Harmonizing Landsat and Sentinel-2 Reflectances for Better Land Monitoring

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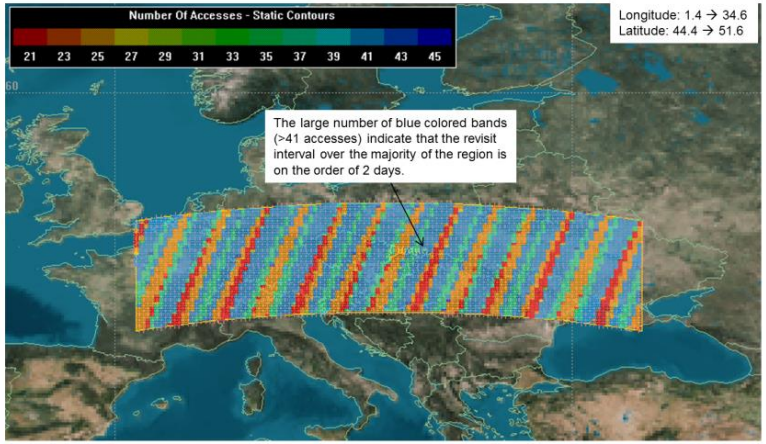
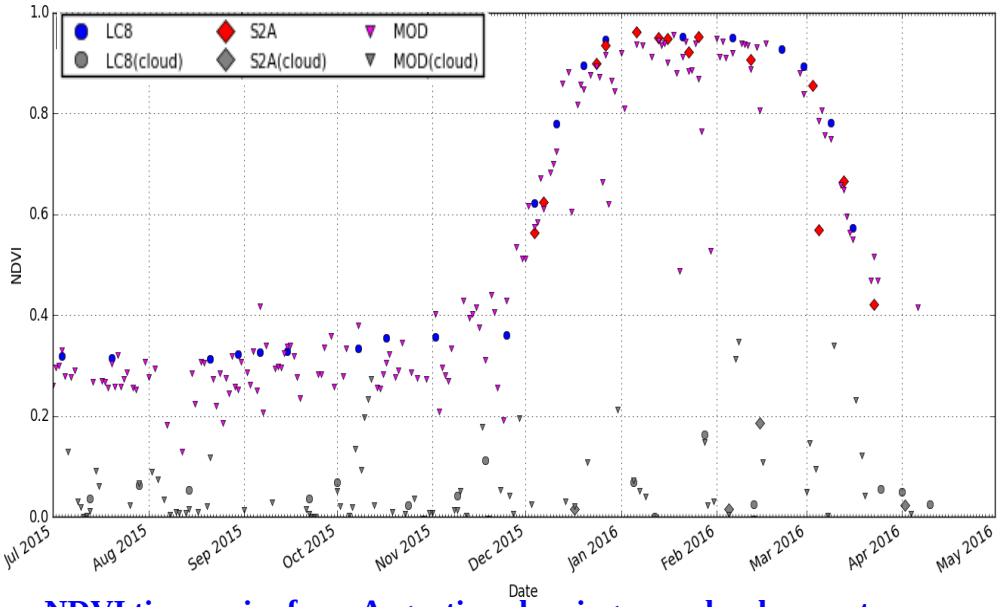
Sentinel 2A and B - LDCM Europe



Coverage frequency in Europe from combining Landsat-8 (LDCM) and Sentinel-2A,B overpasses (courtesy Brian Killough, LaRC)



NDVI time series from Argentina showing crop development (greening) from combining Landsat (LC8) and Sentinel-2 (S2A), with MODIS included for comparison.

When combined, Landsat and ESA Sentinel-2 observations can provide 2-4 day coverage for the global land area. A collaboration among NASA GSFC, University of Maryland, and NASA Ames has developed a processing chain to create seamless, "harmonized" reflectance products using standardized atmospheric correction, BRDF adjustment, spectral bandpass adjustment, and gridding algorithms. These products point the way to a "30-m MODIS" capability for agricultural and ecosystem monitoring by leveraging international sensors.

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References:
N/A

Data Sources: Surface reflectance products derived from Landsat-8 OLI, Sentinel-2 MSI, and Terra/Aqua MODIS.

Technical Description of Figures:
(left): Acquisition frequency over mid-latitudes (Europe) expected from two Sentinel-2 satellites (Sentinel-2a,b) combined with Landsat-8. Blue-colored areas indicate an expected frequency of at least one observation every two days (figure courtesy Brian Killough, LaRC).
(right): Seasonal cycle of greenness (NDVI) derived from Landsat (blue) and Sentinel-2a (red) harmonized reflectance data for a single agricultural field in Argentina. The NDVI values closely track the more frequent MODIS (small red triangle) acquisitions. Cloud-contaminated observations are shown in grey, and typically have low apparent NDVI values (figure courtesy Belen Franch, UMD).

Scientific significance, societal relevance, and relationships to future missions: Monitoring patch-scale vegetation dynamics, particularly for agricultural regions, requires both fine spatial resolution and <8-day temporal frequency. While it is difficult for a single satellite program (such as Landsat) to satisfy these goals, harmonizing multiple international sources of data can provide a cost-effective pathway to such a “30-m MODIS” capability. The Sentinel-2 (ESA) and Landsat (NASA/USGS) are complementary systems, with similar spectral bands and spatial resolution. Work by NASA GSFC, ARC, and University of Maryland has created a processing chain to create harmonized surface reflectance time series using data from both sensors. The processing chain applies a common atmospheric correction based on the MODIS MCD09 approach, and corrects for differences in view angle, spectral bandpass, and gridding. These harmonized 30-m reflectance products can be used to monitor field-scale agricultural productivity and crop type in support of the GEO Global Agricultural Monitoring (GEO-GLAM) initiative.