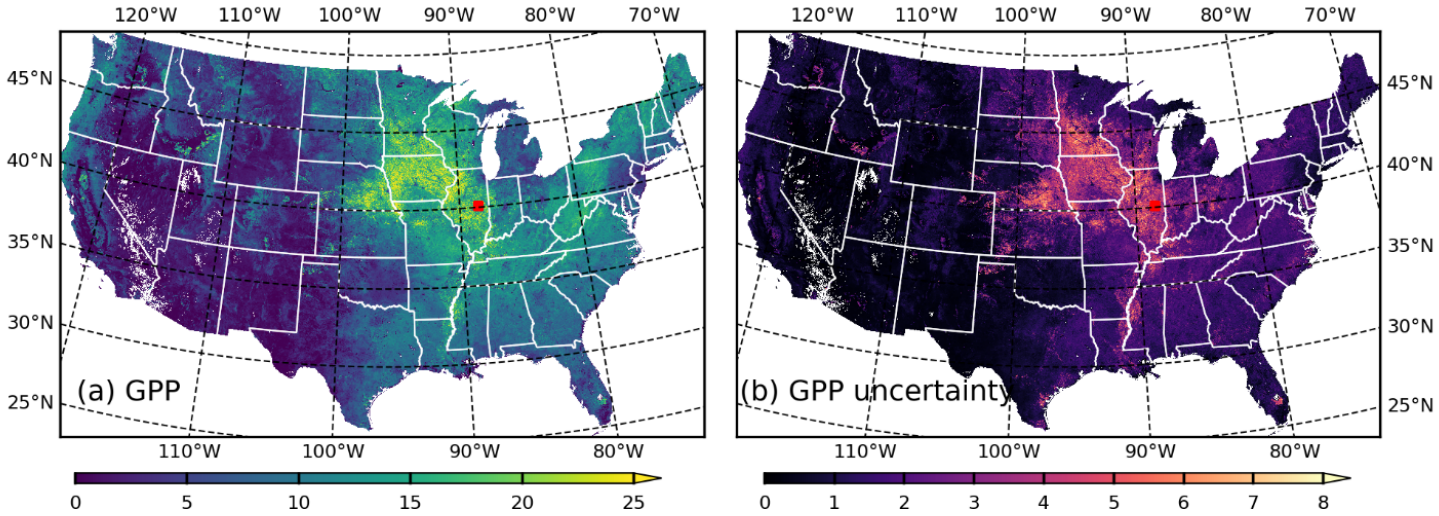
BRC Science Highlight
March 2021

A Daily, 250 M and Real-Time Gross Primary Productivity Product (2000-Present) Covering the Contiguous United States

Objective

Gross primary productivity (GPP) is the amount of carbon dioxide fixed by plants via photosynthesis. Although GPP is a key metric for describing terrestrial ecosystems, a product for real-time, observation-based GPP estimates at high resolution is lacking. Researchers addressed this gap by developing the SatelLite Only Photosynthesis Estimation (SLOPE) GPP product, described here.



Spatial distribution (250 m resolution) of (a) GPP (gC m^{-2} d^{-1}) and (b) GPP uncertainty (gC m^{-2} d^{-1}) across the contiguous United States on July 10, 2020.

Approach

- SLOPE estimates photosynthetically active radiation (PAR) by coupling machine learning models with MODIS atmosphere and land products.
- SLOPE calculates gap-free soil-adjusted near-infrared reflectance of vegetation (SANIRv) from MODIS surface reflectance data.
- SLOPE predicts C4 crop dynamics by coupling temporal pattern recognition with a long-term cropland data layer product.

Results

- SLOPE has higher spatial (250 m vs. >500 m) and temporal (daily vs. 8 d) resolution, and higher instantaneity (1 d vs. >2 weeks) than previously available products. SLOPE also incorporates per-pixel uncertainty, where previous products included no uncertainty information.
- SLOPE explained 85% of spatiotemporal GPP radiation from 49 AmeriFlux eddy-covariance sites. The median R^2 for C4 plants was 0.94.

Significance

The SLOPE tool improves GPP monitoring and shows great potential to help researchers better understand carbon cycling, land management, and water and soil health in agricultural ecosystems.

Jiang et al., 2021. "A Daily, 250 M and Real-Time Gross Primary Productivity Product (2000-Present) Covering the Contiguous United States." Earth System Science Data. DOI: 10.5194/essd-13-281-2021.

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