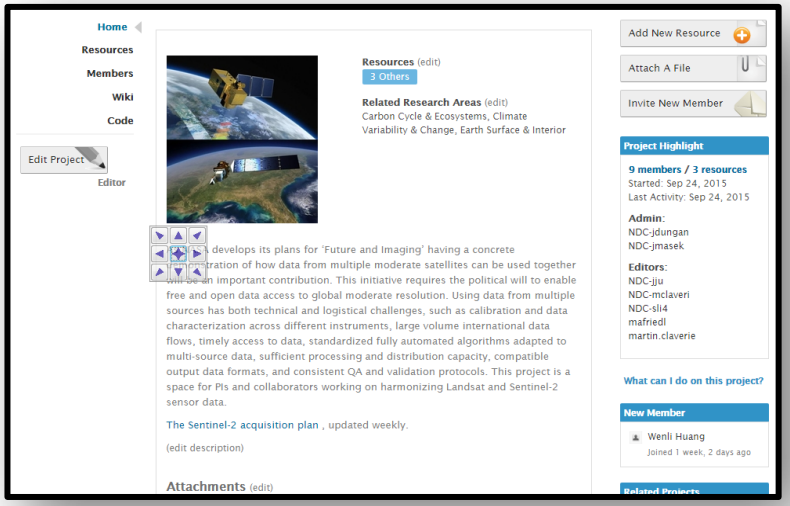
HLS website

- https://hls.gsfc.nasa.gov
- Public access
- Sample data available (via FTP)
- Algorithm & Product descriptions
- **Request new sites**



NEX project page

- https://nex.nasa.gov/nex/projects/1371
- Registered user access
- All HLS data available
- Documents (slides, user guides)




Thank You
Delaware / New Jersey