PROPOSAL FOR FLUXNET SYNTHESIS

**Initial proposers:** Myroslava Khomik[1], Markus Reichstein[1], Marion Schrumpf[1]

**Initial co-workers needing access to data:** Christian Beer[1], Ivan Janssens[2], Jorge Curiel Yuste[3], Sebastiaan Luyssaert[2], Susan Trumbore[2], Thomas Wutzler[1]

**Affiliations:**
[1] Max-Plank Institute for Biogeochemistry, Jena, Germany
[2] Department of Biology, University of Antwerp, Belgium
[3] CREAF, Universitat Autònoma de Barcelona, Spain

TITLE OF PAPER AND OUTLINE

# Analysis of across-site variability of carbon-flux and -pool relations (e.g. turnover times) derived from chamber and eddy covariance based measurements as affected by climate, vegetation and other factors.

**Outline:**

In this synthesis paper we propose to answer the following questions:

1. Does soil organic matter (SOM) decay constant (or its inverse, the SOM residence time) vary spatially:
    a. across different climate zones
    b. between different vegetation and
    c. soil types
2. What environmental factors can explain some of this spatial variability (considering: climate, edaphic conditions, and vegetation)

The goal of this study is to derive, as an overall ecosystem diagnostic , the relationships between carbon fluxes and pools within the whole ecosystem and possibly within different compartments (e.g. litter, mineral soil). We hope to substantially improve the study by Sanderman et al (2003), where eddy flux measurements were used to derive SOM decay constants, which were then related to variability in mean annual air temperature and precipitation. In that study, SOM decay constant, k, was derived for several forested sites as the ratio between total annual soil heterotrophic respiration (Rh) and soil organic carbon content (SOC), assuming steady state conditions. Rh was derived from eddy covariance measurements, while SOC was derived from global soil maps. However, since the publication of that paper, monitoring of soil respiration and of its components across the globe has increased. At many flux sites, soil respiration is now often monitored with chambers. At some of these sites, soil heterotrophic respiration is also measured, directly or indirectly (i.e. via trenching or girdling experiments). Furthermore, the soil at these sites is analyzed for soil carbon content, in some cases at different soil depths. Therefore, we would like to make use of this more comprehensive data. We would like to

compute k or related diagnostics from more direct measurements of Rh and SOC across a number of sites located in different climate zones and ecosystem types. Finally, once the values are computed, we would use multivariate statistical analysis to see how the different k values vary among climate zones, ecosystem types, within the soil profile, and if any of the observed variability can be related to climatic, edaphic or physiological variables (i.e. temperature, moisture, soil texture, nutrients, species composition).

The results of this proposed study would benefit those trying to create and improve models on soil carbon dynamics by providing empirical constraints on the models. This synthesis would also add to our understanding of spatial variability of SOC dynamics and controls, helping to improve and/or direct future studies on soil carbon cycling.

**Sites involved:** All sites containing at least one year of respiration measurements. For soil respiration measurements, total and heterotrophic respiration from autochambers, or manual chamber measurements collected at least monthly throughout the year are desirable, as well as measurements of soil carbon and ancillary data.

**Rules for Co-authorship:** The rules of the FLUXNET synthesis terms of reference apply. For this study additional data (such as soil pools, respiration measurements, etc.) will be needed. Since the thorough collection and consolidation of such data involves considerable additional intellectual input, and will need discussion and interpretation at a site level basis, we will consider collaborators as co-authors, usually one per site, but in well justified cases also more.

**Reference:** Sanderman J., Amundson R.G., Baldocchi D. (2003) Application of eddy covariance measurements to the temperature dependence of soil organic matter mean residence time. *Global Biogeochemical Cycles*, 17: doi: 10.1029/2001GB001833.