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Most of our knowledge on forest-edge flows comes from numerical and wind-tunnel experiments where canopies are horizontally homogeneous. To investigate the impact of tree-scale heterogeneities (>1 m) on the edge-flow dynamics, the flow in an inhomogeneous forest edge on Falster island in Denmark is investigated using large-eddy simulation. The three-dimensional forest structure is prescribed in the model using high resolution helicopter-based lidar scans. After evaluating the simulation against wind measurements upwind and downwind of the forest leading edge, the flow dynamics are compared between the scanned forest and an equivalent homogeneous forest. The simulations reveal that forest inhomogeneities facilitate flow penetration into the canopy from the edge, inducing important dispersive fluxes in the edge region as a consequence of the flow spatial variability. Further downstream from the edge, the forest inhomogeneities accentuate the canopy-top turbulence and the skewness of the wind-velocity components while the momentum flux remains unchanged. This leads to a lower efficiency in the turbulent transport of momentum within the canopy. Dispersive fluxes are only significant in the upper canopy. Above the canopy, the mean flow is less affected by the forest inhomogeneities. The inhomogeneities induce an increase in the mean wind speed that was found to be equivalent to a decrease in the aerodynamic height of the canopy. Overall, these results highlight the importance of forest inhomogeneities when looking at canopy–atmosphere exchanges in forest-edge regions.

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