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The variation of sky factor from urban geometry

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1. Introduction

The sky view factor (SVF) of urban surfaces has been shown to associate with microclimatic conditions such as the level of day-lighting and radiant cooling potential. The SVF contributes to the urban heat island (UHI) effect for shielding from the sky and the consequent long and short wave radiation gains and losses. It is possible to generate SVF values from the hemispherical image and a simple model. This study estimates various forms of urban geometry using a simple hemispherical image for SVF. The study demonstrates that the SVF analysis is a useful and effective tool for building designers and urban planners conducting studies on high-rise and high-density cities.

2. Sky view factor for canyon and courtyard using analytical models

Analytical models use equations and geometrical characteristics to calculate an approximate, simple, SVF. Oke[12] proposed a method to calculate SVF at the center point of a symmetric canyon of infinite length, and Johnson and Watson[3] extended the method and established expressions for nonsymmetrical canyons of finite length. Zakšek et al.[4] proposed a new relief visualization technique using sky view factor. Fig.1 and Fig.2 show the sky view factor for canyon and courtyard.

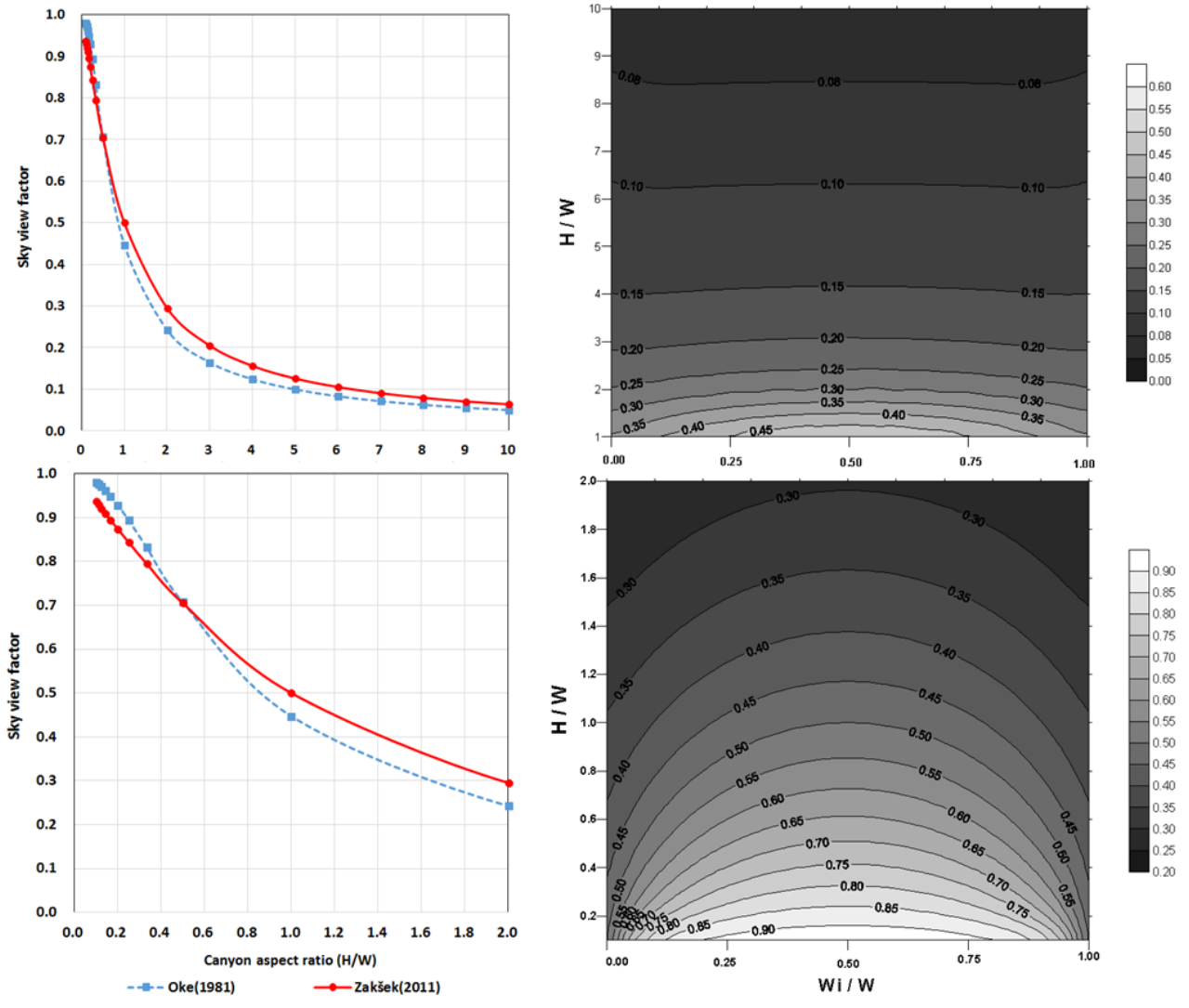

Fig. 1 Sky view factor for canyon

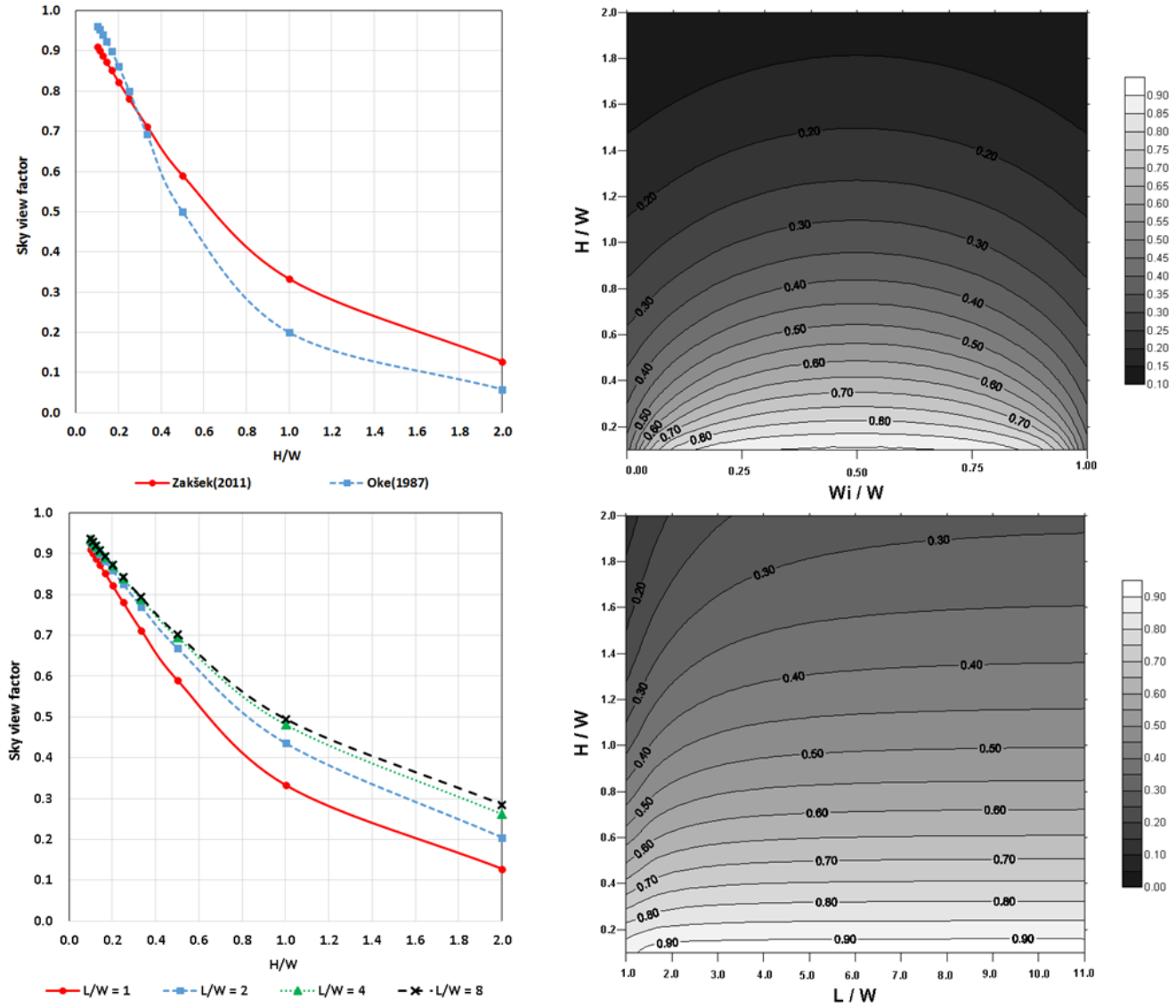

Fig. 2 Sky view factor for rectangular courtyard

3. Sky view factor for canyon and courtyard using fish eye images

Sky view factor was measured in downtown Manchester using fish-eye photographs[5] and simple geometric measurements. The fish-eye lens is used to capture a sky view[6] in a real urban setting and the SVF can then be measured from the image.

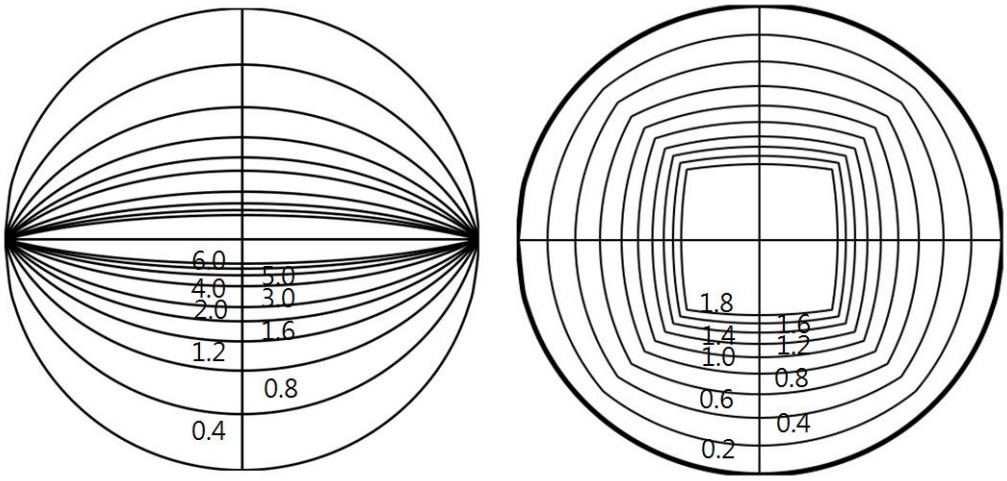

Fig. 3 H/W and fish eye image for canyon and rectangular courtyard

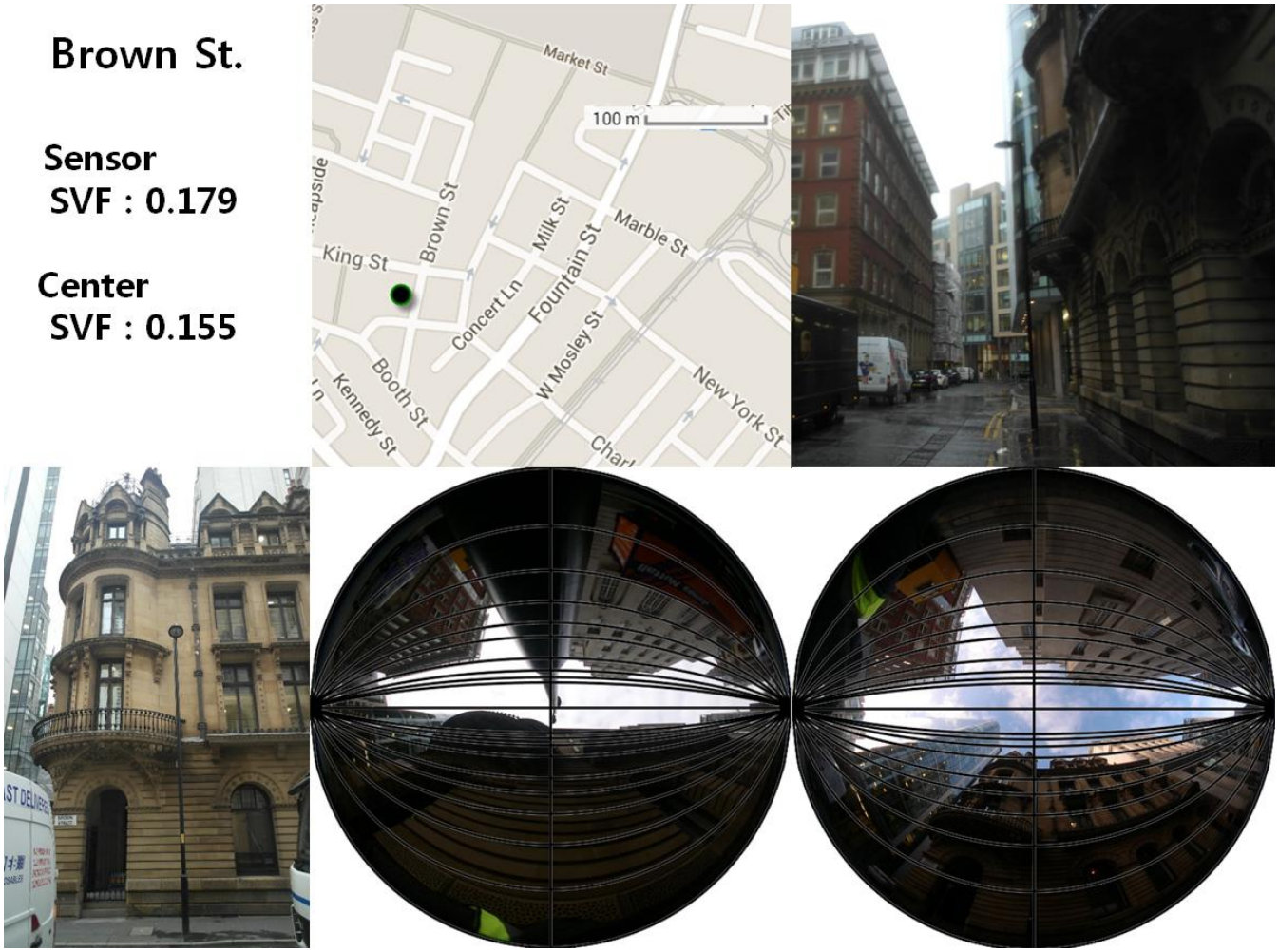

Fig. 4 Picture of fish-eye lens and SVF for sensor and center of road in Manchester center

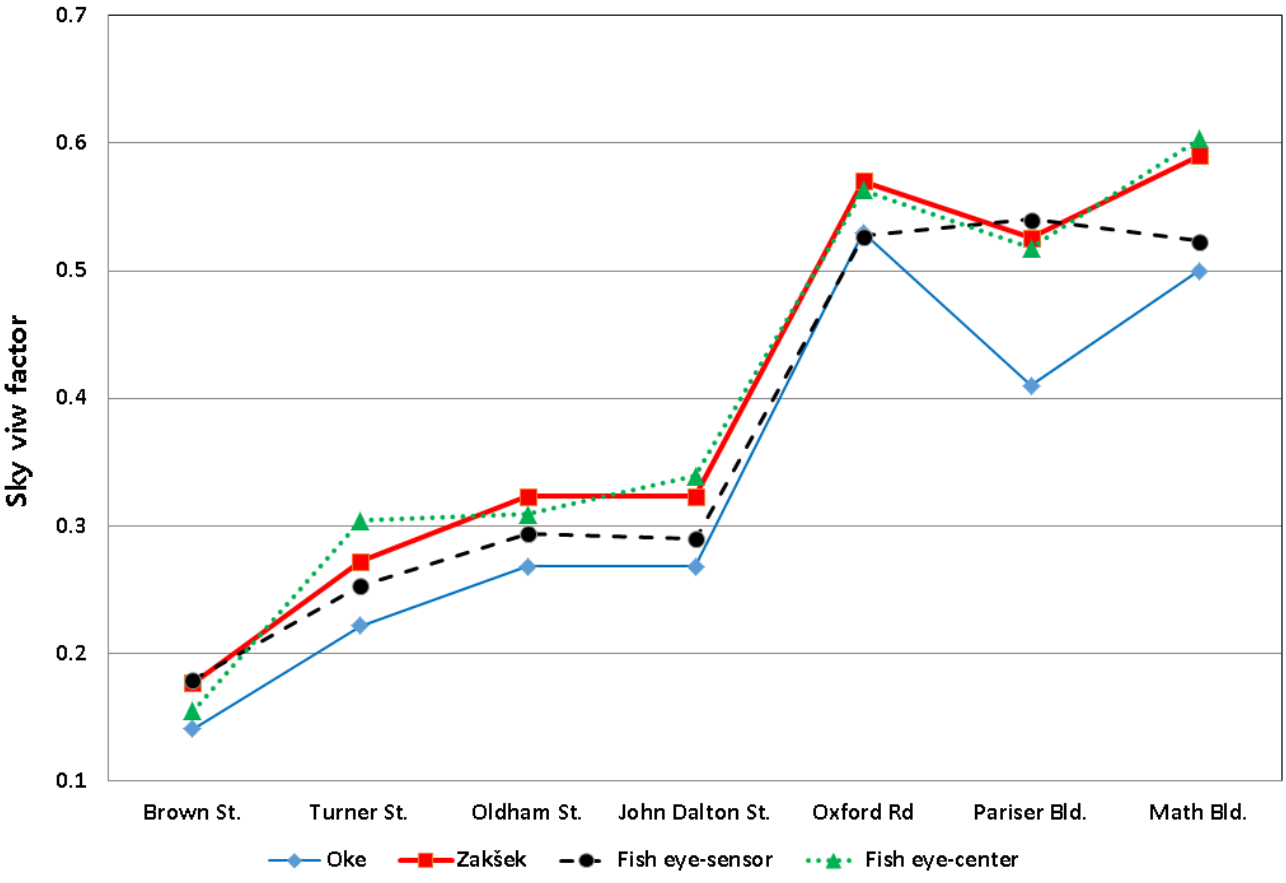

Fig. 5 Comparison between SVF results obtained using Oke, Zakšek and fish eye image methods

4. Conclusion

This study aims to derive a method to estimate the average SVF of sensor and center of road for urban forms with simple geometric measurements and fish eye images. The method provides an efficient and accuracy way to estimate both the canyon and courtyard SVF.

Acknowledgment

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