2.007 Impact of severe drought on photosynthesis, isoprene emission and atmospheric formaldehyde in the Missouri Ozarks.

Early Career Scientist

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Abstract:

Isoprene plays a critical role in air quality and climate. Photosynthesis and formaldehyde (HCHO) both hold quantitative information on isoprene emission at large spatiotemporal scales, but neither is a perfect proxy due to their different responses to meteorology. Here, we apply multiple observational data sets: satellite-based solar-induced chlorophyll fluorescence (SIF), flux-derived gross primary productivity (GPP), in-situ measured isoprene emission, and four satellite-based tropospheric HCHO column products to examine the impact of water deficit on the three interlinked processes during the 2012 severe central U.S. drought. At the Missouri Ozarks site (38.74°N, 92.20°W), the 2012 July-to-August SIF, GPP and isoprene emission show substantial reductions of 26%, 80% and 60%, respectively, relative to climatological year values. For the four satellite HCHO products, no concomitant reduction was observed. Possible reasons for the decoupling of isoprene emission and HCHO columns in drought conditions may include: high temperatures accelerate the HCHO production despite less isoprene precursor; lack of precipitation reduces scavenging of reactive oxidants and nitrogen oxides thus facilitating HCHO formation; large retrieval uncertainties result in insensitiveness of vertical column concentration to surface perturbation. Our results suggest that satellite HCHO column is not a good proxy for surface isoprene emission under severe drought conditions.