Plant wax integration and transport from the Mississippi River Basin to the Gulf of Mexico inferred from GIS-enabled isoscapes and mixing models

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Understanding the fate of terrestrial plant waxes from source to sink is critical for improving paleoclimate interpretations from sedimentary plant waxes. This study investigated the vegetation and climatic controls on plant wax integration and transport from the Mississippi River Basin (MRB), the largest river in the U.S., to the Gulf of Mexico (GOM). We first estimated the geographic distribution of *n*-alkane carbon ($\delta^{13}C_{alk}$) and hydrogen ($\delta^{2}H_{alk}$) isotopic compositions (i.e. isoscapes) in the MRB using plant isotope fractionation calibrations from North America and similar climate regions for the pre-industrial. Then, we developed mixing models weighting the isotope values by biological and climatic parameters (i.e. vegetation area, n-alkane production by chain lengths, net primary productivity (NPP), and runoff) to test the sensitivity of basin-integrated plant wax isotopic compositions to these variables. Vegetation area weighting alone predicted relatively high C_4 plant contributions to the pool of waxes exported from the basin. When production, NPP, or runoff was considered, the contribution of forest-derived plant waxes increased. Sensitivity of plant wax isotopic compositions to productivity and transport efficiency varied among models and chain lengths. For example, *n*-C_{29} alkanes were sensitive to plant wax contribution increases from forests whereas *n*-C_{33} alkanes were more sensitive to increases in C_4 grassland productivity. Despite large differences in $\delta^{13}C_{alk}$ and $\delta^{2}H_{alk}$ values across the MRB, variation in the predicted $\delta^{13}C$ and $\delta^{2}H$ of exported *n*-alkanes is small across all models. This small range is consistent with a predominance of plant wax export from wet and tree-dominated biomes and suggests that drier and C_4 grass-dominated biomes may be under-represented in the sedimentary plant wax record.