



## **On the coupling of plant productivity and soil respiration across space and time scales**

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The aim of this study was to analyze the role of plant productivity on the variability of soil respiration (SR) across sites (spatial variability) and the variability of soil respiration (SR) within-site at the seasonal and short-time (diel) temporal scales. The influence of productivity over soil respiration (SR) was studied on a wide range of ecosystems with continuous data series of soil respiration (hourly/half-hourly), soil moisture and soil temperature, and ecosystem gross primary productivity (GPP). We used a multiple linear regression (MR) to: 1. Study whether adding productivity (Biotic Model, BM) would increase the goodness of fit (Akaike information coefficients, AIC) obtained for an Abiotic Model, AM (temperature and moisture) at three scales (across-sites, seasonal and diel); and 2. To understand the relative role of productivity with respect to climate ([U+F062] coefficients) to explaining SR variability across scales. Across sites, canopy photosynthesis was the best single factor explaining spatial variability of monthly/annual SR averages over moisture or temperature, which confirms the important role of plant productivity on modeling SR at larger spatial and temporal scales. Within sites seasonal evolution of SR appeared to be more coupled to climate than to productivity, which typically lagged before/after SR in the season. However, seasonal SR variations were better explained when including recent-days and/or same-day productivity, which confirm the important role of plant productivity as supplier of recently synthesized photosynthates to belowground organs. Diel variations in SR, which were defined as the amplitude of the diel change in SR with respect to temperature (diel Q10) were again well explained by abiotic factors. However the goodness of fit increased when adding same-day productivity to AM, confirming that leaves were fast and consistently communicating with the root zone on the scale of hours. Hence, our results indicate that while productivity is indeed affecting variations of SR beyond climate, the magnitude of this biotic effect differed strongly across scales. It is also likely that the biotic effect of plants over SR respond to different mechanisms depending on the scale at which the process were study.