

Supplementary Material for *Wind Extremes over Built Terrain: Characterization and Geometric Determinants*

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S1 Satellite maps for the realistic urban topography

To help better understand the digital surface maps, here we also include the satellite images downloaded from Google Map. The DSM of S_{OKC} input is rotated in our simulation but it does not affect the conclusions.



(a) Baltimore



(b) Boston



(c) Oklahoma City



(d) Vancouver

Fig. S1: Satellite maps for the 4 simulated areas

12 S2 Schematic for the simulation domain for validation

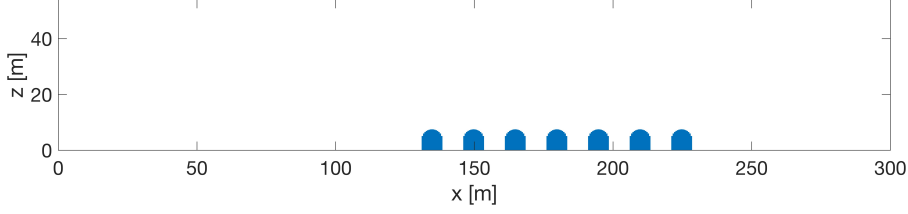


Fig. S2: Schematic for the simulation domain of the round roof case with higher resolution

13 S3 Mesh design of the four cities

14 Here we are showing the mesh setup for the four neighborhoods. Because it
 15 is the real city, we cannot ensure 6-8 grids (Tseng et al. 2006) on each edge
 16 of all the buildings, but we use different grid size based on the size of the
 17 buildings. For example, in S_{Bos} where buildings are in larger size, we used
 18 $dx \approx dy \approx dz \approx 6$ m, while in S_{Van} we used $dx \approx dy \approx dz \approx 1$ m.

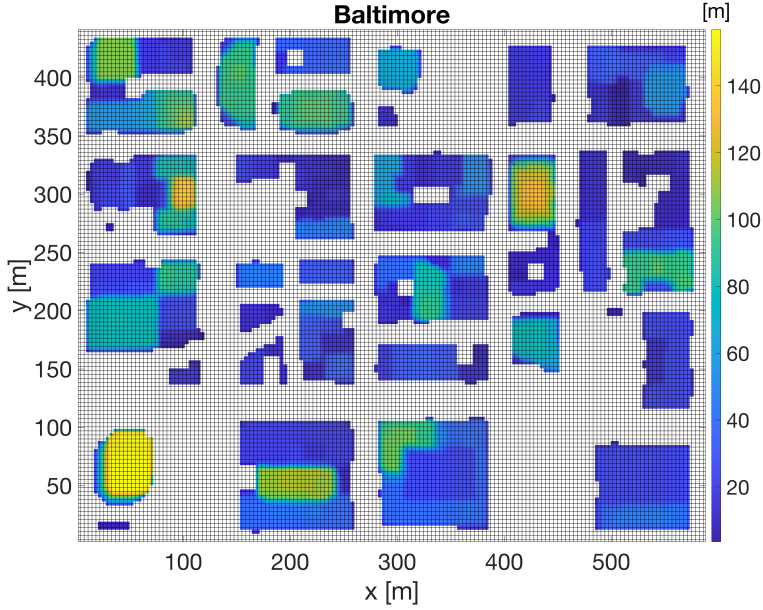


Fig. S3: The mesh design for S_{Bal}

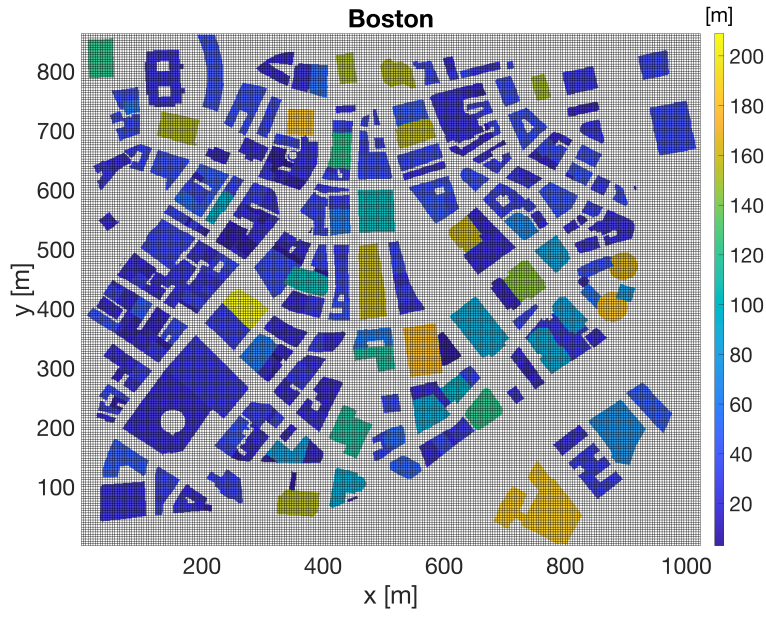


Fig. S4: The mesh design for S_{Bos}

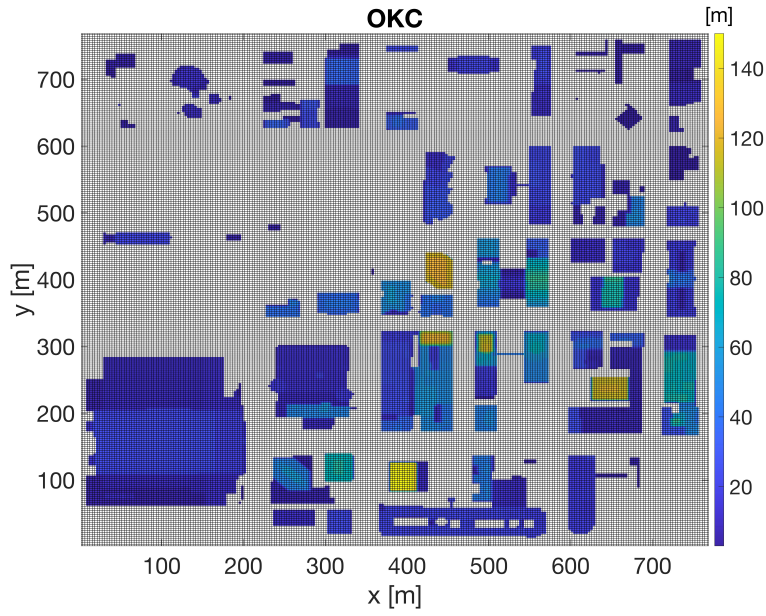


Fig. S5: The mesh design for S_{OKC}

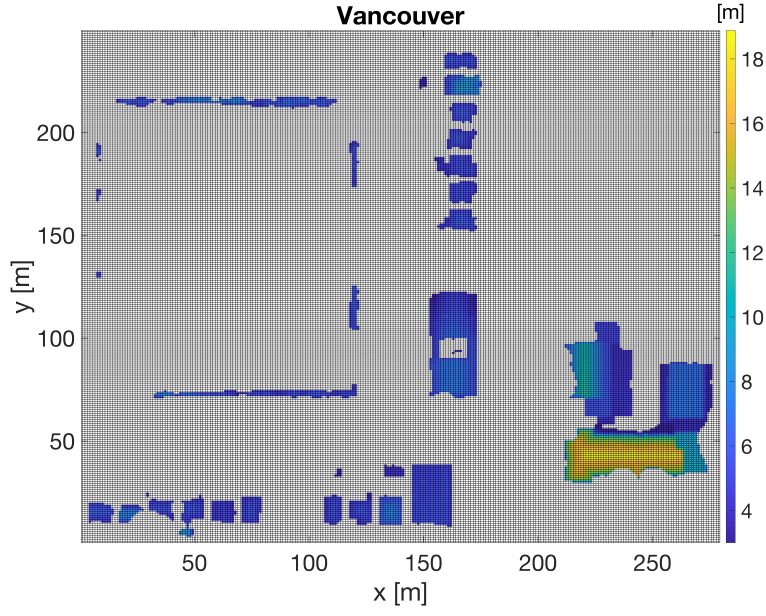


Fig. S6: The mesh design for S_{Van}

19 S4 PDF of the velocity

20 To see how the wind velocity varies in time in a real city, we collected the time
 21 series for several randomly selected grids for 30 minutes in our simulation in
 22 S_{Bal} . The PDF of the 3 velocity components generally matches the Gaussian
 23 curve well, as illustrated for the two grid point at $(x, y, z) = (100\text{m}, 70\text{m},$
 24 $20\text{m})$ and $(x, y, z) = (270\text{m}, 120\text{m}, 30\text{m})$ here.

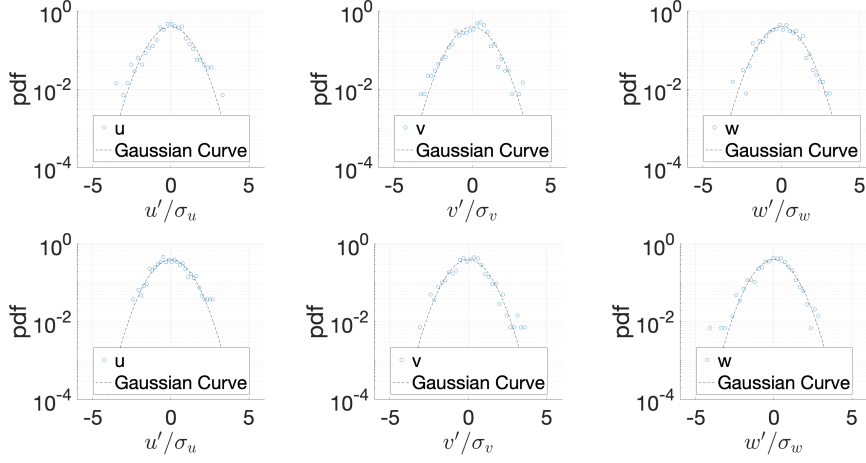


Fig. S7: The PDF of the velocity components (u, v, w). Figures in the first row are the PDF of the 3 velocity components at $(x, y, z) = (100\text{m}, 70\text{m}, 20\text{m})$, and figures in the second row are the PDF of the 3 velocity components at $(x, y, z) = (100\text{m}, 70\text{m}, 20\text{m})$

S5 The vertical structure of λ_p and λ_f

Figure S8 displays the vertical structure of λ_p and λ_f for the four neighborhoods, which are consistent with the features of building layouts for these neighborhoods: high-density, high-rise buildings in S_{Bal} and S_{Bos} giving large fractions, mid-rise buildings in S_{OKC} giving intermediate values, and sparse low-rise buildings in S_{Van} giving low values.

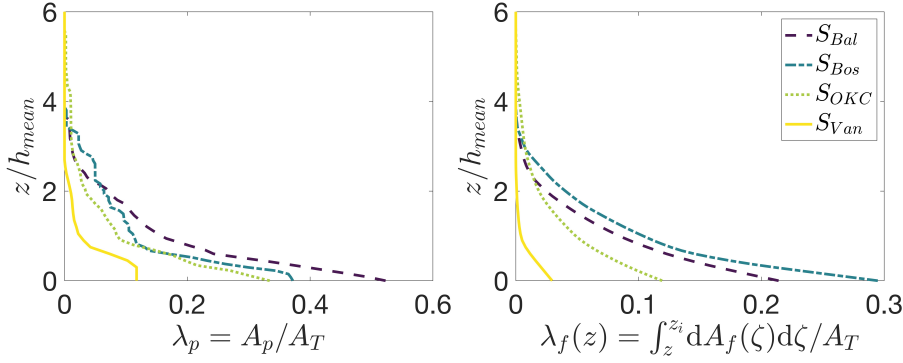


Fig. S8: The vertical profiles of λ_p and λ_f

References

Tseng YH, Meneveau C, Parlange MB (2006) Modeling flow around bluff bodies and predicting urban dispersion using large eddy simulation. *Environmental science & technology* 40(8):2653–2662, doi:<https://doi.org/10.1021/es051708m>