

Publication

Rapid atmospheric transport and large-scale deposition of recently synthesized plant waxes

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Sedimentary plant wax H-2/H-1 ratios are important tools for understanding hydroclimate and environmental changes, but large spatial and temporal uncertainties exist about transport mechanisms from ecosystem to sediments. To assess atmospheric pathways, we collected aerosol samples for two years at four locations within a similar to 60 km radius in northern Switzerland. We measured n-alkane distributions and H-2/H-1 ratios in these samples, and from local plants, leaf litter, and soil, as well as surface sediment from six nearby lakes. Increased concentrations and H-2 depletion of long odd chain n-alkanes in early summer aerosols indicate that most wax aerosol production occurred shortly after leaf unfolding, when plants synthesize waxes in large quantities. During autumn and winter, aerosols were characterized by degraded n-alkanes lacking chain length preferences diagnostic of recent biosynthesis, and H-2/H-1 values that were in some cases more than 100 parts per thousand higher than growing season values. Despite these seasonal shifts, modeled deposition-weighted average H-2/H-1 values of long odd chain n-alkanes primarily reflected summer values. This was corroborated by n-alkane H-2/H-1 values in lake sediments, which were similar to deposition-weighted aerosol values at five of six sites. Atmospheric deposition rates for plant n-alkanes on land were similar to 20% of accumulation rates in lakes, suggesting a role for direct deposition to lakes or coastal oceans near similar production sources, and likely a larger role for deposition on land and transport in river systems. This mechanism allows mobilization and transport of large quantities of recently produced waxes as fine-grained material to low energy sedimentation sites over short timescales, even in areas with limited topography. Widespread atmospheric transfer well before leaf senescence also highlights the importance of the isotopic composition of early season source water used to synthesize waxes for the geologic record. (C) 2017 Elsevier Ltd. All rights reserved.

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