Cropland carbon uptake delayed and reduced by 2019 Midwest floods

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L. He, R. Jeyaram, V. Humphrey, T. Gerken, S. Feng, J.P. Digangi, C. Frankenberg (2020)

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Science Question

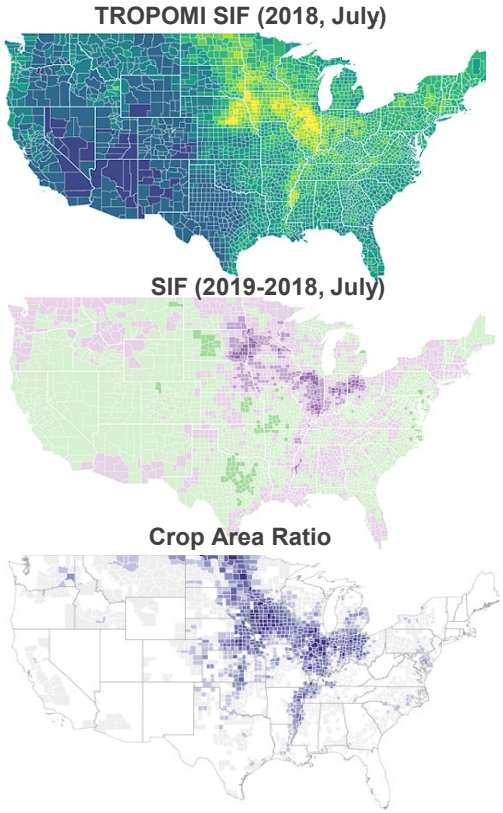
- What are the impacts of the 2019 Midwest floods on cropland carbon cycle?
- Do solar-induced chlorophyll fluorescence (SIF) and atmospheric CO_2 observations provide consistent information?

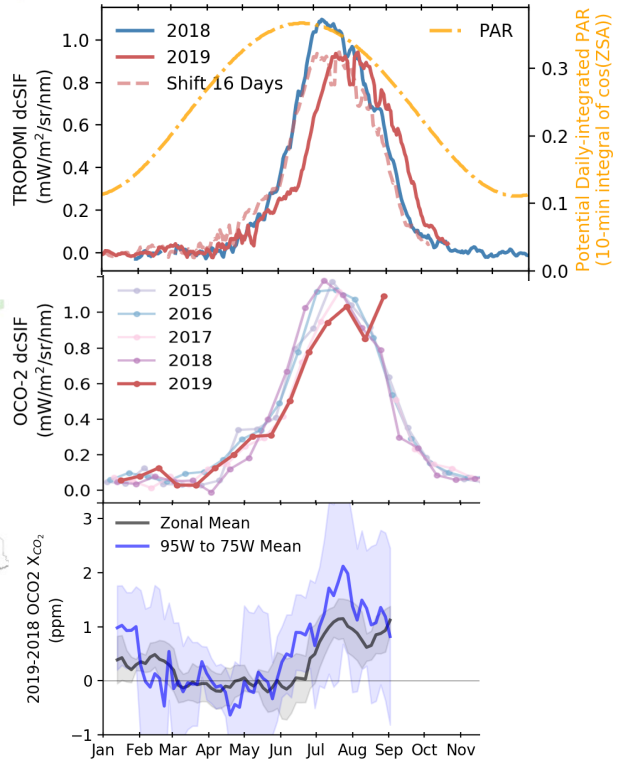
Analysis

- SIF observations from TROPOMI & OCO-2
- Atmospheric CO_2 observations from OCO-2 & ACT-America aircraft campaign
- GPP estimates inferred from SIF
- Atmospheric Transport Model to connect carbon fluxes with CO_2 concentrations

Results

- Flood-induced delay in planting delayed the 2019 SIF seasonal cycle by ~16 days
- Growing season SIF indicates a 15% reduction in the 2019 Midwest crop productivity
- A ~100 million-ton reduction in net ecosystem uptake during June and July (equiv. to 70% of monthly US fossil fuel emissions) is consistent with observed atmospheric CO_2 enhancement





Significance

- Shows a method to reconcile bottom-up SIF-based and top-down CO_2-based estimates of carbon cycle anomalies
- Demonstrates our ability to monitor regional carbon cycle anomalies in near-real-time, which can benefit future ecological forecasting efforts