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Momentum Transport in Heterogeneous Forest Canopies[1]
HAWWA KADUM, RYAN SCOTT, SARAH SMITH, Portland State University, GIULIA SALMASO, University of Utah, CHAD HIGGINS, Oregon State University, RAUL CAL, Portland State University, MARC CALAF, University of Utah
— The effect of spatial heterogeneity on momentum transport in forest canopies is investigated in a series of wind tunnel experiments. Forest models of 1:200 scale were manufactured from 10 PPI reticulated foam with porosity equivalent to a LAI of 5.3. The model forest canopy consists of identical, uniformly distributed trees with spatial heterogeneity introduced via alternating patches and gaps of various sizes. Lacunarity analysis is used to quantify the heterogeneity of these arrangments. The various arrangements are then tested against surface and volume integrated terms of the momentum equation obtained using control volume analysis. Two canopy layers are considered: upper canopy above the canopy height and lower canopy below the canopy height. The lower canopy is dominated by local flow features and its response to heterogeneity is lower than the upper canopy. The upper canopy shows a significant increase in momentum advection and residual terms with increased heterogeneity. The most heterogeneous case shows an advection value that is 14 times the homogeneous case. The stress gradient term also increases with heterogeneity although the difference between upper and lower canopies is less pronounced. The stress gradient term is more influenced by the gap size.

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Hawwa Kadum
Portland State University

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