National Aeronautics and Space Administration
Jet Propulsion Laboratory
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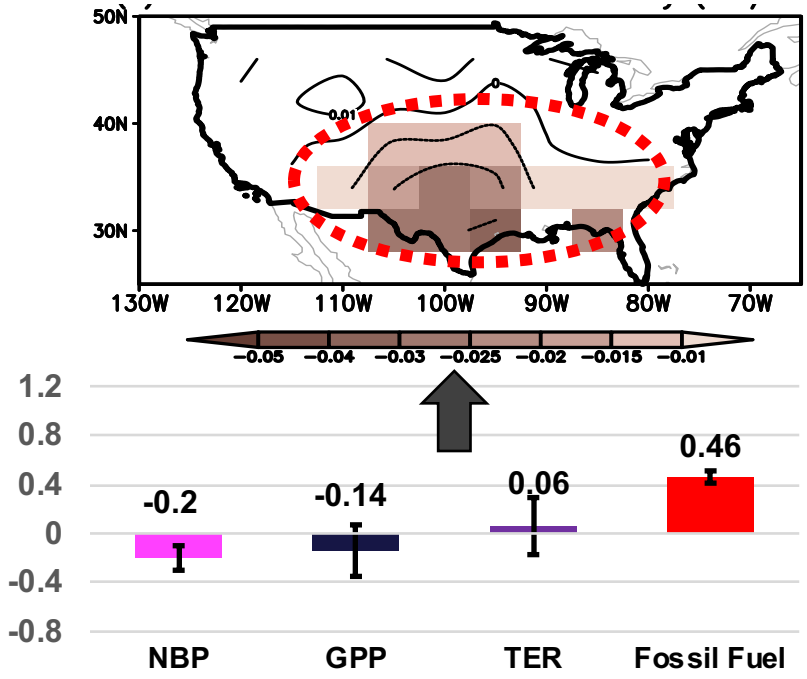
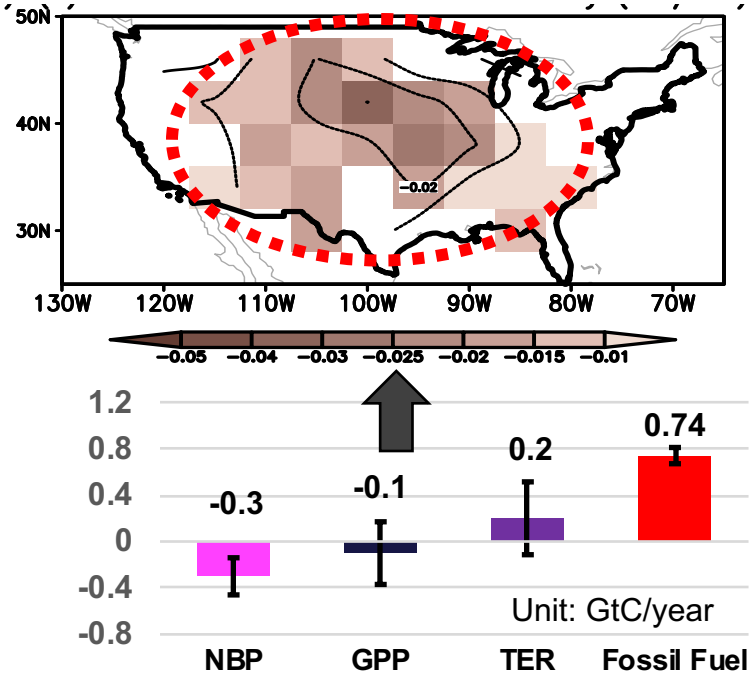
Detecting drought impact on terrestrial biosphere carbon fluxes over contiguous US with satellite observations

Liu, J. et al. (2018), Environ. Res. Lett., **13** 095003

2011 mean soil moisture anomaly



2012 mean soil moisture anomaly



Brown color indicates drought impacted region.

Biosphere carbon flux anomalies from drought in comparison to regional fossil fuel emissions.

Science Question: The 2011 dry spell in Texas was the worst one-year period of drought since 1895, and the area span of 2012 summer drought was comparable to the dust bowl era. Liu et al addressed the following questions: 1) What are the impacts of these two severe droughts on terrestrial biosphere net biosphere production (NBP)? 2) what are the driving processes (growth vs. decomposition)? 3) How significant of the biosphere flux anomaly relative to regional fossil fuel emissions?

Data and Results: We used NASA CMS-Flux inversion system to infer monthly NBP and GPP from GOSAT B7.3 xCO2 and Solar induced fluorescence (SIF) over 2010-2015, calculating TER as a residual. Over the drought impacted region, the annual NBP decreased by 0.2 ± 0.1 GtC and 0.3 ± 0.16 GtC respectively in 2011 and 2012, equal to 40% of the mean fossil fuel emission over these regions. About half of the NBP reduction was due to a decrease of GPP, and the other half was due to an increase of respiration.

Significance: The large magnitude of natural biosphere carbon flux anomalies relative to regional fossil fuel emissions indicate that any mitigation policy to reduce regional contributions to atmospheric CO_2 growth needs to consider the interannual variability and long-term trend of the natural carbon cycle.