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Urban ventilation corridors mapping using surface morphology data based GIS analysis

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This paper describes deriving the most appropriate method for mapping urban ventilation corridors, which, if properly designed, reduce heat stress, air pollution and increase air quality, as well as increase the horizontal wind speed. Urban areas are – in terms of surface texture – recognized as one of the roughest surfaces, which results in wind obstruction and decreased ventilation of densely built up areas. As urban heat islands, private household and traffic emissions or large scale industries occur frequently in many cities, both in temperate and tropical regions. A proper ventilation system has been suggested as an appropriate mitigation mean [1] . Two concepts of morphometric analyses of the urban environment are used on the example of Warsaw, representing a dense, urban environment, located in the temperate zone. The utilized methods include firstly a roughness mapping calculation [2] , which analyses zero plane displacement height (z_d) and roughness length (z_0) and their distribution for the eight (inter-)cardinal wind directions and secondly a grid-based frontal area index mapping approach [3] , which uses least cost path analysis. Utilizing the advantages and minimizing the disadvantages of those two concepts, we propose a hybrid approach. All concepts are based on a 3D building database obtained from satellite imagery, aided by a cadastral building database. Derived areas (ventilation corridors), that facilitate the ventilation system, should be considered by the local authorities as worth preserving, if not expanding, in order to improve the air quality in the city. The results also include designation of the problematic areas, which greatly obscure the ventilation and might be investigated as to reshape or rebuilt to introduce the air flow in particularly dense areas like city centers.

Keywords: roughness mapping; GIS; ventilation corridors; frontal area index

1. Rizwan, A. M., Dennis, L. Y., & Chunho, L. I. U. (2008). A review on the generation, determination and mitigation of Urban Heat Island. *Journal of Environmental Sciences*, 20(1), 120-128.

2. Gál, T., & Unger, J. (2009). Detection of ventilation paths using high-resolution roughness parameter mapping in a large urban area. *Building and Environment*, 44(1), 198-206.

3. Wong, M. S., Nichol, J. E., To, P. H., & Wang, J. (2010). A simple method for designation of urban ventilation corridors and its application to urban heat island analysis. *Building and Environment*, 45(8), 1880-1889.