Geophysical Research Abstracts,
Vol. 10, EGU2008-A-09580, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-09580
EGU General Assembly 2008

Influence of tree height on the carbon isotopic discrimination of canopy photosynthesis in southeastern US pine forest ecosystems

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Intensive investigations of carbon and water exchange in highly productive pine forests in the Southeastern US are restricted to a limited numbers of locations that are equipped with eddy covariance towers. These towers are mostly located within homogenous stands. However, the southeastern pine forests are composed of plantations of different ages/heights that are interlaced with hardwood forests. We examined trends in canopy foliage bulk organic matter ^{13}C, leaf wax ^{13}C and the ^{13}C of foliage respired CO_2 as a function of tree height at the Ameriflux tower site in Gainesville, FL, a slash pine ecosystem. Sampled tree heights ranged from 5 to 25 meters along the transect, characteristic of pine plantations within this region. A highly significant positive correlation was observed between tree height and the ^{13}C of foliage bulk organic matter. Leaf wax ^{13}C mirrored the trend observed in foliage respired CO_2 and bulk organic matter, with approximately a -3 per mil offset from foliage respired CO_2. Point measurements of upper-crown light-saturated net photosynthesis rate were not correlated with height, but were likely confounded by water stress effects. Research in other forest ecosystems has demonstrated tree height effects on hydraulics and leaf gas exchange, but these effects have not been explored in southern pines. These data suggest that southern pine hydraulics and leaf gas exchange may be influenced by tree

height, and that scaling of isotopic data in these forests will require careful consideration of age and height variation.