Multiscale Assessment of Urban Emissivity
Porter, K. and Voogt, J.A.
University of Western Ontario

Abstract

In urban areas, emissivity values are required as input for urban canyon parameterizations, to correct ground-based infrared measurements of surface temperature and for use with remotely sensed thermal infrared imagery. These applications require appropriately scaled emissivity values. Presently, most urban emissivity information is derived from tabled values for specific materials and relatively little work is available that can provide emissivity values at the different scales necessary.

This study undertakes a multiscale assessment of emissivity for London, Ontario. The scales are defined as micro, facet, canyon, urban climate zone and the entire urban area. Three methods are used in the assessment; ground-based instrumentation, numerical modeling and remote sensing. At the smallest scale, we examine how measured emissivities compare to tabled values and at larger scales we assess how the choice of microscale emissivity affects results at that scale.

A series of acceptable emissivity values were determined for all five urban scales. Results showed that spatial variations in urban emissivity were directly correlated to the surface material composition, including presence of low emissivity materials, canyon geometry, and vegetation. At smaller scales, large differences in emissivity were possible depending on how the microscale emissivity was estimated; results showed convergence at the urban scale.

Key words: Urban emissivity, Multi-scale, Urban Climatology, Numerical Modeling, Thermal Remote Sensing, Ground-Based Measurements