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Aerodynamic Canopy Height: A Simple Metric for Temporal Dynamics of Canopy Heights Derived with Eddy Covariance Momentum Data Collected Across North American Flux Networks

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The networks of eddy covariance tower sites (e.g., AmeriFlux, European Flux Networks, AsiaFlux) have collected ~10^8 hours of momentum flux and wind statistics data worldwide. We present the first synthesis utilizing this abundant data set and demonstrate how a simple flux-derived metric— aerodynamic canopy height—can be calculated and used to infer the variation of canopy heights from site to site and from time to time. Testing across 74 forest sites from the North American flux networks (~550 site-years), we show the robustness of aerodynamic canopy heights in capturing the site-to-site difference across a wide range of forest canopy heights (~1 to ~60 m). With caution, the yearly estimates could potentially be used for detecting long-term growing trends or structural changes at forest sites. At 23 cropland and grassland sites (~94 site-years), we show that the weekly aerodynamic canopy heights captured the canopy dynamics over the course of growing seasons across the majority of tested years. This suggests that aerodynamic canopy height could serve as an independent approach for tracking the seasonal dynamics of vegetation canopy, and be used to validate next generation satellite LiDAR measurements. Given the amount of momentum flux data collected and the diversity of vegetation covered by the flux networks, the flux-derived canopy heights have great potential for a variety of further applications and research.