PROPOSAL FOR FLUXNET SYNTHESIS PUBLICATION

Initial coordinators: Eli Melaas[1], Mark Friedl[1], Jin Hongxiao[2], Lars Eklundh[2], Andrew Richardson[3]

Affiliations:
[1] Boston University
[2] Lund University
[3] Harvard University

DATASET PROPOSED

LaThuile Access

TITLE OF PAPER AND OUTLINE

Improving Estimation of Growing Season Length using MODIS and FLUXNET

In forested ecosystems the "growing season length" (GSL) is the time period during which leaves complete a single ontogenetic cycle and the canopy is photosynthetically active. In deciduous forests, the GSL strongly controls net annual productivity while the appearance of leaves significantly influences biosphere-atmosphere feedbacks in the climate system (Baldocchi et al. 2001; Peñuelas et al. 2009). Meanwhile, the GSL and carbon uptake period in coniferous forests largely corresponds with the timing of freeze-thaw cycles of air and soil temperature. As such, temporal trends in the GSL serve as an excellent indicator of climate change.

The GSL can be accurately measured by visual observation, though only across a relatively small spatial footprint. Alternatively, the GSL can be approximated and scaled across larger footprints (~1km) using time series of net or gross fluxes of CO_2. Additionally, remotely sensed vegetation indices such as the normalized difference vegetation index (NDVI) exhibit strong seasonality and are valuable tools for estimating the GSL across regional to continental scales.

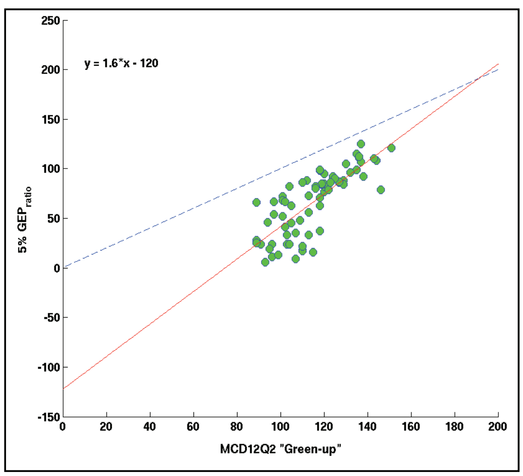

Figure 0 Significant offset between dates of onset of springtime photosynthesis and predicted dates for start of growing season according to MODIS Land Cover Dynamics algorithm (median of 9x9 window) across La Thuile evergreen needleaf sites. (R^2 = 0.60) [Melaas et al., unpublished]

However, while most current satellite phenology algorithms are able to capture broad spatial scale patterns of the start and end of the growing season, their estimations are either significantly biased (see Figure 1) or do not correspond well interannually with surface observations. This result occurs, in part, because the algorithms were designed to detect phenological changes similarly across all land cover types and climate regions whereas, realistically, each land cover type exhibits different patterns of seasonality in both satellite-derived reflectance and CO_2 flux measurements. In particular, it is necessary to explore and develop methods for detecting phenological metrics specific to known pairings of biome and climate (e.g., boreal conifer vs. warm temperate deciduous). Hence, we propose to use time series of CO_2 fluxes to calibrate and test novel phenology algorithms derived from MODIS satellite data and compare their accuracy with other existing schemes.

Once we have established an effective model for each climate-biome pairing, we will use MODIS' 11-year time series to determine spatial and temporal trends in the GSL across continental scales.

PROPOSED SITES TO BE INVOLVED

We will focus primarily on data from forested (both conifer and deciduous) sites (i.e., sites with pronounced seasonality in carbon fluxes). To analyze both interannual and spatial patterns, we will emphasize sites for which 4 or more years of good-quality data are available between 2000 and 2006 (corresponding period for which MODIS data is also available).

PROPOSED RULES FOR CO-AUTHORSHIP

All data contributors making and intellectual contribution will be included as named coauthors. Data contributors not making an intellectual contribution will be included as group coauthors in the author list, if possible with the journal. Group coauthors will be identified by name in the acknowledgements. We will circulate a summary of initial findings to all data providers and solicit feedback; this will be followed by a draft manuscript, which we will also circulate for feedback. Data providers who have contributed intellectually and who will be included as coauthors will be sent the final version of the manuscript prior to journal submission.

REFERENCES

Baldocchi, D., Falge, E., Gu, L.H., Olson, R., Hollinger, D., Running, S., Anthoni, P., Bernhofer, C., Davis, K., Evans, R., Fuentes, J., Goldstein, A., Katul, G., Law, B., Lee, X.H., Malhi, Y., Meyers, T., Munger, W., Oechel, W., U, K.T.P., Pilegaard, K., Schmid, H.P., Valentini, R., Verma, S., Vesala, T., Wilson, K., & Wofsy, S. (2001). FLUXNET: A new tool to study the temporal and spatial variability of ecosystem-scale carbon dioxide, water vapor, and energy flux densities. Bulletin of the American Meteorological Society, 82, 2415-2434

Penuelas, J., Rutishauser, T., & Filella, I. (2009). Phenology Feedbacks on Climate Change. Science, 324, 887-888