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The Landsat Phenology Study (LaPS): Preliminary CONUS Results for 2008

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Most studies of land surface phenology (LSP) have used time series derived from moderate spatial resolution satellite sensor data (e.g. AVHRR, MODIS, VEGETATION) because these data are freely available and because they provide an acceptable trade-off between higher, near daily, temporal frequency of observation needed to reduce cloud contamination against lower (500m-5km) spatial resolution. The recent opening of the USGS Landsat archive to web-enabled access presents the opportunity to explore how well Landsat time series can portray LSPs at high spatial resolution. The NASA Web-enabled Landsat data (WELD) project (http://landsat.usgs.gov/WELD.php) has produced 30m composited mosaics for all the conterminous US (CONUS) from Landsat 7 ETM+ data. The composited mosaics are generated on monthly, seasonal, and annual basis and include spectral reflectance, normalized difference vegetation index (NDVI), and the acquisition date of each composited pixel. The WELD compositing approach is designed to select valid land surface observations with minimal cloud, snow, and atmospheric contamination. We extracted 30m pixel time series from the twelve monthly WELD composited mosaics for 2008 at 320 locations across the CONUS where we have ground phenological observations that are heterogeneous with respect to the types of plants observed, the phenophases recorded (predominantly spring green-up) and the ground sampling protocols used. The ground data came from several sources, including the cloned lilac/honeysuckle network, the Phenocam network, five LTER sites (H.J. Andrews, Harvard Forest, Jornada, Konza Prairie, and Sevilleta), and a private woodlot in Maine. Temporal profiles of the 30m WELD Landsat NDVI, the green NDVI (GNDVI), the normalized difference infrared index (NDII) derived from the composited reflectances, are compared to the ground observations. Results show that (i) inclusion of the Landsat acquisition date for each pixel improves the characterization of the LSP, (ii) the use of the NDII and GNDVI in conjunction with the NDVI improves identification of the onset both of canopy development and senescence, and (iii) the WELD compositing approach and the resulting mosaics provide a rich new data source for phenological investigations.