What is the spatial and temporal coherence of flux tower signals?

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We address two broad questions. First, what are the CO_2 fluxes from temperate North America and Europe? Second, what processes drive variations in CO_2 flux strengths? To address these questions, we propose the following hypotheses regarding ecosystem model residuals (observed flux minus modeled flux):

Hypotheses:

i Model residuals show a statistically-significant autocorrelation in space and time.

ii Seasonally-averaged residual variograms are characterized by isotropic behavior.

iii Seasonally-averaged residual variograms show positive correlation between distance and variance.

iv Residuals will show positive correlation to observed long-term soil moisture levels, autumn air temperature, and leaf area index (LAI).

Methods: To evaluate these hypotheses, we will assimilate CO_2 and meteorological driver data from flux tower sites across the Continental USA, Canada, and Europe into the SiB-CASA ecosystem model. The optimized model will generate CO_2 fluxes for the tower sites. The residuals will be used to evaluate i, ii, iii, and iv.

Key Conclusions: If valid, i, ii, and iii obtain error covariance matrices for SiB-CASA. This will provide new information to efforts to quantify regional CO_2 fluxes. Failure of flux tower data to support i would indicate that flux tower signals provide little information beyond the limited area of direct observation. This result implies that the current flux tower network does not adequately constrain regional CO_2 fluxes.

Initial Sites Included: US-PFa, US-WCr, US-Los, US-Syl, US-Ho1, US-Ha1, US-UMB, US-MMS. Will later expand analysis to include temperate USA, Canada, and Europe.

Rules applied for co-authorship: Intellectual input will govern co-authorship.