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Data-driven predictions of root mean square pressure fluctuations from RANS simulations[1] GIACOMO LAMBERTI, CATHERINE GORLE, Stanford University — Wind engineering applications often employ computationally efficient Reynolds-averaged Navier-Stokes (RANS) simulations, even if the turbulence models can compromise the accuracy of the prediction. Furthermore, the estimation of turbulent quantities such as fluctuating pressure loads requires additional, potentially inaccurate, models. For example, empirical models to estimate the root mean square (rms) pressure fluctuations from of the mean pressure, turbulent kinetic energy and velocity, are known to produce incorrect results on the lateral facades of tall buildings. To address this problem, we propose a data-driven approach to determine the best functional form that relates high-fidelity data of rms pressure fluctuations to time-averaged variables predicted by RANS. The high-fidelity data is obtained from large-eddy simulations or wind tunnel experiments of a tall building at different wind directions. We perform RANS simulations for the same conditions and construct features from the resulting time-averaged quantities. Then, we employ machine learning to relate these features to the available training data. We investigate the ability of the data-driven model to provide predictions for wind directions or regions of the building that were not included in the training data.

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