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**How trees uptake carbon, release water and cool themselves in air: a marriage between biophysics and turbulent fluid dynamics** TIRTHA BANERJEE, RODMAN LINN, Los Alamos National Laboratory — Resolving the role of the biosphere as a terrestrial carbon sink and the nature of nonlinear couplings between carbon and water cycles across a very wide range of spatiotemporal scales constitute the scope of this work. To achieve this goal, plant physiology models are coupled with atmospheric turbulence simulations. The plant biophysics code is based on the following principles: (1) a model for photosynthesis; (2) a mass transfer model through the laminar boundary layer on leaves; (3) an optimal leaf water use strategy regulated by stomatal aperture variation; (4) a leaf-level energy balance to accommodate evaporative cooling. Leaf-level outputs are upscaled to plant, canopy and landscape scales using HIGRAD/FIRETEC, a high fidelity large eddy simulation (LES) framework developed at LANL. The coupled biophysics-CFD code can take inputs such as wind speed, light availability, ambient CO2 concentration, air temperature, site characteristics etc. and can deliver predictions for leaf temperature, transpiration, carbon assimilation, sensible and latent heat flux, which is used to illustrate the complex the complex interaction between trees and their surrounding environments. These simulation capabilities are being used to study climate feedbacks of forests and agroecosystems.

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