Poster #69

Does Vapor Pressure Deficit Drive the Seasonality of $\delta^{13}C$ of the Net Land-Atmosphere CO_2 Exchange Across the United States?

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The seasonal pattern of the carbon isotope content ($\delta^{13}C$) of atmospheric CO_2 depends on local and non-local land-atmosphere exchange and atmospheric transport. Previous studies suggested that the $\delta^{13}C$ of the net land-atmosphere CO_2 flux (δ_{source}) varies seasonally as stomatal conductance of plants responds to vapor pressure deficit of air (VPD). We studied the variation of δ_{source} at 7 sites across the United States representing forests, grasslands, and an urban center. Using a 2-part mixing model, we calculated the seasonal δ_{source} for each site after removing background influence and, when possible, removing $\delta^{13}C$ variation of non-local sources. Compared to previous analyses, we found a reduced seasonal (April-September) variation in δ_{source} at the forest sites (0.5‰ increase). This small variation did not reflect the significant seasonal changes in VPD at these sites, providing evidence that stomatal response to VPD was not a dominant influence on the $\delta^{13}C$ of land-atmosphere exchange in these forests, and unlikely to the be the cause of the global, coherent seasonal cycle in atmospheric δ13C. In contrast to the forest sites, grassland and urban sites had a larger seasonal variation in δ_{source} (5‰) dominated by seasonal transitions in C_3/C_4 grass productivity, and in fossil fuel emissions, respectively. Our findings were sensitive to the location used to account for atmospheric background variation within the mixing model method that determined δ_{source}. Special consideration should be given to background location depending on whether the intent is to understand site level dynamics or regional scale impacts of land-atmosphere exchange.