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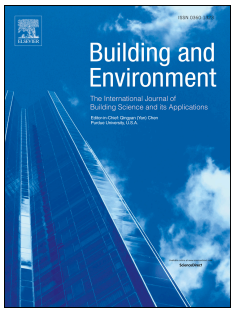

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EXPLORATION OF A LONG-TERM MEASUREMENT APPROACH FOR AIR CHANGE RATE

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KEYWORDS

Ventilation, Signal processing, Fourier Transform, Carbon dioxide (CO_2), Air leakage

ABSTRACT

Ventilation using outdoor air can have both favorable and unfavorable impacts on indoor air pollution. It also can be an important contributor to energy use in buildings. Outdoor ventilation air change rate (ACR), the rate at which outdoor air enters a building divided by its volume, is a temporally dynamic metric that can be used to characterize ventilation performance of buildings. Conventional measurement techniques for ACR have either complex or invasive experimental procedures or present a temporal snapshot of ACR. In this study, we further developed and explored a novel signal processing approach to measure yearlong time-resolved ACR in a residence using the variations in indoor and outdoor CO_2 concentrations. Results showed that ACR varies considerably over the year [geometric mean (GM) = 0.47, geometric standard deviation (GSD) = 3.44] and that the air change rates calculated from the signal processing approach were in good agreement (on average, within 13%) with those measured simultaneously from 15 hour-long decay periods. In addition, estimates of ACR are largely insensitive to the occupancy status of the building. This behavior may be because the indoor CO_2 concentration variations introduced by changes in occupancy status are not large enough to impact long-term ACR values, but they may be sufficient to impact short-term ACR values. Moreover, we anticipate that cut-off frequency and filter order, two parameters needed for the signal processing

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