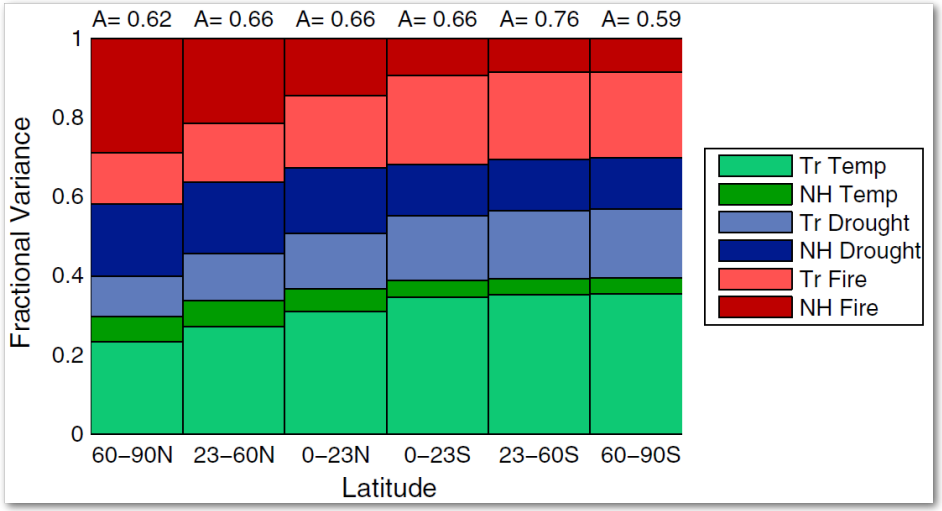
Quantifying Drivers of CO_2 Interannual Variability

Objective:
Quantify the contributions of known drivers of interannual variability in the growth rate of atmospheric carbon dioxide (CO_2).

Approach:
We examined how the temporal evolution of CO_2 in different latitude bands may be used to separate contributions from temperature stress, drought stress, and fire emissions to CO_2 variability.

Results/Impacts:



Relative contributions to the simulated variability in atmospheric CO_2 in different latitude bands (x axis) from net ecosystem exchange responses to temperature, drought stress, and fire emissions originating from the tropics and Northern Hemisphere.

- Net ecosystem exchange (NEE) responses to temperature, drought, and fire emissions all contributed significantly to CO_2 variability; no single mechanism was dominant.
- Combined, drought and fire contributions to CO_2 variability exceeded direct NEE responses to temperature in both the Northern and Southern Hemispheres.
- Accounting for fires, the sensitivity of tropical NEE to temperature stress decreased by 25% to 2.9 ± 0.4 Pg C yr^{-1} K^{-1}.
- Results will inform the improvement of the representation of terrestrial ecosystem processes in Earth system models.

Keppel-Aleks, Gretchen, Aaron S. Wolf, **Mingquan Mu**, Scott C. Doney, Douglas C. Morton, Prasad S. Kasibhatla, John B. Miller, Edward J. Dlugokencky, and **James T. Randerson** (2014), Separating the Influence of Temperature, Drought, and Fire on Interannual Variability in Atmospheric CO_2. *Global Biogeochem. Cycles*, 28(11):1295–1310. doi:10.1002/2014GB004890.