Role of horizontal eddy diffusivity within the canopy on fire spread

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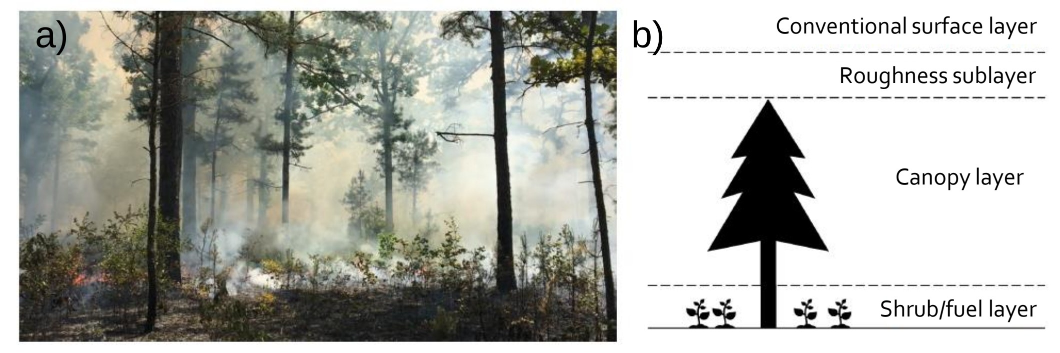


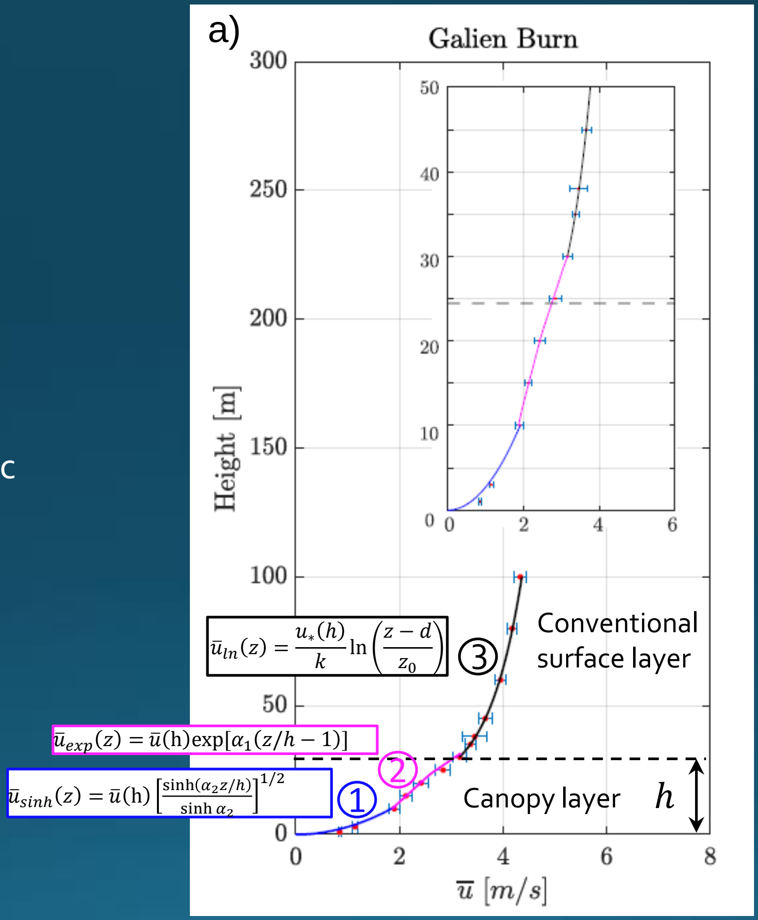
a) Photograph of the experiment site at Gallien Burn, FL. b) Schematic showing the layered structure above and within the canopy.

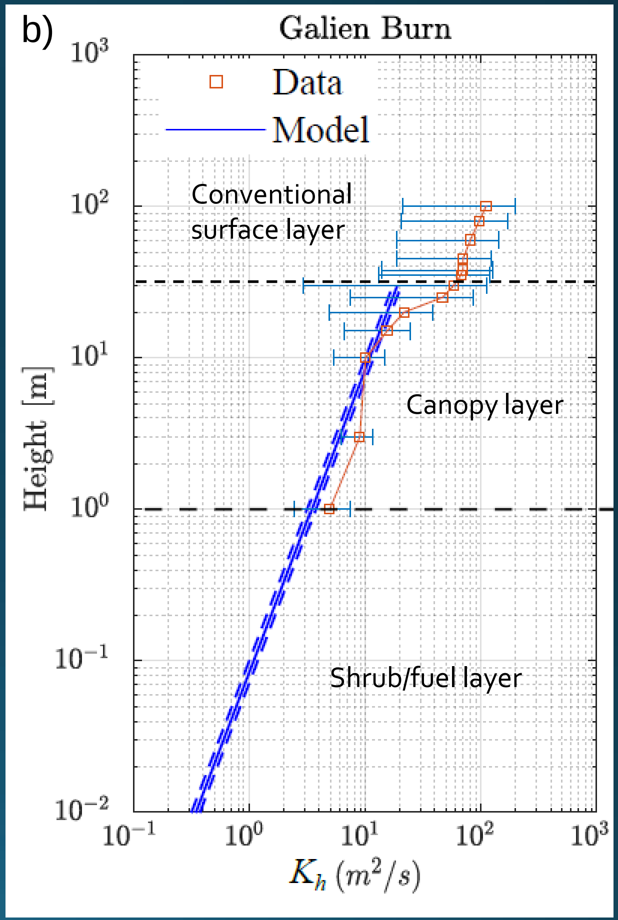
Based on the observations together with theoretical models for the mean horizontal velocity $\bar{u}(z)$ and empirical relations between mean flow and variance u', we derive the lateral diffusivity K_h using Taylor's frozen turbulence hypothesis in the thin surface fuel layer.

integral timescale — height of the canopy — const

$$K_h = T\langle u'^2 \rangle \qquad K_h(z) \sim h\beta\bar{u}(z)$$

Estimated K_h is used in a simple 1D model to predict the spread of surface fires in different wind conditions. Our results support the conceptual framework that **eddy dynamics in the fuel layer is set by larger eddies developed in the canopy layer aloft**.





a) Background mean (non-fire induced) horizontal velocity; dots show computed $\bar{u}$ from the observations. Lines indicate the different theoretical models. b) Estimates of horizontal diffusivity K_h